FINAL

UNIFORM FEDERAL POLICY – QUALITY ASSURANCE PROJECT PLAN

REMEDIAL INVESTIGATION AT FORMER NAVAL AIR STATION, CAPE MAY, NEW JERSEY

Contract No.: W912WJ-19-D-0008
Task Order No.: 002
USACE IDIQ Architect-Engineering Services

Prepared For:

US Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742

Prepared By:

RENOVA-SOVEREIGN JOINT VENTURE

October 2022

This page intentionally left blank.

TABLE OF CONTENTS

Section Page

INTRODUCTION....11

WORKSHEET #1 & #2 TITLE AND APPROVAL PAGE....13

WORKSHEET #3 & #5 PROJECT ORGANIZATION AND UFP-QAPP/DOCUMENT DISTRIBUTION....14

WORKSHEET #4, #7, & #8 PROJECT PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET....15

WORKSHEET #6 COMMUNICATION PATHWAYS....16

WORKSHEET #9 PROJECT PLANNING SESSION SUMMARY....17

WORKSHEET #10 CONCEPTUAL SITE MODEL....20

WORKSHEET #11 PROJECT DATA QUALITY OBJECTIVES....31

WORKSHEET #12 MEASUREMENT PERFORMANCE CRITERIA....37

WORKSHEET #13 SECONDARY DATA CRITERIA AND LIMITATIONS....69

WORKSHEET #14 & #16 PROJECT TASKS AND SCHEDULE....70

WORKSHEET #15 PROJECT ACTION LIMITS AND LABORATORY SPECIFIC DETECTION/QUANTITATION LIMITS....72

WORKSHEET #17 SAMPLING DESIGN AND RATIONALE....131

WORKSHEET #18 SAMPLING LOCATIONS AND METHODS....141

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES....145

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY....153

WORKSHEET #21 FIELD STANDARD OPERATING PROCEDURES....158

WORKSHEET #22 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION....159

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES....161

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION....174

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION....205

WORKSHEET #26 & #27 SAMPLE HANDLING, CUSTODY, AND DISPOSAL....210

WORKSHEET #28 ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTIONS....211

WORKSHEET #29 PROJECT DOCUMENTS AND RECORDS....244

WORKSHEET #31, #32, & #33 PLANNED PROJECT ASSESSMENTS....248

TABLE OF CONTENTS (CONTINUED)

WORKSHEET #34 DATA VERIFICATION AND VALIDATION INPUTS 251
WORKSHEET #35 DATA VERIFICATION PROCEDURE 253
WORKSHEET #36 DATA VALIDATION PROCEDURES 255
WORKSHEET #37 USABILITY ASSESSMENT.....259
REFERENCES.....264

LIST OF FIGURES

Figure 10-1 Typical Fresh Water – Salt Water Interfaces (Fetter, 2001)
Figure 10-2 Former NAS Cape May Preliminary Conceptual Site Model - Human Receptors
Figure 10-3 Former NAS Cape May Preliminary Conceptual Site Model - Ecological Receptors
Figure 10-4 Aeromag Anomaly Map
Figure 10-5 Terrestrial Geophysical Anomaly Map
Figure 18-1 Site Location Map
Figure 18-2 Test Pit Locations
Figure 18-3 Surface Soil and Soil Boring Locations
Figure 18-4 Sediment Sample Locations
Figure 18-5 Monitoring Well Locations

LIST OF TABLES

Table 10-1 Summary of Identified COPCs for AOC 1 26
Table 18-1 Proposed Sampling Locations and Methods.....141
Table 21-1 List of Applicable SOPs.....158

APPENDICES

Appendix A Summary of Ecological and Human Health Screening Level Hierarchy
Appendix B Analytical Laboratory Certifications
Appendix C Accident Prevention Plan (Provided separately by Renova-Sovereign Joint Venture.)
Appendix D Standard Operating Procedures
Appendix E Quality Control Forms
Appendix F Field Documentation Forms
Appendix G Ecological Screening Levels
Appendix H Analytes of Concern with LOQ > PAL

LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
%R	percent recovery
≤	less than or equal to
°C	degrees Celsius
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ADR	automated data review
AHA	Activity Hazard Analysis
amu	atomic mass unit
APP	Accident Prevention Plan
ARAR	Appropriate or Relevant and Appropriate Requirement
ASTM	ASTM International (formerly American Society for Testing and Materials)
BFB	4-bromofluoro-benzene
bgs	below ground surface
Bluestone	Bluestone Environmental Group
BTAG	Biological Technical Assistance Group
CA	corrective action
CAS	Chemical Abstracts System
CCV	continuing calibration verification
CEC	cation exchange capacity
CENAE	U.S. Army Corps of Engineers, New England District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COPC	contaminant of potential concern
CSM	Conceptual Site Model
CVAA	cold vapor atomic absorption
DDT	dichlorodiphenyltrichloroethane
DERP	Defense Environmental Restoration Program
DERP-FUDS	Defense Environmental Restoration Program – Formerly Used Defense Sites
DFTPP	decafluorotriphenylphosphine
DL	detection limit
DoD	Department of Defense
DOE	Department of Energy

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

DPT	direct push technology
DQI	data quality indicator
DQO	data quality objective
e2M	engineering-environmental Management, Inc.
Eco-SSL	Ecological Soil Screening Level
EDD	electronic data deliverable
EICP	extracted ion current profile
ELAP	Environmental Laboratory Accreditation Program
ELLE	Eurofins Lancaster Laboratories Environment Testing, LLC
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ER	Engineer Regulation
ESV	Ecological Screening Value
Eurofins	Eurofins Lancaster Laboratories Environmental, LLC
ft	feet
FUDS	Formerly Used Defense Site
FUDSChem	Formerly Used Defense Site Chemical
GC/ECD	gas chromatography/electron capture device
GC/MS	gas chromatography/mass spectrometry
GIS	Geographic Information System
GPR	ground-penetrating radar
GPS	Global Positioning System
GWQS	Groundwater Quality Standards
HDPE	high-density polyethylene
HHRA	Human Health Risk Assessment
HNO_3	nitric acid
HPLC	high performance liquid chromatography
HTRW	Hazardous, Toxic, and Radioactive Waste
ICAL	initial calibration
ICP-AES	inductively coupled plasma atomic emission spectroscopy
ICP-MS	inductively coupled plasma mass spectroscopy
ICS-A	Interference Check Standard A
ICS-AB	Interference Check Standard AB

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

ICV	initial calibration verification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
IS	internal standard
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDC	Laboratory Data Consultants
LDR	linear dynamic range
LOD	limit of detection
LOQ	limit of quantification
MCL	Maximum Contaminant Level
MD	matrix duplicate
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolt
N/A	not applicable
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
ND	non-detect
NFG	National Functional Guidelines
NJDEP	New Jersey Department of Environmental Protection
No.	Number
NRALC	National Recommended Water Quality Criteria - Aquatic Life Criteria
NSL	no screening level
NTU	nephelometric turbidity unit
Ogden	Ogden Environmental and Energy Services Company, Inc.
ORP	oxidation reduction potential
PAH	polycyclic aromatic hydrocarbon
PAL	Project Action Limit

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

PCB	polychlorinated biphenyl
PDS	post-digestion spike
PID	photoionization detector
PIP	Public Involvement Plan
POL	petroleum, oil, and lubricants
PPE	personal protective equipment
PT	proficiency testing
PTFE	polytetrafluoroethylene
PWS	Performance Work Statement
QA	quality assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RA	risk assessment
RCRA	Resource Conservation and Recovery Act
Renova-Sovereign Joint Venture	Renova Environmental Services and Sovereign Consulting, Inc. Joint Venture
RI	Remedial Investigation
RPD	relative percent difference
RRT	relative retention time
RSD	relative standard deviation
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SIM	selected ion monitoring
SLERA	Screening-Level Ecological Risk Assessment
SM	Standard Method
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSV	Surface Water Screening Values
SVOC	semi-volatile organic compound
TAL	target analyte list
TBD	to be determined

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

TCL	target compound list
TCLP	Toxicity Characteristic Leachate Procedure
TNI	the NELAC Institute
TOC	total organic carbon
TR	Target Cancer Risk
TRACENCM	Training Center Cape May
TSCA	Toxic Substances Control Act
U.S.C.	United States Code
UCL	Upper Confidence Limit
UFP-QAPP	Uniform Federal Policy Quality Assurance Plan
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VOC	volatile organic compound

INTRODUCTION

Renova Environmental Services and Sovereign Consulting, Inc. Joint Venture (Renova-Sovereign Joint Venture) was retained by the U.S. Army Corps of Engineers (USACE) New England District (CENAE) to prepare this Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) and associated Remedial Investigation (RI) Work Plan, which is included as **Appendix A**, for the RI of the Former Naval Air Station Cape May Abandoned Dumping Station (AOC 1) located in Cape May County, New Jersey (Site).

This QAPP has been prepared in accordance with the Uniform Federal Policy for Quality Assurance Project Plans (Intergovernmental Data Quality Task Force [IDQTF], 2012) and generally with the U.S. Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans (EPA, 2001). This QAPP and Work Plan were also developed in accordance with the Performance Work Statement (PWS) prepared by CENAE and dated 24 June 2019 (CENAE, 2019). This work will be completed as a task order (Task Order No. 002) under the Hazardous, Toxic, and Radioactive Waste (HTRW) contract between the USACE and Renova-Sovereign Joint Venture (Contract No. 912WJ-10-D-0003 under USACE IDIQ Architect-Engineering Services Contract # W912WJ-19-D-0008). The work required under the PWS falls under the Defense Environmental Restoration Program (DERP) Formerly Used Defense Sites (FUDS), which complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), Resource Conservation and Recovery Act (RCRA), the National Oil and Hazardous Substances Contingency Plan (NCP), the Toxic Substances Control Act (TSCA – 15 U.S.C. § 2601 et seq. [1976]), and consistent with New Jersey Department of Environmental Protection (NJDEP) requirements, as deemed appropriate by USACE.

The scope of work includes assessment of the FUDS-eligible Abandoned Dumping Station (AOC 1) identified in the Expanded Technical Memorandum (Bluestone Environmental Group [Bluestone], 2019). The potential source area was identified based on review of prior environmental reports and historical information. The Expanded Technical Memorandum's objective was to provide a summary of historical documents and previous investigations, develop a preliminary Site-specific Conceptual Site Model (CSM), identify data gaps, provide recommendations to address the data gaps, and develop a general approach for the risk assessment. Based on previous investigations conducted at AOC 1 additional site characterization is deemed necessary to address the project in the DERP-FUDS Program. These investigations include geophysical investigation, completion of test pits, subsurface soil collection, surface soil and sediment sample collection, and installation and sampling of groundwater monitoring wells.

All work completed under the work scope will be in compliance with an approved Site Specific Health & Safety Plan (SSHASP) and an Accident Prevention Plan (APP) (**Appendix C**). The SSHASP and APP will be prepared in accordance with the USACE EM-385-1-1 and will include Activity Hazard Analysis (AHA)s for required tasks. Site personnel will complete unexploded ordnance (UXO) Awareness training. Any potential UXOs identified will be reported to the base security.

This page intentionally left blank.

WORKSHEET #1 & #2 TITLE AND APPROVAL PAGE

PROJECTG INFORMATION

Former Naval Air Station Cape May
Cape May, New Jersey
FUDS PROJECT NUMBER: C02NJ0951

Contract No. W912WJ-19-D-0008
Task Order No. 002
USACE IDIQ Architect-Engineering Services Contract No.: W912WJ-19-D-0008

LEAD ORGANIZATION

U.S. Army Corps of Engineers (USACE)
New England District (CENAE)
New England District
696 Virginia Road
Concord, Massachusetts 01742

CONTRACTOR

Renova-Sovereign Joint Venture

Federal Regulatory Agency:

Name
USACE Project Manager-Greg Hencir

State Regulatory Agency:

Name
NJDEP/Title

Other Stakeholders:

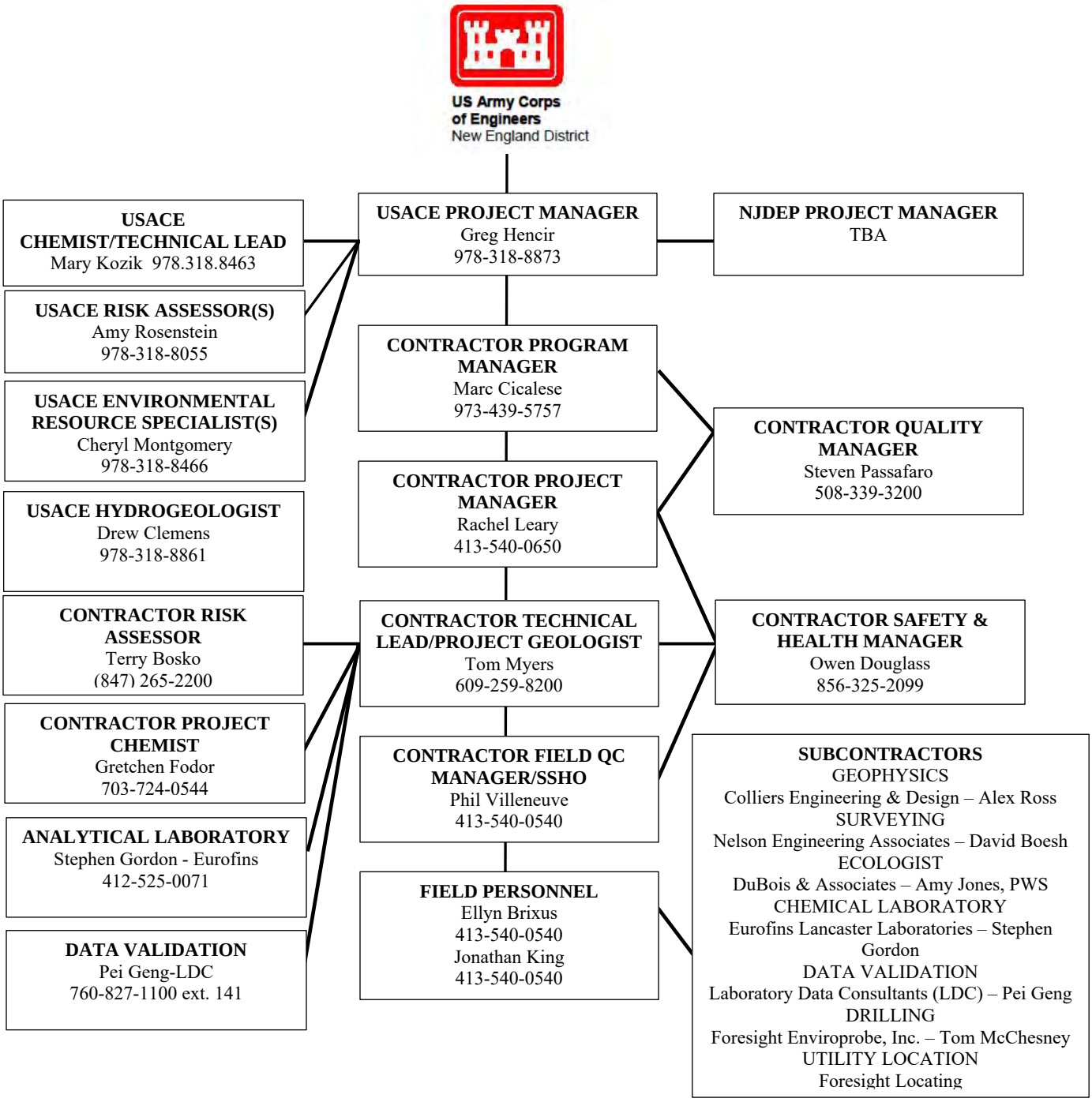
Rachel Leary
Contractor Project Manager

Steven Passafaro
Contractor Quality Manager

Gretchen Fodor
Contractor Project Chemist

WORKSHEET #3 & #5 PROJECT ORGANIZATION AND UFP-QAPP/DOCUMENT DISTRIBUTION

The Project Organization Flow Chart below details the organizational structure of the project and includes the lead agency, regulatory agencies, contractors, and subcontractors involved in the project. QAPP recipients who are required to be notified of changes are indicated with an *.



WORKSHEET #4, #7, & #8 PROJECT PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

This worksheet identifies key project personnel, their responsibilities and qualifications, and specialized training/certifications required by the project and documents that all key project personnel performing work have read the applicable sections of this UFP-QAPP and will perform the tasks as described.

Name	Project Title/ Role	Organization Affiliation	Qualifications	Signature/ Date
Rachel Leary	Project Manager	Renova-Sovereign Joint Venture	Professional Engineer	
Steven Passafaro	QA/QC Manager	Renova-Sovereign Joint Venture	Professional Engineer	
Gretchen Fodor	Project Chemist	Weston Solutions, Inc.	Experienced Project Chemist	
Pei Geng	Data Validator	Laboratory Data Consultants (LDC)	Ph.D. Chemist	
Stephen Gordon	Laboratory Project Manager	Eurofins Lancaster Laboratories Environmental, LLC (Eurofins)	Experienced Laboratory Chemist	
Barbara Sanchez	Assistant Lab Manager	Geotesting Express	Experienced Laboratory Scientist	

Notes:
LDC = Laboratory Data Consultants
Ph.D. = Doctor of Philosophy
QA = quality assurance
QC = quality control

WORKSHEET #6 COMMUNICATION PATHWAYS

Communication Driver	Organization/ Responsible Individual	Name	Contact Information	Procedure
Regulatory agency interface	USACE Project Manager	Greg Hencir	978-318-8873	Contractor will direct correspondence from project stakeholders, as needed
Manage all project phases	Contractor Project Manager	Rachel Leary	413-540-0650	Manage day-to-day operations of the project. Reports to USACE Project Manager issues with cost, schedule, etc.
Field Progress Reports	Contractor Project Manager	Rachel Leary	413-540-0650	For this phase of the project, Contractor will provide an email work summary report at the completion of field activities, unless additional progress updates due to delays or unforeseen circumstances are required.
Stop work due to safety issue	Contractor Field QC Manager	Scott Smith	609-259-8200	Field QC managers/personnel will communicate with the Safety and Health Manager for stop work issues.
Public interface	USACE	Greg Hencir	978-318-8873	Contractor will direct public comments/questions during implementation of the project to USACE.
QAPP changes prior to and during project execution	USACE Contractor Quality Manager	Steven Passafaro	508-339-3200	QAPP changes prior to or during execution will be communicated between the indicated parties.
Field corrective action	Contractor Field QC Manager	Scott Smith	609-259-8200	The Field QC Manager will coordinate with the Project Manager for field corrective action. The Project Manager will contact USACE if significant issues impacting the program arise.
Sample receipt variances	Contractor Technical Lead/ Contractor Project Chemist	Gretchen Fodor	703-724-0544	The laboratory will communicate with the Technical Lead to rectify sample receipt variances.
Laboratory quality control variances				Laboratory quality control variances and corrective actions identified by the lab or validator will be reported to the Technical Lead who will communicate issues to USACE if the data quality objectives will be compromised.
Analytical corrective action				
Data verification issues				Data Validator will notify Technical Lead to communicate verification and corrective actions.
Data review corrective action				

WORKSHEET #9 PROJECT PLANNING SESSION SUMMARY

The following summarizes the project planning sessions completed to support preparation of this QAPP.

Date of Planning Session: 4 February 2020
Location: Teleconference
Purpose: Project team meeting to consider basic scope, review background, and logistics.

Name	Organization/Title
Greg Hencir	USACE/Project Manager
Drew Clemens	USACE/Project Hydrogeologist
Mary Kozik	USACE/Project Chemist
Amy Rosenstein	USACE/Human Health Risk Assessor
Cheryl Montgomery	USACE/Ecological Risk Assessor
Brooke Stevens	USACE/Ecological Risk Assessor
Rachel Leary	Renova-Sovereign Joint Venture/Project Manager
Scott Smith	Renova-Sovereign Joint Venture /Project Geologist
Gretchen Fodor	Weston Solutions, Inc./Project Chemist
Terry Bosko	Weston Solutions, Inc./Risk Assessor

Notes/Comments:

- Sample Collection and Analysis Work Plan (SAP)
  - The Renova-Sovereign Joint Venture project team will prepare draft Applicable or Relevant and Appropriate Requirements (ARARs) for USACE review
  - NJ State requirements will not be specified in the ARARs, but will meet the intent of the NJDEP regulations.
  - The SAP will comply with the FUDs ER, USACE Engineering Manual (EM) 200-1, Data Management ER and EM and FUDs electronic data deliverables (EDDs).
  - SAP will be included in the QAPP.
  - If additional information, such as procedures, are need in worksheets of the QAPP then they will be included as an appendix.
  - An ecological resources and receptors survey will be required prior to any field sampling activities. It was suggested to complete it during the terrestrial geophysical survey. The Renova-Sovereign Joint Venture team will email suggested scope to Brooke Stevens and Cheryl Montgomery for review and comment.

- The Renova-Sovereign Joint Venture team is suggesting the field activities take place in three mobilizations. Sample locations for each round would be determined based on data collected in events prior.
  - Test Pits
  - Soil borings, surface soil sampling, and sediment sampling
  - Monitoring well installation
- CSM should be included in SAP and will be updated as project proceeds. The CSM will be added to Worksheet #15

- UFP-QAPP
  - The Renova-Sovereign Joint Venture project team will prepare draft Data Quality Objectives (DQOs) for USACE review. DQOs will follow EPA process and any step out decision making rules.
  - Project Action Level (PALs)
    - References for ecological and human health should be sent to USACE for review prior to submitting PALs. Weston Solutions, Inc. and the Renova-Sovereign Joint Venture will email references and then will hold a conference call to discuss.
    - Freshwater and saltwater benchmarks from EPA Regions 3 and 4 will be considered. NJDEP screening levels will not be used.
    - A hierarchy of sources for ecological and human health screening levels was approved by USACE in May 2020. See **Appendix A** for these approved screening levels.

- QAPP
  - The Renova-Sovereign Joint Venture project team to discuss with lab different sample prep procedures for saltwater intrusion. Consider metals interference with high sodium content in wells and avoiding dilution of samples.
  - Site-specific parameter lists will be suggested to USACE for review. The entire method parameter list does not have to be used.
  - Evaluate if Cr^{+6} analysis should be included in parameter list.
  - Diane Quigley and Mary Kozik will look into difference between 8270D and 8270E.
  - USACE has requested a certain format for worksheet 15. It should have compound, CAS number, Highest priority Federal reg limit (most likely Federal Soil ECO SSLs) to least priority EPA Region limit, PAL, Lab limits.
  - pH and Oxidation reduction potential (ORP) will be field parameters only.
  - Grain size analysis will be completed by a USACE-approved lab. A DoD certification is not required.

  - Waste characterization sample list will come from a NJ facility. The Renova-Sovereign Joint Venture is to provide list.

- Formerly Used Defense Sites Chemical (FUDSChem)
  - Project has been set up in FUDSChem.
  - Diane Quigley to contact Emily Hill to make sure appropriate access levels are given to project team
  - The following deliverables will be uploaded in FUDSChem during the project (will also double check FUDS EDD list):
  - Geophysical data
    - Spatial information
    - Field parameters
    - Grain size analysis
    - Well logs – system compatible descriptions
    - Well development logs
    - Soil logs
    - UXO data
    - Historical Site data
    - Photos
  - When project team contacts Synectics, please copy Mary Kozik.
- Background
  - Regional and Site-specific background needs to be established. A statistically significant data set should be established to ensure future remedial decisions can be made with appropriate data. Tom Meyers will look into area data he may have access to.
  - Human health risk assessment (RA) will consider the Site for future commercial use only. There are no recreational standards to use.
- Schedule
  - The project schedule will be updated when conference call with Maser has been established to discuss draft magnetometer survey results.
  - The Renova-Sovereign Joint Venture will submit an information request to U.S. Fish and Wildlife Service (USFWS) and National Heritage to determine what nesting seasons the schedule needs to consider.
- UXO
  - UXO awareness training will be required for field staff. Dabra Seiken will look into U.S. Coast Guard (USCG) training requirements and what awareness training is acceptable.

WORKSHEET #10 CONCEPTUAL SITE MODEL

10.1 SITE DESCRIPTION

The Site is currently being operated as the USCG Training Center Cape May (TRACENCM) and is located in Cape May County, New Jersey, approximately 50 miles south of Atlantic City. The Training Center is bound to the west by residential areas; to the north by Cape May Harbor; to the east by Cape May Inlet; and to the south by the Atlantic Ocean. The TRACENCM is accessed from Pennsylvania Avenue in Cape May, New Jersey.

The Abandoned Dumping Station (AOC 1) is located along the Cape May Inlet, approximately 600 feet (ft) northeast of the Former Eastern Firing Range and 750 ft due east of Arcus Road. The AOC 1 boundary was established in the FUDS Inventory Project Report (INPR) (USACE, 1994a) based on interviews with former base employees that the area may have been a dumping ground for waste generated on base. Refer to enclosed **Figures 18-1** through 1**8-5**. AOC-1 is currently bound to the west by a dirt access road and beyond that by surface impoundments made of earthen berms to dewater dredge spoils from periodic dredging of the Cape May Inlet. The Site is currently bound to the north by Cape May Harbor and east by the Cape May Inlet. The southern end of the Site is adjacent to the Cape May jetty and the Atlantic Ocean. Much of the estimated footprint of AOC 1 is now underwater, due to over 100 ft of shoreline erosion since 1931. Site investigation efforts within AOC 1 by Ogden Environmental (Ogden, 1998) observed surface debris and confirmed the presence of contaminants of concern as described in Section 10.5. The Site boundary may be adjusted, as needed, based on the results of the Site investigation activities.

10.2 PHYSICAL SETTING

The Site is in the Coastal Plain Physiographic Province. This province is characterized by a low, gently to moderately rolling land surface and low relief. Elevation at the Site ranges from 0 ft North American Vertical Datum of 1988 (NAVD88) at the shoreline to approximately 15 ft NAVD88 in the area between the harbor and the ocean. In December 2019, an Unmanned Aerial Survey (UAS) was completed, which included: an aeromagnetic (aeromag) surveying, an aero-geophysical surveying aerial photography and a LIDAR survey (Maser, 2019). Aerial imagery and topographic data of AOC-1 generated during this survey are included in the Sampling and Analysis Plan for this project.

10.2.1 Meteorology

Based on a three-decade average of climatological data ("1981-2010 Climate Normals") for Cape May, New Jersey, the average minimum temperature for the region is 27.9°F in January and average maximum temperature is 84.5°F in July. Precipitation averages 41.88 inches annually, relatively evenly distributed during the year [National Oceanic and Atmospheric Administration (NOAA), 2018].

10.2.2 Surface Water Drainage

Surface water runoff at the Site follows topography to the south, north, and east. Surface water flows southward to the Atlantic Ocean, northward to Cape May Harbor, and eastward to Cape May

Inlet. No streams were observed at the Site. There is no stormwater infrastructure near the area targeted for this investigation.

10.2.3 Geology

The geology of the Site consists of coastal plain deposits, with beach sands and dunes overlying interbedded estuarine and marsh deposits. Pieces of the salt marsh deposits ("Meadow Mat", comprised of peat and organic silt) were found, during previous Site investigation, on the beach near the Former Eastern Firing Range. As sea level rises and the beach, dune, and overwash sand deposits are eroded, buried marsh deposits are exposed at the shoreline. These marsh deposits are eroded and carried by high tides, storm surges, and overwash processes that are deposited on the surface further inland (Bluestone, 2019).

In general, this surficial unit overlies the Cape May Formation Unit 1, which consists of sand and pebble gravel, silt, and fine sand from shoreline deposits. The surficial unit consists of Holocene sand, silt, clay, and peat (Bluestone, 2019). The sand forms the beaches and dunes and the fine sand, silt, clay, and peat forms salt marshes. The mineralogy of the beaches and dunes includes silica sand as well as heavy minerals, of which 42% is horneblende. Horneblende contains calcium, sodium, magnesium, iron, aluminum, and silica, which may affect soil and groundwater sampling results. These elements are included in sample analysis as presented in Worksheet #17. The beach and dune sands also include 10% garnet and smaller amounts of hypersthene, epidote, apatite, and diopside. These lesser components may contribute calcium, magnesium, iron, manganese, vanadium, and phosphorus to analytical results. The Meadow Mat is a low permeability, discontinuous, semi-confining unit, due to the silt, clay, and organic material constituents; it is not an aquitard, however, and surface spills may infiltrate through the unit over time (Bluestone, 2019). This layer was noted below the surface sand layer to depth of 10 ft below ground surface (bgs); the specific thickness of the mat was not noted in previous Site investigations.

10.2.4 Hydrogeology

Groundwater underlying AOC 1 was reported to be less than 4 ft bgs in borings advanced during the previous investigation (Ogden, 1998) and groundwater flows toward the Cape May Harbor, Cape May Inlet, and the Atlantic Ocean. Previous investigations do not indicate if the groundwater is fresh, brackish, or saline, and no data was collected to determine the groundwater salinity levels. Depth to the fresh water-salt water interface is expected to be shallower at the coast and increase in depth as you move inward on land, as represented in **Figure 10-1**. In addition, the interface is likely a zone of mixing based on diffusion rates. The Meadow Mat beneath the surficial sand has been observed at a depth of approximately 6 to 10 ft bgs in the area of the concrete bunker in the Former Western Firing Range (AOC 3). These meadow mat units may be only locally occurring as coastal depositional environments are highly dynamic, and in other areas, the meadow mat layer might not have formed and/or may have been eroded already. The boring logs from the soil borings collected within the area of the former dumping ground (AOC1) during the 1997 investigation do not indicate any presents of a meadow mat in this area, although soil borings are only logged to 4 ft in depth. The surficial aquifer underlying the Site, the Holly Beach Aquifer, supplies water for domestic and irrigation uses (Bluestone, 2019).

Located along the eastern shoreline, AOC 1 is predominantly underwater due to substantial shoreline erosion in this area. The Expanded Technical Memorandum reported that the entire

AOC 1 is saturated with ocean water two times a day at high tide and floods (over the road) up to ten times per year due to storm surges and astronomical high tides (or "king tides").

10.2.5 Ecology

The Cape May peninsula is located between the Delaware Bay and the Atlantic Ocean and thus has 60 more frost-free days than northern Cape May County. This results in species common in the southern states. Tree species such as swamp chestnut oak (*Quercus michauxii*) and loblolly pine (*Pinus taeda*) are present in the lower peninsula [U.S. Fish and Wildlife Service (USFWS), 2006]. The exposed portion of the landfill is approximately 1 acre and is dominated by invasive plant species like ragweed, goldenrod, and phragmites.

The Cape May peninsula is a migratory corridor for birds, primarily due to the large horseshoe crab population along the western shoreline and the configuration of the land between the Delaware Bay and the Atlantic Ocean. This corridor attracts birds that eat horseshoe crab eggs, such as sharp-shinned hawk (*Accipiter striatus*), osprey (*Pandion haliaetus*), northern harrier (*Circus cyaneus*), and many species of owls, as well as the red knot (*Calidris canutus*, a candidate for Federal listing), least sandpiper (*Calidris minutilla*), dowitcher (*Limnodromus* spp.), and ruddy turnstone (*Arenaria interpres*) (USFWS, 2006). The beach at AOC 1 is a known nesting area for horseshoe crabs. Avian species observed in this area during a site visit included: seaside sparrows, laughing and herring gulls, red-winged blackbirds, and starlings (Bluestone, 2019).

The Cape May peninsula is home to rare species including 27 birds, two mammals, three amphibians, four reptiles, 30 invertebrates, and 147 plants. The following are endangered, threatened, or rare species identified during an ecological survey by DuBois & Associates in the fall of 2020, that are listed to be in the vicinity of the Site by USFWS, NJDEP or National Heritage Program (DuBois, 2021):

<u>Wildlife:</u>

- Atlantic sturgeon (*Acipenser oxyrinchus*) - Federally listed threatened and State listed as endangered.
- Yellow-crowned night-heron (*Nyctanassa violacea*) – State listed as threatened.
- Osprey (*Pandion haliaetus*) – State listed as threatened.
- Least tern (*Sterna antillarum*) – State listed as endangered.
- Black-crowned night-heron (*Nycticorax nycticorax*) – State listed as threatened.
- Black skimmer (*Rynchops niger*) – State listed as endangered.
- Cattle egret (*Bubulcus ibis*) - State listed as threatened.
- Bald eagle (*Haliaeetus leucocephalus*) – Federally listed threatened and State listed as endangered. Observed on Site.

- Piping plover (*Charadrius melodus*) – Federally listed threatened and state listed as endangered.

- Red knot (*Calidris canutus*) Federally listed threatened and state listed as endangered.

Portions of the beach along the southern shore of the Site are closed seasonally, to protect the nesting habitats of the piping plover and least tern. However, this portion of the beach is distant from the Abandoned Dumping Station (Ogden, 1998). Based on the Site-specific ecological study (DuBois, 2021), colonial water birds observed (black-crowned night heron, yellow-crowned night heron and the cattle egret) have a general history of nesting in the vicinity of AOC-1. NJDEP recommends avoidance of activities from April 1 to August 15 in the area, but a nesting survey can be completed prior to invasive Site activities, if work is required during that timeframe.

The following rare plants were identified during an ecological survey by DuBois and Associates in the fall of 2020, that listed the vicinity of the Site by USFWS, NJDEP or National Heritage Program (DuBois, 2021):

<u>Rare Plants:</u>

- Seabeach amaranth (*Amaranthus pumilus*) – Federally listed as threatened.

Additional details regarding the threatened and endangered species on or in the immediate vicinity of the Site are provided in the DuBois report. USACE had planned to conduct a resource and receptor inventory in May 2022 to observe species listed during the spring when they would be potentially present to verify the use and habitat suitability. Some of these species include piping plovers, red knot, black skimmer, and least terns. In addition, the results of this field investigation could support the conclusion that species would not be impacted in the event of work in the area. The USCG. provided their Beach Management Plan to the USACE while planning the event. The plan states, "The beach at TRACEN Cape May is managed as a "vehicle-free" and "people-free" area during the nesting season, March 15 through September 15, as the beach is closed to all person with the following exceptions: EP&SS, Security, NJDFW, and USFWS personnel." Due to the limitations regarding site access, it was determined an additional field investigation was not necessary. Any activity proposed would comply with the Beach Management Plans time of year restrictions.

10.2.6 Wetlands

According to the National Wetlands Inventory Map managed by the USFWS, most of the undeveloped portion of the Site (approximately 49 acres) consists of palustrine freshwater emergent wetland. This wetland is characterized by trees, shrubs, and persistent emergent vegetation that are present for most of the year. The area is seasonally flooded, with surface water remaining for at least 1 month. When the surface is not flooded, the substrate is saturated at or near the surface (USFWS, 2018).

The freshwater forested/shrub wetland (approximately 6 acres) is located along Arcus Road north of the Former Eastern Firing Range (AOC 2). This wetland is characterized by continuously saturated substrate with woody vegetation no more than 20 ft tall, such as shrubs and saplings. The vegetation has wide, flat leaves that are shed during cold or dry seasons (USFWS, 2018).

Estuarine and marine wetlands are present along the northeastern (approximately 2 acres) and southeastern (approximately 4 acres) corners of the Site. These wetlands are characterized by water salinity greater than 30 parts per thousand with little to no dilution and a substrate that floods with high tide, though the surface does not always flood. Only about 30 percent of the area is vegetated (USFWS, 2018); the remaining 70 percent has been developed by the USCG as roads, buildings, parking lots, and maintained lawns.

10.3 SITE HISTORY

The U.S. Government obtained the 426.774-acre property through a deed dated 2 December 1918 and Declarations of Taking dated 16 July 1941 and 24 June 1942. The U.S. Navy operated the Site from 1918 to 1946 (USACE, 1994a and 1994b). In 1946, the U.S. Navy conveyed 426.774-acres fee to the USCG (USACE, 1994a and 1994b). According to the USACE Inventory Project Report Site Survey Summary Sheet, "Since 1946, approximately 101.814 acres has been lost to erosion and other forces of nature" (USACE, 1994a).

Prior to use by the Navy, the oceanfront portion of the Site was used as an amusement park. After World War I, the Site was used for dirigible landing and storage. By 1924, the Site was used as a landing strip for planes used by the USCG for coastal patrols. In 1941, the airfield was expanded, and the Site was used as a training base for Navy carrier pilots. The USCG also utilized the Site for coastal patrol, anti-submarine warfare, air/sea rescue, and buoy service (engineering-environmental Management, Inc. [e2M], 2003).

TRACENCM was established in 1948 (e2M, 2003). The USCG, part of the Department of Homeland Security, is the owner of record for the Site. The Training Center is the fifth largest USCG base, and is comprised of housing, offices, clinics, a chapel, shops, and a child development center (Bluestone, 2019).

Previous research at the Site suggests that there may be a potential for encountering UXO during intrusive activities at AOC 1. 25-ft deep sheet pile was installed in the past in the area to maintain the integrity of the road from shoreline erosion at an un-specified date. UXO support was not used during the installation of these shoreline sheet (Bluestone, 2019) according to former base personnel.

Details regarding disposal history at AOC 1 have not been found in the historical records, but it is believed that it was used for the dumping of municipal waste. USCG personnel indicated that municipal-type waste and general debris have been observed along the shoreline and drums could have also been disposed in the area. Based on typical operations at military facilities, chemicals that may have been used on the Site and potentially disposed of at AOC 1 include: solvents; petroleum, oil, and lubricants (POL); fuel oils; and metallic debris (Bluestone, 2019). During 2018, Site visits only concrete debris was noted along the shoreline. Plastic ocean trash was the only other debris noted. Site visits conducted during low-tide conditions in December 2019 and August 2021 indicated wood and concrete piles and suspected utility remnants exposed within the tidal zone of the existing beachfront.

10.4 ENVIRONMENTAL INVESTIGATION HISTORY

In October 1997, Ogden conducted sampling at all three potential AOCs, on behalf of Northern Ecological Associates, Inc., for USACE, New York District. The purpose of the investigation at

AOC 1 was to evaluate the potential presence of toxic or hazardous materials in the soil and groundwater (Ogden, 1998).

Ogden collected eight soil samples from four borings to a depth ranging from 7 to 8 ft and two groundwater samples from two borings and analyzed for target compound list (TCL) (volatile organic compounds [VOCs] and semi-volatile organic compounds [SVOCs]) and target analyte list (TAL) metal compounds. Ogden compared the results to NJDEP Soil Cleanup Criteria (1996) and NJDEP Groundwater Quality Standards (GWQS) (1997). No soil cleanup standards were exceeded. In groundwater, GWQS were exceeded for pesticides (DDE and DDT) in one groundwater sample. Total and dissolved iron, manganese, and sodium exceeded the GWQS in both groundwater samples; total and dissolved aluminum and total chromium, lead, and nickel exceeded criteria in one of the groundwater samples (Ogden, 1998).

Ogden attributed the exceedances of iron and manganese in groundwater to the mineralogy of the surface soils; of sodium to sea water mixing; and of aluminum, chromium, lead, nickel, and arsenic to on -Site disposal (Ogden, 1998).

In December 2019, Maser Consulting completed an aero-magnetic geophysical survey deployed by unmanned aerial systems (aka drone). Refer to Geophysical Evaluation Report – Former NAS Cape May, April 2020 by Maser Consulting. These non-invasive efforts were performed to evaluate near-surface conditions for anomalies representative of buried ferrous iron debris and targets associated with an area suspected as a former near-shore dumping facility. In addition to aeromagnetic geophysical surveying, the UAS was deployed to collect aerial photography and LIDAR data. 23 geophysical anomalies were identified as potential buried debris, remnant infrastructure, and possible utilities. The majority of geophysical anomalies were coincident with observed former structures and objects according to historical aerials photos for the region. Possible metallic debris was located in close proximity to a submerged object(s) east of and outside the geophysical survey area. Anomaly A18 (**Figure 10-4**) was located near a larger submerged object(s) outside the investigation boundary and was identified as possible FUDs debris. It was recommended the survey area be expanded to evaluate the area outside of A18 and unknown submerged object.

In August 2021, Colliers Engineering & Design (formerly Maser Consulting) conducted a subsequent geophysical survey consisting of an aeromag evaluation expanded area measuring approximately 150 ft east and 100 ft north of the prior survey area. An additional 21 anomalies were identified during the August 2021 event. 8 objects were identified as high priority targets by Colliers for a total of 15 objects in both investigations that have the potential to be associated with the former dump site (**Figures 10-4** and **10-5**). Terrestrial geophysical surveying, using electromagnetic induction and ground penetrating radar, was also conducted during low-tide conditions conducted to allow for refine greater resolution of subsurface anomalies and potential underground utilities. Review of the GPR profiles indicate that the survey area has undergone possible excavation, backfilling, and regrading activities. Discontinuous and overlapping horizontal soil horizons were observed in the top 10 ft of the area. The presence of the meadow mat was not detected which is likely from the attenuating signal from shallow saturated conditions. Refer to draft document NAS Cape May Geophysical Evaluation Addendum 1.

10.5 CONTAMINANTS OF POTENTIAL CONCERN

The list of contaminants of potential concern (COPCs) for this investigation has been derived from the previous investigation conducted by Ogden. **Table 10-1** was excerpted from the Expanded Technical Memorandum (Bluestone, 2019) and summarizes the COPC screening conducted for AOC 1, using the human health and ecological screening criteria outlined in that document. The previous investigation identified VOCs, SVOCs, pesticides, PCBs, explosives, and metals as potential Site contaminants. Based on the results of the previous investigation, VOCs, SVOCs, and PAHs were not considered to be COPCs. While POL has been identified as typically found at military facilities, total petroleum hydrocarbons are not considered a COPC. Rather, PAH analysis will be performed for soil, sediment, and groundwater, providing information on these components of POL with available toxicity data, as PAHs were detected in soil during the previous investigation.

Table 10-1 Summary of Identified COPCs for AOC 1

Media	Potential Site Contaminants	Status
Soil/Sediment	VOCs – low level detections of methylene chloride (below current industrial soil Regional Screening Levels [RSLs])	VOCs not retained as COPCs for soil and sediment, but may be reconsidered for the RI analytical suite, if drums are located during the geophysical surveys
	SVOCs – several polycyclic aromatic hydrocarbons (PAHs) detected in soil, but below screening criteria	SVOCs (limited to PAHs) retained as COPCs for soil; PAHs are indicator of POL.
	Pesticides – DDT and DDE (above Ecological Soil Screening Levels [Eco-SSLs])	Pesticides retained as COPCs for soil and sediment
	Polychlorinated biphenyl (PCB) – not detected in previous soil samples; no records suggesting the disposal of old transformers at AOC 1	PCBs not retained as COPCs for soil and sediment
	Explosives – not analyzed during the previous investigation at AOC 1; however, due to proximity to the former ammunition bunkers, containers contaminated with explosives compounds may have been disposed at AOC 1	Explosives retained as COPCs for soil and sediment
	Metals – detected below current industrial soil RSLs and Eco-SSLs; however, detected in groundwater above screening criteria	Metals retained as COPCs for soil and sediment
Groundwater	VOCs – low level of toluene in one groundwater sample, but below current Maximum Contaminant Level (MCL) and tap water RSL	VOCs not retained as COPCs for groundwater, but may be reconsidered for the RI analytical suite, if drums are located during the geophysical surveys
	SVOCs – none detected in groundwater, but low levels of PAHs detected in soil	SVOCs (limited to PAHs) retained as COPCs for groundwater; PAHs are indicator of POL.
	Pesticides – DDE (above tap water RSL)	Pesticides retained as COPCs for groundwater

Table 10-1 Summary of Identified COPCs for AOC 1 (Continued)

Media	Potential Site Contaminants	Status
	PCBs – not detected in previous groundwater samples; no records suggesting the disposal of old transformers at AOC 1	PCBs not retained as COPCs for groundwater
	Explosives – not analyzed during the previous investigation at AOC 1; however, due to proximity to the former ammunition bunkers, containers contaminated with explosives compounds could have been disposed at AOC 1	Explosives retained as COPCs for groundwater
	Metals – Aluminum, arsenic, cadmium, chromium, cobalt, iron, lead, manganese, and mercury (above MCLs and/or tap water RSLs)	Metals retained as COPCs for groundwater

Notes:
Referenced: Bluestone Environmental Group, Inc. (Bluestone), 2019. Expanded Technical Memorandum, Former Naval Air Station (NAS), Cape May, New Jersey, Formerly Used Defense Site (FUDS) Project Number C02NJ0951. February 2019.

10.6 NATURE AND EXTENT OF CONTAMINATION

Potential surface spills and direct disposal of waste at AOC 1 may have led to the adsorption of contaminants to soil and sediment. COPCs may have also migrated to the buried marsh deposits in the subsurface ("Meadow Mat"), anticipated at a depth of approximately 6 to 10 ft bgs along the shoreline in AOC 1.

10.7 FATE AND TRANSPORT OF CONTAMINATION

Due to the porous nature of the sand substrate throughout AOC 1; the lack of adsorption material; the constant flushing of the area by tidal and storm activity; and the dynamic movement of sand in and out of the Cape May Inlet; transport of most of the contaminant material dumped over 40 years ago has probably occurred through redistribution via:

- Infiltration/leaching to subsurface soil and groundwater.
- Groundwater discharging to surface water.
- Erosion and runoff to sediments and beach sands.

Further, COPCs which have migrated to the subsurface may also be bound in the semipermeable organic peat and silt within the "Meadow Mat." Based on the limited data available for the Site, samples are needed to determine fate of DoD-related contaminants in potentially impacted environmental media. Additionally, analysis of physical parameters (i.e., grain size, total organic carbon [TOC], cation exchange capacity [CEC], oxidation reduction potential [ORP], pH, and moisture content) will be conducted to support the evaluation of fate and transport of site contaminants between media as well as provide information on contaminant bioavailability and exposure potential for completion of the risk assessment, as discussed in Section 10.8.

As a first estimate of the significance of sorption at a site, it is necessary to determine the polar and nonpolar nature of the material with which the contaminant will come into contact. This is usually done by measuring the cation exchange capacity and the natural organic carbon content, respectively (EPA, 1990). For example, large organic cations and heavy metals would not normally be expected to move far through soils with a measurable cation exchange capacity (EPA, 1990). TOC is used to calculate the soil to water partition coefficient (Kd) for organics; higher TOC indicates higher potential for sorption. Soil pH affects the partitioning behavior and mobility of metals and ionizing organic compounds (EPA, 1996). The ecotoxicity of select metals (e.g., aluminum and iron) are pH dependent. Soil particle size analysis (grain size) is performed to quantify the distribution of soil particle sizes, estimate average soil moisture conditions, and predict water percolation rates through the vadose zone (EPA, 1996). Moisture content is needed to express analytical results on a dry weight basis; volatility also differs between moist and dry soil. Oxidation-reduction potential (ORP) or redox potential is a measure of the intensity or activity of an aqueous environment or soil to mediate reactions of important elements in biological systems (e.g., O, N, Mn, Fe, S, and C) and other metallic elements. A positive ORP represents an environment conducive to the oxidation of an introduced substance by reduction of the original media (EPA, 2017).

10.8 EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS

The Expanded Technical Memorandum (Bluestone, 2019) identified the following potential receptors (Expanded Technical Memorandum CSM Figures included as **Figures 10-2** and **10-3**):

<u>Human Health Receptors and Exposure Routes</u>

- Current recreational visitors (adult recreational visitors – guided access only),
- Current adolescent trespassers, and
- Potential future construction workers.

The Site is located on the USCG Training Center Cape May and has restricted entry. However, occasional bird-watching groups may visit AOC 1 and surrounding areas with a guide. Recreational visitors may be exposed to contaminants in surface soil through ingestion and dermal contact. These escorted visitors are not anticipated to be frequently exposed to the shoreline sediment. Adolescent trespassers may be exposed to contaminants in surface soil and sediment through ingestion and dermal contact. Construction workers may potentially be exposed in the future if construction were to occur at AOC 1, to contaminants in surface and subsurface soil (0 to 10 ft bgs, or to the water table) through ingestion and dermal contact, and to shallow groundwater through dermal contact and inhalation of volatiles in trench air. Particulates in ambient air (dust arising from surface soil or subsurface soil during excavation activities) could also be a potential exposure medium (through inhalation). These pathways are considered potentially complete**.** While portions of AOC 1 are underwater, the surface water pathway will not be evaluated due to the proximity to the ocean and tidal intrusion. In addition, the area has been subject to numerous storm and tidal events over the decades since historic DoD-related dumping activities occurred, so current surface water conditions could not be attributed to historic activities.

Potential Ecological Receptors and Exposure Routes

There are two small areas within AOC 1 on land that are of potential concern for ecological receptors: the approximately 0.5-acre vegetated area in the eastern portion of AOC 1 and the narrow segment of beach (approximately 200 ft long) located west of the vegetated area. The remaining portions of AOC 1, primarily underwater, are extremely dynamic and have been subject to numerous storm and tidal events that resulted in a biotic zone whose current characteristics cannot be attributed to historical activity in the area. Although there is a limited likelihood of exposure of ecological receptors at AOC 1 to contamination resulting from historical DoD-related dumping activities, a screening-level ecological risk assessment will be conducted using the soil, sediment, and groundwater (presuming discharge to surface water) data collected. Physical parameters (e.g., TOC, pH) will be used to characterize the bioavailability of contaminants in soil and sediment and evaluate the potential toxicity of contaminants (e.g., iron and aluminum). As interstitial water concentration is the most accurate indicator of the bioavailable concentration, higher organic carbon content typically results in lower toxicity as metals and organics partition to sediment organic carbon (EPA, 2005d; EPA, 2009b). For example, total aluminum in soils is not considered suitable or reliable for the prediction of potential toxicity and bioaccumulation. Potential ecological risks associated with aluminum are identified based on the measured soil pH less than 5.5 (EPA, 2003a). The SLERA will evaluate direct contact and incidental ingestion of these media by comparing screening values in specific media to chemical concentrations to evaluate exposure to representative receptor categories. If appropriate, listed/species of special concern or interest will also be discussed. Intertidal zone receptors (benthic invertebrates/aquatic organisms and wading birds) may directly contact or incidentally ingest COPCs in sediment and COPCs in groundwater that may discharge to surface water. Wading birds may consume prey that has accumulated COPCs from sediment. Terrestrial receptors (plants, soil invertebrates, birds, and small mammals) may directly contact or incidentally ingest COPCs in soil. Herbivorous, invertivorous, and carnivorous birds and small mammals may consume prey that have accumulated COPCs from soil. Contact with subsurface soil and sediment (>1 ft bgs) is not considered to be of concern for ecological receptors, as burrowing organisms are not expected at this shoreline site. While evidence of red fox digging was observed at the Site during the Site habitat evaluation, this wide-ranging receptor is anticipated to have limited exposure to subsurface soil at this small (<0.5 acre) site. While inhalation and dermal contact may occur, these exposure routes are considered insignificant in relation to ingestion and because there is limited information to quantify these exposure routes.

10.9 DATA GAP ANALYSIS

The following approach and rationale addresses the five potential data gaps that were identified in the 2019 Expanded Technical Memorandum:

1. Characterization of Potential Buried Waste:

    a) To address this data gap a geophysical investigation is included in this Site assessment to identify any subsurface anomalies that are indicative of potential buried containerized waste. Up to 3 test pits will be conducted in the vicinity of identified objects to determine if they pose harm to the environment.

2. Soil and Sediment Data:

a) Additional subsurface soil data is required to further assess low levels of DDE and DDT that exceed current Eco-SSLs in one previous soil sample, and total metals (aluminum, arsenic, cadmium, chromium, cobalt, iron, lead, and mercury) that were detected above current MCLs and/or tap water RSLs in groundwater. There were no contaminants detected above current EPA industrial RSLs in soil at the AOC-1. To address this data gap up to 15 subsurface soil samples will be taken from 1-2 ft bgs and 2-4 ft bgs.

b) Additional surface soil samples will be taken to characterize the nature and extent of pesticides and metals impacts in AOC-1 under this Site investigation. Up to 15 surface soil samples will be taken to address this data gap.

c) Sediment was not collected during the previous investigation. To address this data gap, up to 15 sediment samples will be taken from a depth of 0-6" for the same set of parameters the Site soils will be sampled for.

3. Groundwater Data: Additional groundwater data is required to properly delineate the extent of impacts in AOC-1. There were no monitoring wells observed at AOC 1 during the Site visit in October 2018. To address this data gap:

a) Up to five monitoring wells will be installed in and in the vicinity of AOC-1 to determine if potentially buried waste has impacted Site groundwater.

b) Groundwater samples will be collected and analyzed for SVOCs, explosives, TAL metals and mercury, in order to properly characterize Site groundwater.

4. Insufficient Background Data: Previous investigations did not include background sampling for soil, sediment, or groundwater. To address this data gap:

a) Background locations will be identified and sampled for surface soils, subsurface soils, and sediment.

b) An upgradient/background monitoring well location will be included in the groundwater investigation.

WORKSHEET #11 PROJECT DATA QUALITY OBJECTIVES

The purpose of this QAPP is to provide guidance for generating data that are of the precision, accuracy, and completeness necessary for the intended end use of the data. The DQO process is a series of planning steps designed to ensure that the type, quantity, and quality of environmental data used in decision making are appropriate for the intended application. All non-chemistry data (e.g., geospatial, physical testing, hydraulic, field water quality, field screening) sets will not undergo the same type of usability analysis as analytical chemistry data (e.g., PARCCS analysis), but will be evaluated for usability. The results of the usability evaluation will be included in the remedial investigation report. There are seven steps in the DQO process; details of these steps are provided below.

- Step 1: State the Problem
- Step 2: Identify Decisions/Goals of the Study
- Step 3: Identify Inputs to the Decision
- Step 4: Define the Study Boundaries
- Step 5: Develop a Decision Rule/Analytic Approach
- Step 6: Specify Limits on Decision Errors
- Step 7: Optimize the Design for Obtaining Data

Steps 1 – 7 are outlined in the *EPA Guidance on Systematic Planning using the Data Quality Objective Process EPA QA/G-4* (EPA, 2006). Additional details on the systematic development of the DQOs are provided in the sections below.

11.1 STEP 1: STATEMENT OF PROBLEM

Historical dumping activities at the Abandoned Dumping Station (AOC 1) may have resulted in the release of contaminants to surface soil, subsurface soil, sediment, and groundwater. The DoD-related COPCs (PAHs, pesticides, explosives, and metals as discussed in Worksheet #10) may pose an unacceptable risk to human and ecological receptors.

11.2 STEP 2: DECISIONS/GOALS OF THE STUDY

The primary objective of this RI is to collect sufficient analytical data to develop the project components that will eventually result in a final Decision Document. This data will be used to define the nature and extent of Site impacts, support the development of a Human Health Risk Assessment (HHRA) and Screening-Level Ecological Risk Assessment (SLERA), and assess the need for remedial action. If it is determined that there is a need for a remedial action, a Feasibility Study will be completed to ascertain the appropriate technology for the Site. The following goals have been established for AOC 1:

- Do geophysical anomalies (interpreted as potential buried containerized waste, buried debris, metallic objects etc.), indicate materials specifically associated with former DoD dumping activities that should be excavated and sampled ? Are anomalies also interpreted as potential existing structures, infrastructure, and existing buried utilities that may conflict with proposed excavation and sampling?

- Are DoD-related COPCs present in soil, sediment, and/or groundwater that pose an unacceptable risk to human health and the environment and is there a need for risk-based remedial action?

11.3 STEP 3: INFORMATION INPUTS

The following information inputs will be used to satisfy the requirements for Step 2:

- Field observations
- Geophysical data from remote sensing and land-based investigations
- UAS-deployed LIDAR and aerial photography collection
- Ecological survey data from Endangered and Threatened Wildlife and Plant Species Habitat Evaluation (Dubois, 2020)
- Collection of physical parameters, geologic data, soil, and sediment, chemical laboratory data during Site subsurface investigation
- Collection of field parameters, including salinity and ORP, and groundwater analytical data

The detailed approach for acquiring these information inputs is provided in the sampling design and rationale presented in Worksheet 17.

11.4 STEP 4: DEFINE THE BOUNDARIES OF THE STUDY

Spatial and temporal boundaries of the study include the following:

- Spatial boundary of the decision statement:
  - The horizontal assessment will be conducted in AOC 1 and is estimated at approximately 2.12 acres.
  - The vertical assessment will include determination of the presence of the "Meadow Mat" and if it is a confining layer, its location and thickness, and the preparation of a hydrogeologic cross-section . The boundary may extend to the "Meadow Mat" or approximately 6 to 10 ft bgs, depending on the location and characterization of the Meadow Mat and the cross-section details.
- Temporal limit and scale of inference of the decision statement:
  - A schedule for fieldwork and project deliverables is presented in Worksheet 14 & 16.
- Practical constraints on data collection:
  - Field constraints may include:

- Equipment and sampling limitations due to weather conditions and accessibility due to debris present at the Site. Scheduling adjustments will be made if physical constraints on planned field events occur as well as for safety considerations.
- Sample locations may be restricted by the presence and location of utilities; the presence of UXOs; and the presence of ecologically sensitive receptors in certain location and in certain times of year.
- Sample locations may also be limited by the water line, which will limit access and/or require more complex deployment of equipment such by barge or diving.
- Work schedules will be constrained by tidal cycles, where work is required at low tide for access.
- Land-based geophysical data collection will be completed within the subject area in conjunction with low-tide to maximize the extent of survey area. Land-based geophysical surveying will not be completed in marine environments (ponded water, tidal/ocean waters, wetlands etc. Some areas may also restrict accessibility of geophysical instruments by topography or structures.
- Drone-based data collection will be completed within the subject area over land and marine environments during low-tide to maximize resolution. No restrictions to the survey area are identified at this time.

11.5 STEP 5: DECISION RULE/ANALYTICAL APPROACH

Development of an analytical approach involves the designation of action levels and use in evaluating decision rules. Each decision rule is a logical "if...then" statement defining conditions that would cause the decision maker to choose among alternative actions. For AOC 1, the decision rule is as follows:

- If COPCs are detected at levels below applicable human health and ecological screening criteria, then no further action is required.
- If COPCs are detected at levels greater than applicable human health screening criteria, conduct a Baseline HHRA to determine if contamination poses risks exceeding target risk thresholds to construction workers, adolescent trespassers, and recreational visitors.
- If COPCs are detected at levels greater than applicable ecological screening criteria, conduct a SLERA through Step 3a (refinement of COPCs) to determine if contamination poses risks to ecological receptors.

The essential components of the analytical approach for decision making can be summarized as follows:

- Collection of soil, sediment, and groundwater samples from locations designated in Worksheets #17 & #18.

- Analyses of soil, sediment, and groundwater samples and physical parameters to generate chemical data in accordance with requirements in Worksheets #17 & #18 that can be used to evaluate compliance with compliance limits in Worksheet #15.

Analytical samples will be analyzed by Eurofins. Eurofins is DoD Environmental Laboratory Accreditation Program (ELAP) accredited. A copy of the laboratory certification is presented in **Appendix B**. Laboratory data will be delivered in compliance with the DoD Quality Systems Manual (QSM) Version 5.4 (v5.4) (DoD, 2021) with EDDs for each sample analytical batch received. Samples will be shipped via preservative and chain of custody requirements specified in Worksheets #26 & 27.

Data verification and validation will be performed in accordance with this UFP-QAPP, the DoD QSM v5.4, and EPA National Functional Guidelines (November 2020) (in priority order). Laboratory data verification/validation will be performed by a third-party chemist who is unaffiliated with the project to satisfy the requirements for independent review of analytical data. One hundred percent of the definitive level data will undergo data verification including review of holding times, blanks, laboratory QC samples, field QC samples, and instrument calibration data.

11.6 STEP 6: LIMITS ON DECISION ERRORS

There are two types of decision errors regarding analytical data: sampling design errors and measurement errors. Sampling design errors are a function of the sampling design, planning, and implementation used for compliance. Although measurement error includes performance variance from laboratory instrumentation, analytical methods, and operator error, procedures relating to sample collection and data recording are also relevant. The EPA identifies the combination of all these errors as “total study error” (EPA, 2006). Elimination of decision errors is necessary to ensure decision-makers can be confident that analytical data accurately represent the conditions of the Site with respect to compliance criteria, including use in statistical analyses. The possible decision errors regarding analytical data are:

- Concluding that a contaminant is present at a location or in media when it is not actually present (i.e., false positive result/Type I Error). This error results in additional compliance actions, including sampling, or corrective actions at a site or for an analyte when they are not necessary.

- Concluding that a contaminant is not present at a location or in media when it is actually present. This error results in not performing additional compliance actions, including sampling, or corrective actions at a site or for an analyte when they are necessary (i.e., false negative result/Type II Error).

- Interpretation of geophysics results (penetration limits, non-unique anomaly interpretations). Geophysical anomalies are interpreted and recognized by their unique signature including orientation, contrast to background, magnitude, and shape. This error results misinterpretation of an anomaly or non-unique feature. Denoted anomalies are based upon the interpreted signal response as a distinctly unique feature. This error results in performing additional compliance actions, or exploration of objects not necessarily representative of targets that are the focus of the evaluation. Geophysical

anomalies may also be representative of UXO. . Positional accuracy is reliant on post-processed RTK and GPS corrected locations offering sub-foot accuracy.

- Concluding that anomaly is an HTRW target of interest when it is not. This error results when an anomaly has a non-unique signature, meets the definition of an HTRW anomaly, or suffers from poor location resolution.

- Concluding that anomaly is not HTRW target of interest when it is. This error results when an anomaly has a non-unique signature, the HTRW anomaly definition is inadequate for the site, or suffers from poor location resolution.

Sampling design errors will be limited to the extent practicable by following approved EPA methods, the UFP-QAPP processes, and applicable Standard Operating Procedures (SOPs) Validated, definitive analytical data will be required to evaluate measurement error. In addition, verification of field documentation is necessary to ensure identification of samples is consistent and accurate. Measurement error will also be evaluated by calibration of field instruments and notations regarding any performance variances during sampling activities. Potential decision errors will be minimized by using the following actions:

- Adherence to sampling methodology, analyses, and reporting summarized in Worksheets #17 & #18.

- Use standard field sampling methodologies as discussed in Worksheets #17 & #18. Perform sampling activities in accordance with SOPs.

- Evaluation of field data using criteria stipulated in Worksheets #12, #15, #22, #24 & #25, and SOPs relevant to the tasks performed.

- Use applicable analytical methods (Worksheet #23) for sample analysis by an analytical laboratory certified by the DoD ELAP according to the DoD QSM v5.4 to reduce measurement errors.

- Confirm analytical data to identify and control potential laboratory error and sampling error using spikes, blanks, and duplicates in accordance with Worksheet #20, and #28. Data will be validated and compared with performance metrics in Worksheets #12, #15, #28, #37, the DoD QSM v5.4, EPA National Functional Guidelines, EPA Methods, and laboratory SOPs.

- Post-processing analysis of geophysical datasets and comparison/contrasting of datasets from all techniques to refine and resolve potential exploration targets. Utilizing available and supplied information, such as historical aerial photography, blueprint plans, schematics, and utility plans, to resolve interpreted anomalies coincident to observed features.

- For geophysical data collection, drone and land-based surveying will include calibration of known metal objects for baseline comparison to all anomaly's datasets.

11.7 STEP 7: DEVELOP THE PLAN FOR OBTAINING DATA

Worksheets #17 & #18 present the detailed sampling design for AOC 1. Worksheets #19 & #30, #20, and #24 through #28 specify analytical design requirements. Worksheet #15 presents the human health and ecological project action limits that investigation results for definitive data will be compared to. The SOPs for field activities are referenced in Worksheet #21 and contained in **Appendix D**.

WORKSHEET #12 MEASUREMENT PERFORMANCE CRITERIA

WORKSHEET #12.1 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR SVOCS AND TCLP SVOCS

Matrix: Groundwater and IDW Water
Analytical Group / Method: Full Scan SVOCs / EPA Methods 3510C (separatory funnel extraction) and 8270E (analysis)
Matrix: Soils, Sediments, and IDW Solid
Analytical Group / Method: Full Scan SVOCs / EPA Methods 3546 (microwave extraction) and 8270E (analysis)
Matrix: TCLP Leachate of IDW Solid
Analytical Group / Method: TCLP SVOCs / EPA Methods 1311 (TCLP extraction), 3510C (separatory funnel extraction) and 8270E (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Method Blank
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Equipment Blank (associated only with investigative soil, sediment, and groundwater samples and not IDW samples)
Accuracy/Bias	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C. If not listed, the laboratory will use in-house control limits.	LCS
	1 per batch of 20 samples. 1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables C-25 (solid) and C-26 (water). If not listed, the laboratory will use in-house control limits.	MS/MSD (associated only with investigative soil, sediment, and groundwater samples, not IDW)
	For each sample, retention times ± 10 seconds from retention time of midpoint standard in the ICAL; and EICP area within -50 to + 100% of ICAL midpoint standard.	IS
	Water - Within recovery limits; Table C-26 of Appendix C, DoD QSM v5.4 and Worksheet 28.1. Solids - Within recovery limits; Table C-25 of Appendix C, DoD QSM v5.4 and Worksheet 28.1.	Surrogates
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD (Soil/sediment and Groundwater only)

WORKSHEET #12.1 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR SVOCS AND TCLP SVOCS (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
		Field duplicates (Soil/sediment and Groundwater only)
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24	ICAL, ICV, CCV, and DFTPP Tune

Notes:

IDW solid will be analyzed for the short list of Toxicity Characteristic Leaching Procedure (TCLP) SVOCs specified in Method 1311.

WORKSHEET #12.2 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR PAHS AND 1,4-DIOXANE BY SELECTIVE ION MONITORING (SIM)

Matrix: Groundwater
Analytical Group / Method: PAHs and 1,4-Dioxane / EPA Methods 3510C (separatory funnel extraction) and 8270E (SIM) (analysis)
Matrix: Soils and Sediment
Analytical Group / Method: PAHs and 1,4-Dioxane / EPA Methods 3546 (microwave extraction) and 8270E (SIM) (analysis)
Concentration Level: Trace

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Method Blank
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Equipment Blank
Accuracy/Bias	Recovery limits per QSM 5.4 or Laboratory statistical control limits for compounds not in QSM 5.4.	LCS and LCSD
	Recovery limits per QSM 5.4 or Laboratory statistical control limits for compounds not in QSM 5.4.	MS/MSD
	Recovery limits per QSM 5.4 or, if not listed in QSM, laboratory statistical control limits.as listed in Worksheet 28.2.	Surrogates
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD Field duplicates
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24	ICAL, ICV, CCV, and DFTPP Tune

WORKSHEET #12.3 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ORGANOCHLORINE PESTICIDES

Matrix: Groundwater
Analytical Group / Method: Organochlorine Pesticides / EPA Methods 3510C (separatory funnel extraction) and 8081B (analysis)
Matrix: Soil and Sediment
Analytical Group / Method: Organochlorine Pesticides / EPA Methods 3546 (microwave extraction) and 8081B (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Method Blank
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Equipment Blank
Accuracy/Bias	1 per batch of 20 samples. Percent Recovery acceptance criteria vary by analyte, as specified by DoD QSM v5.4 Appendix C, Table C-15 (soil) and Table C-16 (water). If not listed, the laboratory will use in-house control limits.	LCS
	1 per batch of 20 samples. Percent Recovery acceptance criteria vary by analyte, as specified by DoD QSM v5.4 Appendix C, Table C-15 (soil) and Table C-16 (water). If not listed, the laboratory will use in-house control limits.	MS/MSD
	Water - Within recovery limits; Table C-16 of Appendix C, DoD QSM v5.4. Solids - Within recovery limits; Table C-15 of Appendix C, DoD QSM v5.4.	Surrogates
	Before sample analysis and at the beginning of each 12-hour shift, DDT and Endrin degradation each ≤15%.	Endrin/DDT Breakdown Check
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD Field duplicates
Precision	%RPD between dual column results ≤ 40% (≤ 25% validation criteria).	Dual column sample concentrations

WORKSHEET #12.3 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ORGANOCHLORINE PESTICIDES (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24	ICAL, ICV, and CCV

WORKSHEET #12.4 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR EXPLOSIVES

Matrix: Groundwater
Analytical Group / Method: Explosives / EPA Methods 3535A (solid phase extraction) and 8330B (analysis).
Matrix: Soil and Sediment
Analytical Group / Method: Explosives / EPA Method 8330B (preparation and analysis).
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Equipment Blank
Accuracy/Bias	1 per batch of 20 samples. Within recovery limits; Table C-36 of Appendix C, DoD QSM v5.4.	LCS
	1 per batch of 20 samples. Within recovery limits; Table C-36 of Appendix C, DoD QSM v5.4.	MS/MSD
	Water - Within recovery limits; Table C-36 of Appendix C, DoD QSM v5.4. Solids - Within recovery limits; Table C-37 of Appendix C, DoD QSM v5.4.	Surrogates
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD Field duplicates
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24.	ICAL, ICV, and CCV

WORKSHEET #12.5 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ICP-AES METALS AND TCLP METALS

Matrix: IDW Water
Analytical Group / Method: Metals / EPA Methods 3005A (acid digestion) and 6010D (analysis).
Matrix: IDW Solid
Analytical Group / Method: Metals / EPA Methods 3050B (acid digestion) and 6010D (analysis)
Matrix: TCLP Leachate of IDW Solid
Analytical Group / Method: TCLP Metals / EPA Methods 1311 (TCLP extraction), 3005A (acid digestion), and 6010D (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Before beginning an analytical run, every 10 field samples, and at the end of the analysis sequence. No analytes detected > LOD.	Initial and Continuing Calibration Blanks
	Not required for IDW samples.	Equipment Blank
Accuracy/Bias	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables. If not listed, the laboratory will use in-house control limits.	LCS
	Not required for IDW samples.	MS/MSD
	Not required for IDW samples.	Serial Dilution
Bias	*Not required for IDW samples.*	Post Digestion Spike Addition
Precision	When analyzed, LCS/LCSD samples should have RPD ≤ 20%. *MS/MSD and field duplicates are not required for IDW samples.*	LCS/LCSD MS/MSD Field duplicates

WORKSHEET #12.5 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ICP-AES METALS AND TCLP METALS (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	± 20% of true concentration daily.	Low Level Calibration Check Standard
	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	If more than one standard is used, r ≥ 0.995 daily.	ICAL
Accuracy	After ICAL, prior to beginning a sample run, 90-110 %R.	ICV
	After every 10 sample injections and at the end of the run, 90-110 %R.	CCV
	At beginning of analytical run, absolute value of the true concentration < LOD.	ICS-A
	± 20% of true concentration at beginning of analytical run.	ICS-AB

Notes:
Water IDW will be analyzed for total RCRA metals plus copper, nickel, and zinc to satisfy the disposal facility requirements.
Solid IDW will be analyzed for total RCRA metals plus copper, nickel, vanadium, and zinc to satisfy the disposal facility requirements.
Solid IDW will be analyzed for the TCLP Metals plus copper, nickel, and zinc to satisfy the disposal facility requirements.

WORKSHEET #12.6 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ICP-MS METALS

Matrix: Groundwater
Analytical Group / Method: Metals / EPA Methods 3005A (acid digestion) and 6020B (analysis)
Matrix: Soil and Sediment
Analytical Group / Method: Metals / EPA Methods 3050B (acid digestion) and 6020B (analysis)
Concentration Level: Trace

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Before beginning an analytical run, every 10 field samples, and at the end of the analysis sequence. No analytes detected > LOD.	Initial and Continuing Calibration Blanks
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Equipment Blank
Accuracy/Bias	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables. If not listed, the laboratory will use in-house control limits.	LCS
	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables. If not listed, the laboratory will use in-house control limits.	MS/MSD
	1 per batch of 20 samples. 5x dilution must agree within 10% of the original result.	Serial Dilution
Bias	When dilution test fails or analyte concentration is <50x LOD, recovery limits 80-120%.	Post Digestion Spike Addition
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD Field duplicates

WORKSHEET #12.6 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ICP-MS METALS (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	± 20% of true concentration daily.	Low Level Calibration Check Standard
	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	If more than one standard is used, r ≥ 0.995 daily.	ICAL
Accuracy	After ICAL, prior to beginning a sample run, 90-110 %R.	ICV
	After every 10 sample injections and at the end of the run, 90-110 %R.	CCV
	At beginning of analytical run, absolute value of the true concentration < LOD.	ICS-A
	± 20% of true concentration at beginning of analytical run.	ICS-AB
	Prior to ICAL, mass calibration ≤ 0.1 atomic mass unit (amu) from the true value; resolution < 0.9 amu full width at 10% peak height.	Instrument Tuning

WORKSHEET #12.7 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR MERCURY AND TCLP MERCURY

Matrix: Groundwater and IDW Water
Analytical Group / Method: Total Mercury / EPA Method 7470A (preparation and analysis)
Matrix: Soil, Sediment and IDW Solid
Analytical Group / Method: Total Mercury / EPA Method 7471B (preparation and analysis)
Matrix: IDW Solid
Analytical Group / Method: TCLP Mercury / EPA Methods 1311 (TCLP extraction) and 7470A (preparation and analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Before beginning an analytical run, every 10 field samples, and at the end of the analysis sequence. No analytes detected > LOD.	Initial and Continuing Calibration Blanks
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Equipment Blank (investigative samples only, not IDW samples)
Accuracy/Bias	Daily or 1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables. If not listed, the laboratory will use in-house control limits.	LCS
	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C Tables. If not listed, the laboratory will use in-house control limits.	MS/MSD (investigative samples only)
	1 per batch of 20 samples. 5x dilution must agree within 10% of the original result.	Serial Dilution (investigative samples only)
Bias	When dilution test fails or analyte concentration is <50x LOD, recovery limits 80-120%.	Post Digestion Spike Addition (investigative samples only)
Precision	For LCS/LCSD and MS/MSD, RPD ≤ 20% When analyzed, all normal and field duplicate samples should have RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	LCS/LCSD MS/MSD Field duplicates (investigative samples only)

WORKSHEET #12.7 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR MERCURY AND TCLP MERCURY (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	If more than one standard is used, r ≥ 0.995 daily.	ICAL
	After ICAL, prior to beginning a sample run, 90-110 %R.	ICV
	After every 10 sample injections and at the end of the run, 90-110 %R.	CCV

WORKSHEET #12.8 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR HEXAVALENT CHROMIUM BY 7196A

Matrix: Groundwater (contingent) and IDW Water (required)
Analytical Group / Method: Hexavalent chromium / EPA Method 7196A (preparation and analysis)
Matrix: Soil and Sediment (contingent) and IDW Solid (required)
Analytical Group or Method: Hexavalent chromium / EPA Methods 3060A (alkaline digestion for soils) and 7196A (analysis).
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	1 per day, when using non-dedicated or non-disposable equipment. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Equipment Blank (associated only with investigative samples, not IDW)
Accuracy/Bias	Water LCS and MS/MSD recovery within laboratory limits of 85-115%. Solid LCS (insoluble) recovery within laboratory limits of 85-115%. Solid MS (soluble and insoluble) recovery within laboratory limits of 75-125%. Post-digestion spike (PDS) recovery within 85-115%.	LCS MS/MSD (groundwater) MS (soluble and insoluble for soil and sediment)
Precision	RPD ≤ 20% when detects for samples are > LOQ. Acceptance criteria specified by DoD QSM 5.4 Appendix B table.	MS/MSD (required only for groundwater) Laboratory duplicate (required only for investigative samples)
Precision	RPD ≤ 30% for water field duplicates and ≤ 50% for solid field duplicates (when both samples exceed the LOQ).	Field Duplicates (investigative samples only)
Sensitivity	Ideally, the LOQ, which is verified or updated annually by the laboratory, will be at least 3 to 10 times lower than the PAL or PQL goal.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Sensitivity	Detection limits ≤ to PALs	Detection Limits

WORKSHEET #12.9 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR CATION EXCHANGE CAPACITY

Matrix: Soil and Sediment
Analytical Group / Method: Cation Exchange Capacity / EPA Method 9081
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Accuracy (Bias/Contamination)	Daily and/or 1 per batch of up to 20 samples. No analytes detected > RL	Method Blank
Precision	RPD $\leq$ 20 %	Sample Duplicate

WORKSHEET #12.10 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR TOTAL CYANIDE AND REACTIVE CYANIDE IN IDW

Matrix: IDW Solid
Analytical Group / Method: Total Cyanide / EPA Method 9012B (preparation and analysis)
Matrix: IDW Solid and IDW Water
Analytical Group / Method: Reactive Cyanide / EPA Methods Chapter 7.3 (reactivity preparation) and 9012B (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Not required for IDW	Field Blank
Accuracy/Bias	1 per batch of 20 samples. The laboratory will use in-house control limits.	LCS MS and MSD not required for IDW.
Precision	RPD ≤ 20%	Laboratory Duplicate
Precision	*Not required for IDW*	Field Duplicate
Completeness	≥ 95% after data validation is complete.	Data completeness check
Sensitivity	Detection limits ≤ to PALs (Comparison to TSDF acceptance limits). See Worksheet 15.	Sample results will be provided to TSDF to determine how IDW will be profiled and disposed.

WORKSHEET #12.11 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR REACTIVE SULFIDE IN IDW

Matrix: IDW Solid and IDW Water
Analytical Group or Method: Reactive Sulfide / EPA Methods Chapter 7.3 (reactivity preparation) and 9034 (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Not required for IDW.	Field Blank
Accuracy/Bias	1 per batch of 20 samples. The laboratory will use in-house control limits of 56-104%R.	LCS *MS and MSD not required for IDW.*
Precision	*Not required for IDW.*	Laboratory Duplicate
Precision	*Not required for IDW*	Field Duplicate
Completeness	≥ 95% after data validation is complete.	Data completeness check
Sensitivity	Detection limits ≤ to PALs (Comparison to TSDF acceptance limits).	Sample results will be provided to TSDF to determine how IDW will be profiled and disposed.

WORKSHEET #12.12 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR CORROSIVITY (PH) IN IDW

Matrix: IDW Water and IDW Solid
Analytical Group / Method: Corrosivity (pH) / EPA Method 9040C (water) and EPA Method 9045D (solid)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	*Not Applicable.*	Method Blank and Equipment Blank
Accuracy/Bias	LCS within ± 0.1 pH units of 7.0 (i.e., 6.9 – 7.1 pH units)	LCS
	Not Applicable.	MS/MSD
Precision	Laboratory statistical RPD (within ± 0.1 pH units).	Laboratory Duplicates
Sensitivity	Sample results will be provided to Treatment, Storage, and Disposal Facility (TSDF) to determine IDW samples profiling and disposal.	Comparison to TSDF acceptance criteria and analytical method specifics.
Completeness	≥ 95% after data validation is complete.	Data completeness check

WORKSHEET #12.13 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR FLASHPOINT AND IGNITABILITY

Matrix: IDW Water and IDW Solid
Analytical Group / Method: Flashpoint (liquid) / EPA 1010A
Analytical Group / Method: Ignitability (solid) / 40 CFR Part 261.21
Concentration Level: Not applicable

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Accuracy/Bias	*Not applicable*	LCS Solid
Accuracy/Bias	LCS prepared from o-xylene flashes between 78.5 and 83.49°F.	LCS Water
Precision	Laboratory statistical RPD	Duplicates
Completeness	≥ 95% after data validation is complete.	Data completeness check

WORKSHEET #12.14: MEASUREMENT PERFORMANCE CRITERIA FOR TOTAL ORGANIC CARBON (TOC)

Matrix: Soil, Sediment, and IDW Solid
Analytical Group / Method: Total Organic Carbon / EPA Method 9060A
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Not required.	Field Blank
Accuracy/Bias	50-153%R	LCS MS and MSD (soil/sediment only. Not required for IDW)
Precision	20% RPD	LCS/LCSD MS/MSD (soil/sediment only)
Quadruplicate Precision	None. Laboratory will not run quadruplicates.	Replicate (4) analyses of each sample
Precision	*Not required.*	Field Duplicate
Completeness	≥ 95%.	Data completeness check
Sensitivity	Ideally, the LOQ, which is verified or updated annually by the laboratory, will be at least 3 to 10 times lower than the PAL or PQL Goal.	Comparison of PAL or PQL Goal with LOQ on WS 15.

WORKSHEET #12.15 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR NEW JERSEY EXTRACTABLE PETROLEUM HYDROCARBONS

Matrix: IDW Solid
Analytical Group / Method: New Jersey (NJ) Department of Environmental Protection (DEP) Extractable Petroleum Hydrocarbons (EPH)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	No analytes detected > LOQ	Method Blank
Accuracy/Bias	%R 40%-140%: o-Terphenyl, 1-Chlorooctadecane, 2-Fluorobiphenyl, and 2-Bromonaphthalene in surrogate spike.	Surrogates
	Not required for IDW.	MS/MSD
	40%-140%R	LCS and LCSD
Precision	RPD ≤ 25%	LCS/LCSD MS/MSD and field duplicates (not required)
Sensitivity	Detection limit compared to project action limits to be determined by disposal facility.	LOD Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	Aromatics C30 / Aromatics C20 > 0.8	Breakthrough
	Naphthalene and 2-Methylnaphthalene in aliphatic fraction must be < 5% of total recovered amount in both aromatic and aliphatic fractions	Mass discrimination

WORKSHEET #12.16 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR TOTAL PETROLEUM HYDROCARBONS (TPH) AS DIESEL RANGE ORGANICS (DRO)

Matrix: IDW Water
Analytical Group / Method: TPH-DRO / EPA Method 8015D (C10-C28)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	No analytes detected > LOQ	Method Blank
Accuracy/Bias	o-Terphenyl recovery 56-125%R	Surrogates
	Not required for IDW.	MS/MSD
	36-132%R	LCS and LCSD
Precision	RPD ≤ 20%	LCS/LCSD MS/MSD and field duplicates (not required)
Sensitivity	Detection limit compared to project action limits to be determined by disposal facility.	LOD Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check

WORKSHEET #12.17 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR POLYCHLORINATED BIPHENYLS (PCBS)

Matrix: IDW Water
Analytical Group / Method: PCBs / EPA Methods 3510C (separatory funnel extraction) and 8082A (analysis).
Matrix: IDW Solid
Analytical Group / Method: PCBs / EPA Methods 3546 (microwave extraction) and 8082A (analysis).
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily and/or 1 per batch of up to 20 samples. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Method Blank
	Not required for IDW.	Equipment Blank
Accuracy/Bias	Water: PCB-1016: 46-129%R PCB-1260: 45-134%R Solids: PCB-1016: 47-134%R PCB-1260: 53-140%R	LCS
	Not required for IDW.	MS/MSD
	Surrogates for Water Matrix: Decachlorobiphenyl: 10-148%R (lab limit, not specified in QSM 5.4) Tetrachloro-m-xylene: 33-137%R (lab limit, not specified in QSM 5.4) Surrogates for Solid Matrix: Decachlorobiphenyl: 66-130%R (lab limit, not specified in QSM 5.4) Tetrachloro-m-xylene: 44-130%R	Surrogates
Precision	For LCS/LCSD RPD ≤ 30%	LCS/LCSD *MS/MSD and Field duplicates - not required for IDW*

WORKSHEET #12.17 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR POLYCHLORINATED BIPHENYLS (PCBS) (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24.	ICAL, ICV, and CCV

WORKSHEET #12.18 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR VOCS AND TCLP VOCS

Matrix: IDW Water
Analytical Group / Method: Full Scan VOCs / EPA Methods 5030C (purge and trap) and 8260D (analysis)
Matrix: IDW Solid
Analytical Group / Method: Full Scan VOCs / EPA Methods 5035A (EnCore option) and 8260D (analysis)
Matrix: TCLP Leachate of IDW Solid
Analytical Group / Method: TCLP VOCs / EPA Methods 1311 (TCLP extraction) and 8260D (analysis)
Concentration Level: Low

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Daily or 1 per 12 hour run. No analytes detected > 1/2 LOQ and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected > LOQ.	Method Blank
	Not required for IDW.	Field Blanks
Accuracy/Bias	1 per batch of 20 samples. Percent recovery acceptance criteria for soil and waters vary by analyte, as specified by DoD QSM 5.4 Appendix C. If analyte is not listed, the laboratory will use in-house control limits.	LCS
	Not required for IDW.	MS/MSD (associated only with investigative soil, sediment, and groundwater samples and not IDW samples)
	For each sample, retention times ± 10 seconds from retention time of midpoint standard in the ICAL; and EICP area within -50 to + 100% of ICAL midpoint standard.	IS
	Water - Within recovery limits; Table C-24 of Appendix C, DoD QSM v5.4 Solid: Within recovery limits; Table C-23 of Appendix C, DoD QSM v5.4 TCLP VOCs: all surrogate recoveries 70-130 %R.	Surrogates
Precision	LCS/LCSD RPD ≤ 20% *Not required for IDW.*	LCS/LCSD MS/MSD and field duplicates (not required for IDW

WORKSHEET #12.18 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR VOCS AND TCLP VOCS (CONTINUED)

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Sensitivity	Initial establishment and quarterly verification. Laboratory establishes the LOD by spiking a matrix at 2-4x the DL.	LOD Determination and Verification
	Initial establishment and quarterly verification. Laboratory sets the LOQ within the calibration range of the instrument. The LOQ must be greater than or equal to the lowest initial calibration standard.	LOQ Determination and Verification
Completeness	≥ 95% after data validation is complete.	Data completeness check
Accuracy	See Worksheet #24	ICAL, ICV, CCV, and BFB Tune

Notes:
The disposal facility requires full list VOCs for IDW water and IDW Solid samples plus, the IDW Solid samples, a TCLP VOC analysis is required.

WORKSHEET #12.19 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR GRAIN SIZE ANALYSIS

Matrix: Soil and Sediment
Analytical Group / Method: Grain Size with Hydrometer / ASTM Method D422
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Accuracy/Bias	Not applicable	LCS
Precision	Not applicable	Lab Duplicates
Sensitivity	Not applicable	LOD Determination and Verification

WORKSHEET #12.20 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR EXTRACTABLE ORGANIC HALIDES (EOX)

Matrix: IDW Solid
Analytical Group / Method: EOX / EPA 9023
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Bias/Contamination and Representativeness	Prepare and analyze daily every 10 samples. No detection detected > LOQ.	Method Blank
	Not required for IDW.	Field Blanks
Accuracy/Bias	Recovery within ± 10% of true value	LCS *MS not required for IDW sample.*
Precision	RPD ≤ 20%	Lab Duplicates
Sensitivity	Not applicable	LOD Determination and Verification

WORKSHEET #12.21 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR FIELD WATER QUALITY DATA

Matrix: Water
Analytical Group or Method: pH, ORP, temperature, conductivity
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Accuracy/Sensitivity	Instrument reading during calibration check	Initial, mid-day, and end of day calibration.
Precision	RPD as set by project	Field duplicate
Completeness	100% of field data collected	Data completeness check

WORKSHEET #12.22 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR POSITIONAL DATA

Matrix: N/A
Analytical Group or Method: GPS
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Accuracy/Sensitivity	UAS horizontal accuracy +/- 0.5 ft via on board GPS UAS vertical accuracy +/- 0.5 ft via on board laser altimeter Sensor positional accuracy +/- 1 ft Terrestrial GPS controls real time differential corrections +/- 12 inches	Two registered benchmarks will be installed to meet land survey tolerances. 2 Control points for survey start, mid, end of day
Completeness	100% of field data collected	Data completeness check

WORKSHEET #12.23 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR DIGITAL GEOPHYSICAL MAPPING DATA

Matrix: N/A
Analytical Group or Method: Digital Geophysical Mapping (DGM) Survey Operations
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Static repeatability	Response (mean static spike minus mean static background) within error budget of predicted response.	Daily dataset review for repeatable anomaly characteristics (see dynamic detection repeatability)
Coverage - Completeness	DRONE Based: 100% coverage at approximately 3-meter spacing. LAND Based: >95% non-marine areas with <1-meter spacing.	Grid and dataset review; verification of conformance to measurement quality objectives for Drone and Land survey spacing. Identify and address data gaps in the field; perform overlap of datasets for quality control and comparison of datasets.
Detection Sensitivity	Detection threshold of unique anomaly as having a signal-to-noise-ratio >5. Depth penetration of land-based geophysical techniques of 15 ft (depending on soil characteristics).	Post-processing analyses and ground-truthing calibration of known objects observed on- Site.
Target selection and Anomaly Resolution	All dig list targets are selected according to project design. Anomalies interpreted to be smaller than minimum target size ('bucket') shall have low priority for target exploration. Magnitude of signal for a given anomaly can be a result of larger features (i.e., bathtub) at greater depths or smaller feature (i.e., wrench) and shallow depths.	Grid and dataset review; Cross correlation and post-processing methods to gauge size and depth.
Geodetic equipment functionality	Position offset of known/temporary control point(s) within 10 centimeters.	Daily
Geodetic accuracy	With position correction from base station GPS systems, drone position accuracy of targets is +/- 0.25m. Land based GPS systems accuracy 0.15 meters	Establish base station GPS system with real-time corrections. Post-processing corrections to geodetic systems.

WORKSHEET #12.24 MEASUREMENT PERFORMANCE CRITERIA TABLE FOR ANALOG GEOPHYSICAL DATA

Matrix: N/A
Analytical Group or Method: Analog Survey Operations
Concentration Level: N/A

DQI	MPC	QC Samples and/or Activity to Assess Measurement Performance
Repeatability (instrument functionality)	All items in instrument test strip (ITS) detected (operator trains ear daily to items of interest). Random blind reconfiguration of the ITS will be conducted at a frequency of once per 5-25 working field days.	The ITS will be run once daily prior to any surveying. The ITS will be seeded with four medium ISOs: two buried at 95-100% of their maximum detection depth and two buried at 12-inches below ground surface. One seed of each pair will be placed at the worst angle of detection, and one will be placed at the best angle of detection.
Coverage, detection, and recovery	All blind coverage seeds and blind detection seeds recovered. All items in the ITS are detected daily. Lane spacing does not exceed 5-ft. Lane spacing is reduced where necessary to address difficult terrain considerations.	Blind seeds (medium industry standard object [ISOs]) randomly placed in both horizontal and vertical orientations (approximately 50% in each orientation). A total of 1-2 medium ISOs buried deep (95-100% of detection depth), and 1-3 medium ISOs buried shallow (2-12 inches bgs) per operator per day.
Anomaly Resolution	Check open holes using a White's MXT, or equivalent. 90% confidence < 1% unresolved anomalies.	Varies by lot size
Geodetic equipment functionality	Instrument positioning will be within 1.0 meter of a known point location surveyed via GPS.	Daily collection of instrument positioning point
Geodetic accuracy	Project control points that are used more than once must be repeatable to within 5 cm.	Monthly and before use check

Notes for Worksheets 12.1 through 12.24:

DoD QSM v5.4 refers to the 2021 DoD DOE *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories Version 5.4*. Based on ISO/IEC 17025:2005(E) and the NELAC Institute (TNI) Standards, Volume 1 (DoD, 2021).

%R = percent recovery
amu = atomic mass unit
BFB = 4-bromofluoro-benzene
CCV = continuing calibration verification
DDT = Dichlorodiphenyltrichloroethane
DFTPP = Decafluorotriphenylphosphine
DL = detection limit
DoD = Department of Defense
DOE = Department of Energy
DQI = data quality indicator
EICP = extracted ion current profile
ft = feet
ICAL = initial calibration
ICS-A = Interference Check Standard A
ICS-AB = Interference Check Standard AB
ICV = initial calibration verification
IS = internal standard
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOD = limit of detection
LOQ = limit of quantitation
MPC = measurement performance criteria
MS = matrix spike
MSD = matrix spike duplicate
QA = quality assurance
QC = quality control
QSM = Quality Systems Manual
RPD = relative percent difference
RRT = relative retention time
RSD = relative standard deviation
SVOC = semi-volatile organic compound
TNI = the NELAC Institute
VOC = volatile organic compound

WORKSHEET #13 SECONDARY DATA CRITERIA AND LIMITATIONS

This worksheet identifies sources of existing and historical data pertinent to project decisions. For each data source, the following considerations were evaluated: whether the data was validated or reviewed, whether the analytical methodologies or technical protocols are comparable to current data handling procedures, and if limitations on use of the data can be identified.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Use for Project	Limitations on Data Use
Analytical data	Bluestone Environmental Group, Expanded Technical Memorandum, February 2019	Figures, Historical Data, and Boring Logs from Ogden (1998)	None
Historical Information		Site background and historical records review (citations incorporated by reference)	None

WORKSHEET #14 & #16 PROJECT TASKS AND SCHEDULE

The following table summarizes the schedule for project activities.

Table 14-1 Project Schedule

Activity	StartDate	Deliverable	Due Date
Monthly Status Reporting	Monthly	Monthly Status Report	By the 10th of each month
Review of Existing Data, Data Gap Evaluation, and Coordination Meeting	7/11/19	Meeting Minutes	9/18/19
Geophysical Investigation Work Plan	8/22/19	Draft and Final Geophysical Work Plan, Accident Prevention Plan (APP) and Activity Hazard Analysis (AHA) (**Appendix C**)	11/4/19, 12/10/19
UFP-QAPP, Work Plan, and Health and Safety Plan	11/24/20	Draft, ITR/CX Draft, Stakeholder Draft and Final QAPP, Remedial Investigation Work Plan, APP, Site Safety and Health Plan (SSHP) and AHA	5/26/21. 8/14/21, 1/7/22, 2/4/22, 3/4/22
Community Relations Plan and Support	3/7/22	Draft, Draft, and Final PIP, Fact Sheets	4/1/22, 5/6/2022, 6/10/22
Geophysical Investigation	12/9/19	Draft and Final Geophysical Report	2/28/2020, 1/7/2022
RI Field Work	7/1/2022	N/A	9/22/2022
Field Report	9/3/2022	Field Report	10/13/2022
RI Project Team Meeting	11/4/2022	Agenda/Draft and Final Meeting Minutes	2 days prior to meeting/7 days after meeting (draft) and 2 days after receipt of USACE comments (final)
RI Report	9/23/2022	Draft, ITR/CX Draft, Stakeholder Draft and Final RI Report	12/8/2022, 1/5/2023, 2/22/2023
Development of Alternatives	2/6/2023	Table of Proposed Alternatives	2/10/2023
FS Report	2/13/2023	Draft, Stakeholder Draft, and Final FS Report	3/3/2023, 4/7/2023, 5/19/2023
Proposed Plan	2/26/2023	Draft, ITR/CX Draft, Stakeholder Draft and Final Proposed Plan	2/10/2023, 3/24/2023, 4/12/2023

Table 14-1 Associated Tasks and Deliverables (Continued)

Activity	StartDate	Deliverable	Due Date
Public Meeting	5/2/2023	Fact Sheet, Public Meeting Materials and Displays	6/2/2023
Decision document	2/6/2023	Draft, Stakeholder Draft, and Final Decision Document	2/10/2023, 3/24/2023, 4/12/2023
Post-Contract Site Walk/Project Transition Meeting	5/1/2023	Draft and Final Meeting Minutes	5/15/2023

WORKSHEET #15 PROJECT ACTION LIMITS AND LABORATORY SPECIFIC DETECTION/QUANTITATION LIMITS

This worksheet provides the target analytes, their project action limits (PALs), the laboratory's limit of detection (LOD) / limit of quantification (LOQ) values, and the DoD QSM v5.4 LCS limits, where applicable. Where available, investigation results for definitive data (as defined in Section 11.3.2 of Worksheet #11 of this UFP-QAPP) will be compared to PALs to screen data following DQOs established in Worksheet #11. The primary PALs for groundwater for the human health risk assessment are the EPA RSLs for tap water (November 2021).

The human health PALs referenced for soil and sediment include the EPA RSLs for residential soil (November 2021). The USEPA Region 2 residential lead screening level of 200 mg/kg was applied for lead in soil and sediment.

A hierarchy of ecological screening levels for soil, sediment, and groundwater (presuming discharge to surface water) are listed below and provided in **Appendix G**. If a value is available from a higher priority source, any values in lower priority sources are not considered, even if its value is lower. Surrogate screening levels may be used for certain chemicals as necessary, with the rationale shown in screening table footnotes. While screening levels from EPA Region 2 are preferred, no relevant ecological screening levels are available for this region. EPA Headquarters Ecological Soil Screening Levels (EcoSSLs) and then EPA Region 4 Ecological Screening Values (ESVs) are the most relevant and were prioritized for soil. For surface water and sediment, EPA Region 3 screening levels are prioritized because this region is geographically closer and the basis for development of the values is understood). Region 3 screening levels have been accepted by New York and New Jersey in the past; therefore, the values for Region 3 are prioritized for surface water and sediment for this site. Values from other sources (e.g., Los Alamos National Laboratory [LANL]) are selected last because these values have been developed by an outside entity. The hierarchy of sources for each medium is:

<u>Soil:</u>

1. EPA Ecological Soil Screening Levels (EcoSSLs) (various dates), minimum value for plants, soil invertebrates, bird and mammals (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents).

2. EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites, Table 3 Screening Level: https://www.epa.gov/sites/default/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

3. LANL, September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.

Sediment:

1. EPA Region 3 Minimum of Freshwater and Saltwater Sediment Benchmarks (https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).

2. EPA Region 4 ESV Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine (https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf).

3. LANL, September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

Surface Water:

1. EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, Minimum value of freshwater or saltwater chronic (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table).

2. EPA Region 3 Biological Technical Assistance Group (BTAG) Minimum value of Freshwater and Marine Screening Benchmarks (https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).

3. EPA Region 4 Minimum of Freshwater and Marine/Estuarine Surface Water Screening Values (SWSV) for Hazardous Waste Sites (March 2018), aquatic life values (https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf)

The PAL is the lower of the human health and ecological values. If no PAL is available for an analyte, the LOD is set as the PAL. As these analytes lack risk-based screening levels, ARARs, or TBCs, they would not be quantitatively evaluated in the risk assessment. The assessment of results for target analytes that do not have established PALs is limited to qualitative evaluation purposes. If possible, analytes lacking PALs or supporting other definable data uses will be excluded from chemical analyses. Values above the LOD have a 99% probability of being properly reported as detected and a 1% chance of being misreported as a non-detect. Positive detections between the LOQ and the LOD or between the LOQ and method DL will be reported as estimated with a "J" qualifier. Estimated values will be used in the risk assessment following EPA's Risk Assessment Guidance for Superfund (EPA, 1989). Because the calculation of EPA RSLs and ecological screening levels do not account for current technology capabilities, some target analytes will not meet the PAL by commercial environmental laboratories. These analytes are shown in the table as bolded values (e.g., LOD/LOQ is greater than the PAL). These analytes have been reviewed by the project team (project manager, project chemists and risk assessors) in consultation with the analytical laboratory and determined that the methodology and procedures that have been set for this project provide for the lowest limits achievable for the respective analyses. The labs that can do the lower-level pesticides analysis are not able to prepare SEDD files to upload to FUDSCHEM; there is not a specific source of pesticides in the study area; the level of salinity in the groundwater is unknown, so the currently planned metal analyses will be conducted and if

there are salinity interferences, re-sampling can occur as needed with a different method. If after this round of sampling, additional, more sensitive, analyses can be performed if the project team determines it necessary. In cases where the LOQ > PAL, a discussion of the uncertainty will be provided in the risk assessment.

Detected analytes lacking a human health and/or ecological screening level will also be discussed in the uncertainty analysis. PALs for structurally similar chemicals (e.g., isomers, metabolites, class) and similar toxic effect (cancer or noncancer) were applied as surrogate values and are presented in footnotes to each worksheet table. If any risk is presented because of these compounds, the assignment of surrogates will be revisited. PALs are not provided for essential nutrients since these compounds would be toxic at concentrations higher than expected at the site. Chemicals lacking human health and/or ecological screening levels for water, soil and/or sediment include 2,2'-oxybis(1-Chloropropane), 2-chloronaphthalene, 4,6-Dinitro-2-methylphenol, acetophenone, caprolactam, tetryl, 4-Bromophenyl-phenylether, 4-Chlorophenyl-phenylether, benzaldehyde, hexachlorobutadiene, 4-Chloro-3-methylphenol, 4-Chlorophenyl-phenylether, bis(2-Chloroethoxy)methane, bis(2-Chloroethyl)ether, isophorone, 3-nitroaniline, and N-Nitroso-di-n-propylamine. Lack of PALs indicates these chemicals are not expected to be highly toxic since lack of screening levels suggests little toxicity research has been performed for the exposure medium/receptor group.

Historical data indicates the presence of several PAHs, metals, and pesticides (DDTs) as likely DoD-related contaminants. Most of the PALs for these likely DoD-related have LOQs below or within an order of magnitude of the PAL, considering the target risk of 1E-06 and the target hazard quotient of 0.1 for the human health screening levels were used to determine the PALs. Similarly, ~~a~~ factor of 10 is considered to adjust screening-level ecological PALs because USEPA (1997) *Ecological Risk Assessment Guidance for Superfund* applies an uncertainty factor of 10 to estimate a No Observed Adverse Effect Level (NOAEL) from a Lowest Observed Adverse Effect Level (LOAEL) for use as a no-effect screening ecotoxicity value. USEPA (1997) notes that 96 percent of chemicals included in a data review had LOAEL/NOAEL ratios of five or less, and that all were ten or less. The presence of other specific contaminants listed in Worksheet #15 is unknown or not likely DoD-related and most have listed LOQs below or within an order of magnitude of the PAL. The LOQ >10x PAL for thallium in sediment and soil; toxaphene in soil and sediment; antimony in soil; arsenic, hexavalent chromium, thallium, aldrin, dieldrin, toxaphene, DDT, 2,4-DNT, 2,6-DNT and nitrobenzene in water. While LOQs for several PAHs in water by EPA Method 8270D exceed 10x PAL, LOQs for PAHs by SIM analysis do not exceed 10x PALs. Additional Site-specific factors will be applied in decision making for analytes whose laboratory limit exceeds PALs including background, risk level the LOQ corresponds to (e.g., LOQ an order of magnitude > PAL for a cancer risk based RSL set at 1E-6 would correspond to being able to screen at a risk level of 1E-5 but below target action level for cumulative cancer risk of < 1E-4), quality of habitat and potential for exposure using refined assumptions for receptors.

After considering a factor of 10 to adjust the ecological PALs and considering SIM analysis of PAHs, the following chemicals have LOQ/LOD > 10x ecological PAL: sediment – toxaphene, nitroglycerin, atrazine, 4-chloroaniline, 2,4-dinitrophenol; soil- thallium, antimony, toxaphene, hexachlorocyclopentadiene, di-n-butylphthalate, atrazine, 2,4-dinitrophenol; water – toxaphene, hexachlorobenzene, hexachlorocyclopentadiene. While the measured sensitivity is not adequate for these analytes (i.e., LOQ>10x ecological PAL), the laboratory method is acceptable for the

above-listed SVOCs because 1) only PAHs, pesticides, explosives and metals are considered to be DoD-related chemicals at this site, or 2) an analyte could be present due to routine/intended use (i.e., toxaphene is a commonly applied crop pesticide), or 3) the ecological PAL is less than the range of reported typical background concentrations in U.S. soils (i.e., antimony and thallium) or 4) the LOQ is below an alternative PAL (i.e., the LOQ for nitroglycerin does not exceed EPA Region 4 refinement screening value (RSV) of 12,074 µg/kg). An evaluation of analytes with human health and /or ecological PALs greater than the PAL was performed by exposure media, and is provided in **Appendix H.** To evaluate the appropriateness of the LOQs in comparison to the human health PALs, analytes within the EPA's risk management range (target risk of 10^{-4} to 10^{-6} and target hazard quotient of 1) are identified in these tables. To evaluate the ecological PALs, alternative screening levels are presented which include screening levels based on effect levels (e.g., acute values for water, EPA Region 4 RSVs for sediment, and minimum LANL low effect ESLs for soil). Chemicals that are known to be site-related based on historical investigation (PAHs, metals, and pesticides [DDTs]) or that may be associated with DoD-activities (i.e., explosives) are identified. In addition, the PubChem online database]PubChem (nih.gov)] was consulted to obtain information in individual chemical use and manufacturing. Chemicals that are used in agriculture, common laboratory chemical, manufacturing intermediate, research and/or as preservative are indicated in these tables and are not anticipated to be related to historic DoD activities.

WORKSHEET #15.1: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN WATER

Matrix: Groundwater and IDW Water
Analytical Group / Method: SVOCs, full scan / EPA Methods 3510C (separatory funnel extraction) and 8270E (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
TCL SVOC in Water – EPA Method 8270E									
1,1'-Biphenyl	92-52-4	µg/L	0.083	14	R3$	**0.083**	**2**	**1**	**0.5**
2,2'-oxybis(1-Chloropropane)	108-60-1	µg/L	71	NSL		71	2	1	0.5
2,4,5-Trichlorophenol	95-95-4	µg/L	120	12	R3#	12	2	1	0.5
2,4,6-Trichlorophenol	88-06-2	µg/L	1.2	4.9	R3$	**1.2**	**2**	1	0.5
2,4-Dichlorophenol	120-83-2	µg/L	4.6	11	R3$	4.6	2	1	0.5
2,4-Dimethylphenol	105-67-9	µg/L	36	15	R4$	15	10	9	3
2,4-Dinitrophenol	51-28-5	µg/L	3.9	48.5	R3#	**3.9**	**30**	**28**	**14**
2,4-Dinitrotoluene	121-14-2	µg/L	0.24	44	R3$	**0.24**	**5**	**2**	**1**
2,6-Dinitrotoluene	606-20-2	µg/L	0.049	81	R3$	**0.049**	**2**	**1**	**0.5**
2-Chloronaphthalene	91-58-7	µg/L	75	NSL		75	1	0.8	0.4
2-Chlorophenol	95-57-8	µg/L	9.1	24	R3$	9.1	2	1	0.5
2-Methylphenol	95-48-7	µg/L	93	13	R3$	13	2	1	0.5
2-Nitroaniline	88-74-4	µg/L	19	17	R4*	17	5	2	1
2-Nitrophenol	88-75-5	µg/L	3.9 a	1920	R3$	**3.9**	**5**	2	1
3,3'-Dichlorobenzidine	91-94-1	µg/L	0.13	4.5	R3$	**0.13**	**10**	**8**	**4**
3-Nitroaniline	99-09-2	µg/L	0.58 d	NSL		**0.58**	**5**	**4**	**2**
4,6-Dinitro-2-methylphenol	534-52-1	µg/L	0.15	NSL		**0.15**	**21**	**20**	**8**
4-Bromophenyl-phenylether	101-55-3	µg/L	NSL	1.5	R3$	**1.5**	**2**	1	0.5
4-Chloro-3-methylphenol	59-50-7	µg/L	140	1	R4$	**1**	**5**	**2**	1
4-Chloroaniline	106-47-8	µg/L	0.37	232	R3$	**0.37**	**10**	**9**	**4**

WORKSHEET #15.1: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN WATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
4-Chlorophenyl-phenylether	7005-72-3	µg/L	NSL	NSL		NSL	2	1	0.5
4-Methylphenol *	106-44-5	µg/L	37	543	R3$	543	2	1	0.5
4-Nitroaniline	100-01-6	µg/L	3.8	17 f	R4*	3.8	3	2	0.9
4-Nitrophenol	100-02-7	µg/L	3.9 a	60	R3$	3.9	**30**	**20**	**10**
Acetophenone	98-86-2	µg/L	190	NSL		190	5	2	1
Atrazine	1912-24-9	µg/L	0.3	1.8	R3$	**0.3**	**5**	**2**	**1**
Benzaldehyde	100-52-7	µg/L	19	143	R4*	19	5	2	1
bis(2-Chloroethoxy)methane	111-91-1	µg/L	5.9	NSL		5.9	2	1	0.5
bis(2-Chloroethyl)ether	111-44-4	µg/L	0.014	NSL		**0.014**	**2**	**1**	**0.5**
bis(2-Ethylhexyl)phthalate	117-81-7	µg/L	5.6	16	R3$	**5.6**	**5**	4	2
Butylbenzylphthalate	85-68-7	µg/L	16	19	R3$	16	5	4	2
Caprolactam	105-60-2	µg/L	990	NSL		990	7	6	3
Carbazole	86-74-8	µg/L	2.03 b	4.0	R4$	4.0	2	1	0.5
Di-n-butylphthalate	84-74-2	µg/L	90	3.4	R3#	**3.4**	**5**	**4**	2
Di-n-octylphthalate	117-84-0	µg/L	20	22	R3$	20	11	10	5
Dibenzofuran	132-64-9	µg/L	0.79	3.7	R3$	**0.79**	**2**	**1**	0.5
Diethylphthalate	84-66-2	µg/L	1500	75.9	R3#	75.9	5	4	2
Dimethylphthalate	131-11-3	µg/L	1500 e	580	R3#	580	5	4	2
Hexachlorobenzene	118-74-1	µg/L	0.0098	0.0003	R3*	**0.0003**	**0.5**	**0.22**	**0.11**
Hexachlorobutadiene	87-68-3	µg/L	0.14	0.3	R3#	**0.14**	**2**	**1**	**0.5**
Hexachlorocyclopentadiene	77-47-4	µg/L	0.041	0.07	R3#	**0.041**	**11**	**10**	**5**
Hexachloroethane	67-72-1	µg/L	0.33	9.4	R3#	**0.33**	**5**	**1**	**0.5**
Isophorone	78-59-1	µg/L	78	129	R3#	78	2	1	0.5

WORKSHEET #15.1: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN WATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
N-Nitroso-di-n-propylamine	621-64-7	µg/L	0.011	120	R3#	**0.011**	**2**	**1**	**0.5**
N-Nitrosodiphenylamine	86-30-6	µg/L	12	210	R3$	12	2	1	0.5
Nitrobenzene	98-95-3	µg/L	0.14	66.8	R3#	**0.14**	**2**	**1**	**0.5**
Pentachlorophenol	87-86-5	µg/L	0.041	7.9	HQ#	**0.041**	**5**	**4**	**1**
Phenol	108-95-2	µg/L	580	4	R3$	4	2	1	0.5
PAHs									
2-Methylnaphthalene	91-57-6	µg/L	3.6	4.2	R3#	3.6	0.5	0.2	0.1
Acenaphthene	83-32-9	µg/L	53	5.8	R3$	5.8	0.5	0.2	0.1
Acenaphthylene	208-96-8	µg/L	12 c	13	R4$	13	0.5	0.2	0.1
Anthracene	120-12-7	µg/L	180	0.012	R3$	**0.012**	**0.5**	**0.2**	**0.1**
Benzo(a)anthracene	56-55-3	µg/L	0.03	0.018	R3$	**0.018**	**0.5**	**0.2**	**0.1**
Benzo(a)pyrene	50-32-8	µg/L	0.025	0.015	R3$	**0.0115**	**0.5**	**0.22**	**0.11**
Benzo(b)fluoranthene	205-99-2	µg/L	0.25	0.06	R4#	**0.06**	**0.5**	**0.2**	**0.1**
Benzo(g,h,i)perylene	191-24-2	µg/L	12 c	0.012	R4*	**0.012**	**0.5**	**0.2**	**0.1**
Benzo(k)fluoranthene	207-08-9	µg/L	2.5	0.06	R4*	**0.06**	**0.5**	**0.2**	**0.1**
Chrysene	218-01-9	µg/L	25	0.35	R4#	**0.35**	**0.5**	0.2	0.1
Dibenz(a,h)anthracene	53-70-3	µg/L	0.025	0.01	R4#	**0.01**	**0.5**	**0.2**	**0.1**
Fluoranthene	206-44-0	µg/L	80	0.04	R3$	**0.04**	**0.5**	**0.2**	**0.1**
Fluorene	86-73-7	µg/L	29	2.5	R3#	2.5	0.5	0.24	0.12
Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.25	0.012	R4*	**0.012**	**0.5**	**0.22**	**0.11**
Naphthalene	91-20-3	µg/L	0.17	1.1	R3$	**0.17**	**0.5**	**0.2**	0.1
Phenanthrene	85-01-8	µg/L	12 c	0.4	R3$	**0.4**	**0.5**	0.22	0.11
Pyrene	129-00-0	µg/L	12	0.025	R3$	**0.025**	**0.5**	**0.2**	**0.1**

WORKSHEET #15.1: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN WATER (CONTINUED)

Notes:

Due to coelution of 3-methylphenol with 4-methylphenol, only 4-methylphenol is listed as an analyte in WS15.1; any detectable 3-methylphenol would be reported as 4-methylphenol.

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

PALs in this table do not apply to IDW water samples; the test is required for IDW, and analytical results will be evaluated by the disposal facility.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout. Note that while laboratory limits exceed PALs for numerous PAHs, the PAHs will be analyzed by EPA Method 8270E (PAH-SIM in water), and the laboratory limits are further evaluated in Worksheet 15.2.

[1] EPA Regional Screening Levels (RSLs) for Tapwater (Target Cancer Risk [TR]=1E-06, Target Hazard Quotient [THQ], 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
A = 2,4-dinitrophenol for 2-nitrophenol and 4-nitrophenol (non-cancer nitrophenol)
b= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022
c= pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)
d= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022
e=diethyl phthalate for di-methyl phthalate (structurally similar; two neutral alkyl substituents; non-cancer phthalates)

[2] Ecological PAL is based off the following hierarchy of sources:

a) HQ = EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)
b) R3 = EPA Region III Biological Technical Assistance Group (BTAG) minimum of Freshwater and Marine Screening Benchmarks (August 2006; https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).
c) R4= EPA Region 4 Minimum of Freshwater and Marine/Estuarine Surface Water Screening Values (SWSV) for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
f = 2-nitraniline for 4-nitroaniline (isomers)
$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.2: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1,4-DIOXANE BY SIM IN GROUNDWATER

Matrix: Groundwater
Analytical Group / Method: PAHs and 1,4-Dioxane / EPA Methods 3510C (separatory funnel extraction) and 8270E by SIM (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
PAH-SIM in Water – EPA Method 8270E									
1-Methylnaphthalene	90-12-0	µg/L	1.1	2.1	R3$	1.1	0.050	0.040	0.020
2-Methylnaphthalene	91-57-6	µg/L	3.6	4.2	R3#	3.6	0.050	0.040	0.020
Acenaphthene	83-32-9	µg/L	53	5.8	R3$	5.8	0.050	0.030	0.010
Acenaphthylene	208-96-8	µg/L	12 a	13	R4$	13	0.050	0.030	0.010
Anthracene	120-12-7	µg/L	180	0.012	R3$	**0.012**	**0.050**	**0.030**	0.010
Benzo(a)anthracene	56-55-3	µg/L	0.03	0.018	R3#	**0.018**	**0.050**	**0.030**	0.010
Benzo(a)pyrene	50-32-8	µg/L	0.025	0.015	R3#	**0.015**	**0.050**	**0.030**	0.010
Benzo(b)fluoranthene	205-99-2	µg/L	0.25	0.06	R4#	0.06	0.050	0.030	0.010
Benzo(g,h,i)perylene	191-24-2	µg/L	12 a	0.012	R4*	**0.012**	**0.050**	**0.030**	0.010
Benzo(k)fluoranthene	207-08-9	µg/L	2.5	0.06	R4*	0.06	0.050	0.030	0.010
Chrysene	218-01-9	µg/L	25	0.35	R4#	0.35	0.050	0.030	0.010
Dibenz(a,h)anthracene	53-70-3	µg/L	0.025	0.01	R4#	**0.01**	**0.050**	**0.040**	**0.020**
Fluoranthene	206-44-0	µg/L	80	0.04	R3$	**0.04**	**0.050**	0.030	0.010
Fluorene	86-73-7	µg/L	29	2.5	R3#	2.5	0.050	0.030	0.010
Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.25	0.12	R4*	0.12	0.050	0.040	0.020
Naphthalene	91-20-3	µg/L	0.17	1.1	R3$	0.17	0.070	0.060	0.030
Phenanthrene	85-01-8	µg/L	12 a	0.4	R3$	0.4	0.070	0.060	0.030

WORKSHEET #15.2: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1.4-DIOXANE BY SIM IN GROUNDWATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Pyrene	129-00-0	µg/L	12	0.025	R3$	**0.025**	**0.050**	**0.030**	0.010
1,4-Dioxane-SIM in Water – EPA Method 8270E SIM									
1,4-Dioxane	123-91-1	µg/L	0.46	22,000	R4$	0.46	0.3	0.2	0.1

Notes:

PAHs and 1,4-Dioxane will be reported from the same extract and analysis.

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Tapwater (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)

[2] Ecological PAL is based off the following hierarchy of sources:

a) HQ = EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)

b) R3 = EPA Region III BTAG minimum of Freshwater and Marine Screening Benchmarks (August 2006; https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).

c) R4 = EPA Region 4 Minimum of Freshwater and Marine/Estuarine SWSV for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

$ = freshwater value

= saltwater value

* = saltwater and freshwater value are the same

WORKSHEET #15.3: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN GROUNDWATER

Matrix: Groundwater
Analytical Group / Method: Explosives / EPA Methods 3535A (solid-phase extraction) and 8330B (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Explosives in Water – EPA Method 8330B									
1,3,5-Trinitrobenzene	99-35-4	µg/L	59	11	R4*	11	1.0	0.92	0.46
1,3-Dinitrobenzene	99-65-0	µg/L	0.20	20	R4#	**0.20**	**1.0**	**0.80**	**0.40**
2,4,6-Trinitrotoluene	118-96-7	µg/L	0.98	100	R3*	**0.98**	**3.7**	**3.6**	**1.8**
2,4-Diamino-6-nitrotoluene	6629-29-4	µg/L	3.9 a	11 a		3.9	2.1	2.0	1.04
2,4-Dinitrotoluene	121-14-2	µg/L	0.24	44	R3$	**0.24**	**0.70**	**0.66**	**0.33**
2,6-Diamino-4-nitrotoluene	59229-75-3	µg/L	3.9 a	11 a		3.9	2.0	1.9	0.93
2,6-Dinitrotoluene	606-20-2	µg/L	0.049	81	R3$	**0.049**	**0.80**	**0.70**	**0.35**
2-Amino-4,6-Dinitrotoluene	35572-78-2	µg/L	3.9	1480	R3$	3.9	0.85	0.84	0.42
2-Nitrotoluene	88-72-2	µg/L	0.31	71	R4$	**0.31**	**0.90**	**0.84**	**0.43**
3-Nitrotoluene	99-08-1	µg/L	0.17	750	R3$	**0.17**	**0.80**	**0.74**	**0.38**
4-Amino-2,6-Dinitrotoluene	19406-51-0	µg/L	3.9	11	R4$	3.9	2.0	1.8	0.92
4-Nitrotoluene	99-99-0	µg/L	4.3	1900	R3$	4.3	0.90	0.88	0.44
HMX	2691-41-0	µg/L	100	150	R3$	100	1.6	1.4	0.70
Nitrobenzene	98-95-3	µg/L	0.14	66.8	R3#	**0.14**	**0.90**	**0.84**	0.40
Nitroglycerin	55-63-0	µg/L	0.20	138	R4$	**0.20**	**20**	**15**	**7.5**
PETN	78-11-5	µg/L	17	85,000	R3$	**3.9**	**23**	**20**	**10**

WORKSHEET #15.3: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN GROUNDWATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
RDX	121-82-4	µg/L	0.97	360	R3$	**0.97**	**1.4**	**1.3**	0.64
Tetryl	479-45-8	µg/L	3.9	NSL		3.9	1.6	0.8	0.40

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Tapwater (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = 4-Amino-2,6-Dinitrotoluene for 2,4-Diamino-6-nitrotoluene and 2,6-Diamino-4-nitrotoluene (structurally similar; noncancer nitrotoluene)

[2] Ecological PAL is based off the following hierarchy of sources:

a) HQ= EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)

b) R3 = EPA Region III BTAG Minimum of Freshwater and Marine Screening Benchmarks (August 2006; https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).

c) R4 = EPA Region 4 Minimum of Freshwater and Marine/Estuarine SWSV for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.4: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN GROUNDWATER

Matrix: Groundwater
Analytical Group / Method: Organochlorine Pesticides / EPA Methods 3510C (separatory funnel extraction) and 8081B (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Pesticides in Water – EPA Method 8081B									
Aldrin	309-00-2	µg/L	0.00092	0.13	R3#	**0.00092**	**0.020**	**0.010**	**0.0020**
Alpha BHC	319-84-6	µg/L	0.0072	2.2	R3$	**0.0072**	**0.020**	**0.010**	0.0030
Alpha Chlordane	5103-71-9	µg/L	0.36	0.004	HQ#	**0.004**	**0.020**	**0.010**	0.0030
Beta BHC	319-85-7	µg/L	0.025	2.2	R3$	**0.025**	**0.030**	0.022	0.011
Delta BHC	319-86-8	µg/L	0.025 a	2.2	R3$	0.025	0.020	0.010	0.0034
Dieldrin	60-57-1	µg/L	0.0018	0.0019	HQ#	**0.0018**	**0.030**	**0.020**	**0.0053**
Endosulfan I	959-98-8	µg/L	10 b	0.0087	HQ#	**0.0087**	**0.020**	**0.010**	0.0043
Endosulfan II	33213-65-9	µg/L	10 b	0.0087	HQ#	**0.0087**	**0.040**	**0.020**	**0.015**
Endosulfan Sulfate	1031-07-8	µg/L	11	0.009	R3#	**0.009**	**0.030**	**0.020**	0.0058
Endrin	72-20-8	µg/L	0.23	0.0023	HQ#	**0.0023**	**0.030**	**0.020**	**0.0081**
Endrin Aldehyde	7421-93-4	µg/L	0.23 c	0.0023 c	HQ#	**0.0023**	**0.10**	**0.060**	**0.020**
Endrin Ketone	53494-70-5	µg/L	0.23 c	0.0023 c	HQ#	**0.0023**	**0.030**	**0.020**	**0.0050**
Gamma BHC - Lindane	58-89-9	µg/L	0.012	0.01	R3$	0.01	0.020	0.010	0.0020
Gamma Chlordane	5103-74-2	µg/L	1	0.004	HQ#	**0.004**	**0.040**	**0.030**	0.0070
Heptachlor	76-44-8	µg/L	0.0014	0.0036	HQ#	**0.0014**	**0.020**	**0.010**	**0.0020**
Heptachlor Epoxide	1024-57-3	µg/L	0.0014	0.0036	HQ#	**0.0014**	**0.020**	**0.010**	**0.0023**
Methoxychlor	72-43-5	µg/L	3.7	0.03	HQ*	**0.03**	**0.11**	**0.10**	0.030
p,p-DDD	72-54-8	µg/L	0.0063	0.011	R3$	**0.0063**	**0.030**	**0.020**	0.0050
p,p-DDE	72-55-9	µg/L	0.046	0.14	R4#	0.046	0.030	0.020	0.0050
p,p-DDT	50-29-3	µg/L	0.23	0.001	HQ*	**0.001**	**0.030**	**0.020**	**0.0052**

WORKSHEET #15.4: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN GROUNDWATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Toxaphene	8001-35-2	µg/L	0.071	0.0002	R3$	**0.0002**	**1.0**	**0.60**	**0.30**

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Tapwater (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = beta BHC for delta BHC (isomer; noncancer)

b = endosulfan for endosulfan I and endosulfan II (metabolite; noncancer)

c = endrin for endrin aldehyde and endrin ketone (metabolite; noncancer)

[2] Ecological PAL is based off the following hierarchy of sources:

a) HQ = EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)

b) R3 = EPA Region III BTAG minimum of Freshwater and Marine Screening Benchmarks (August 2006; https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values). Surrogates: BHC (non-lindane) applied for alpha-BHC, beta-BHC and delta-BHC

c) R4 = EPA Region 4 Minimum of Freshwater and Marine/Estuarine SWSV for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

$ = freshwater value

= saltwater value

* = saltwater and freshwater value are the same

WORKSHEET #15.5: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN GROUNDWATER

Matrix: Groundwater
Analytical Group / Method: TAL Metals (ICP-MS) / EPA Methods 3005A (acid digestion) and 6020B (analysis)
Concentration Level: Trace
Analytical Group / Method: TAL Metals (CVAA) / EPA Methods 7470A (preparation and analysis)
Analytical Group / Method: Hexavalent Chromium / EPA Method 7196A (preparation and analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Metals in Water – EPA Method 6020B									
Aluminum	7429-90-5	µg/L	2000	87	R3$	87	30	24	12
Antimony	7440-36-0	µg/L	0.78	30	R3$	**0.78**	**1.0**	**0.50**	0.20
Arsenic	7440-38-2	µg/L	0.052	36	HQ#	**0.052**	2.0	1.7	0.68
Barium	7440-39-3	µg/L	380	4	R3#	4	2.0	1.6	0.746
Beryllium	7440-41-7	µg/L	2.5	0.66	R3$	0.66	0.50	0.30	0.119
Cadmium	7440-43-9	µg/L	0.18	0.72	HQ$	**0.18**	**0.50**	**0.40**	0.151
Calcium	7440-70-2	µg/L	NUT	116,000	R3$	116,000	120	100	50.0
Chromium	7440-47-3	µg/L	2200 (trivalent)	74 (trivalent)	HQ$	74	2.0	0.80	0.334
Cobalt	7440-48-4	µg/L	0.60	23	R3$	0.60	0.50	0.40	0.156
Copper	7440-50-8	µg/L	80	3.1	HQ#	3.1	1.0	0.90	0.362
Iron	7439-89-6	µg/L	1,400	1,000	HQ$	1,000	50	40	20
Lead	7439-92-1	µg/L	15	2.5	HQ$	2.5	0.50	0.20	0.071
Magnesium	7439-95-4	µg/L	NUT	82,000	3$	82,000	50	32	16
Manganese	7439-96-5	µg/L	43	120	R3$	43	2.0	1.9	0.95
Nickel	7440-02-0	µg/L	39	8.2	HQ#	8.2	1.5	0.80	0.40
Potassium	7440-09-7	µg/L	NUT	53,000	R3$	53,000	200	180	65
Selenium	7782-49-2	µg/L	10	71	HQ#	10	1.0	0.60	0.278
Silver	7440-22-4	µg/L	9.4	0.23	R3#	**0.23**	**0.50**	**0.30**	0.10

WORKSHEET #15.5: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN GROUNDWATER (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			EPA Tapwater RSL				LOQ	LOD	DL
Sodium	7440-23-5	µg/L	NUT	680,000	R3$	680,000	200	180	90
Thallium	7440-28-0	µg/L	0.020	0.8	R3$	**0.020**	**0.50**	**0.30**	**0.13**
Vanadium	7440-62-2	µg/L	8.6	20	R3$	8.6	4.0	2.0	0.794
Zinc	7440-66-6	µg/L	600	81	HQ#	81	15	8.0	4.0
Mercury in Water – EPA Method 7470A									
Mercury	7439-97-6	µg/L	0.063	0.77	HQ$	**0.063**	**0.20**	**0.16**	0.079
Hexavalent Chromium in Water – EPA Method 7196A									
Hexavalent Chromium [3]	18540-29-9	µg/L	0.035	11	HQ$	**0.035**	**30**	**20**	**10**

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.
[1] EPA RSLs for Tapwater (TR=1E-06, THQ, 0.1; November 2021). NUT = essential nutrient
[2] Ecological PAL is based off the following hierarchy of sources:
a) HQ = EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)
b) R3 = EPA Region III BTAG minimum of Freshwater and Marine Screening Benchmarks (August 2006; https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).
c) R4 = EPA Region 4 Minimum of Freshwater and Marine/Estuarine SWSV for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf
[3] Hexavalent chromium analysis will be performed, if necessary, after evaluation of total chromium results.
$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.6: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SOIL

Matrix: Soil (including IDW Solid)
Analytical Group / Method: SVOCs (full scan) / EPA Methods 3546 (microwave extraction) and 8270E (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		Project Action Limit (PAL)	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
TCL SVOCs in Soil – EPA Method 8270E									
1,1'-Biphenyl	92-52-4	µg/kg	4,700	200	R4	200	37	33	17
2,2'-oxybis(1-Chloropropane)	108-60-1	µg/kg	310,000	NSL		310,000	43	40	20
2,4,5-Trichlorophenol	95-95-4	µg/kg	630,000	4,000	R4	4,000	37	33	17
2,4,6-Trichlorophenol	88-06-2	µg/kg	6,300	9,940	R4	6,300	37	33	17
2,4-Dichlorophenol	120-83-2	µg/kg	19,000	50	R4	50	43	40	20
2,4-Dimethylphenol	105-67-9	µg/kg	130,000	40	R4	40	37	33	17
2,4-Dinitrophenol	51-28-5	µg/kg	13,000	61	R4	61	**1,000**	**330**	**167**
2,4-Dinitrotoluene	121-14-2	µg/kg	1,700	6,000	R4	1,700	170	67	33
2,6-Dinitrotoluene	606-20-2	µg/kg	360	4,000	R4	360	37	33	17
2-Chloronaphthalene	91-58-7	µg/kg	480,000	NSL		480,000	33	27	13
2-Chlorophenol	95-57-8	µg/kg	39,000	60	R4	60	37	33	17
2-Methylphenol	95-48-7	µg/kg	320,000	100	R4	100	50	40	20
2-Nitroaniline	88-74-4	µg/kg	63,000	20	R4	**20**	**50**	**33**	17
2-Nitrophenol	88-75-5	µg/kg	13,000 a	20	R4	**20**	**50**	**40**	20
3,3'-Dichlorobenzidine	91-94-1	µg/kg	1,200	30	R4	**30**	**170**	**67**	**33**
3-Nitroaniline	99-09-2	µg/kg	1,900 d	NSL		1,900	170	67	33

WORKSHEET #15.6: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		Project Action Limit (PAL)	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
4,6-Dinitro-2-methylphenol	534-52-1	µg/kg	510	NSL		510	500	330	170
4-Bromophenyl-phenylether	101-55-3	µg/kg	NSL	NSL		NSL	37	33	17
4-Chloro-3-methylphenol	59-50-7	µg/kg	630,000	NSL		630,000	50	40	20
4-Chloroaniline	106-47-8	µg/kg	2,700	1,000	R4	1,000	170	67	33
4-Chlorophenyl-phenylether	7005-72-3	µg/kg	NSL	NSL		NSL	37	33	17
4-Methylphenol	106-44-5	µg/kg	130,000	80	R4	80	50	33	17
4-Nitroaniline	100-01-6	µg/kg	25,000	20 f	R4	**20**	**170**	**67**	**33**
4-Nitrophenol	100-02-7	µg/kg	13,000 a	5,120	R4	5,120	500	330	170
Acetophenone	98-86-2	µg/kg	780,000	NSL		780,000	50	33	17
Atrazine	1912-24-9	µg/kg	2,400	0.05	R4	**0.05**	**170**	**130**	**67**
Benzaldehyde	100-52-7	µg/kg	170,000	NSL		170,000	170	67	33
bis(2-Chloroethoxy)methane	111-91-1	µg/kg	19,000	NSL		19,000	37	33	17
bis(2-Chloroethyl)ether	111-44-4	µg/kg	230	NSL		230	37	33	17
bis(2-Ethylhexyl)phthalate	117-81-7	µg/kg	39,000	20	R4	**20**	**170**	**130**	**67**
Butylbenzylphthalate	85-68-7	µg/kg	290,000	590	R4	590	170	130	67
Caprolactam	105-60-2	µg/kg	3,100,000	NSL		3,100,000	170	67	33
Carbazole	86-74-8	µg/kg	27 b	70	R4	**27**	**37**	**33**	17
Di-n-butylphthalate	84-74-2	µg/kg	630,000	11	R4	**11**	**170**	**130**	**67**

WORKSHEET #15.6: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		Project Action Limit (PAL)	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Di-n-octylphthalate	117-84-0	µg/kg	63,000	910	R4	910	170	130	67
Dibenzofuran	132-64-9	µg/kg	7,300	150	R4	150	37	33	17
Diethylphthalate	84-66-2	µg/kg	5,100,000	250	R4	250	170	130	67
Dimethylphthalate	131-11-3	µg/kg	5,100,000 e	350	R4	350	170	130	67
Hexachlorobenzene	118-74-1	µg/kg	78	79	R4	79	17	13	6.7
Hexachlorobutadiene	87-68-3	µg/kg	1,200	9	R4	**9**	**50**	**40**	**20**
Hexachlorocyclopentadiene	77-47-4	µg/kg	180	1	R4	**1**	**500**	**330**	**170**
Hexachloroethane	67-72-1	µg/kg	1,800	24	R4	**24**	**170**	**67**	**33**
Isophorone	78-59-1	µg/kg	570,000	NSL		570,000	67	33	17
N-Nitroso-di-n-propylamine	621-64-7	µg/kg	78	NSL		78	67	50	33
N-Nitrosodiphenylamine	86-30-6	µg/kg	110,000	545	R4	545	37	33	17
Nitrobenzene	98-95-3	µg/kg	5,100	2,200	R4	2,200	37	33	17
Pentachlorophenol	87-86-5	µg/kg	1,000	2,100	EcoSSL	1,000	170	130	67
Phenol	108-95-2	µg/kg	1,900,000	790	R4	790	37	33	17
PAHs									
2-Methylnaphthalene	91-57-6	µg/kg	24,000	29,000	EcoSSL	24,000	17	10	5.0
Acenaphthene	83-32-9	µg/kg	360,000	29,000	EcoSSL	29,000	17	6.7	3.3
Acenaphthylene	208-96-8	µg/kg	180,000 c	29,000	EcoSSL	29,000	17	8.0	4.0

WORKSHEET #15.6: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		Project Action Limit (PAL)	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Anthracene	120-12-7	µg/kg	1,800,000	29,000	EcoSSL	29,000	17	6.7	3.3
Benzo(a)anthracene	56-55-3	µg/kg	1,100	1,100	EcoSSL	1,100	17	13	3.3
Benzo(a)pyrene	50-32-8	µg/kg	110	1,100	EcoSSL	110	17	6.7	3.3
Benzo(b)fluoranthene	205-99-2	µg/kg	1,100	1,100	EcoSSL	1,100	17	6.7	3.3
Benzo(g,h,i)perylene	191-24-2	µg/kg	180,000 c	1,100	EcoSSL	1,100	17	6.7	3.3
Benzo(k)fluoranthene	207-08-9	µg/kg	11,000	1,100	EcoSSL	1,100	17	6.7	3.3
Chrysene	218-01-9	µg/kg	110,000	1,100	EcoSSL	1,100	17	6.7	3.3
Dibenz(a,h)anthracene	53-70-3	µg/kg	110	1,100	EcoSSL	110	17	13	6.7
Fluoranthene	206-44-0	µg/kg	240,000	1,100	EcoSSL	1,100	17	6.7	3.3
Fluorene	86-73-7	µg/kg	240,000	29,000	EcoSSL	29,000	17	6.7	3.3
Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1,100	1,100	EcoSSL	1,100	17	8.0	4.0
Naphthalene	91-20-3	µg/kg	3,800	29,000	EcoSSL	3,800	17	13	6.7
Phenanthrene	85-01-8	µg/kg	180,000 c	29,000	EcoSSL	29,000	17	8.0	4.0
Pyrene	129-00-0	µg/kg	180,000	1,100	EcoSSL	1,100	17	6.7	3.3

WORKSHEET #15.6: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SOIL (CONTINUED)

Notes:

Due to coelution of 3-methylphenol with 4-methylphenol, only 4-methylphenol is listed as an analyte in WS15.1; any detectable 3-methylphenol would be reported as 4-methylphenol.

PALs in this table do not apply to IDW soil samples; the test is required for IDW, and analytical results will be evaluated by the disposal facility.

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout. Note that while laboratory limits exceed PALs for numerous PAHs, the PAHs will be analyzed EPA Method 8270D (PAH-SIM in water) and the laboratory limits are further evaluated in Worksheet 15.7.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).
Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
a = 2,4-dinitrophenol for 2-nitrophenol and 4-nitrophenol (non-cancer nitrophenol)
b= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022
c= pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)
d= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022
e=diethyl phthalate for di-methyl phthalate (structurally similar; two neutral alkyl substituents; non non-cancer phthalates)

[2] Ecological PAL is based off the following hierarchy of sources:
a) EPA Ecological Soil Screening Levels (EcoSSLs) (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.
b) R4 = EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.
c) Los Alamos National Lab (LANL). September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
f= 2-nitraniline for 4-nitroaniline (isomers)

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.7: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SEDIMENT

Matrix: Sediment
Analytical Group / Method: SVOCs (full scan) / EPA Methods 3546 (microwave extraction) and 8270E (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
TCL SVOC in Sediment – EPA Method 8270E									
1,1'-Biphenyl	92-52-4	µg/kg	4,700	1,220	a$	1,220	37	33	17
2,2'-oxybis(1-Chloropropane)	108-60-1	µg/kg	310,000	NSL		310,000	43	40	20
2,4,5-Trichlorophenol	95-95-4	µg/kg	630,000	819	a#	819	37	33	17
2,4,6-Trichlorophenol	88-06-2	µg/kg	6,300	89	b$	89	37	33	17
2,4-Dichlorophenol	120-83-2	µg/kg	19,000	117	a$	117	43	40	20
2,4-Dimethylphenol	105-67-9	µg/kg	130,000	29	a$	**29**	**37**	**33**	17
2,4-Dinitrophenol	51-28-5	µg/kg	13,000	45	b#	**45**	**1,000**	**330**	**167**
2,4-Dinitrotoluene	121-14-2	µg/kg	1,700	42	b$	**42**	**170**	**67**	33
2,6-Dinitrotoluene	606-20-2	µg/kg	360	296	b$	296	37	33	17
2-Chloronaphthalene	91-58-7	µg/kg	480,000	NSL		480,000	33	27	13
2-Chlorophenol	95-57-8	µg/kg	39,000	31	a$	**31**	**37**	**33**	17
2-Methylphenol	95-48-7	µg/kg	320,000	63	b#	**63**	**50**	40	20
2-Nitroaniline	88-74-4	µg/kg	63,000	7,300	c	7,300	50	33	17
2-Nitrophenol	88-75-5	µg/kg	13,000 a	168	b$	168	50	40	20
3,3'-Dichlorobenzidine	91-94-1	µg/kg	1,200	127	a$	**127**	**170**	67	33
3-Nitroaniline	99-09-2	µg/kg	1,900 d	NSL		1,900	170	67	33

WORKSHEET #15.7: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
4,6-Dinitro-2-methylphenol	534-52-1	µg/kg	510	1,477	b*	510	500	330	170
4-Bromophenyl-phenylether	101-55-3	µg/kg	NSL	1,230	a$	1,230	37	33	17
4-Chloro-3-methylphenol	59-50-7	µg/kg	630,000	5	b$	**5**	**50**	**40**	**20**
4-Chloroaniline	106-47-8	µg/kg	2,700	0.9	b*	**0.9**	**170**	**67**	**33**
4-Chlorophenyl-phenylether	7005-72-3	µg/kg	NSL	NSL		NSL	37	33	17
4-Methylphenol	106-44-5	µg/kg	130,000	670	a$	670	50	33	17
4-Nitroaniline	100-01-6	µg/kg	25,000	7,300 f	c	7,300	170	67	33
4-Nitrophenol	100-02-7	µg/kg	13,000 a	153	b$	**153**	**500**	**330**	**170**
Acetophenone	98-86-2	µg/kg	780,000	NSL		780,000	50	33	17
Atrazine	1912-24-9	µg/kg	2,400	6.6	a$	**6.6**	**170**	**130**	**67**
Benzaldehyde	100-52-7	µg/kg	170,000	59	b*	**59**	**170**	**67**	33
bis(2-Chloroethoxy)methane	111-91-1	µg/kg	19,000	NSL		19,000	37	33	17
bis(2-Chloroethyl)ether	111-44-4	µg/kg	230	NSL		230	37	33	17
bis(2-Ethylhexyl)phthalate	117-81-7	µg/kg	39,000	180	a$	180	170	130	67
Butylbenzylphthalate	85-68-7	µg/kg	290,000	10,900	a$	10,900	170	130	67
Caprolactam	105-60-2	µg/kg	3,100,000	NSL		3,100,000	170	67	33
Carbazole	86-74-8	µg/kg	27 b	69	b$	**27**	**37**	**33**	17
Di-n-butylphthalate	84-74-2	µg/kg	630,000	1,160	a#	1,160	170	130	67
Di-n-octylphthalate	117-84-0	µg/kg	63,000	39	b$	**39**	**170**	**130**	**67**

WORKSHEET #15.7: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Dibenzofuran	132-64-9	µg/kg	7,300	415	a$	415	37	33	17
Diethylphthalate	84-66-2	µg/kg	5,100,000	218	a#	218	170	130	67
Dimethylphthalate	131-11-3	µg/kg	5,100,000 e	530	b#	530	170	130	67
Hexachlorobenzene	118-74-1	µg/kg	78	20	R3$	20	17	13	6.7
Hexachlorobutadiene	87-68-3	µg/kg	1,200	NSL		1,200	50	40	20
Hexachlorocyclopentadiene	77-47-4	µg/kg	180	139	R3#	**139**	**500**	**330**	**170**
Hexachloroethane	67-72-1	µg/kg	1,800	804	R3#	804	170	67	33
Isophorone	78-59-1	µg/kg	570,000	876	R4$	876	67	33	17
N-Nitroso-di-n-propylamine	621-64-7	µg/kg	78	NSL		78	67	50	33
N-Nitrosodiphenylamine	86-30-6	µg/kg	110,000	2,680	R3$	2,680	37	33	17
Nitrobenzene	98-95-3	µg/kg	5,100	407	R4$	407	37	33	17
Pentachlorophenol	87-86-5	µg/kg	1,000	504	R3$	504	170	130	67
Phenol	108-95-2	µg/kg	1,900,000	420	R3$	420	37	33	17
PAHs									
2-Methylnaphthalene	91-57-6	µg/kg	24,000	20.2	R3*	**20.2**	17	10	5.0
Acenaphthene	83-32-9	µg/kg	360,000	6.7	R3*	**6.7**	**17**	6.7	3.3
Acenaphthylene	208-96-8	µg/kg	180,000 c	5.9	R3*	**5.9**	**17**	**8.0**	4.0
Anthracene	120-12-7	µg/kg	1,800,000	47	R3#	47	17	6.7	3.3
Benzo(a)anthracene	56-55-3	µg/kg	1,100	75	R3#	75	17	13	3.3

WORKSHEET #15.7: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Benzo(a)pyrene	50-32-8	µg/kg	110	89	R3#	89	17	6.7	3.3
Benzo(b)fluoranthene	205-99-2	µg/kg	1,100	190	R4$	190	17	6.7	3.3
Benzo(g,h,i)perylene	191-24-2	µg/kg	180,000 c	170	R3$	170	17	6.7	3.3
Benzo(k)fluoranthene	207-08-9	µg/kg	11,000	240	R3$	240	17	6.7	3.3
Chrysene	218-01-9	µg/kg	110,000	108	R3#	108	17	6.7	3.3
Dibenz(a,h)anthracene	53-70-3	µg/kg	110	6.2	R3#	**6.2**	**17**	**13**	**6.7**
Fluoranthene	206-44-0	µg/kg	240,000	113	R3#	113	17	6.7	3.3
Fluorene	86-73-7	µg/kg	240,000	21	R3#	21	17	6.7	3.3
Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1,100	17	R3$	17	17	8.0	4.0
Naphthalene	91-20-3	µg/kg	3,800	35	R3#	35	17	13	6.7
Phenanthrene	85-01-8	µg/kg	180,000 c	87	R4#	87	17	8.0	4.0
Pyrene	129-00-0	µg/kg	180,000	153	R3#	153	17	6.7	3.3

WORKSHEET #15.7: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—SVOCS IN SEDIMENT (CONTINUED)

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout. Note that while laboratory limits exceed PALs for numerous PAHs, the PAHs will be analyzed EPA Method 8270D (PAH-SIM in water) and the laboratory limits are further evaluated in Worksheet 15.13.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = 2,4-dinitrophenol for 2-nitrophenol and 4-nitrophenol (non-cancer nitrophenol)

b= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022

c= pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)

d= ORNL RAIS on-line Chemical PRG Calculator (https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem); Output 21SEP2022

e=diethyl phthalate for di-methyl phthalate (structurally similar; two neutral alkyl substituents non-cancer phthalates)

[2] Ecological PAL is based off the following hierarchy of sources:

a) R3 = EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values.

b) R4 = EPA Region 4 Ecological Screening Value (ESV): https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

f= 2-nitraniline for 4-nitroaniline (isomers)

$ = freshwater value

= saltwater value

* = saltwater and freshwater value are the same

WORKSHEET #15.8: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1,4-DIOXANE BY SIM IN SOIL

Matrix: Soil
Analytical Group / Method: PAHs and 1,4-Dioxane by SIM / EPA Methods 3546 (microwave extraction) and 8270E (analysis)
Concentration Level: Trace

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
PAH-SIM in Soil – EPA Method 8270E SIM									
1-Methylnaphthalene	90-12-0	µg/kg	18,000	29,000	EcoSSL	18,000	1.7	1.3	0.67
2-Methylnaphthalene	91-57-6	µg/kg	24,000	29,000	EcoSSL	24,000	3.3	2.7	1.3
Acenaphthene	83-32-9	µg/kg	360,000	29,000	EcoSSL	29,000	1.7	1.3	0.67
Acenaphthylene	208-96-8	µg/kg	180,000 a	29,000	EcoSSL	29,000	1.7	1.3	0.33
Anthracene	120-12-7	µg/kg	1,800,000	29,000	EcoSSL	29,000	1.7	1.3	0.67
Benzo(a)anthracene	56-55-3	µg/kg	1,100	1,100	EcoSSL	1,100	1.7	1.3	0.67
Benzo(a)pyrene	50-32-8	µg/kg	110	1,100	EcoSSL	110	1.7	1.3	0.67
Benzo(b)fluoranthene	205-99-2	µg/kg	1,100	1,100	EcoSSL	1,100	1.7	1.3	0.67
Benzo(g,h,i)perylene	191-24-2	µg/kg	180,000 a	1,100	EcoSSL	1,100	1.7	1.3	0.67
Benzo(k)fluoranthene	207-08-9	µg/kg	11,000	1,100	EcoSSL	1,100	1.7	1.3	0.67
Chrysene	218-01-9	µg/kg	110,000	1,100	EcoSSL	1,100	1.7	1.3	0.33
Dibenz(a,h)anthracene	53-70-3	µg/kg	110	1,100	EcoSSL	110	1.7	1.3	0.67
Fluoranthene	206-44-0	µg/kg	240,000	1,100	EcoSSL	1,100	1.7	1.3	0.67
Fluorene	86-73-7	µg/kg	240,000	29,000	EcoSSL	29,000	1.7	1.3	0.67
Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1,100	1,100	EcoSSL	1,100	1.7	1.3	0.67
Naphthalene	91-20-3	µg/kg	3,800	29,000	EcoSSL	3,800	3.3	2.7	1.3

WORKSHEET #15.8: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1,4-DIOXANE BY SIM IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Phenanthrene	85-01-8	µg/kg	180,000 a	29,000	EcoSSL	29,000	2.3	2.0	1.0
Pyrene	129-00-0	µg/kg	180,000	1,100	EcoSSL	1,100	1.7	1.3	0.67
1,4-Dioxane-SIM in Soil – EPA Method 8270E SIM									
1,4-Dioxane	123-91-1	µg/kg	5,300	2,050	R5	2,050	3.3	2.7	1.3

Notes:

PAHs and 1,4-Dioxane will be reported from the same extract and analysis.

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).
Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
a = pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)

[2] Ecological PAL is based off the following hierarchy of sources:
a) EPA EcoSSLs (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.
b) R4 = EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.
c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.).
d) R5 = EPA (2003b). Region 5 Ecological Screening Level. August 22, 2003.

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.9: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1,4-DIOXANE BY SIM IN SEDIMENT

Matrix: Sediment
Analytical Group/Method: PAHs and 1,4-Dioxane by SIM / EPA Methods 3546 (microwave extraction) and 8270E (analysis)
Concentration Level: Trace

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
PAH-SIM in Sediment – EPA Method 8270E SIM									
1-Methylnaphthalene	90-12-0	µg/kg	18,000	141	R4$	141	1.7	1.3	0.67
2-Methylnaphthalene	91-57-6	µg/kg	24,000	20.2	R3*	20.2	3.3	2.7	1.3
Acenaphthene	83-32-9	µg/kg	360,000	6.7	R3*	6.7	1.7	1.3	0.67
Acenaphthylene	208-96-8	µg/kg	180,000 a	5.9	R3 *	5.9	1.7	1.3	0.33
Anthracene	120-12-7	µg/kg	1,800,000	47	R3#	47	1.7	1.3	0.67
Benzo(a)anthracene	56-55-3	µg/kg	1,100	75	R3#	75	1.7	1.3	0.67
Benzo(a)pyrene	50-32-8	µg/kg	110	89	R3#	89	1.7	1.3	0.67
Benzo(b)fluoranthene	205-99-2	µg/kg	1,100	190	R4$	190	1.7	1.3	0.67
Benzo(g,h,i)perylene	191-24-2	µg/kg	180,000 a	170	R3$	170	1.7	1.3	0.67
Benzo(k)fluoranthene	207-08-9	µg/kg	11,000	240	R3$	240	1.7	1.3	0.67
Chrysene	218-01-9	µg/kg	110,000	108	R3#	108	1.7	1.3	0.33
Dibenz(a,h)anthracene	53-70-3	µg/kg	110	6.2	R3#	6.2	1.7	1.3	0.67
Fluoranthene	206-44-0	µg/kg	240,000	113	R3#	113	1.7	1.3	0.67
Fluorene	86-73-7	µg/kg	240,000	21	R3#	21	1.7	1.3	0.67
Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1,100	17	R3$	17	1.7	1.3	0.67
Naphthalene	91-20-3	µg/kg	3,800	35	R3#	35	3.3	2.7	1.3
Phenanthrene	85-01-8	µg/kg	180,000 a	87	R4#	87	2.3	2.0	1.0

WORKSHEET #15.9: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PAHS AND 1,4-DIOXANE BY SIM IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Pyrene	129-00-0	µg/kg	180,000	153	R3#	153	1.7	1.3	0.67
1,4-Dioxane-SIM in Sediment – EPA Method 8270E SIM									
1,4-Dioxane	123-91-1	µg/kg	5,300	119	R5	119	3.3	2.7	1.3

Notes:

PAHs and 1,4-Dioxane will be reported from the same extract and analysis.

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = pyrene for acenaphthylene, benzo(ghi)perylene and phenanthrene (non-cancer PAH; worst case)

[2] Ecological PAL is based off the following hierarchy of sources:

a) R3 = EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values

b) R4 = EPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

d) R5 = EPA (2003b). Region 5 Ecological Screening Level. August 22, 2003.

$ = freshwater value

= saltwater value

* = saltwater and freshwater value are the same

WORKSHEET #15.10: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN SOIL

Matrix: Soil
Analytical Group / Method: Explosives / EPA Method 8330B (preparation and analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSLs				LOQ	LOD	DL
Explosives in Soil – EPA Method 8330B									
1,3,5-Trinitrobenzene	99-35-4	µg/kg	220,000	300	R4	300	120	80	32
1,3-Dinitrobenzene	99-65-0	µg/kg	630	34	R4	**34**	**120**	**80**	20
2,4,6-Trinitrotoluene	118-96-7	µg/kg	3,600	7,500	R4	3,600	200	196	83
2,4-Diamino-6-nitrotoluene	6629-29-4	µg/kg	15,000 a	12,000 a	R4	**12,000**	300	240	120
2,4-Dinitrotoluene	121-14-2	µg/kg	1,700	6,000	R4	**1,700**	120	80	36
2,6-Diamino-4-nitrotoluene	59229-75-3	µg/kg	15,000 a	12,000 a	R4$	12,000	300	240	120
2,6-Dinitrotoluene	606-20-2	µg/kg	360	4,000	R4	360	150	148	47
2-Amino-4,6-Dinitrotoluene	35572-78-2	µg/kg	15,000	14,000	R4	14,000	200	196	98
2-Nitrotoluene	88-72-2	µg/kg	3,200	190	R4	190	150	148	74
3-Nitrotoluene	99-08-1	µg/kg	630	130	R4	**130**	**150**	**148**	48
4-Amino-2,6-Dinitrotoluene	19406-51-0	µg/kg	15,000	12,000	R4	12,000	120	80	30
4-Nitrotoluene	99-99-0	µg/kg	25,000	140	R4	140	**150**	**148**	54
HMX	2691-41-0	µg/kg	390,000	16,000	R4	16,000	200	150	71
Nitrobenzene	98-95-3	µg/kg	5,100	2,200	R4	2,200	120	80	22
Nitroglycerin	55-63-0	µg/kg	630	13,000	R4	**630**	**2,400**	**2,000**	**760**
PETN	78-11-5	µg/kg	57,000	2,200	R4	2,200	**2,400**	2,000	1,000
RDX	121-82-4	µg/kg	8,300	2,300	R4	2,300	120	100	45

WORKSHEET #15.10: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSLs				LOQ	LOD	DL
Tetryl	479-45-8	µg/kg	16,000	18	R4	18	**150**	**148**	**68**

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = 4-Amino-2,6-Dinitrotoluene for 2,4-Diamino-6-nitrotoluene and 2,6-Diamino-4-nitrotoluene (structurally similar; noncancer nitrotoluene)

[2] Ecological PAL is based off the following hierarchy of sources:

a)R3 = EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values.

b) R4 = EPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.11: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN SEDIMENT

Matrix: Sediment
Analytical Group / Method: Explosives / EPA Method 8330B (preparation and analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSLs				LOQ	LOD	DL
Explosives in Sediment – EPA Method 8330B									
1,3,5-Trinitrobenzene	99-35-4	µg/kg	220,000	15	R4*	**15**	**120**	**80**	**32**
1,3-Dinitrobenzene	99-65-0	µg/kg	630	37	R4#	**37**	**120**	**80**	20
2,4,6-Trinitrotoluene	118-96-7	µg/kg	3,600	92	R3$	**92**	**200**	**196**	83
2,4-Diamino-6-nitrotoluene	6629-29-4	µg/kg	15,000 a	28 a	R4$	**28**	**300**	**240**	**120**
2,4-Dinitrotoluene	121-14-2	µg/kg	1,700	41.6	R3$	**41.6**	**120**	**80**	36
2,6-Diamino-4-nitrotoluene	59229-75-3	µg/kg	15,000 a	28 a	R4$	**28**	**300**	**240**	**120**
2,6-Dinitrotoluene	606-20-2	µg/kg	360	296	R4$	296	150	148	47
2-Amino-4,6-Dinitrotoluene	35572-78-2	µg/kg	15,000	47	R4$	**47**	**200**	**196**	**98**
2-Nitrotoluene	88-72-2	µg/kg	3,200	207	R4$	207	150	148	74
3-Nitrotoluene	99-08-1	µg/kg	630	145	R4$	**145**	**150**	**148**	48
4-Amino-2,6-Dinitrotoluene	19406-51-0	µg/kg	15,000	28	R4$	**28**	**120**	**80**	**30**
4-Nitrotoluene	99-99-0	µg/kg	25,000	4,060	R3$	4,060	150	148	54
HMX	2691-41-0	µg/kg	390,000	108	R4$	**108**	**200**	**150**	71
Nitrobenzene	98-95-3	µg/kg	5,100	407	R4$	407	120	80	22
Nitroglycerin	55-63-0	µg/kg	630	10	R4$	**10**	**2,400**	**2,000**	**760**
PETN	78-11-5	µg/kg	57,000	1,300,000	LANL	13,000	2,400	2,000	1,000
RDX	121-82-4	µg/kg	8,300	13	R3$	**13**	**120**	**100**	**45**

WORKSHEET #15.11: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—EXPLOSIVES IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSLs				LOQ	LOD	DL
Tetryl	479-45-8	µg/kg	16,000	91,000	LANL	16,000	150	148	68

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).

Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):

a = 4-Amino-2,6-Dinitrotoluene for 2,4-Diamino-6-nitrotoluene and 2,6-Diamino-4-nitrotoluene (structurally similar; noncancer nitrotoluene)

[2] Ecological PAL is based off the following hierarchy of sources:

a)R3 = EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values.

b) R4 = EPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.12: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN SOIL

Matrix: Soil
Analytical Group / Method: Organochlorine Pesticides / EPA Methods 3546 (microwave extraction) and 8081B (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Pesticides in Soil – EPA Method 8081B									
Aldrin	309-00-2	µg/kg	39	30	R4	30	0.83	0.60	0.17
Alpha BHC	319-84-6	µg/kg	86	0.3	R4	**0.3**	**0.83**	**0.60**	0.17
Alpha Chlordane	5103-71-9	µg/kg	3.6	2.9	R4	2.9	0.83	0.60	0.17
Beta BHC	319-85-7	µg/kg	300	0.3	R4	**0.3**	**1.0**	**0.90**	**0.44**
Delta BHC	319-86-8	µg/kg	300 a	0.3 a	R4	0.3	**1.0**	**0.90**	**0.45**
Dieldrin	60-57-1	µg/kg	34	4.9	EcoSSL	4.9	1.7	1.2	0.33
Endosulfan I	959-98-8	µg/kg	47 b	0.9	R4	0.9	0.83	0.60	0.22
Endosulfan II	33213-65-9	µg/kg	47 b	0.9	R4	**0.9**	**2.3**	**2.2**	**1.1**
Endosulfan Sulfate	1031-07-8	µg/kg	38,000	6.5	R4	6.5	1.7	1.2	0.33
Endrin	72-20-8	µg/kg	1,900	1.9	R4	1.9	1.7	1.4	0.68
Endrin Aldehyde	7421-93-4	µg/kg	1900 c	1.9 c	R4	1.9	1.7	1.2	0.33
Endrin Ketone	53494-70-5	µg/kg	1900 c	1.9 c	R4	1.9	2.0	1.8	0.60
Gamma BHC - Lindane	58-89-9	µg/kg	71	3.1	R4	3.1	0.83	0.60	0.21
Gamma Chlordane	5103-74-2	µg/kg	3.6	20	R4	3.6	0.83	0.60	0.25
Heptachlor	76-44-8	µg/kg	130	1.6	R4	1.6	0.83	0.62	0.31
Heptachlor Epoxide	1024-57-3	µg/kg	70	0.15	R4	**0.15**	**0.83**	**0.60**	**0.17**
Methoxychlor	72-43-5	µg/kg	32,000	2.1	R4	**2.1**	**6.7**	**5.9**	1.8
p,p-DDD	72-54-8	µg/kg	190	21	EcoSSL	21	1.7	1.6	0.33

WORKSHEET #15.12: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
p,p-DDE	72-55-9	µg/kg	2,000	21	EcoSSL	21	1.7	1.2	0.33
p,p-DDT	50-29-3	µg/kg	1,900	21	EcoSSL	21	1.7	1.2	0.79
Toxaphene	8001-35-2	µg/kg	490	0.15	R4	**0.15**	**33**	**28**	**14**

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

** TCLP Extraction Method 1311 for waste characterization.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).
Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
a = beta BHC for delta BHC (isomer; noncancer)
b = endosulfan for endosulfan I and endosulfan II (metabolite; non-cancer)
c = endrin for endrin aldehyde and endrin ketone (metabolite; non-cancer)

[2] Ecological PAL is based off the following hierarchy of sources:
a) EPA EcoSSLs (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.
b)R4 = EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.
c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.).

$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.13: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN SEDIMENT

Matrix: Sediment
Analytical Group / Method: Organochlorine Pesticides / EPA Methods 3546 (microwave extraction) and 8081B (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Pesticides in Sediment – EPA Method 8081B									
Aldrin	309-00-2	µg/kg	39	2	R3$	2	0.83	0.60	0.17
Alpha BHC	319-84-6	µg/kg	86	6	R3$	6	0.83	0.60	0.17
Alpha Chlordane	5103-71-9	µg/kg	3.6	2.26	R3#	2.26	0.83	0.60	0.17
Beta BHC	319-85-7	µg/kg	300	5	R3$	5	1.0	0.90	0.44
Delta BHC	319-86-8	µg/kg	300 a	6,400	R3$	300	1.0	0.90	0.45
Dieldrin	60-57-1	µg/kg	34	0.72	R3#	**0.72**	**1.7**	**1.2**	0.33
Endosulfan I	959-98-8	µg/kg	47 b	2.9	R3$	2.9	0.83	0.60	0.22
Endosulfan II	33213-65-9	µg/kg	47 b	14	R3$	14	2.3	2.2	1.1
Endosulfan Sulfate	1031-07-8	µg/kg	38,000	0.36	R3#	**0.36**	**1.7**	**1.2**	0.33
Endrin	72-20-8	µg/kg	1,900	2.22	R3$	2.22	1.7	1.2	0.68
Endrin Aldehyde	7421-93-4	µg/kg	1900 c	2.22	R3$	2.22	1.7	1.2	0.33
Endrin Ketone	53494-70-5	µg/kg	1900 c	2.22	R3$	2.22	2.0	1.8	0.60
Gamma BHC - Lindane	58-89-9	µg/kg	71	0.32	R3#	**0.32**	**0.83**	**0.60**	0.21
Gamma Chlordane	5103-74-2	µg/kg	3.6	2.26	R3#	2.26	0.83	0.60	0.25
Heptachlor	76-44-8	µg/kg	130	68	R3$	68	0.83	0.62	0.31
Heptachlor Epoxide	1024-57-3	µg/kg	70	0.6	R3#	**0.60**	**0.83**	0.60	0.17
Methoxychlor	72-43-5	µg/kg	32,000	18.7	R3$	18.7	6.7	5.9	1.8

WORKSHEET #15.13: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—PESTICIDES IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
p,p-DDD	72-54-8	µg/kg	190	1.2	R3#	**1.2**	**1.7**	**1.6**	0.33
p,p-DDE	72-55-9	µg/kg	2,000	2.07	R3#	2.07	1.7	1.2	0.33
p,p-DDT	50-29-3	µg/kg	1,900	1.19	R3#	**1.19**	**1.7**	**1.2**	0.79
Toxaphene	8001-35-2	µg/kg	490	0.1	R3$	**0.1**	**33**	**28**	**14**

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.
[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021).
Surrogate chemicals (If any risk is presented because of these compounds, the assignment of surrogates will be revisited):
a = beta BHC for delta BHC (non-cancer isomer)
b = endosulfan for endosulfan I and endosulfan II
c = endrin for endrin aldehyde and endrin ketone
[2] Ecological PAL is based off the following hierarchy of sources:
a) R3= EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values. Endrin used as surrogate for endrin aldehyde and endrin ketone
b) R4 = EPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.
c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.
$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.14: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/ QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN SOIL

Matrix: Soil
Analytical Group / Method: TAL Metals / EPA Methods 3050B (acid digestion) and 6020B (analysis)
Concentration Level: Trace
Analytical Group / Method: Mercury / EPA Method 7471B (preparation and analysis)
Concentration Level: Low
Matrix: Soil
Analytical Group / Method: Hexavalent Chromium / EPA Methods 3060A (alkaline digestion) and 7196A (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
TAL Metals in Soil – EPA Methods 6020B									
Aluminum	7429-90-5	mg/kg	7,700	NSL	pH	7,700	10	9.0	4.37
Antimony	7440-36-0	mg/kg	3.1	0.27	EcoSSL	0.27	0.10	0.080	0.040
Arsenic	7440-38-2	mg/kg	0.68	18	EcoSSL	0.68	0.20	0.16	0.0669
Barium	7440-39-3	mg/kg	1,500	330	EcoSSL	330	0.20	0.18	0.0915
Beryllium	7440-41-7	mg/kg	16	21	EcoSSL	16	0.050	0.025	0.0119
Cadmium	7440-43-9	mg/kg	0.71	0.36	EcoSSL	0.36	0.050	0.040	0.020
Calcium	7440-70-2	mg/kg	NUT	NUT		NUT	20	19.6	9.80
Chromium	7440-47-3	mg/kg	12,000 trivalent	26	EcoSSL	26	0.20	0.15	0.0769
Cobalt	7440-48-4	mg/kg	2.3	13	EcoSSL	2.3	0.10	0.050	0.020
Copper	7440-50-8	mg/kg	310	28	EcoSSL	28	0.20	0.15	0.044
Iron	7439-89-6	mg/kg	5,500	NSL	pH	5,500	10	9.0	4.61
Lead	7439-92-1	mg/kg	200	11	EcoSSL	11	0.10	0.080	0.038
Magnesium	7439-95-4	mg/kg	NUT	NUT		NUT	5.0	4.0	1.57
Manganese	7439-96-5	mg/kg	180	220	EcoSSL	180	0.25	0.20	0.106
Nickel	7440-02-0	mg/kg	150	38	EcoSSL	38	0.20	0.16	0.0814
Potassium	7440-09-7	mg/kg	NUT	NUT		NUT	20	16	9.52
Selenium	7782-49-2	mg/kg	39	0.52	EcoSSL	0.52	0.20	0.10	0.050

WORKSHEET #15.14: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN SOIL (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Silver	7440-22-4	mg/kg	39	4.20	EcoSSL	4.20	0.050	0.040	0.0203
Sodium	7440-23-5	mg/kg	NUT	NUT		NUT	25	20	10
Thallium	7440-28-0	mg/kg	0.078	0.05	R4	0.05	0.050	0.040	0.0196
Vanadium	7440-62-2	mg/kg	39	7.80	EcoSSL	7.80	0.40	0.20	0.10
Zinc	7440-66-6	mg/kg	2,300	46	EcoSSL	46	15	4.0	2.0
Mercury in Soil – EPA Method 7471B									
Mercury	7439-97-6	mg/kg	1.1	0.013	R4	**0.013**	**0.060**	**0.040**	**0.020**
Hexavalent Chromium – EPA Method 7196A									
Hexavalent Chromium [3]	18540-29-9	mg/kg	0.30	0.34	R4	**0.30**	**0.42**	0.30	0.14

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021). NUT = essential nutrient
[2] Ecological PAL is based off the following hierarchy of sources:
a) EPA EcoSSLs (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.
b) R4 = EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.
c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.
[3] Hexavalent chromium analysis will be performed, if necessary, after evaluation of total chromium results.
$ = freshwater value
# = saltwater value
* = saltwater and freshwater value are the same

WORKSHEET #15.15: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/ QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN SEDIMENT

Matrix: Sediment
Analytical Group / Method: TAL Metals / EPA Methods 3050B (acid digestion) and 6020B (analysis)
Concentration Level: Trace
Analytical Group / Method: Mercury / EPA Method 7471B (preparation and analysis)
Concentration Level: Low
Analytical Group / Method: Hexavalent Chromium / EPA Methods 3060A (alkaline digestion) and 7196A (analysis)
Concentration Level: Low

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
TAL Metals in Sediment – EPA Methods 6020B									
Aluminum	7429-90-5	mg/kg	7,700	25,000	R4$	7,700	10	9.0	4.37
Antimony	7440-36-0	mg/kg	3.1	2	R3$	2	0.10	0.080	0.040
Arsenic	7440-38-2	mg/kg	0.68	7.24	R3#	0.68	0.20	0.16	0.0669
Barium	7440-39-3	mg/kg	1,500	20	R4$	20	0.20	0.18	0.0915
Beryllium	7440-41-7	mg/kg	16	66	LANL	16	0.050	0.025	0.0119
Cadmium	7440-43-9	mg/kg	0.71	0.68	R3#	0.68	0.050	0.040	0.020
Calcium	7440-70-2	mg/kg	NUT	NUT		NUT	20	19.6	9.80
Chromium	7440-47-3	mg/kg	12,000 (trivalent)	43.4	R3$	43.4	0.20	0.15	0.0769
Cobalt	7440-48-4	mg/kg	2.3	50	R3$	2.3	0.10	0.050	0.020
Copper	7440-50-8	mg/kg	310	18.7	R3#	18.7	0.20	0.15	0.044
Iron	7439-89-6	mg/kg	5,500	20,000	a$	5,500	10	9.0	4.61
Lead	7439-92-1	mg/kg	200	30.2	R3#	30.2	0.10	0.080	0.038
Magnesium	7439-95-4	mg/kg	NUT	NUT		NUT	5.0	4.0	1.57
Manganese	7439-96-5	mg/kg	180	460	R3$	180	0.25	0.20	0.106
Nickel	7440-02-0	mg/kg	150	15.9	R3#	15.9	0.20	0.16	0.0814
Potassium	7440-09-7	mg/kg	NUT	NUT		NUT	20	16	9.52
Selenium	7782-49-2	mg/kg	39	2	R3$	2.0	0.20	0.10	0.050

WORKSHEET #15.15: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/ QUANTITATION LIMITS—TAL METALS AND HEXAVALENT CHROMIUM IN SEDIMENT (CONTINUED)

Analytes of Concern and Methods	CAS Number	Units	Human Health[1]	Ecological PAL[2]		PAL	Achievable Laboratory Limits		
			Residential Soil RSL				LOQ	LOD	DL
Silver	7440-22-4	mg/kg	39	0.73	R3#	0.73	0.050	0.040	0.0203
Sodium	7440-23-5	mg/kg	NUT	NUT		NUT	25	20	10
Thallium	7440-28-0	mg/kg	0.078	0.73	LANL	0.078	0.050	0.040	0.0196
Vanadium	7440-62-2	mg/kg	39	29	LANL	29	0.40	0.20	0.10
Zinc	7440-66-6	mg/kg	2,300	121	R3$	121	15	4.0	2.0
Mercury in Sediment – EPA Method 7471B									
Mercury	7439-97-6	mg/kg	1.1	0.13	R3#	0.13	0.060	0.040	0.020
Hexavalent Chromium – EPA Method 7196A [3]									
Hexavalent Chromium	18540-29-9	mg/kg	0.30	660	LANL	**0.30**	**0.42**	0.30	0.14

Notes:

Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.

BOLD values indicate Achievable Laboratory Limits exceed the PAL. If the DL is the only Achievable Laboratory Limit to exceed a PAL, it was not **BOLDED** as the DL does not have a statistical basis as it is simply the instrument readout.

[1] EPA RSLs for Residential Soil (TR=1E-06, THQ, 0.1; November 2021). NUT = essential nutrient

[2] Ecological PAL is based off the following hierarchy of sources:

a) R3 = EPA Region 3 minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values

b) R4 = EPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

[3] Hexavalent chromium analysis will be performed, if necessary, after evaluation of total chromium results.

$ = freshwater value

= saltwater value

* = saltwater and freshwater value are the same

WORKSHEET #15.16: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS — PHYSICAL PARAMETERS

Matrix: Soil and Sediment
Analytical Group / Method: Physical Parameters / varies (see below)
Concentration Level: Low (when applicable)

Analyte	Method	Units	Project Quantitation Limit Goal[1]	Achievable Laboratory Limits		
				LOQ	LOD	DL
Grain Size with hydrometer	ASTM D422	% (Passing through various sized sieves) and microns (hydrometer)	None	N/A	N/A	N/A
Total Organic Carbon (TOC)	EPA 9060A	mg/kg	1500	300	200	100
Cation Exchange Capacity (CEC)	EPA 9081 prep with analysis by EPA 6010D	meq/100g	25	5.0	N/A	N/A
Moisture Content (or % solids)	SM 2540G-2011	%	None	0.10	0.10	0.10

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
[1] Samples for Physical parameters are being analyzed for physical characteristics. There are no applicable regulatory limits or Project Action Limit (PAL) for these parameters, so a Project Quantitation Limit Goal is provided in lieu of the PAL.

WORKSHEET #15.17: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/ QUANTITATION LIMITS—TOTAL METALS, MERCURY, AND HEXAVALENT CHROMIUM IN IDW SOLID

Matrix: IDW Solid
Analytical Group / Method: Total Metals / EPA Methods 3050B (acid digestion) and 6010D (analysis)
Concentration Level: Low
Analytical Group / Method: Mercury / EPA Method 7471B (preparation and analysis)
Concentration Level: Low
Analytical Group / Method: Hexavalent Chromium / EPA Methods 3060A (alkaline digestion) and 7196A (analysis)
Concentration Level: Low

Analytes	Method	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
					LOQ	LOD	DL
Arsenic	EPA 6010D	7440-38-2	mg/kg	15	3.0	2.8	1.4
Barium	EPA 6010D	7440-39-3	mg/kg	2.5	0.50	0.30	0.15
Cadmium	EPA 6010D	7440-43-9	mg/kg	2.5	0.50	0.20	0.10
Chromium	EPA 6010D	7440-47-3	mg/kg	7.5	1.5	0.70	0.35
Copper	EPA 6010D	7440-50-8	mg/kg	10	2.0	1.54	0.77
Lead	EPA 6010D	7439-92-1	mg/kg	7.5	1.5	1.2	0.60
Nickel	EPA 6010D	7440-02-0	mg/kg	5	1.0	0.52	0.26
Selenium	EPA 6010D	7782-49-2	mg/kg	25	5.0	3.0	1.5
Silver	EPA 6010D	7440-22-4	mg/kg	5	1.0	0.80	0.40
Vanadium	EPA 6010D	7440-62-2	mg/kg	5	1.0	0.86	0.43
Zinc	EPA 6010D	7440-66-6	mg/kg	10	2.0	1.6	0.80
Mercury	EPA 7471B	7439-97-6	mg/kg	3	0.60	0.040	0.020
Hexavalent Chromium [3]	EPA 7196A	18540-29-9	mg/kg	2.1	0.42	0.30	0.14

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
There are no applicable regulatory limits or Project Action Limit (PAL) for these parameters, so a Project Quantitation Limit Goal is provided in lieu of the PAL.

WORKSHEET #15.18: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/ QUANTITATION LIMITS—TOTAL METALS, MERCURY, AND HEXAVALENT CHROMIUM IN IDW WATER

Matrix: IDW Water
Analytical Group / Method: Total Metals / EPA Methods 3005A (acid digestion) and 6010D (analysis)
Analytical Group / Method: Mercury / EPA Method 7470A (preparation and analysis)
Analytical Group / Method: Hexavalent Chromium / EPA Method 7196A (analysis)
Concentration Level: Low

Analytes	Method	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
					LOQ	LOD	DL
Arsenic	EPA 6010D	7440-38-2	µg/L	250	50	32	16
Barium	EPA 6010D	7440-39-3	µg/L	25	5	2	1
Cadmium	EPA 6010D	7440-43-9	µg/L	25	5	2	1
Chromium	EPA 6010D	7440-47-3	µg/L	75	15	6.3	3.0
Copper	EPA 6010D	7440-50-8	µg/L	150	30	16	8
Lead	EPA 6010D	7439-92-1	µg/L	75	15	14	7.1
Nickel	EPA 6010D	7440-02-0	µg/L	50	10	4.2	2.1
Selenium	EPA 6010D	7782-49-2	µg/L	250	50	32	16
Silver	EPA 6010D	7440-22-4	µg/L	50	10	8.0	5.0
Zinc	EPA 6010D	7440-66-6	µg/L	100	20	7.4	3.7
Mercury	EPA 7470A	7439-97-6	µg/L	1	0.20	0.16	0.079
Hexavalent Chromium	EPA 7196A	18540-29-9	mg/L	0.15	0.030	0.020	0.010

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
There are no applicable Project Action Limit (PAL) for these parameters, so a Project Quantitation Limit Goal is provided in lieu of the PAL.
The disposal facility requested additional metals beyond the eight RCRA metals.

WORKSHEET #15.19 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TCLP VOCS, TCLP SVOCS, AND TCLP METALS IN IDW SOLIDS

Matrix: IDW Solid
Analytical Group / Method: TCLP VOCs / EPA Methods 1311 (TCLP prep) and 8260D (analysis)
Analytical Group / Method: TCLP SVOCs / EPA Methods 1311 (TCLP prep), 3510C (separatory funnel extraction), and 8270E (analysis)
Analytical Group / Method: TCLP Metals / EPA Methods 1311 (TCLP prep), 3005A (acid digestion), and 6010D (analysis)
Analytical Group / Method: TCLP Mercury / EPA Methods 1311 (TCLP prep) and 7470A (preparation and analysis)
Concentration Level: Low

Analytes	Method	CAS Number	Units	TCLP Regulatory Limit	Achievable Laboratory Limits		
					LOQ	LOD	DL
TCLP VOCs							
Benzene	EPA 1311/8260D	71-43-2	µg/L	500	1.0	none	0.30
Carbon tetrachloride	EPA 1311/8260D	56-23-5	µg/L	500	1.0	none	0.30
Chlorobenzene	EPA 1311/8260D	108-90-7	µg/L	100,000	1.0	none	0.30
Chloroform	EPA 1311/8260D	67-66-3	µg/L	6,000	1.0	none	0.30
1,1-Dichloroethene	EPA 1311/8260D	75-35-4	µg/L	700	1.0	none	0.30
1,2-Dichloroethane	EPA 1311/8260D	107-06-2	µg/L	500	1.0	none	0.30
2-Butanone	EPA 1311/8260D	78-93-3	µg/L	200,000	10	none	0.50
Tetrachloroethene	EPA 1311/8260D	127-18-4	µg/L	700	1.0	none	0.30
Trichloroethene	EPA 1311/8260D	79-01-6	µg/L	500	1.0	none	0.30
Vinyl chloride	EPA 1311/8260D	75-01-4	µg/L	200	1.0	none	0.20
1,4-Dichlorobenzene	EPA 1311/8260D	106-46-7	µg/L	7,500	5.0	none	0.30
TCLP SVOCs							
1,4-Dichlorobenzene	EPA 1311/8270E	106-46-7	mg/L	7.5	0.010	0.005	0.0025
2,3,5-Trichlorophenol	EPA 1311/8270E	95-95-4	mg/L	400	0.010	0.005	0.0025
2,3,6-Trichlorophenol	EPA 1311/8270E	88-06-2	mg/L	2	0.010	0.005	0.0025
2,4-Dintrotoluene	EPA 1311/8270E	121-14-2	mg/L	0.13	0.025	0.010	0.005
2-Methylphenol	EPA 1311/8270E	95-48-7	mg/L	200	0.010	0.005	0.0025
4-Methylphenol	EPA 1311/8270E	106-44-5	mg/L	200	0.010	0.005	0.0025
Hexachlorobenzene	EPA 1311/8270E	118-74-1	mg/L	0.13	0.0025	0.0011	0.00055

WORKSHEET #15.19 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TCLP VOCS, SVOCS, AND METALS IN IDW SOLIDS (CONTINUED)

Analytes	Method	CAS Number	Units	TCLP Regulatory Limit	Achievable Laboratory Limits		
					LOQ	LOD	DL
Hexachlorobutadiene	EPA 1311/8270E	87-68-3	mg/L	0.5	0.010	0.005	0.0025
Hexachloroethane	EPA 1311/8270E	67-72-1	mg/L	3	0.025	0.005	0.0025
Nitrobenzene	EPA 1311/8270E	98-95-3	mg/L	2	0.010	0.005	0.0025
Pentachlorophenol	EPA 1311/8270E	87-86-5	mg/L	100	0.025	0.020	0.005
Pyridine	EPA 1311/8270E	110-86-1	mg/L	5	0.025	0.020	0.010
TCLP Metals							
Arsenic	EPA 1311/6010D	7440-38-2	µg/L	5,000	50	32	16
Barium	EPA 1311/6010D	7440-39-3	µg/L	100,000	5	2	1
Cadmium	EPA 1311/6010D	7440-43-9	µg/L	1,000	5	2	1
Chromium	EPA 1311/6010D	7440-47-3	µg/L	5,000	15	6.3	3.0
Copper	EPA 1311/6010D	7440-50-8	µg/L	None (TSDF limit applies)	30	16	8
Lead	EPA 1311/6010D	7439-92-1	µg/L	5,000	15	14	7.1
Nickel	EPA 1311/6010D	7440-02-0	µg/L	None (TSDF limit applies)	10	4.2	2.1
Selenium	EPA 1311/6010D	7782-49-2	µg/L	1,000	50	32	16
Silver	EPA 1311/6010D	7440-22-4	µg/L	5,000	10	8.0	5.0
Zinc	EPA 1311/6010D	7440-66-6	µg/L	None (TSDF limit applies)	20	7.4	3.7
Mercury	EPA 1311/7470A	7439-97-6	µg/L	200	0.20	0.16	0.079

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
Federal TCLP Regulatory Limits are provided in lieu of the PAL and the TSDF permit limit applies where Federal TCLP limits are not provided. The disposal facility requested additional metals beyond the eight TCLP metals.

WORKSHEET #15.20 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—NJDEP EPH IN IDW SOLID

Matrix: IDW Solid
Analytical Group / Method: NJDEP EPH / NJDEP EPH Method Version 7
Concentration Level: Low

Analyte	CAS Number	Units	Project Quantitation Limit Goal[1]	Achievable Laboratory Limits		
				LOQ	LOD	DL
C12-C16 Aliphatics	STL00159	mg/kg	50	10	6	3
C12-C16 Aromatics	STL00266	mg/kg	50	10	6	3
C16-C21 Aliphatics	STL00950	mg/kg	50	10	6	3
C16-C21 Aromatics	STL00004	mg/kg	50	10	6	3
C21-C36 Aromatics	STL01060	mg/kg	50	10	6	3
C21-C40 Aliphatics	STL01059	mg/kg	50	10	6	3
C10-C12 Aromatics	STL00011	mg/kg	50	10	6	3
C9-C12 Aliphatics	STL00191	mg/kg	50	10	6	3
Total Aliphatics	STL01064	mg/kg	50	10	6	3
Total Aromatics	STL01063	mg/kg	50	10	6	3
Total EPH	STL00362	mg/kg	50	10	6	3

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
Since there are no true CAS numbers for the EPA fractions, a lab-assigned code is substituted for the CAS number.
[1] There is no PAL for EPH, so a Quantitation Limit Goal was provided. EPH data will be provided to the disposal facility.

WORKSHEET #15.19 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TCLP VOCS, SVOCS, AND METALS IN IDW SOLIDS (CONTINUED)

WORKSHEET #15.21 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TOTAL PETROLEUM HYDROCARBONS (TPH) AS DIESEL RANGE ORGANICS (DRO) IN IDW WATER

Matrix: IDW Water
Analytical Group / Method: TPH as DRO / EPA 3510C (separatory funnel) and 8015D (analysis)
Concentration Level: Low

Analyte	CAS Number	Units	Project Quantitation Limit Goal [1]	Achievable Laboratory Limits		
				LOQ	LOD	DL
Diesel Range Organics (DRO) (C10-C28)	STL00143	µg/L	500	100	90	45

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
Since there are no true CAS numbers for the DRO fraction, a lab-assigned code is substituted for the CAS number.
[1] There is no PAL for DRO, so a Quantitation Limit Goal was provided. DRO data will be provided to the disposal facility.

WORKSHEET #15.19 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—TCLP VOCS, SVOCS, AND METALS IN IDW SOLIDS (CONTINUED)

WORKSHEET #15.22: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—POLYCHLORINATED BIPHENYLS (PCBS) IN IDW WATER AND IDW SOLID

Matrix: IDW Water
Analytical Group / Method: PCBs / EPA 3510C (low volume separatory funnel extraction) and 8020A (analysis)
Matrix: IDW Solid
Analytical Group / Method: PCBs / EPA 3546 (microwave extraction) and 8020A (analysis)
Concentration Level: Low

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
PCBs in IDW Water						
PCB-1016	12674-11-2	µg/L	1.25	0.25	0.20	0.10
PCB-1221	11104-28-2	µg/L	1.25	0.25	0.20	0.10
PCB-1232	11141-16-5	µg/L	1.25	0.25	0.20	0.10
PCB-1242	53469-21-9	µg/L	1.25	0.25	0.20	0.10
PCB-1248	12672-29-6	µg/L	1.25	0.25	0.20	0.10
PCB-1254	11097-69-1	µg/L	1.25	0.25	0.20	0.078
PCB-1260	11096-82-5	µg/L	1.25	0.25	0.20	0.078
PCB-1262	37324-23-5	µg/L	1.25	0.25	0.20	0.078
PCB-1268	11100-14-4	µg/L	1.25	0.25	0.20	0.078
PCBs in IDW Solid						
PCB-1016	12674-11-2	µg/kg	85	17	10	5.3
PCB-1221	11104-28-2	µg/kg	85	17	10	5.3
PCB-1232	11141-16-5	µg/kg	85	17	10	5.3
PCB-1242	53469-21-9	µg/kg	85	17	10	5.3

WORKSHEET #15.22: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS—POLYCHLORINATED BIPHENYLS (PCBS) IN IDW WATER AND IDW SOLID (CONTINUED)

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
PCB-1248	12672-29-6	µg/kg	85	17	10	5.3
PCB-1254	11097-69-1	µg/kg	85	17	10	6.4
PCB-1260	11096-82-5	µg/kg	85	17	10	6.4
PCB-1262	37324-23-5	µg/kg	85	17	10	6.4
PCB-1268	11100-14-4	µg/kg	85	17	10	6.4

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
[1] There is no PAL for PCBs, so a Project Quantitation Limit Goal was provided. PCB data will be provided to the disposal facility.

WORKSHEET #15.23: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— WASTE CHARACTERIZATION PARAMETERS FOR IDW SAMPLES

Matrix: IDW Solid and IDW Water
Analytical Group / Method: Varies (see below)
Concentration Level: Low

Analytical Group	Matrix	Method	Units	Project Action Level or Project Quantitation Goal[1]	Achievable Laboratory Limits		
					LOQ	LOD	DL
Reactive Cyanide [2]	IDW Water and IDW Solid	SW-846 Chapter 7.3.3.2/EPA 9012B	mg/kg	Detection	60	50	20
Reactive Sulfide [2]		SW-846 Chapter 7.3.4.2/EPA 9034	mg/kg	Detection	160	143	53.6
Corrosivity (pH) [3]		EPA 9040C (water)	SU	≤ 2 or ≥ 12.5	0.01	0.01	0.01
Total Cyanide (solid)	IDW Solid	EPA 9012B	mg/kg	Detection	0.50	0.45	0.18
Flashpoint (liquids)	IDW Water	EPA 1010A	̊C	Flash observed	50 ̊C	50 ̊C	50 ̊C
Ignitability [4]	IDW Solid	40 CFR Part 261.21	none	capable of ignition	N/A	N/A	N/A
Paint Filter Test[5]	IDW Solid	EPA 9095B	not applicable	Free Liquids present	N/A	N/A	N/A
Extractable Organic Halide (EOX) [5]	IDW Solid	EPA 9023	mg/kg	Halides detected	5	5	5
Total Organic Carbon (TOC)	EPA 9060A	EPA 9060A	mg/kg	1,500	300	200	100

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
[1] For IDW samples analyzed for waste characterization parameters, the PAL is the level that would potentially classify the waste as hazardous.
[2] The PALs for Total Cyanide, Reactive Cyanide, and Reactive Sulfide are listed as "Detection" so if detections are reported, then the waste disposal facility will manage the waste based on analytical results.
[3] IDW samples will be analyzed for pH to assess the Corrosivity characteristic . In accordance with EPA hazardous waste regulations, if the pH is ≤ 2 or ≥ 12.5 the waste is classified as corrosive.
[4] Ignitability for solids is defined as being capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture, or spontaneous chemical changes and when ignited, burns so vigorously and persistently that it creates a hazard (40 CFR 261.21). Soil samples will be analyzed for ignitability as part of waste disposal characterization.
[5] The paint filter test, TOC, and EOX are only required for IDW solid samples.

WORKSHEET #15.24: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW SOLID

Matrix: IDW Solid
Analytical Group / Method: VOCs / EPA Method 5035A (soil sample preparation) and 8260D (analysis)
Concentration Level: Low

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
1,1,1-Trichloroethane	71-55-6	µg/kg	25	5.00	2.00	0.600
1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	25	5.00	1.00	0.400
1,1,2-Trichloroethane	79-00-5	µg/kg	25	5.00	2.00	0.500
1,1-Dichloroethane	75-34-3	µg/kg	25	5.00	2.00	0.500
1,1-Dichloroethene	75-35-4	µg/kg	25	5.00	2.00	0.500
1,2,4-Trichlorobenzene	120-82-1	µg/kg	50	10.0	8.00	5.00
1,2-Dibromo-3-Chloropropane	96-12-8	µg/kg	25	5.00	1.00	0.500
1,2-Dibromoethane (EDB)	106-93-4	µg/kg	25	5.00	1.00	0.400
1,2-Dichlorobenzene	95-50-1	µg/kg	25	5.00	2.00	0.500
1,2-Dichloroethane	107-06-2	µg/kg	25	5.00	2.00	0.600
1,2-Dichloropropane	78-87-5	µg/kg	25	5.00	2.00	0.500
1,3-Dichlorobenzene	541-73-1	µg/kg	25	5.00	2.00	0.500
1,4-Dichlorobenzene	106-46-7	µg/kg	25	5.00	1.00	0.400
2-Butanone	78-93-3	µg/kg	50	10.0	4.00	2.00
2-Hexanone	591-78-6	µg/kg	50	10.0	4.00	1.00
4-Methyl-2-pentanone	108-10-1	µg/kg	50	10.0	4.00	1.00
Acetone	67-64-1	µg/kg	20	20.0	16.0	6.00
Benzene	71-43-2	µg/kg	25	5.00	2.00	0.500
Bromodichloromethane	75-27-4	µg/kg	25	5.00	1.00	0.400
Bromoform	75-25-2	µg/kg	50	10.0	8.00	5.00

WORKSHEET #15.24: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW SOLID (CONTINUED)

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
Bromomethane	74-83-9	µg/kg	25	5.00	2.00	0.700
Carbon disulfide	75-15-0	µg/kg	25	5.00	2.00	0.600
Carbon tetrachloride	56-23-5	µg/kg	25	5.00	2.00	0.500
Chlorobenzene	108-90-7	µg/kg	25	5.00	2.00	0.500
Chloroethane	75-00-3	µg/kg	25	5.00	4.00	1.00
Chloroform	67-66-3	µg/kg	25	5.00	2.00	0.600
Chloromethane	74-87-3	µg/kg	25	5.00	2.00	0.600
cis-1,2-Dichloroethene	156-59-2	µg/kg	25	5.00	2.00	0.500
cis-1,3-Dichloropropene	10061-01-5	µg/kg	25	5.00	1.00	0.400
Cyclohexane	110-82-7	µg/kg	25	5.00	2.00	0.500
Dibromochloromethane	124-48-1	µg/kg	25	5.00	1.00	0.500
Dichlorodifluoromethane	75-71-8	µg/kg	25	5.00	2.00	0.600
Ethylbenzene	100-41-4	µg/kg	25	5.00	1.00	0.400
Freon 113	76-13-1	µg/kg	50	10.0	2.00	0.600
Isopropylbenzene	98-82-8	µg/kg	25	5.00	1.00	0.400
Methylcyclohexane	108-87-2	µg/kg	25	5.00	2.00	0.600
Methyl acetate	79-20-9	µg/kg	25	5.00	4.00	1.00
Methyl tert-butyl ether	1634-04-4	µg/kg	25	5.00	2.00	0.500
Methylene Chloride	75-09-2	µg/kg	25	5.00	4.00	2.00
Styrene	100-42-5	µg/kg	25	5.00	1.00	0.400
Tetrachloroethene	127-18-4	µg/kg	25	5.00	2.00	0.500
Toluene	108-88-3	µg/kg	25	5.00	2.00	0.600

WORKSHEET #15.24: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW SOLID (CONTINUED)

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
trans-1,2-Dichloroethene	156-60-5	µg/kg	25	5.00	2.00	0.500
trans-1,3-Dichloropropene	10061-02-6	µg/kg	25	5.00	1.00	0.500
Trichloroethene	79-01-6	µg/kg	25	5.00	2.00	0.500
Trichlorofluoromethane	75-69-4	µg/kg	25	5.00	2.00	0.700
Vinyl chloride	75-01-4	µg/kg	25	5.00	2.00	0.600
Xylenes, Total	1330-20-7	µg/kg	50	10.0	2.00	1.40

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
[1] There is no PAL for VOCs, so a Quantitation Limit Goal was provided. VOC data will be provided to the disposal facility.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER

Matrix: IDW Water
Analytical Group / Method: VOCs / EPA Methods 5030C (purge and trap) and 8260D (analysis)
Concentration Level: Low

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
cis-1,3-Dichloropropene	10061-01-5	µg/L	5	1.00	0.500	0.200
trans-1,3-Dichloropropene	10061-02-6	µg/L	5	1.00	0.500	0.200
Ethylbenzene	100-41-4	µg/L	5	1.00	0.800	0.400
Styrene	100-42-5	µg/L	25	5.00	0.600	0.300
1,4-Dichlorobenzene	106-46-7	µg/L	25	5.00	0.600	0.300
1,2-Dibromoethane (EDB)	106-93-4	µg/L	5	1.00	0.500	0.200
1,2-Dichloroethane	107-06-2	µg/L	5	1.00	0.600	0.300
4-Methyl-2-pentanone	108-10-1	µg/L	50	10.0	1.00	0.500
Methylcyclohexane	108-87-2	µg/L	25	5.00	1.00	0.500
Toluene	108-88-3	µg/L	5	1.00	0.500	0.200
Chlorobenzene	108-90-7	µg/L	5	1.00	0.600	0.300
Cyclohexane	110-82-7	µg/L	25	5.00	2.00	1.00
1,2,4-Trichlorobenzene	120-82-1	µg/L	25	5.00	1.00	0.300
Dibromochloromethane	124-48-1	µg/L	5	1.00	0.500	0.200
Xylenes, Total	1330-20-7	µg/L	5	1.00	0.800	0.400
Tetrachloroethene	127-18-4	µg/L	5	1.00	0.600	0.300
cis-1,2-Dichloroethene	156-59-2	µg/L	5	1.00	0.600	0.300

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
trans-1,2-Dichloroethene	156-60-5	µg/L	10	2.00	1.40	0.700
Methyl tert-butyl ether	1634-04-4	µg/L	5	1.00	0.500	0.200
1,3-Dichlorobenzene	541-73-1	µg/L	25	5.00	1.40	0.680
Carbon tetrachloride	56-23-5	µg/L	5	1.00	0.600	0.300
2-Hexanone	591-78-6	µg/L	50	10.0	1.70	0.850
Acetone	67-64-1	µg/L	100	20.0	2.00	0.700
Chloroform	67-66-3	µg/L	5	1.00	0.600	0.300
Benzene	71-43-2	µg/L	5	1.00	0.600	0.300
1,1,1-Trichloroethane	71-55-6	µg/L	5	1.00	0.600	0.300
Bromomethane	74-83-9	µg/L	5	1.00	0.600	0.300
Chloromethane	74-87-3	µg/L	10	2.00	1.10	0.550
Chloroethane	75-00-3	µg/L	5	1.00	0.500	0.200
Vinyl chloride	75-01-4	µg/L	5	1.00	0.500	0.200
Methylene Chloride	75-09-2	µg/L	5	1.00	0.600	0.300
Carbon disulfide	75-15-0	µg/L	25	5.00	0.600	0.300
Bromoform	75-25-2	µg/L	20	4.00	2.00	1.00
Bromodichloromethane	75-27-4	µg/L	5	1.00	0.500	0.200
1,1-Dichloroethane	75-34-3	µg/L	5	1.00	0.600	0.300
1,1-Dichloroethene	75-35-4	µg/L	5	1.00	0.600	0.300

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

Analyte	CAS Number	Units	Project Quantitation Limit Goal	Achievable Laboratory Limits		
				LOQ	LOD	DL
Trichlorofluoromethane	75-69-4	µg/L	5	1.00	0.500	0.200
Dichlorodifluoromethane	75-71-8	µg/L	5	1.00	0.500	0.200
Freon 113	76-13-1	µg/L	50	10.0	0.600	0.300
1,2-Dichloropropane	78-87-5	µg/L	5	1.00	0.600	0.300
2-Butanone	78-93-3	µg/L	50	10.0	1.00	0.500
1,1,2-Trichloroethane	79-00-5	µg/L	5	1.00	0.600	0.300
Trichloroethene	79-01-6	µg/L	5	1.00	0.600	0.300
Methyl acetate	79-20-9	µg/L	25	5.00	0.600	0.300
1,1,2,2-Tetrachloroethane	79-34-5	µg/L	5	1.00	0.600	0.300
1,2-Dichlorobenzene	95-50-1	µg/L	25	5.00	0.500	0.200
1,2-Dibromo-3-Chloropropane	96-12-8	µg/L	25	5.00	1.00	0.300
Isopropylbenzene	98-82-8	µg/L	25	5.00	0.500	0.200

Notes:
Laboratory SOPs for preparation and analysis are referenced in Worksheet 23.
[1] There is no PAL for VOCs, so a quantitation limit goal was provided. VOC data will be provided to the disposal facility.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

Acronyms for all Worksheet #15 Tables:

°C = degrees Celsius
% = percent
≥ = greater than or equal to
≤ = less than or equal to
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
ASTM = ASTM International
BHC = hexachlorocyclohexane
BTAG = Biological Technical Assistance Group
CAS = Chemical Abstract Number
CEC = cation exchange capacity
CFR = Code of Federal Regulations
CVAA = cold vapor atomic absorption
DL = detection limit
DRO = diesel range organics
EOX = extractable organic halide
EPA = U.S. Environmental Protection Agency
EPH = extractable petroleum hydrocarbon
ESV = Ecological Screening Value
HQ = hazard quotient
ICP-MS = inductively coupled plasma mass spectroscopy
IDW = investigation-derived waste
LOD = limit of detection
LOQ = limit of quantitation
meq/100g = milliequivalents per 100 grams
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NJDEP = New Jersey Department of Environmental Protection
NRALC = National Recommended Aquatic Life Criteria
NSL = no screening level
NUT = essential nutrient
ORNL = Oak Ridge National Laboratory
PAH = polycyclic aromatic hydrocarbon
PAL – project action limit
PCB = polychlorinated biphenyl
PETN = Pentaerythritol tetranitrate
PRG = Preliminary Remediation Goal
RAIS = Risk Assessment Information System
RCRA = Resource Conservation and Recovery Act
RDX = hexogen
RSL = regional screening level
SIM = selected ion monitoring
SOP = Standard Operating Procedure
SVOC = semivolatile organic compound
SWSV = surface water screening value
TAL = target analyte list
TCL = target compound list
TCLP = Toxicity Characteristic Leachate Procedure
THQ = target hazard quotient
TOC = total organic carbon
TPH = total petroleum hydrocarbon
TR = target cancer risk
TSDF = Treatment, Storage, and Disposal Facility
VOC = volatile organic compound

WORKSHEET #17 SAMPLING DESIGN AND RATIONALE

The following sampling program has been designed to meet the objectives outlined in Worksheet #11 and in accordance with the PWS (CENAE, 2019). The tasks outlined below will be completed based on the project Schedule outlined in Worksheets #14 & #16.

The potential for UXO on Site been identified in historical investigations, as a general concern. Staff on Site during intrusive investigation activities, will have UXO awareness training. If potential UXO are identified during subsurface activities, base emergency staff will be notified, and work will cease until the issue is addressed. Specific procedures are identified in the Site Specific Health & Safety Plan.

17.1 GEOPHYSICAL INVESTIGATION

The geophysical survey was conducted for the initial phase of the investigation in December 2019, to locate any potential buried containerized waste and metallic debris. The area for the first geophysical survey was approximately 0.9 acres offshore and 1.76 acres onshore. The aerial survey was designed to identify buried metal objects such as metallic drums and buckets. A 15-ft x 15-ft line spacing was selected for the drone flight pattern based on this assumption. Maser followed UAS requirements of EC 1110-1-109 for the Aerial Magnetometer Survey. This initial survey identified 23 geophysical anomalies that have the potential to buried debris, remnant infrastructure or possible utilities. The data was processed and presented in the Geophysical Evaluation Report for Former NAS Cape May, dated April 2020 by Maser Consulting (now Colliers Engineering & Design [CED]).

Based on the results of the first aerial survey it was decided a second aerial survey across an expanded area 150 ft to the east and 100 ft to the north to help identify 18 other submerged anomalies. In addition to the aerial survey, a combination of land-based Ground Penetrating Radar) GPR and Electromagnetic Induction surveying over areas where subsurface anomalies were identified and the depth of the meadow horizon. On August of 2021, CED conducted a Phase II geophysical evaluation to include surveying of an area expanded from previous efforts performed in December 2019. Using a combination of aeromagnetic surveying, aerial photography, and terrestrial geophysical surveying, the evaluation identified 21 additional anomalies for a total of 44 geophysical anomalies within the survey area. The low-priority-designated geophysical anomalies were coincident with observed surface debris, corrugated sheet-pile, and possible former structures observed on historical aerials photos and verified with foot reconnaissance visual observations of remnant wood and concrete piers and remnant infrastructure.

Land-based geophysical data collection was completed within the subject area in conjunction with low-tide to maximize the extent of survey area. Land-based geophysical surveying was not completed in marine environments (ponded water, tidal/ocean waters, wetlands etc.). Some areas also had restricted accessibility of geophysical instruments by topography, potential nesting areas or structures.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

In total, fifteen anomalies were designated high-priority targets as having the potential to be associated with FUDS-related debris. These anomalies are recommended for invasive exploration which might be in the form of test pit and/or test boring exploration to characterize subsurface conditions and ground-truth anomaly targets. Due to limitations of geologic conditions, the meadow mat was not observed. These limitations were likely the result of fluctuating shallow water table ranging from 3.0 to 8.0 ft (tide-dependent). Active utilities were not observed within the survey area. It is not the focus nor the goal for geophysical surveying to evaluate UXO or their condition. However, geophysical anomalies shall be considered to have the potential to be buried UXO for the purpose of health and safety.

17.2 UTILITY CLEARANCE AND AVOIDANCE

Prior to any subsurface work at AOC-1, utility clearance protocols will be followed to ensure any invasive activities are done safely and in location s that are in absence of utilities. The base will provide current maps where utilities enter and travel on property, especially in areas where drilling, trenching and/or excavating. In addition, a private underground utility service will be contracted to locate utilities in the project area. Ground penetrating radar (GPR), using the appropriate radar strength, and passive radio detection (RD) will be utilized to identify potential subsurface utilities.

All utilities identified by base and private utility locating services shall be illustrated on a Site plan for reference during current and/or future subsurface activities and marked in the field. There will be no intrusive work within 5 ft of any identified subsurface utility. Also, no work will be performed within 10 ft of an aboveground utility.

17.3 SOIL SAMPLING

Test Pits:

Following completion of the Phase II geophysical investigation, fifteen anomalies were designated high-priority targets as having the potential to be associated with FUDS-related debris. A total of three test pits in the vicinity of these targets will be completed within the boundaries of AOC 1 to determine the nature and extent of the buried debris to an approximate depth of 5-7 ft-bgs as estimated for the geophysics. Only anomalies above the low tide line will be intrusively investigated under this QAPP. The locations of test pits will be field determined, based on the results of the geophysical investigations. Soil within the test pits will be described in accordance with ASTM D2487-17 Standard Practice for Classification of Soils for Engineering Purposes – Unified Soil Classification System (ASTM, 2017), and any debris observed within the test pits will be noted in the field log. Up to five soil samples will be collected from each test pit (one from each of the four side walls in each pit and one from the floor of each pit) for chemical analysis. Due to the unknown nature of the waste within AOC 1, soil samples will be submitted for laboratory analysis for SVOCs, PAHs and 1,4-dioxane by SIM, pesticides, explosives, and TAL metals. The number of samples taken for laboratory analysis will be determined in the field by

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

visual, olfactory, and screening instrument results, and will be finalized the ACOE Project Manager prior to submittal.

Subsurface Soil:

Up to five soil borings will be collected using a Direct Push Technology (DPT) rig to characterize the horizontal and vertical extent of contamination at locations selected based on the results of the geophysical investigation. Two soil samples will be collected from each boring: one shallow sample (from 1 to 2-ft bgs) and one (1) deeper sample (from approximately 2 to 4-ft bgs). No subsurface soil samples will be collected below the water table. By collecting a minimum of ten subsurface soil samples, an adequate data set is available to calculate the 95% Upper Confidence Limits (UCLs), using EPA's ProUCL statistical software.

Drilling logs will be completed in accordance with USACE Engineer Manual 1110-1-4000, Monitoring Well Design, Installation, and Documentation at Hazardous Toxic and Radioactive Waste Sites (USACE, 1998). Soils will be described in accordance with Each log shall include general information regarding the drilling contractor, boring location, drilling method, borehole depth and diameter, weather conditions, depth to groundwater, ground surface elevation, description of samples collected (i.e., soil type, color (by the Munsell System), and moist/dry), photoionization detector (PID) readings, and field notes. The location and thickness of the top-of-meadow mat will also be recorded at each boring location.

At locations where groundwater monitoring wells are not installed, soil cuttings shall be placed back into the borehole from which they were removed unless the soil is visibly contaminated. Any removed contaminated soil must be covered and protected from rainfall.

Erosion control measures will be required around the removed contaminated material, until it can be containerized and removed from the Site. Bentonite will be used to finish backfilling the hole.

Subsurface soil samples will be submitted for laboratory analysis for SVOCs, PAHs and 1,4-dioxane by SIM, pesticides, explosives, and TAL metals and physical parameters: grain size, TOC, cation exchange capacity (CEC), and moisture content as to support the discussions of fate and transport and risk assessment. The number of samples taken for laboratory analysis will be determined in the field, by visual, olfactory, and screening instrument results, and will be finalized the ACOE Project Manager prior to submittal. Physical parameters will be analyzed by a USACE-approved laboratory and follow ER 1110-1-8157. Oxidation reduction potential (ORP), and pH will be recorded in the field. The reported ORP data will also be Standard Hydrogen Electrode (SHE) corrected. SHE corrected data will be used for any metals fate and transport analysis. If VOCs are detected, SHE corrected ORP will be used to assess biodegradation, if required.

If the meadow mat is encountered it will be sampled, segregated from the subsurface soils, at each location and analyzed for the same parameter suite as the soils. This data will be used to determine if COPCs have been adsorbed in the mat and have to potential to be considered a residual source.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

Surface Soil:

Up to 15 surface soil samples will be collected from within the limits of AOC 1. The objective of these samples is for areal coverage. Five of the fifteen samples will be collocated with the subsurface soil borings, to provide a complete vertical contaminant profile. Surface soil shall be collected manually using a stainless-steel hand trowel or stainless- steel hand auger, at a depth of approximately 0 to 12 inches bgs. Surface soil samples will be submitted for laboratory analysis for SVOCs, PAHs and 1,4-dioxane by SIM, pesticides, explosives, and TAL metals and physical parameters: grain size, TOC, CEC, and moisture content. ORP, and pH will be recorded in the field. The number of samples taken for laboratory analysis will be determined in the field by visual, olfactory, and screening instrument results, and will be finalized the ACOE Project Manager prior to submittal.

All soil samples will be placed in a cooler containing wet ice to keep the sample at a cool temperature (6 degrees Celsius [°C]). All non-dedicated equipment used for sampling activities will be decontaminated prior to and following use.

All PPE, Geoprobe liners and decontamination materials generated during sampling will be containerized as IDW until laboratory analysis results are received to determine if it is solid waste or should be disposed at an appropriate facility.

17.4 SEDIMENT SAMPLING

Up to 15 sediment samples (but no less than ten) will be collected from within the limits of AOC 1. Sediment samples will be collected from a depth of 0 to 6 inches bgs (and not covered by more than 1-2 ft of surface water at mid-tide) using a Petite Ponar grab sampler, or equivalent. The sediment samples will be submitted for laboratory analysis for SVOCs, PAHs and 1,4-dioxane by SIM, pesticides, explosives, and TAL metals and physical parameters: grain size, TOC, CEC, and moisture content. ORP, and pH will be recorded in the field. The number of samples taken for laboratory analysis will be determined in the field by visual, olfactory, and screening instrument results, and will be finalized the ACOE Project Manager prior to submittal.

All PPE, Geoprobe liners and decontamination materials generated during sampling will be containerized as IDW until laboratory analysis results are received to determine if it is solid waste or should be disposed at an appropriate facility.

17.5 GROUNDWATER INVESTIGATION

No monitoring wells have been observed at AOC 1 and it is unknown if permanent monitoring wells were installed during previous investigations.

Up to five new groundwater monitoring wells will be installed at AOC 1, collocated with the soil borings at locations selected based on the results of the geophysical investigation. The groundwater encountered at AOC 1 during previous investigations may have been perched groundwater, due to

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

the decreased hydraulic conductivity of the underlying Meadow Mat. Care should be taken in drilling through the Meadow Mat, as contamination present in the overlying sand may be dispersed to the Meadow Mat or to underlying units. The objective is to install groundwater table wells to delineate the potential groundwater impacts of the former dumping area. The groundwater encountered may be freshwater, saline, or brackish, depending on the level of saltwater intrusion, which varies based on the location and depth of the well.

In general, there is a 4 to 6-ft tidal change in surface water at Cape May. A longer screen length may be selected to account for the change in groundwater elevation due to tidal influences. The monitoring well screen length will be selected in the field to account for evidence of the saturated zone, evidence of contamination (if any), and presence of meadow mat. If the meadow mat is present the monitoring well will be installed below the meadow mat, with the intention of determining the vertical hydraulics in the investigation area. The well installation procedures will include sealing the screen from the meadow mat, if present, with bentonite. Well screens measuring 5 ft in length will be installed unless the meadow mat is encountered deeper than anticipated. If longer wells screens are necessary, they will be no more than 10 ft in length. The QAPP text will be updated to clarify screen lengths, and decision factors for potential longer screens. If longer screens are necessary, additional technical strategies for checking smaller intervals in 10-ft screens may be utilized (i.e., diffusion bag samplers or similar).

Drilling logs and well completion diagrams will be completed in accordance USACE EM 1110-1-4000, as discussed above for subsurface soil sampling. Recorded well specifications will include the following: screen and casing diameter, total depth of the well, screened interval, sand pack interval and type of sand used, bentonite seal interval, grout interval, and well finishing specifications (protective casing, concrete pad, and bumper guards).

Well development will be conducted in accordance with the EPA SERAS SOP (refer to SOP ERT-PROC-2044-20 in **Appendix D**) using a surging and pumping method. Development activities will be conducted as soon as practical following installation but at a minimum of at least after 48hrs of installation. Each well will be gauged for depth to water (DTW) and depth to bottom (DTB) using an electronic water level meter with an accuracy of ± 0.01 ft. A surge block and pump will be used to conduct well development. The pumping rate and the drawdown will be monitored during the well development process to determine the recovery rate and calculate the specific capacity of each well

Water quality parameters (pH, Temperature, Specific conductivity, Dissolved Oxygen (DO), salinity, Oxidation-reduction potential (ORP) and Turbidity) will be monitored during the development process. Additionally, color, clarity and odor are also documented at the initial time and throughout the process.

The recovery rate will be recorded to assess the hydraulic performance of the new monitoring well. The stability of the well will be determined by plotting the three most recent data records of the recovery rate to establish trend of a horizontal to straight line (i.e., horizontal to decreasing line).

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

Development will continue until turbidity has reached and is stable below 50 NTUs and water quality parameters temperature, specific conductivity, and pH, are also stable, in accordance with the well development SOP. If the well data does not stabilize the USACE PM will be contacted to determine how to proceed.

Groundwater sampling will be conducted using the EPA Region 1 Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Groundwater (refer to SOP in **Appendix D**) samples from monitoring wells identified on **Table 18-1** will be collected using a non-dedicated submersible bladder pump. A flow-through cell and water parameter meter will be used during the purging to determine when the process is complete. The parameters to be measured during groundwater purging will include:

- pH
- Temperature
- Specific Conductivity
- ORP
- Turbidity
- DO
- Salinity

Turbidity will be collected prior to the flow-through cell. The reported ORP data will also be SHE corrected. SHE corrected data will be used for any metals fate and transport analysis.

Stabilization is achieved after all parameters have stabilized for three successive readings within the following criteria:

- pH (± 0.1 pH unit)
- Temperature (± 3%)
- Specific Conductivity (± 3%)
- Salinity (±3%)
- ORP (± 10 millivolts [mV])
- DO (± 10% for values greater than 0.5 mg/L, if 3 DO values are less than 0.5 mg/L consider values stabilized)
- Turbidity (± 10% for values greater than 5 nephelometric turbidity units [NTUs], if three Turbidity values are less 5 NTUs consider values stabilized)

The volumes of water removed and any physical conditions (e.g., cloudy or discolored) will be recorded. The anticipated volume of water in each well will be calculated using collected elevation data. Equipment calibration will be conducted in accordance with manufacturer's specifications on a minimum daily basis or use between separate sites and the calibration data recorded.

Groundwater samples will be submitted for laboratory analysis for SVOCs, PAHs and 1,4-dioxane by SIM, pesticides, explosives, and TAL metals. Quality Assurance (QA)/QC samples will be

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

collected as indicated in Worksheet #20. Samples will be containerized and preserved as indicated in Worksheet #19 and inspected for identification consistency, completeness, and accuracy prior to shipment to the laboratory for analyses. The lab will be notified if the water samples have a high saline content so they may adjust their sample preparation methods accordingly.

Upon completion of sample collection, the sample team will replace and lock the well cap, complete field label documentation including the chain-of-custody. The samples will be placed in a cooler containing wet ice to keep the sample at a cool temperature (6°C). All non-dedicated equipment used for sampling activities will be decontaminated prior to and following use.

17.6 SAMPLE LOCATION SURVEY

Sediment, soil sample, soil boring and monitoring well location will be logged with Real Time Kinematic (RTK) GPS by a professional surveyor. The high resolution survey will properly identify sample locations which may influence future remedial efforts. The survey will comply with EM 1110-1-1005, (USACE, 2007). Surveyors will establish two registered benchmarks in compliance with IAW USACE standards, to tie all positional data into same consistent control. All location data must be state plan (NAD83, ft), and most recent USACE approved datum (NAVD88, ft).

17.7 SAMPLE CONTAINERS AND PREPARATION

The types of sampling containers and preservation requirements for the analyses are described in Worksheet #19 & #30. Sample containers, types of preservative, and number of containers will be inspected by field sampling personnel prior to mobilization for sampling activities. In addition, a review of the sample containers will be performed before daily field work begins to ensure the number, type, and preservation methods for the provided containers are sufficient for the planned sampling activities that day.

Sample containers will be placed in a zip-lock type bag and sealed, squeezing as much air as possible from the bag before closing. Samples will be placed into another zip-lock type bag to ensure the samples and sample labels remain dry during shipment. Glass jars or bottles should be wrapped in bubble wrap before placing them into zip-lock type bags, or placed into the zip-lock type bags and placed in the cooler with sufficient packing material to ensure safe transport of the jars. The general preservation method employed during delivery consists of sufficient wet ice to maintain samples in a cool environment (6°C). Wet ice will be placed in sealed plastic bags separate from the sample containers to protect the samples from the water and possible leakage into the sample containers. The samples and wet ice used for preservation will be placed inside of a separate sealed plastic bag that serves as the liner for the shipping cooler. The plastic liner will be taped shut inside the cooler prior to sealing for shipment.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

17.8 SAMPLE TRANSPORTATION

Water samples will be delivered to the laboratory by sampling personnel, a courier service, or a commercial shipping service. Samples that are delivered to the laboratory by sampling personnel will not require custody seals on the containers. Possession of the samples during transport must be documented by each individual on the chain-of-custody records. The completed chain-of-custody records will be placed inside a plastic bag that is sealed and taped to the inside of the cooler lid. If the samples are delivered by a courier service, then the appropriate information relinquishing control of the samples will be recorded on the chain-of-custody record before placement inside the cooler. Two or more signed custody seals, consisting of tape imprinted with the date and initials from the sampler(s) will be placed on the cooler, so that the cooler cannot be opened without one or more of the seals being broken. Wide, clear tape will be placed over the seals to help ensure against accidental breakage or tearing. The cooler will be closed and taped shut with strapping tape (filament-type) around both ends and around the lid to form a seal with the cooler body.

The air bill used for commercial shipment (if applicable) will be filled out before the samples are handed over for shipping. Samples will be submitted for delivery allowing for sufficient time to perform extractions or analyses by the laboratory, as designated in Worksheet #19 & #30. Sampling for analytes with extremely short holding times will not be scheduled on a Friday or weekend. Samples that are shipped will conform to all regulations for packaging and shipment. It is assumed that concentrations of constituents potentially present in water samples will not exist at levels requiring field screening to determine if shipping is acceptable. This is based upon the analytes and concentrations detected during previous investigations. The proposed well locations are also not anticipated to yield water samples that contain analytes that differ significantly from those in previous investigations.

17.9 WASTE MANAGEMENT

Several different types of waste will be generated during the field activities and will be managed and disposed of in accordance with local, state, and federal regulations. Types of investigation-derived waste (IDW) anticipated for the RI field work consist of the following:

- Solid Waste Trash or Debris – Items such as plastic/paper bags, cardboard, plastic containers, and paper.
- Consumable Sampling Materials – Sampling-related items such as bailers, sampling tubing, expended filters, plastic trowels, sponges, Teflon sheeting, and containers used to transfer water. Personal protective equipment (PPE) used during sampling activities is also included.
- Liquid Waste – Liquids generated as a result of well purging or equipment decontamination procedures during sampling.

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

17.9.1 Investigation-Derived Waste Collection and Containerization

The consumable solid IDW associated with sampling (e.g., trash, consumable sampling equipment) will be appropriately contained in plastic trash bags for disposal. Decontamination fluids and purge water generated during water sampling will be collected in 5-gallon buckets and consolidated into a 55-gallon drum. Drill cuttings and sediment will be containerized into a separate 55-gallon drum.

17.9.2 Waste Container Labeling

Consumable solid IDW will be contained in plastic trash bags and not require labeling for disposal. Liquid and non-consumable IDW containers will be labeled. Labels will be affixed to all IDW containers prior to demobilization for the event when the waste was generated. In general, all IDW containers will be considered Non-classified Waste upon generation and remain so until the waste classification process is complete. The appropriate type of waste label will be affixed to IDW containers upon completion of the classification process, and prior to transport for disposal. The USACE Project Manager will be provided with the waste classification information to initiate the profiling and transport process for disposal. Additional labeling may be required and affixed depending upon the IDW type and transport method for disposal. Any additional labeling will be confirmed with the IDW transporter/disposal contractor prior to removal of the IDW from the Site.

17.9.3 Waste Characterization and Disposal

Consumable solid IDW (i.e., trash) from sampling activities will not require characterization sampling and analyses for disposal. In addition, IDW materials generated during maintenance will be characterized as inert construction debris and disposed accordingly. Disposable solid IDW sampling materials and PPE used during sample collection are not expected to constitute significant volumes for disposal. Disposable sampling materials and PPE used during sample collection are considered IDW that have been in incidental contact with sample media. However, due to the removal of surficial media by decontamination procedures, residual mass will be minimal or absent. Therefore, the condition of the IDW will not meet the characteristics of ignitability, reactivity, or corrosivity. In addition, any residual adhering media will be insufficient to result in the material or IDW exceeding toxicity characteristic leachate procedure (TCLP) levels for individual analytes. Therefore, disposable sampling equipment and PPE will be assumed as non-hazardous and disposed consistent with solid waste trash. Items used for sampling will be dry brushed to remove adhering material and contained in plastic bags with used PPE. The location of sampling and types of IDW will be recorded in field documentation with the number of bags generated.

Liquid and non-consumable IDW will be sampled for characterization and will be performed by using disposable samplers, to transfer the liquid or solid into appropriate containers as stipulated in Worksheet #19 & #30. Sampling and analyses of IDW will be performed following the completion of all field activities for an event that the IDW is generated. Existing information regarding detected COPCs and waste characterization/profiling has been used to compile the

WORKSHEET #15.25: PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION LIMITS/QUANTITATION LIMITS— VOLATILE ORGANIC COMPOUNDS (VOCS) FOR IDW WATER (CONTINUED)

analyses for liquid and non-consumable solid IDW characterization in Worksheet #19 & #30. Laboratory analytical data will be used to prepare the necessary waste profile information and submit to the USACE for approval and signature prior to transport and disposal by a contractor as non-hazardous waste to an appropriate facility. Documentation of all phases of IDW management, including waste profile sheets and shipping documents, will be provided to USACE and reproduced in subsequent reporting documents as applicable.

WORKSHEET #18 SAMPLING LOCATIONS AND METHODS

Table 18-1 summarizes the investigative samples to be collected. Field QC samples are identified in Worksheet #20.

Table 18-1 Proposed Sampling Locations and Methods

Sample ID	Sample Location Type	Matrix	Depth	Analytical Method	Comments
ADS-TP1-1	Test Pit (Show in **Figure 18-2**)	Soil	One (1) from each of the four sidewalls and one (1) from bottom of excavation	TCL SVOCs (EPA Method 8270E, full scan) PAHs and 1,4-Dioxane (EPA Method 8270E by SIM) Pesticides (EPA Method 8081B) Explosives (EPA Method 8330B) TAL Metals (EPA Method 6020B and EPA Method 7471B for mercury)	
ADS-TP1-2					
ADS-TP1-3					
ADS-TP1-4					
ADS-TP1-5					
ADS-TP2-1			One (1) from each of the four sidewalls and one (1) from bottom of excavation		
ADS-TP2-2					
ADS-TP2-3					
ADS-TP2-4					
ADS-TP2-5					
ADS-TP3-1			One (1) from each of the four sidewalls and one (1) from bottom of excavation		
ADS-TP3-2					
ADS-TP3-3					
ADS-TP3-4					
ADS-TP3-5					

Table 18-1 Proposed Sampling Locations and Methods (Continued)

Sample ID	Sample Location Type	Matrix	Depth	Analytical Method	Comments
ADS-BH1-S1	Borehole (Shown in **Figure 18-3**)	Soil	1-2 ft bgs	TCL SVOCs (EPA Method 8270E, full scan) PAHs and 1,4-Dioxane (EPA Method 8270E by SIM) Pesticides (EPA Method 8081B) Explosives (EPA Method 8330B) TAL Metals (EPA Method 6020B and EPA Method 7471B for mercury) Grain size, TOC, CEC, and moisture content	
ADS-BH1-S2			2-4 ft bgs		
ADS-BH2-S1			1-2 ft bgs		
ADS-BH2-S2			2-4 ft bgs		
ADS-BH3-S1			1-2 ft bgs		
ADS-BH3-S2			2-4 ft bgs		
ADS-BH4-S1			1-2 ft bgs		
ADS-BH4-S2			2-4 ft bgs		
ADS-BH5-S1			1-2 ft bgs		
ADS-BH5-S2			2-4 ft bgs		
ADS-BH1-SS1	Surface Soils (Shown in **Figure 18-3**)	Soil	0-12 inches bgs	TCL SVOCs (EPA Method 8270E, full scan) PAHs and 1,4-Dioxane (EPA Method 8270E by SIM) Pesticides (EPA Method 8081B) Explosives (EPA Method 8330B) TAL Metals (EPA Method 6020B and EPA Method 7471B for mercury) Grain size, TOC, CEC, and moisture content	Collocated with BH1
ADS-BH2-SS2					Collocated with BH2
ADS-BH2-SS3					Collocated with BH3
ADS-BH4-SS4					Collocated with BH4
ADS-BH5-SS5					Collocated with BH5
ADS-SS6					
ADS-SS7					
ADS-SS8					
ADS-SS9					
ADS-SS10					
ADS-SS11					

Table 18-1 Proposed Sampling Locations and Methods (Continued)

Sample ID	Sample Location Type	Matrix	Depth	Analytical Method	Comments
ADS-SS12					
ADS-SS13					
ADS-SS14					
ADS-SS15					
ADS-SD1	Sediment (not covered by more than 1-2 ft of surface water at mid-tide) (See **Figure 18-4**)	Sediment	0-6 inches bgs	TCL SVOCs (EPA Method 8270E, full scan) PAHs and 1,4-Dioxane (EPA Method 8270E by SIM) Pesticides (EPA Method 8081B) Explosives (EPA Method 8330B) TAL Metals (EPA Method 6020B and EPA Method 7471B for mercury) Grain size, TOC, CEC, and moisture content	
ADS-SD2					
ADS-SD3					
ADS-SD4					
ADS-SD5					
ADS-SD6					
ADS-SD7					
ADS-SD8					
ADS-SD9					
ADS-SD10					
ADS-SD11					
ADS-SD12					
ADS-SD13					
ADS-SD14					
ADS-SD15					

Table 18-1 Proposed Sampling Locations and Methods (Continued)

Sample ID	Sample Location Type	Matrix	Depth	Analytical Method	Comments
ADS-MW1-GW1	Monitoring Well See **Figure 18-5**)	Groundwater	N/A	TCL SVOCs (EPA Method 8270E, full scan)	
ADS-MW2-GW1				PAHs and 1,4-Dioxane (EPA Method 8270E by SIM)	
ADS-MW3-GW1				Pesticides (EPA Method 8081B)	
ADS-MW4-GW1				Explosives (EPA Method 8330B)	
ADS-MW5-GW1				TAL Metals (EPA Method 6020B and EPA Method 7470A for mercury)	

Notes:

bgs = below ground surface
CEC = cation exchange capacity
EPA = U.S. Environmental Protection Agency
ft = feet
ORP = oxidation reduction potential
PAH = polycyclic aromatic hydrocarbons
SVOC = semi-volatile organic compounds
TAL = Target Analyte List
TOC = total organic carbon

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Laboratory Name: Eurofins Lancaster Laboratory Environmental (ELLE), 2425 New Holland Pike, Lancaster, PA 17601
Accreditation/Certification:
A2LA DoD ELAP Certificate Number 0001.01, expiration date 11/30/2022
NJDEP Certificate Lab ID # PA011, expiration date 6/30/2023

Laboratory Name: ALS Middletown, 301 Fulling Mill Road, Middletown, PA 17057
Accreditation/Certification:
PJLA DoD ELAP Certificate Number L21-781, expiration date 02/29/2024
NJDEP Certificate Lab ID # PA010, expiration date 6/30/2023

Laboratory Name: Eurofins Houston, 4141-4147 Greenbriar Drive, Stafford, TX 77477-3907
Accreditation/Certification:
TCEQ Certificate Lab ID # T104704215-22-47, expiration date 6/30/2023 (NELAC)

Matrix: See table below

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Soil and Sediment (Investigative Samples)							
TCL SVOCs (full scan)	Soil/ Sediment	EPA 8270E/ T-SVOA-WI9617	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool 0-6°C	14 days	40 days
PAHs and 1,4-Dioxane by SIM	Soil/ Sediment	EPA 8270E SIM / T-SVOA-WI9995	DoD ELAP: 11/30/2022			14 days	40 days
Organochlorine Pesticides	Soil/ Sediment	EPA 8081B/ T-PEST-WI9232	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool 0-6°C	14 days	40 days
Explosives	Soil/ Sediment	EPA 8330B/ T-PEST-WI9981	DoD ELAP: 11/30/2022			14 days	40 days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
TAL Metals by ICP-MS	Soil/ Sediment	EPA 6020B/ T-MET-WI11933	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool 0-6°C	Included in analytical holding time	180 days
Mercury	Soil/ Sediment	EPA 7471B/ T-MET-WI7965	DoD ELAP: 11/30/2022				28 days
Hexavalent Chromium *(contingent analysis)* *Not collected in round 1*	Soil/ Sediment	EPA 7196A/ T-WC-WI11501	DoD ELAP: 11/30/2022	4-oz. glass jar *Not collected in round 1*	Cool 0-6°C	30 days	168 hours
Soil and Sediment (Physical Parameters)							
Grain Size	Soil/ Sediment	ASTM D422/ T-WC-WI46354	DoD ELAP: 11/30/2022	16-oz. glass jar	Cool 0-6°C	none	none
Total Organic Carbon (TOC)	Soil/ Sediment	EPA 9060A/ T-WC-WI11627	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool 0-6°C	Included in analytical holding time	28 days
Percent Moisture / Percent Solid	Soil/ Sediment	SM 2540G-2011/ S-SS-WI10697	DoD ELAP: 11/30/2022			none	none
Cation Exchange Capacity (CEC) 3 (Eurofins Houston)	Soil/ Sediment	EPA 6010D/ MET-18-001 (analysis)	NELAC3: 6/30/2023	4-oz. glass jar	Cool 0-6°C	none	none

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Groundwater							
TCL SVOCs (full scan)	Groundwater	EPA 8270E / T-SVOA-WI9617	DoD ELAP: 11/30/2022	(2) 250-mL amber glass bottles with PTFE lined lids	Cool 0-6°C	7 days	40 days
PAHs and 1,4-Dioxane by SIM	Groundwater	EPA 8270E (SIM)/ T-SVOA-WI9995	DoD ELAP: 11/30/2022	(2) 250-mL amber glass bottles with PTFE lined lids	Cool 0-6°C	7 days	40 days
Organochlorine Pesticides	Groundwater	EPA 8081B/ T-PEST-WI9998	DoD ELAP: 11/30/2022	(2) 250-mL glass bottles with PTFE lined lids	Cool 0-6°C	7 days	40 days
Explosives	Groundwater	EPA 8330B/ T-PEST-WI9981	DoD ELAP: 11/30/2022	(2) 1-L amber glass bottles with PTFE lined lids	Cool 0-6°C	7 days	40 days
TAL Metals by ICP-MS	Groundwater	EPA 6020A/ T-MET-WI11933	DoD ELAP: 11/30/2022	(1) 250-mL plastic	HNO_3 to pH <2, Cool to 0-6°C	Included in analytical holding time	180 days
Mercury	Groundwater	EPA 7470A/ T-MET-WI7965	DoD ELAP: 11/30/2022				28 days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Hexavalent Chromium *(contingent parameter)* *Not collected in round 1*	Groundwater	EPA 7196A/ WI11501	DoD ELAP: 11/30/2022	(1) 250-mL plastic *Not collected in round 1*	Cool to 0-6°C; filtered	Included in analytical holding time	24 hours
IDW Water Parameters							
TCL VOCs (full scan)	IDW water	EPA 8260D / T-VOA-WI8194	DoD ELAP: 11/30/2022	(3) x 40-mL glass vials	HCl and Cool 0-6°C	Included in analytical holding time	14 days if preserved to pH <2; otherwise 7 days
TCL SVOCs (full scan)	IDW water	EPA 8270E / T-SVOA-WI9617	DoD ELAP: 11/30/2022	(2) 250-mL amber glass bottles with PTFE lined lids	Cool 0-6°C	7 days	40 days
PCB	IDW water	EPA 8082A/ T-PEST-WI9238	DoD ELAP: 11/30/2022	(2) x 250-mL amber glass bottle	Cool 0-6°C	1 year	40 days
TPH-DRO	IDW water	EPA 8015D/ T-GC-WI9786	DoD ELAP: 11/30/2022	(2) x 250-mL amber glass bottle	HCl to pH <2; Cool 0-6°C	7 days	40 days
Total Metals by ICP-AES (RCRA7 + Cu, Ni, Zn)	IDW water	EPA 6010D/ T-MET-WI11931	DoD ELAP: 11/30/2020	(1) 250-mL plastic	HNO_3 to pH <2, Cool to 0-6°C	Included in analytical holding time	180 days
Total Mercury	IDW water	EPA 7470A/ T-MET-WI7965	DoD ELAP: 11/30/2022				28 days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Hexavalent Chromium (required analysis)	IDW water	EPA 7196A/ T-WC-WI11501	DoD ELAP: 11/30/2022	(1) 250-mL plastic	Cool to 0-6°C; filtered	Included in analytical holding time	24 hours
Reactive Cyanide	IDW water	Chapter 7.3 and EPA 9012B/ T-WC-WI11629	DoD ELAP: 11/30/2022	(1) 250-mL plastic	Cool to 0-6°C	none	none
Reactive Sulfide	IDW water	Chapter 7.3 and EPA 9034/ T-WC-WI11572	DoD ELAP: 11/30/2022	(1) 250-mL plastic	Cool to 0-6°C	none	none
pH (Corrosivity)	IDW water	EPA 9040C/ T-WC-WI11475	DoD ELAP: 11/30/2022	(1) 250-mL plastic	Cool to 0-6°C	none	Immediately
Flashpoint	IDW water	EPA 1010A/ T-WC-WI11501	DoD ELAP: 11/30/2022	*Included with pH*	Cool to 0-6°C	none	none
IDW Solid Parameters							
TCL VOCs (full scan)	IDW solid	EPA 8260D / T-VOA-WI8236	DoD ELAP: 11/30/2022	(3) x 5-gram EnCore™ samplers	Cool 0-6°C	48 hours to extrude	14 days
TCLP VOCs	IDW solid	EPA 8260D / T-VOA-WI8544	DoD ELAP: 11/30/2022	(3) x 25-gram EnCore™ samplers or 4-oz. glass jar	Cool 0-6°C	14 days to TCLP extraction	14 days
TCL SVOCs (full scan)	IDW solid	EPA 8270E / T-SVOA-WI9617	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool 0-6°C	14 days	40 days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
PCBs	IDW solid	EPA 8082A/ T-PEST-WI10004	DoD ELAP: 11/30/2022		Cool 0-6°C	1 year	40 days
NJDEP EPH	IDW Solid	NJDEP EPH / T-GC-WI9736	DoD ELAP: 11/30/2022	4-oz. glass jar, minimal headspace	Cool 0-6°C	14 days	40 days
TCLP SVOCs	IDW Solid	EPA 8270E/ T-SVOA-WI9617	DoD ELAP: 11/30/2022	16-oz. glass jar	Cool to 0-6°C	14 days to TCLP extraction, 7 days to preparative extraction	40 days
TCLP Metals (ICP-AES) *Report TCLP metals + Cu, Ni, Zn*	IDW Solid	EPA 6010D/ T-MET-WI11931	DoD ELAP: 11/30/2022			180 days to TCLP extraction	180 days
TCLP Mercury	IDW Solid	EPA 7470A/ T-MET-WI17965	DoD ELAP: 11/30/2022			28 days to TCLP extraction	28 days
Total Metals (RCRA + Cu, Ni, V, and Zn)	IDW Solid	EPA 6010D/ T-MET-WI11931	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool to 0-6°C	Included in analysis hold time	180 days
Total Mercury	IDW Solid	EPA 7470A/ T-MET-WI17965	DoD ELAP: 11/30/2022			Included in analysis hold time	28 days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Hexavalent Chromium *(required)*	IDW Solid	EPA 7196A/ T-WC-WI11501	DoD ELAP: 11/30/2022			30 days	168 hours
Percent Solids	IDW Solid	SM 2540G-2011/ S-SS-WI10697	DoD ELAP: 11/30/2022			none	none
pH (corrosivity)	IDW Solid	EPA 9045D/ T-WC-WI11518	DoD ELAP: 11/30/2022	4-oz. glass jar, no headspace	Cool to 0-6°C	none	Immediately
Ignitability	IDW Solid	40 CFR 261.21/ T-WC-WI10627	DoD ELAP: 11/30/2022			none	none
TOC	IDW Solid	EPA 9060A/ T-WC-WI11627	DoD ELAP: 11/30/2022			Included in analytical holding time	28 days
Total Cyanide	IDW Solid	EPA 9012B/ T-WC-WI11629	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool to 0-6°C	Included in analytical holding time	14 days
Reactive Cyanide	IDW Solid	EPA 9012B/ T-WC-WI11629	DoD ELAP: 11/30/2022			none	14 Days
Reactive Sulfide	IDW Solid	EPA 9034/ T-WC-WI11572	DoD ELAP: 11/30/2022			none	7 Days

WORKSHEET #19 & #30 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (CONTINUED)

Analytical Group	Matrix	Analytical Method/ SOP Reference[1]	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation (chemical, temperature, light protected)	Preparation Holding Time	Analytical Holding Time[2]
Paint Filter (Free Liquids)	IDW Solid	EPA 9095A/ T-WC-WI11513	DoD ELAP: 11/30/2022	4-oz. glass jar	Cool to 0-6°C	none	none
Extractable Organic Halides (EOX) (ALS Middletown)	IDW Solid	EPA 9023/ 07-TOX S	DoD ELAP: 02/29/2024	4-oz. glass jar, minimize headspace	Cool to 0-6°C	none	28 days

Notes:
[1] Refer to the Analytical SOP References table (Worksheet #23) and the Analytical SOPs in **Appendix D**. Laboratory certifications are included in **Appendix B**.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
[3] Eurofins Houston is certified for EPA method 6010D which is the analytical determination of the sodium content of the prepped soil sample. Cation Exchange Capacity (CEC) method 9081 is a sample preparatory method and does not appear on the Eurofins Houston NELAC laboratory certificate.

< = less than
°C = degrees Celsius
CEC -= cation exchange capacity
DoD = Department of Defense
ELAP = Environmental Laboratory Accreditation Program
EPH = extractable petroleum hydrocarbons
HNO_3 = Nitric acid
HDPE = High-density polyethylene
L = liters
mL = milliliter
N/A = not applicable
NJ = New Jersey
NJDEP = New Jersey Department of Environmental Protection
ORP = oxidation reduction potential
PAH = polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
pH = Measures acidity/basicity in aqueous solution
PTFE = polytetrafluoroethylene
SOP = Standard operating procedure
SM = Standard Methods
SW846 = Solid Waste Manual 846
SVOC = Semi-volatile organic compound
TAL = Target Analyte List
TOC = total organic carbon
VOC = volatile organic compound

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY

The frequency and location of field QC samples (e.g., field duplicates, MS/MSD samples, etc.) are summarized in the following table.

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Equipment Blanks[1]	No. of MS/MSDs[2]	No. of Trip Blanks[3]	No. of Temperature Blanks	Total No. of Samples to Laboratory
Sampling Frequency:			1 per 10 samples	1 per day	1 per 20 samples	1 per cooler with VOCs	1 per cooler	
Soil and Sediment								
Soil (test pit)	SVOCs (full scan, TCL list)	15	2	N/A	1	N/A	N/A	18
	PAHs and 1,4-Dioxane by SIM	15	2	N/A	1	N/A	N/A	18
	Pesticides	15	2	N/A	1	N/A	N/A	18
	Explosives	15	2	N/A	1	N/A	N/A	18
	TAL Metals [4]	15	2	N/A	1	N/A	N/A	18
	Hexavalent Chromium [5]	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	GIS Coordinates (x, y, z)	15	N/A	N/A	N/A	N/A	N/A	15
Soil (boreholes)	TCL SVOCs (full scan)	10	1	N/A	1	N/A	N/A	12
	PAHs and 1,4-Dioxane by SIM	10	1	N/A	1	N/A	N/A	12
	Pesticides	10	1	N/A	1	N/A	N/A	12
	Explosives	10	1	N/A	1	N/A	N/A	12
	TAL Metals [4]	10	1	N/A	1	N/A	N/A	12
	Hexavalent Chromium [5]	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Field Parameters (ORP, pH)	10	1	N/A	N/A	N/A	N/A	11

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY (CONTINUED)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Equipment Blanks[1]	No. of MS/MSDs[2]	No. of Trip Blanks[3]	No. of Temperature Blanks	Total No. of Samples to Laboratory
Soil (boreholes)	Physical Parameters (grain size, TOC, CEC, moisture content)	10	1	N/A	N/A	N/A	N/A	11
	GIS Coordinates (x, y, z)	10	N/A	N/A	N/A	N/A	N/A	10
Soil (Surface)	SVOCs (full scan, TCL list)	15	2	N/A	1	N/A	N/A	18
	PAHs and 1,4-Dioxane by SIM	15	2	N/A	1	N/A	N/A	18
	Pesticides	15	2	N/A	1	N/A	N/A	18
	Explosives	15	2	N/A	1	N/A	N/A	18
	TAL Metals [4]	15	2	N/A	1	N/A	N/A	18
	Hexavalent Chromium [5]	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Field Parameters (oxidation reduction potential (ORP), pH)	15	2	N/A	N/A	N/A	N/A	17
	Physical Parameters (grain size, TOC, CEC, moisture content)	15	2	N/A	N/A	N/A	N/A	17
	GIS Coordinates (x, y, z)	15	N/A	N/A	N/A	N/A	N/A	15
Sediment	SVOCs (full scan, TCL list)	15	2	N/A	1	N/A	N/A	18
	PAHs and 1,4-Dioxane by SIM	15	2	N/A	1	N/A	N/A	18
	Pesticides	15	2	N/A	1	N/A	N/A	18
	Explosives	15	2	N/A	1	N/A	N/A	18
	TAL Metals [4]	15	2	N/A	1	N/A	N/A	18

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY (CONTINUED)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Equipment Blanks[1]	No. of MS/MSDs[2]	No. of Trip Blanks[3]	No. of Temperature Blanks	Total No. of Samples to Laboratory
Sediment (continued)	Hexavalent Chromium [5]	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Field Parameters (oxidation reduction potential (ORP), pH)	15	2	N/A	N/A	N/A	N/A	17
	Physical Parameters (grain size, TOC, CEC, moisture content)	15	2	N/A	N/A	N/A	N/A	17
	GIS Coordinates (x, y, z)	5	N/A	N/A	N/A	N/A	N/A	15
Groundwater								
Groundwater	SVOCs (full scan, TCL list)	5	1	N/A	1	N/A	N/A	7
	PAHs and 1,4-Dioxane by SIM	5	1	N/A	1	N/A	N/A	7
	Pesticides	5	1	N/A	1	N/A	N/A	7
	Explosives	5	1	N/A	1	N/A	N/A	7
	TAL Metals [4]	5	1	N/A	1	N/A	N/A	7
	Hexavalent Chromium [5]	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Field Parameters (oxidation reduction potential (ORP), pH, dissolved oxygen (DO), turbidity, temperature, depth to water, specific conductivity)	5	1	N/A	1	N/A	N/A	7
	GIS Coordinates (x, y, z)	5	N/A	N/A	N/A	N/A	N/A	N/A

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY (CONTINUED)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Equipment Blanks[1]	No. of MS/MSDs[2]	No. of Trip Blanks[3]	No. of Temperature Blanks	Total No. of Samples to Laboratory
IDW								
Water IDW	VOCs (TCL List)	1	N/A	N/A	N/A	N/A	N/A	1
	SVOCs (TCL List)	1	N/A	N/A	N/A	N/A	N/A	1
	PCBs	1	N/A	N/A	N/A	N/A	N/A	1
	TPH-DRO	1	N/A	N/A	N/A	N/A	N/A	1
	RCRA Metals + Cu, Ni, Zn	1	N/A	N/A	N/A	N/A	N/A	1
	Hexavalent Chromium	1	N/A	N/A	N/A	N/A	N/A	1
	Reactive sulfide	1	N/A	N/A	N/A	N/A	N/A	1
	Reactive cyanide	1	N/A	N/A	N/A	N/A	N/A	1
	Flashpoint	1	N/A	N/A	N/A	N/A	N/A	1
	pH/corrosivity	1	N/A	N/A	N/A	N/A	N/A	1
Solid IDW	VOCs - TCL List	1	N/A	N/A	N/A	N/A	N/A	1
	TCLP VOCs	1	N/A	N/A	N/A	N/A	N/A	1
	SVOCs - TCL List	1	N/A	N/A	N/A	N/A	N/A	1
	TCLP SVOCs	1	N/A	N/A	N/A	N/A	N/A	1
	PCBs	1	N/A	N/A	N/A	N/A	N/A	1
	NJDEP EPH (fractionation)	1	N/A	N/A	N/A	N/A	N/A	1
	Extractable Organic Halide (EOX)	1	N/A	N/A	N/A	N/A	N/A	1
	TOC	1	N/A	N/A	N/A	N/A	N/A	1

WORKSHEET #20 FIELD QUALITY CONTROL SAMPLE SUMMARY (CONTINUED)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of Equipment Blanks[1]	No. of MS/MSDs[2]	No. of Trip Blanks[3]	No. of Temperature Blanks	Total No. of Samples to Laboratory
Solid IDW	Total RCRA8 Metals + Cu, Ni, Zn, V	1	N/A	N/A	N/A	N/A	N/A	1
	TCLP Metals + Cu, Ni, Zn	1	N/A	N/A	N/A	N/A	N/A	1
	Hexavalent Chromium	1	N/A	N/A	N/A	N/A	N/A	1
	Total Cyanide	1	N/A	N/A	N/A	N/A	N/A	1
	Reactive sulfide	1	N/A	N/A	N/A	N/A	N/A	1
	Reactive cyanide	1	N/A	N/A	N/A	N/A	N/A	1
	pH/corrosivity	1	N/A	N/A	N/A	N/A	N/A	1
	Paint Filter	1	N/A	N/A	N/A	N/A	N/A	1
	Ignitability	1	N/A	N/A	N/A	N/A	N/A	1

Notes:
[1] If non-dedicated sampling equipment is used, an equipment blank will be collected at a frequency of one per day per site and analyzed for the same analytes as the samples.
[2] Sample count for MS/MSD sample are shown as a combined value for the MS and MSD samples.
[3] One trip blank per cooler required containing VOC samples (not currently included in this QAPP)
[4] TAL metals list includes the following: Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper (Cu), Iron, Lead, Magnesium, Manganese, Mercury, Nickel (Ni), Potassium, Selenium, Silver, Sodium, Thallium, Vanadium (V), and Zinc (Zn).

[5] Hexavalent chromium may be sampled in future sampling rounds for soil, sediment, and groundwater, depending on the total chromium results from the first round of sampling. All IDW samples required analysis for hexavalent chromium.

EPH = extractable petroleum hydrocarbons
EOX = Extractable Organic Halides
MS/MSD = Matrix Spike/Matrix Spike Duplicate
N/A = Not applicable
RCRA = Resource Conservation and Recovery Act
SVOC = semivolatile organic compound
TAL = Target Analyte List
TCL = Target Compound List

WORKSHEET #21 FIELD STANDARD OPERATING PROCEDURES

SOPs for field activities are contained in **Appendix D** and referenced in **Table 21-1**.

Table 21-1 List of Applicable SOPs

SOP ID	Title
EM 1110-1-1802 (USACE, 1995)	Geophysical Exploration
ASTM Method D6429 (2011)	Guide for Selecting Surface Geophysical Methods
UAS EC 1110-1-109	Aerial Magnetometer Survey
EM 200-1-3 (USACE, 2001)	Waste Sampling Instructions
EM 1110-1-1005, (USACE, 2007)	Control and Topographic Surveying
EM 1110-2-2907, (USACE, 2003)	Remote Sensing
SERAS SOP Number 2007, Rev.1 4/28/2017 (2007-r11)	Groundwater Well Sampling
SERAS SOP Number 2013, Rev. 1.0, 7/31/2016 (2013-r10)	Surface Water Sampling
ERT-PROC-2044-19, Rev. 1.0, 1/31/20 (2044-r19)	Monitoring Well Development
ERT-PROC-2074-20, Rev. 1.1, 05/1/2020 (2074-r20)	Field Description of Soil and Sediment Borings
SERAS SOP 2012, Rev. 1.0, 7/11/01 (2012-r10)	Soil Sampling
SERAS SOP 2016, Rev. 1.0, 7/31/2016 (2016-r10)	Sediment Sampling
ERT-PROC-2048-19, Rev. 1.0, 4/25/20 (2048-r19)	Groundwater Monitoring Well Installation
SERAS SOP 1844, Rev. 0.0, 11/08/02	Soil pH Determination
Sovereign Consulting, Inc., Rev. 1.0, 10/3/2022	SOP for ORP Measurement in Soil

Analytical procedures that will be used in support of the investigative work are listed in Worksheet #23. Laboratory SOPs for water and soil/sediment matrix preparation and analysis are summarized in Worksheet #23.

WORKSHEET #22 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Hand-held GPS unit[1]	N/A	Charge battery and place in case at the end of each day.	Field test in accordance with the equipment manual. Perform checks at known points to assess function and potential drift	Inspect for external damage (e.g., screen dents, etc.).	Morning and evening	Refer to manufacturer's instructions.	Refer to manufacturer's instructions.	Field personnel	
Water Level Indicator	N/A	N/A	If two on-Site, verify they both produce the same result.	Visually inspect for cleanliness.	Prior to use	N/A	Replace	Field personnel	
YSI Multi-Meter	Refer to manufacturer's instructions.	Clean prior and after each use.	Calibration check	Visually inspect for cleanliness.	Prior to use	Refer to manufacturer's instructions.	Replace	Field personnel	
Turbidity Meter	Refer to manufacturer's instructions.	Clean prior and after each use.	Calibration check	Visually inspect for cleanliness.	Prior to use	Refer to manufacturer's instructions.	Replace	Field personnel	
Low Flow Bladder Pump	N/A	N/A	N/A	Visually inspect for cleanliness	Prior to use	N/A	Replace	Field personnel	

WORKSHEET #22 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION (CONTINUED)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
PID and/or Flame ionization Detector	Refer to manufacturer's instructions.	Charge battery and place in case at the end of each day. Ensure adequate supply of calibration gas.	Calibration check	Ensure probe tip not fouled. Ensure connection is sealed. Visually inspect for cleanliness.	Prior to use	Refer to manufacturer's instructions.	Replace	Field personnel	
DPT	N/A	Change oil/other fluids and lubricate as needed	Operational equipment check	Visual inspection	Prior to use	Hydraulics are operational	Repair as needed	Field Personnel	

Notes:
[1] GPS units will be checked against a known survey point to ensure their accuracy to within ±3 meter prior to their use in the field. Field conditions such as confining topography may reduce the level of accuracy of the GPS. Additional reference points generally consisting of building corners, road intersections, permanent fencing/walls/infrastructure, or other similar structures will be acquired as local control points for spatial orientation of the GPS.

GPS = global positioning system

N/A = not applicable

PID = photoionization detector

SOP = Standard Operating Procedure

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
SOPs for Soil (including Test Pit Soils, Soil Borings, Surface Soil) and Sediment						
SVOCs (full scan)						
T-OE-SVOA-WI10928	*Microwave Extraction by Method 3546 for Semi-volatiles*, Version 14, 04/15/2022.	Definitive (preparation)	Soil/SVOCs (full scan)	Microwave (EPA 3546)	No	N
T-SVOA-WI9617	*Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Nonaqueous Matrices using GC-MS*, Version 12.1, 04/26/2021.	Definitive (analysis)	Soil/SVOC (full scan)	GC/MS (EPA 8270E)	No	N
PAHs by SIM and 1,4-Dioxane by SIM						
T-OE-SVOA-WI10928	*Microwave Extraction by Method 3546 for Semi-volatiles*, Version 14, 04/15/2022.	Definitive (preparation)	Soil/PAHs and 1,4-Dioxane by SIM	Microwave (EPA 3546)	No	N
T-SVOA-WI9995	*Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS*, Version 19, 06/03/2022.	Definitive (analysis)	Soil/PAHs and 1,4-Dioxane by SIM	GC/MS EPA 8270E SIM)	No	N
Pesticides						
T-OE-PEST-WI10926	*Microwave Extraction Method 3546 for Pesticides in a Solid Matrix*, Version 11, 04/12/2022.	Definitive (preparation)	Soil/Pesticides	Microwave (EPA 3546)	No	N
T-OE-PEST-WI10281	*Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs),* Version 15, 03/16/2019.	Definitive (preparation)	Soil/Pesticides	Extract Cleanup methods (as needed)	No	N
T-PEST-WI9232	*Analysis of Pesticides by 8081B in Solid Samples using GC-ECD*, Version 8, 02/25/2022.	Definitive (analysis)	Soil/Pesticides	GC/ECD (EPA 8081B)	No	N
Explosives						

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
T-OE-PEST-WI10943	*Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330B in Solids*, Version 18.1, 03/30/2022.	Definitive (preparation)	Soil/Explosives	Ultrasonic bath (method)	No	N
T-PEST-WI9981	*Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection*, Version 7, 07/13/2022.	Definitive (analysis)	Soil/Explosives	HPLC (EPA 8330B)	No	N
Metals						
T-MET-WI8636	*Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICPMS*, Version 27, 07/01/2022.	Definitive (preparation)	Soil/Metals	Hot Block digestor (EPA 3050B)	No	N
T-MET-WI11933	*Metals by ICPMS by Methods SW846 Methods 6020/6020A/6020B (water, solid, tissue) and EPA 200.8 (water)*, Version 13, 07/27/2022.	Definitive (analysis)	Soil/Metals	ICP-MS (EPA 6020B)	No	N
Mercury						
T-MET-WI11948	*Preparation of Solids by EPA 7471A or B for Mercury Analysis*, Version 22, 07/01/2022.	Definitive (preparation)	Soil/Mercury	Hot Block digestor (EPA 7471B)	No	N
T-MET-WI7965	*Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA*, Version 20, 04/27/2022.	Definitive (analysis)	Soil/Mercury	CVAA (EPA 7471B)	No	N
Reserved for Potential Future Use (Contingent Parameter):						
T-WC-WI10618	*Digestion of Hexavalent Chromium in Solids by SW-846 3060A*, Version 19, 10/08/2021.	Definitive (preparation)	Soil/ Hexavalent Chromium	Hotplate (EPA 3060A)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
T-WC-WI11501	*Hexavalent Chromium in Waters and Soils Colorimetric) by SW-846 7196A*, Version 14, 03/31/2022.	Definitive (analysis)	Soil/ Hexavalent Chromium	Spectro-photometer (EPA 7196A)	No	N
Physical Parameters for Soil and Sediment (Grain Size, TOC, CEC, moisture content)						
T-WC-WI46354	*Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422-63 (reapproved 2007) – Modified*, Version 1, 11/25/2021.	Definitive (analysis)	Soil and Sediment/Grain Size	Sieves and hydrometer (ASTM D422)	Not applicable	N
T-WC-WI11627	*TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A, Lloyd Kahn*, Version 17.1, 07/06/2021.	Definitive (analysis)	Soil/Sediment/ TOC	TOC Analyzer (EPA 9060A)	No	N
WC-22-007 (Eurofins Houston)	*LDNR 29 B Parameters*, Revision 0, 09/09/2022.	Definitive (preparation)	Solid/ Cation Exchange Capacity (CEC)	Oven (EPA 9081)	Not applicable	N
MET-17-001 (Eurofins Houston)	*Standard Operating Procedure for Microwave Assisted Acid Digestion of Sediments, Sludges, Soil and Oils by SW 3051A, Rev. 1, February 2007, for analysis by ICP and ICP- MS*, Revision 2020.1, 08/13/2020.	Definitive (preparation)	Solid/ Cation Exchange Capacity (CEC)	Microwave (EPA 3051A)	No	N
MET-18-001 (Eurofins Houston)	*Standard Operating Procedure for Metals Analysis by ICP, SW846 6010B Revision 2, December 1996, Total Hardness Calculation SM 2340-B-2011, SW846 6010C, Revision 3, February 2007, SW846 6010D, Revision 6, July 2018*, Revision 2020.1, 06/15/2020.	Definitive	Solid/ Cation Exchange Capacity (CEC)	ICP-AES (EPA 6010D)	Not applicable	N
S-SS-WI10697	*% Moisture Calculation and % Solids Calculation (Gravimetric)*, Version 19, 05/14/2021.	Definitive (analysis)	Soil/Sediment/ Percent Solid/ Percent Moisture	Balance (SM 2540G-2011)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
SOPs for Groundwater						
SVOCs (full scan)						
T-OE-SVOA-WI11432	*Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater*, Version 19, 07/29/2022.	Definitive (preparation)	Water/ SVOCs, full scan	Separatory Funnel (EPA 3510C)	No	N
T-SVOA-WI9617	*Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Nonaqueous Matrices using GC-MS*, Version 12.1, 04/26/2021.	Definitive (analysis)	Water / SVOCs, full scan	GC/MS (EPA 8270E)	No	N
PAHs by SIM and 1,4-Dioxane by SIM						
T-OE-SVOA-WI11432	*Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater*, Version 19, 07/29/2022.	Definitive (preparation)	Water/ PAHs and 1,4-Dioxane (SIM)	Separatory Funnel (EPA 3510C)	No	N
T-SVOA-WI9995	*Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS*, Version 19, 06/03/2022.	Definitive (analysis)	Water /PAHs and 1,4-Dioxane (SIM)	GC/MS (EPA 8270E SIM)	No	N
Pesticides						
T-OE-PEST-WI10920	*Separatory Funnel Extraction by Method 3510C, 608, 608.3 for Pesticides and PCBs in a Wastewater*, Version 22, 04/15/2022.	Definitive (preparation)	Water/ Pesticides	Separatory Funnel (EPA 3510C)	No	N
T-OE-PEST-WI10281	*Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)*, Version 15, 03/16/2019.	Definitive (preparation)	Water/ Pesticides	Cleanup methods as needed	No	N
T-PEST-WI9998	*Pesticides in Water by Method 8081A and 8081B using GC-ECD*, Version 17, 05/31/2022.	Definitive (analysis)	Water/ Pesticides	GC/ECD (EPA 8081B)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
Explosives						
T-OE-PEST-WI10942	*Extraction of Nitroaromatics and Nitroamines by Method 3535A in Water*, Version 15, 08/25/2022.	Definitive (preparation)	Water/ Explosives	Sep-pak extraction cartridges (EPA 3535A)	No	N
T-PEST-WI9981	*Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection*, Version 7, 07/13/2022.	Definitive (analysis)	Water/ Explosives	HPLC (EPA 8330B)	No	N
Metals						
T-MET-WI8639	*Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS*, Version 19, 08/24/2021.	Definitive (analysis)	Water/ Metals	Hot plate or Hot block (EPA 3005A)	No	N
T-MET-WI11933	*Metals by ICPMS by Methods SW846 Methods 6020/6020A/6020B (water, solid, tissue) and EPA 200.8 (water)*, Version 13, 07/27/2022.	Definitive (analysis)	Water/Metals	ICP-MS (EPA 6020B)	No	N
Mercury						
T-MET-WI11924	*Digestion of Aqueous Samples by SW-846 Method 7470A*, Version 23, 05/20/2022.	Definitive (preparation)	Water/Mercury	Hot block digester (EPA 7470A)	No	N
T-MET-WI7965	*Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA*, Version 20, 04/27/2022.	Definitive (analysis)	Water/Mercury	CVAA (EPA 7470A)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
Reserved for Potential Future Use (Contingent Parameter):						
T-WC-WI11501	*Hexavalent Chromium in Waters and Soils Colorimetric) by SW-846 7196A*, Version 14, 03/31/2022.	Definitive (analysis)	Water/ Hexavalent Chromium	Spectrophoto-meter (EPA 7196A)	No	N
SOPs for IDW Samples						
VOCs (TCL List) by Full Scan						
T-VOA-WI8194	*VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D*, Version 11, 5/11/2022.	Definitive (analysis)	IDW Water /VOCs	GC/MS (EPA 8260D with 5030C prep)	No	N
T-VOA-WI11242	*Preparation of Vials for Field Preservation of Soils for Volatile Analysis*, Version 18, 01/20/2022.	Bottleware prep for VOC soils	Organic Solids Preparation SW-846 5035,5030A, 5035A	N/A	No	N
T-VOA-WI8236	*VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D*, Version 10, 5/11/2022.	Definitive (analysis)	IDW Solid/VOCs	GC/MS (EPA 8260D, 5035A prep)	No	N
TCLP VOCs						
T-TL-WI17258	*Volatiles by Zero Headspace Extractor (ZHE) – Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312*, Version 14, 03/31/2022.	Definitive (preparation)	IDW Solid/ TCLP VOCs	ZHE extractor (EPA 1311)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
T-VOA-WI8544	*Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitate Leaching Procedure (SPLP); VOCs by GCMS in Zero Headspace Extraction (ZHE) by 8260B/C/D*, Version 14, 11/02/2020.	Definitive (analysis)	IDW Solid - TCLP leachate/ TCLP VOCs	GC-MS (EPA 8260D)	No	N
SVOCs (TCL List) by Full Scan						
T-OE-SVOA-WI10928	*Microwave Extraction by Method 3546 for Semi-volatiles*, Version 14, 04/15/2022.	Definitive (preparation)	IDW Solid/SVOCs (full scan)	Microwave (EPA 3546)	No	N
T-OE-SVOA-WI11432	*Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater*, Version 19, 07/29/2022.	Definitive (preparation)	IDW Water/ SVOCs, full scan	Separatory Funnel (EPA 3510C)	No	N
T-SVOA-WI9617	*Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Nonaqueous Matrices using GC-MS*, Version 12.1, 04/26/2021.	Definitive (analysis)	IDW Solid and IDW Water / SVOCs, full scan	GC/MS (EPA 8270E)	No	N
TCLP SVOCs						
T-TL-WI7151	*Nonvolatiles-Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312*, Version 17, 08/26/2022.	Definitive (preparation of TCLP Leachate)	IDW Solid/ TCLP SVOCs	Rotary tumbler (EPA 1311)	No	N
T-OE-SVOA-WI10935	*Separatory Funnel Extraction (Method 3510C) of Base Neutrals and Acid Extractables in Leachates*, Version 16, 04/18/2022.	Definitive (preparation)	IDW Solid - TCLP leachate/ TCLP SVOCs	Separatory Funnel (EPA 3510C)	No	N
T-SVOA-WI9617	*Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Nonaqueous Matrices using GC-MS*, Version 12.1, 04/26/2021.	Definitive (analysis)	Extracted TCLP leachate prepared from IDW Solid / TCLP SVOCs	GC/MS (EPA 8270E)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
PCBs						
T-OE-PEST-WI10920	*Separatory Funnel Extraction by Method 3510C, 608, 608.3 for Pesticides and PCBs in a Wastewater*, Version 22, 04/15/2022.	Definitive (preparation)	IDW Water/PCBs	Separatory Funnel (EPA 3510C)	No	N
T-OE-PEST-WI10281	*Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs),* Version 15, 03/16/2019.	Definitive (preparation)	IDW Water/PCBs	Extract Cleanup as needed (varies)	No	N
T-PEST-WI9238	*Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD*, Version 8, 10/02/2021.	Definitive (analysis)	IDW Water/PCBs	GC-ECD (EPA 8082A)	No	N
T-OE-PEST-WI10922	*Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550B and 3550C*, Version 18, 12/31/2021.	Definitive	IDW Solid/PCB	Sonication (EPA 3550C)	No	N
T-OE-PEST-WI10927	*Microwave Extraction Method 3546 for PCBs in a Solid Matrix*, Version 10, 11/08/2021.	Definitive (preparation)	IDW Solid/PCBs	Microwave (EPA 3546)	No	N
T-OE-PEST-WI10281	*Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs),* Version 15, 03/16/2019.	Definitive (preparation)	IDW Solid/PCBs	Extract Cleanup if needed (varies)	No	N
T-PEST-WI10004	*Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD*, Version 11, 06/01/2022.	Definitive (analysis)	IDW Solid/PCBs	GC/ECD (EPA 8082A)	No	N
NJDEP EPH						
T-OE-GC-WI10883	*Microwave Extraction Method 3546 for NJEPH in a Solid Matrix*, Version 6, 12/31/2021.	Definitive (preparation)	IDW Solid/ NJDEP EPH	Microwave (EPA 3546)	No	N
T-OE-GC-WI10879	*Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices*, Version 12, 05/04/2021.	Definitive (preparation)	IDW Solid/ NJDEP EPH	Disposable silica gel columns	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
T-GC-WI9736	*New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID*, Version 10, 10/31/2021.	Definitive (analysis)	IDW Solid/ NJDEP EPH	GC-FID (NJDEP EPH)	No	N
Total Petroleum Hydrocarbons – Diesel Range Organics (DRO)						
T-OE-GC-WI10944	*Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater*, Version 24, 04/25/2022.	Definitive (preparation)	IDW Water/ DRO	Separatory funnel (EPA 3510C)	No	N
T-GC-WI9786	*DRO and ORO by 8015B/C/D in Water using GC-FID*, Version 11, 09/06/2022.	Definitive (analysis)	IDW Water/ DRO	GC-FID (EPA 8015D)	No	N
Extractable Organic Halides (EOX) subcontracted to ALS Middletown						
07-TOX-S (ALS Middletown)	*Standard Operating Procedure for Extractable Organic Halides in Solids*, Revision 9, 08/30/2022.	Definitive (analysis)	IDW Solid/ EOX	Mitsubishi TOX-100 (EPA 9023)	No	N
Total Metals						
T-MET-WI8639	*Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS*, Version 19, 08/24/2021.	Definitive (preparation)	IDW Water/ Total Metals	Hot plate or Hot block (EPA 3005A)	No	N
T-MET-WI8636	*Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICPMS*, Version 27, 07/01/2022.	Definitive (preparation)	IDW Solid/ Total Metals	Hot Block digestor (EPA 3050B)	No	N
T-MET-WI11931	*Metals by ICP for Methods SW846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)*, Version 15, 05/09/2022.	Definitive (analysis)	IDW Solid and IDW Water/Total Metals	ICP-AES (EPA 6010D)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
Total Mercury						
T-MET-WI11948	*Preparation of Solids by EPA 7471A or B for Mercury Analysis*, Version 22, 07/01/2022.	Definitive (preparation)	IDW Solid/Total Mercury	Hot Block digestor (EPA 7471B)	No	N
T-MET-WI11924	*Digestion of Aqueous Samples by SW-846 Method 7470A*, Version 23, 05/20/2022.	Definitive (preparation)	IDW Water/ Total Mercury	Hot block digester (EPA 7470A)	No	N
T-MET-WI7965	*Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA*, Version 20, 04/27/2022.	Definitive (analysis)	IDW Solid and IDW Water/ Total Mercury	CVAA (EPA 7470A and 7471B)	No	N
TCLP Metals and TCLP Mercury						
T-TL-WI7151	*Nonvolatiles-Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312*, Version 17, 08/26/2022.	Definitive (preparation)	IDW Solid/TCLP Metals and TCLP Mercury	Rotary tumbler (EPA 1311)	No	N
T-MET-WI8639	*Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS*, Version 19, 08/24/2021.	Definitive (preparation)	Digestate of IDW Solid – TCLP leachate / TCLP Metals	Hot plate or hot block (EPA 3005A)	No	N
T-MET-WI11931	*Metals by ICP for Methods SW846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)*, Version 15, 05/09/2022.	Definitive (analysis)	Digestate of IDW Solid – TCLP leachate / TCLP metals	ICP-AES (EPA 6010D)	No	N
T-MET-WI7965	*Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA*, Version 20, 04/27/2022.	Definitive (analysis)	IDW Solid and /TCLP Mercury	CVAA (EPA 7470A)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
Flashpoint (Liquid) and Ignitability (Solid)						
T-WC-WI10437	*Flash Point for Liquids and Solids by ASTM D93, EPA 1010A or EPA 1010B*, Version 12, 09/13/2021.	Definitive (analysis)	IDW Water/ Flashpoint	Pensky-Martens Closed Cup flash Tester (EPA 1010A)	No	N
T-WC-WI10627	*Ignitability of Solids by 40 CFR, Part 261.21*, Version 9, 02/15/2022.	Definitive (analysis)	IDW Solid/ Ignitability	Crucible and Pensky-Martens closed cup tester (40 CFR Part 261.21)	No	N
Hexavalent Chromium						
T-WC-WI10618	*Digestion of Hexavalent Chromium in Solids by SW-846 3060A*, Version 19, 10/08/2021.	Definitive (preparation)	IDW Solid/ Hexavalent Chromium	Hotplate (EPA 3060A)	No	N
T-WC-WI11501	*Hexavalent Chromium in Waters and Soils Colorimetric) by SW-846 7196A*, Version 14, 03/31/2022.	Definitive (analysis)	IDW Solid and IDW Water/ Hexavalent Chromium	Spectrophoto-meter (EPA 7196A)	No	N
Corrosivity (pH)						
T-WC-WI11475	*Multi-Parameters in Solids and Waters by ManTech Multi-Parameter System*, Version 16.1, 110/08/2021.	Definitive (analysis)	IDW Water/ Corrosivity (pH)	ManTech Multi-Parameter System (EPA 9040C)	No	N
T-WC-WI11518	*pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometric Methods*, Version 14, 04/30/2021.	Definitive (analysis)	IDW Solid/ Corrosivity (pH)	pH meter (EPA 9045D)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
Total Cyanide						
T-WC-WI10085	*Cyanide (Total and Amenable) Distillation in Water and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011*, Version 20.1, 06/22/2021.	Definitive (preparation)	IDW Solid/Total Cyanide	Distillation apparatus (EPA 9012B)	No	N
T-WC-WI11629	*Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011*, Version 20.1, 08/22/2022.	Definitive (analysis)	IDW Solid/Total Cyanide	Automatic Flow Analyzer (EPA 9012B)	No	N
Reactivity (Reactive Cyanide and Reactive Sulfide)						
T-WC-WI11574	*Reactivity of Waste*, Version 15, 11/30/2020.	Definitive (preparation)	IDW Solid and IDW Water/ Reactive Cyanide and Reactive Sulfide	Distillation apparatus (Chapter 7.3.3 and Chapter 7.3.4)	No	N
T-WC-WI11629	*Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011*, Version 20.1, 08/22/2022.	Definitive (analysis)	IDW Solid and IDW Water/ Reactive Cyanide	Automatic Flow Analyzer (EPA 9012B)	No	N
T-WC-WI11572	*Reactive Sulfide (titration) by SW-846 9034 (1996) Prepared by Chapter 7.3.4 (1996) in Waste*, Version 12, 11/09/2021.	Definitive (analysis)	IDW Solid and IDW Water/ Reactive Sulfide	Burette (EPA 9034)	No	N
Miscellaneous Waste Tests						
T-WC-WI11627	*TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A, Lloyd Kahn*, Version 17.1, 07/06/2021.	Definitive (analysis)	IDW Solid/ TOC	TOC Analyzer (EPA 9060A)	No	N

WORKSHEET #23 ANALYTICAL STANDARD OPERATING PROCEDURES (CONTINUED)

Eurofins SOP Number[1]	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix / Analytical Group	Equipment Type or Instrument (Method Ref)	Variance to QSM	Modified for Project Work?[2] (Y/N)
T-WC-WI11513	*Paint Filter Liquids Test (Free Liquids Test) in Waste by SW-846 9095B.* Version 10, 11/04/2021.	Definitive	Solid Waste other than Water/Free Liquids	Glass funnel with paper paint filter (EPA 9095A)	No	N
Quality Assurance Manual						
QA-QM11872	*Eurofins Lancaster Laboratories Environmental Quality Policy Manual,* Version 20, 08/28/2022.	Not Applicable	N/A	Not Applicable	No	N
EX-QS-QAM	*Eurofins Xenco Quality Assurance Manual,* Revision 0, 12/20/2021.	Not Applicable	N/A	Not Applicable	No	N
ALS-MDT QAM	*Quality Assurance Manual. ALS Environmental Middletown,* Revision 32, 11/16/2020.	Not Applicable	N/A	Not Applicable	No	N

Notes:

[1] SOPs are reviewed/revised as needed. The current version will be followed at the time of sample receipt. Analytical SOPs are provided in **Appendix D**.

[2] If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the DoD chemist.

Cation Exchange Capacity is calculated based on the sodium result from the ICP-AES analysis of the prepared sample. Eurofins Houston is TCEQ certified for EPA 6010D, but the CEC preparation method (9081) is not on their NELAC certification.

CVAA = cold vapor atomic absorption
CEC = cation exchange capacity
GC/ECD = gas chromatography/electron capture device
GC/MS = gas chromatography/mass spectrometry
HPLC = high performance liquid chromatography
ICP-AES = Inductively Coupled plasma atomic emission spectroscopy
ICP-MS = Inductively Coupled plasma mass spectroscopy
ORP = oxidation reduction potential
PAH = polynuclear aromatic hydrocarbons
SIM = Selected Ion Monitoring
SVOC = semi-volatile organic compounds
TOC = total organic carbon

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS (VOC and TCLP VOCs)	BFB Tune	Before ICAL and at the start of every 12 hour period of sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Eurofins Analyst	T-VOA-WI8194 and T-VOA-WI8194
GC/MS (VOC and TCLP VOCs)	ICAL	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Option 1: RSD for each analyte ≤ 15%. Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$ Minimum 5-point calibration for linear regression and 6-point for quadratic.	Correct problem then repeat ICAL No samples shall be analyzed until ICAL has passed. Flagging is not appropriate	Eurofins Analyst	T-VOA-WI8194 and T-VOA-WI8194
GC/MS (VOC and TCLP VOCs)	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	80-120% Recovery as specified in DoD QSM 5.4	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Eurofins Analyst	T-VOA-WI8194 and T-VOA-WI8194

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS (VOC and TCLP VOCs)	CCV	At the beginning of the analytical sequence; after every 12 hours; at the end of the analytical batch.	All reported analytes and surrogates within +/-20%D. For CCV at end of analytical batch, all reported analytes and surrogates within +/-50%D for end of analytical batch.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs) these additional requirements must also be met.	Eurofins Analyst	T-VOA-WI8194 and T-VOA-WI8194
GC/MS (SVOC full scan)	DFTPP Tune	Before ICAL and at the start of every 12-hour period of sample analysis	Refer to method for specific ion criteria. Benzidine and pentachlorophenol should not exceed a tailing factor of 2. Degradation less than or equal to 20% for DDT.	Retune instrument and verify. Repeat breakdown checks. Rerun affected samples.	Eurofins Analyst	T-SVOA-WI9617

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS (SVOC full scan)	ICAL	At instrument set-up and after ICV or CCV failure, prior to sample analysis	Option 1: RSD for each analyte ≤ 15%. Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$ Minimum 5-point calibration for linear regression and 6-point for quadratic.	Correct problem then repeat ICAL No samples shall be analyzed until ICAL has passed. Flagging is not appropriate	Eurofins Analyst	T-SVOA-WI9617
GC/MS (SVOC full scan)	RT Window position for each analyte and surrogate	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard for the ICAL. On days when ICAL is not performed, the initial CCV is used.	N/A	Eurofins Analyst	T-SVOA-WI9617
GC/MS (SVOC full scan)	RRT for each analyte and surrogate	With each sample. After maintenance is performed which may affect retention times, RRTs may be updated based on the daily CCV.	RRT of each reported analyte within ± 0.06 RRT units. RRTs shall be compared with the most recently updated RRTs.	Correct problem, then reanalyze all samples analyzed since the last RT check. If fails, then rerun ICAL and samples.	Eurofins Analyst	T-SVOA-WI9617
GC/MS (SVOC full scan)	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	80-120% Recovery	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Eurofins Analyst	T-SVOA-WI9617

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS (SVOC full scan)	CCV	At the beginning of the analytical sequence; after every 12 hours; at the end of the analytical batch.	All reported analytes and surrogates within +/-20% of true value. For CCV at end of analytical batch, all reported analytes and surrogates within +/-50% for end of analytical batch.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Results may not be reported without valid CCVs. Flagging is only appropriate in cases where the samples cannot be reanalyzed. If the specific version of a method requires additional evaluation (e.g., average RFs) these additional requirements must also be met.	Eurofins Analyst	T-SVOA-WI9617
GC/MS (SVOC full scan)	Internal Standards	Added to all samples, blanks, and QC samples	RT ± 10 seconds from RT of the IS in the ICAL mid-point standard. EICP area within -50% to +100% of area from IS in ICAL mid-point standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed during failure is mandatory. If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the non-compliant IS.	Eurofins Analyst	T-SVOA-WI9617

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS by SIM (PAHs and 1,4-Dioxane)	GC/MS Tuning and Performance Check	Tune with DFTPP before an ICAL or CCV	Per ion abundance criteria in SW-846 method; DDT breakdown ≤20%; tailing factors: benzidine ≤2; pentachlorophenol ≤2	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	Initial calibration with a minimum 5 points: Solid, tissue and water 1000 mL= 0.05 ppm through 10 ppm; Water 250 mL= 0.01 ppm through 2.5 ppm	After continuing calibration fails.	Avg RRF is used if % RSD ≤20%, if >20% a linear fit can be used if r2≥0.99. A linear curve fit is a suitable alternative when only 5 calibration standards have been analyzed. When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve. The recalculated concentration of the low calibration point should be within ±30% of the standard's true concentration.	Perform more aggressive instrument maintenance and recalibrate	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	MDL standard	After each initial calibration	All compounds must be detected	Repeat tuning and ICAL procedure prior to analyzing samples. Repeat maintenance if needed.	Eurofins Analyst	T-SVOA-WI9995

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/MS by SIM (PAHs and 1,4-Dioxane)	Retention Time Window Establishment	Once per ICAL and at the beginning of the analytical sequence	Position is set using the midpoint standard of the ICAL curve when ICAL is performed. On days with no ICAL use the initial CCV	N/A	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	Evaluation of Relative Retention Times (RRT)	With each sample	RRT of each reported analyte within ±0.06 RRT units	Correct problem, then recalibrate	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	ICV standard	After each initial calibration	All target compounds ≤20% drift	Reanalyze the ICV and samples associated with the non-compliant ICV. If ICV fails again do system maintenance, recalibrate, and reanalyze samples.	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	CCV standard	Every 12 hours	Target compounds ≤20% drift	Reanalyze CCV in duplicate immediately. If both pass, samples can be report. If either fails or if immediate reanalysis of CCV in duplicate cannot be performed all samples since acceptable CCV must be reanalyzed. If the CCV fails high any associated samples that are ND can be reported.	Eurofins Analyst	T-SVOA-WI9995
GC/MS by SIM (PAHs and 1,4-Dioxane)	SECC standard	End of analytical run	Run within 12 hour tune time; ±50% drift	Reanalyze the SECC if within the 12 hour tune period. If not or if the reanalyzed SECC fails do system maintenance, retune, recalibrate, and reanalyze samples.	Eurofins Analyst	T-SVOA-WI9995

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
HPLC[2] (Explosives)	Ion Transitions (Parent to Ion Product)	Prior to method implementation	The chemical derivation of the ion transitions must be documented	Flagging is not appropriate.	Eurofins Analyst	T-PEST-WI9981
HPLC[2] (Explosives)	Initial calibration with 6 points.	At instrument set-up and after ICV or CCV fails	% RSD ≤20%, if >20% then alternate fit linear r^2 ≥0.99 or quadratic r2 ≥0.99. Must use 6 points for quadratic curve.	Correct problem and repeat ICAL.	Eurofins Analyst	T-PEST-WI9981
HPLC[2] (Explosives)	MDL Standard	After each initial calibration	All compounds must be detected	Repeat ICAL procedure prior to analyzing samples. Repeat maintenance if needed.	Eurofins Analyst	T-PEST-WI9981
HPLC[2] (Explosives)	ICV Standard	After each initial calibration of a second source standard	Target compounds +/- 20% of the nominal concentration and within established retention time windows	Reanalyze the ICV and samples associated with the non-compliant ICV. If ICV fails again do system maintenance, recalibrate, and reanalyze samples. Flagging is not appropriate	Eurofins Analyst	T-PEST-WI9981

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
HPLC[2] (Explosives)	CCV Standard	Prior to sample analysis, after every 10 samples, and at the end of the sequence.	Target compounds +/- 20% of the nominal concentration and within established retention time windows. If CCV fails, immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.	All samples since acceptable CCV must be reanalyzed. If the CCV fails high, any associated samples that are ND can be reported. If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Eurofins Analyst	T-PEST-WI9981
HPLC[2] (Explosives)	RT Windows	Establish RT windows over a 72-hr period or once daily; Once per ICAL and at the beginning of the sequence.	RT width is ±3x the standard deviation over a 72-hour period; if RTs for a CCV outside established 72 hour window, update RTs once daily from mid-point CCV	N/A	Eurofins Analyst	T-PEST-WI9981

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
HPLC[2] (Explosives)	Confirmation of positive results	All results > the DL must be confirmed.	Calibration and QC criteria are the same for the confirmation analysis as for primary analysis. RPD for results between primary and confirmation is ≤40%; positive identifications for target compounds made on the Primary Luna Phenyl -Hexyl column must be confirmed by injection on the Synergi column	Apply J-flag if RPD > 40%. Discuss in the Case Narrative.	Eurofins Analyst	T-PEST-WI9981
GC/ECD (Organo-chlorine pesticides)	Breakdown Check	Before sample analysis and at the beginning of each 12-hour shift.	Degradation of DDT and Endrin must each be ≤15%	Correct problem, then repeat breakdown check Flagging is not appropriate.	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)
GC/ECD (Organo-chlorine pesticides)	ICAL	Initially and as needed for single component analytes, toxaphene, and chlordane.	Each analyte must meet one of the three options below: Option 1: RSD ≤20%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$ Minimum 5 point for linear calibration (minimum 6 point for quadratic)	Correct problem then repeat ICAL Flagging is not appropriate.	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/ECD (Organo-chlorine pesticides)	RT Window position for each analyte and surrogate	Position shall be set using the midpoint standard for the ICAL. On days when ICAL is not performed, the initial CCV is used.	N/A	N/A	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)
GC/ECD (Organo-chlorine pesticides)	RT Window width for each analyte and surrogate	Performed at method set-up and after major maintenance	RT width is ± 3x standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	N/A	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)
GC/ECD (Organo-chlorine pesticides)	ICV	After each ICAL, analysis of a second source standard prior to analysis of field samples.	All reported analytes and surrogates within established RT windows. Results within ± 20% of the expected value	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging is not appropriate.	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/ECD (Organo-chlorine pesticides)	CCV	Daily before sample analysis, after every ten field samples, and at the end of the analysis sequence. Applies to the single component analytes only. Multicomponent analytes (toxaphene, chlordane) will only be run at the beginning of analysis sequence	All reported analytes and surrogates within established RT windows. All reported analytes and surrogates within ± 20% of true value for	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Matrix of samples preceding the end of the analytical batch CCV will be reviewed for impact to CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	T-PEST-WI9232 (soils) T-PEST-WI9998 (water)
GC/ECD (PCBs)	Breakdown Check	Before sample analysis and at the beginning of each 12-hour shift.	Degradation of DDT and Endrin must each be ≤15%	Correct problem, then repeat breakdown check Flagging is not appropriate.	Eurofins Analyst	T-PEST-WI10004 (IDW water) T-PEST-WI9238 (IDW solid)
GC/ECD (PCBs)	ICAL – Minimum 5-	After continuing calibration fails	% RSD ≤20%, if >20% then alternate fit. Linear r2 ≥0.99 or	Correct problem then repeat ICAL. No samples shall be analyzed until ICAL has passed.	Eurofins Analyst	T-PEST-WI10004 (IDW

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
	point calibration Ranges from 2 µg/L to 200 µg/L		quadratic r2 ≥0.99. Must use six points for quadratic curve.			water) T-PEST-WI9238 (IDW solid)
GC/ECD (PCBs)	RT Window position for each analyte and surrogate	Position shall be set using the midpoint standard for the ICAL. On days when ICAL is not performed, the initial CCV is used.	N/A	N/A	Eurofins Analyst	T-PEST-WI10004 (IDW water) T-PEST-WI9238 (IDW solid)
GC/ECD (PCBs)	RT Window width for each analyte and surrogate	Performed at method set-up and after major maintenance	RT width is ± 3x standard deviation for each analyte RT from the 72-hour study or 0.03 minutes, whichever is greater.	N/A	Eurofins Analyst	T-PEST-WI10004 (IDW water) T-PEST-WI9238 (IDW solid)
GC/ECD (PCBs)	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Target Aroclors ± 20% of the nominal concentration and within established RT windows.	Correct problem, rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Eurofins Analyst	T-PEST-WI10004 (IDW water) T-PEST-WI9238 (IDW solid)

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/ECD (PCBs)	CCV	Before sample analysis, after every 10 field samples, and at the end of the analysis run.	Target Aroclors ± 20% of the nominal concentration and within established RT windows.	All samples since acceptable CCV must be reanalyzed. If the CCV fails high, any associated samples that are ND can be reported.	Eurofins Analyst	T-PEST-WI10004 (IDW water) T-PEST-WI9238 (IDW solid)
GC/FID (DRO)	LOD standard	Quarterly	All analytes must be detected.	Reprep and reanalyze LOD.	Eurofins Analyst	T-GC-WI9786
GC/FID (DRO)	ICAL with a minimum of 5 points	After continuing calibration fails.	1. All ranges must exhibit a %RSD ≤20%. If this criterion is met, the external standard calibration is used with the average response factor (AVGCF). 2. Extrapolate or force zero is not allowed. Set the zero to ignore. 3. When a linear fit is used, the % error is measured between the calculated and expected amounts at each calibration level to determine the calibration function acceptability for linear curves. The % error must be ≤50% for standard levels at or below the LOQ. For standard levels above the LOQ the % error must be ≤30%.	1. If the %RSD is >20%, a linear calibration curve is used provided the correlation coefficient is ≥0.99. 2. If this criterion cannot be met, inspect the data points to see if one or more calibration levels appear to be off. A specific calibration level may have concentrated due to solvent evaporation or degraded over time. 3. Re-inject or remake the standard(s) if this is the cause. 4. Perform system maintenance as outlined in T-GC-WI9689 and re-calibrate.	Eurofins Analyst	T-GC-WI9786

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/FID (DRO)	MDL standard	After each ICAL	All analytes must be detected. The scaling of chromatograms and peak integration parameters must be set so that a standard at the concentration of the Method Detection Limit (MDL) gives a pattern that is discernible from the baseline and can be integrated properly. This ensures that the quantitation limits and MDLs can be met.	Perform system maintenance as outlined in T-GC-WI9689 and recalibrate.	Eurofins Analyst	T-GC-WI9786
GC/FID (DRO)	ICV	After each ICAL	All analytes/ranges within ±20% of the nominal concentration and within established RT windows.	Reanalyze the ICV. If ICV fails again, do system maintenance and recalibrate.	Eurofins Analyst	T-GC-WI9786
GC/FID (DRO)	CCV	1. The CCV is analyzed each day a curve is not analyzed. 2. The CCV is performed prior to the analysis of any samples and then at least every 12 hours throughout the sequence using the mid-level standard.	1. The concentration of the #2 fuel in the CCV must be within the method defined % difference (%D) of the nominal concentration. NOTE: The #2 fuel standard is evaluated using the area eluting between and including C10 through C28. 2. The surrogate (o-terphenyl) response in the mid-level standard must also meet the defined method criterion: EPA 8015D: ±20%.	1. For opening CCV failure, reinject or remake the standard. 2. If the bracketing CCV fails the acceptance criterion by exhibiting a decreasing response, the samples must be reanalyzed. 3. If the bracketing CCV fails the acceptance criterion by exhibiting an increasing response, the samples before it do not need to be reanalyzed if the target analytes are not detected. A comment must be added to the analytical report.	Eurofins Analyst	T-GC-WI9786

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-MS[3]	Linear Dynamic Range (LDR) or High-Level Check Standard	At initial set-up and checked every 6 months with a high standard at the upper limit of the range.	Within ± 10% of true value.	Dilute samples within the calibration range or re-establish/verify the LDR.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	Tuning	Prior to ICAL	Mass calibration ≤0.1 amu from the true value. Resolution < 0.9 amu full width at 10% peak height.	Retune instrument and verify. No Samples shall be analyzed without a valid tune.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	ICAL - 1-point calibration plus blank or multipoint	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r2 ≥ 0.99.	Correct problem, then repeat ICAL. Flagging is not appropriate.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	ICV	Second source standard immediately following ICAL	All reported analytes ± 10% of expected value.	Correct any problems and rerun ICV. If that fails, correct problem and repeat ICAL. No samples shall be analyzed until the second-source calibration verification is successful.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	ICB	Immediately after the ICV.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample.	Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL.	Eurofins Analyst	T-MET-WI11933

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-MS[3]	Low- level calibration check standard	Daily	%R must within 80%-120% for all project analytes. LLCCV should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as LLCCV prior to the analysis of any samples.	Correct problem, then repeat ICAL. No samples shall be analyzed without a valid LLCCV. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	Internal Standards	Every field sample, standard and QC sample.	IS intensity in the samples within 30-120% of intensity of the IS in the ICAL blank.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Reanalyze sample at 5-fold dilutions until criteria is met. For failed QC samples, correct problem and rerun all associated failed field samples. Samples suffering from matrix effect should be diluted until criteria are met, or an alternate IS should be selected.	Eurofins Analyst	T-MET-WI11933

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-MS[3]	ICS (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOD (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis; locate and correct problem; reanalyze ICS, reanalyze all samples.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	CCV	After every 10 field samples and at the end of the analysis sequence.	All analytes within ± 10% of true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Eurofins Analyst	T-MET-WI11933
ICP-MS[3]	CCB	Before beginning a sample sequence, after every 10 samples and at end of the analysis sequence.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample.	All samples following the last acceptable calibration blank must be reanalyzed. CCBs may not be re-analyzed without re-analysis of the associated samples and CCVs.	Eurofins Analyst	T-MET-WI11933

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES[4]	Linear Dynamic Range (LDR) or high-level check standard	At initial set up and checked every 6 months with a high standard at the upper limit of the range.	Within ± 10% of true value.	Dilute samples within the calibration range or re-establish/ verify the LDR. Flagging is not appropriate.	Eurofins Analyst	T-MET-WI11931
ICP-AES[4]	ICAL - 1-point calibration plus blank or multipoint	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, r2 ≥ 0.99.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Eurofins Analyst	T-MET-WI11931
ICP-AES[4]	ICV	Once after each ICAL, prior to beginning a sample run.	%R must be within 90-110% for all project analytes.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL. Flagging is not appropriate	Eurofins Analyst	T-MET-WI11931
ICP-AES[4]	ICB	Immediately after the ICV.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample.	Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL.	Eurofins Analyst	T-MET-WI11931

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES[4]	LLCCV	Daily	%R must within 80%-120% for all project analytes. LLCCV should be less than or equal to the LOQ. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as LLCCV prior to the analysis of any samples.	Correct problem, then repeat ICAL No samples shall be analyzed without a valid LLCCV. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.	Eurofins Analyst	T-MET-WI11931
ICP-AES[4]	ICS (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Terminate analysis; locate and correct the problem, reanalyze ICS, reanalyze all samples.	Eurofins Analyst	T-MET-WI11931

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES[4]	CCB	Before beginning a sample sequence, after every 10 samples and at end of the analysis sequence.	The absolute values of all analytes must be < ½ LOQ or < 1/10th the amount measured in any sample.	All samples following the last acceptable calibration blank must be reanalyzed. CCBs may not be re-analyzed without re-analysis of the associated samples and CCVs.	Eurofins Analyst	T-MET-WI11931
ICP-AES[4]	CCV	After every 10 field samples and at the end of each run sequence.	%R must be within 90-110% for all project analytes.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Eurofins Analyst	T-MET-WI11931
ICP-AES (CEC)	ICAL run is comprised of a blank and four calibration standards.	Daily ICAL prior to sample analysis.	If more than one calibration standard is used, $r^2 \geq 0.99$.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Eurofins Houston Analyst	MET-18-001
ICP-AES (CEC)	ICV	Once after each ICAL, prior to beginning a sample run.	%R must be within 90-110% for all project analytes.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Eurofins Houston Analyst	MET-18-001

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES (CEC)	ICB	Immediately after the ICV.	The absolute values of all analytes must be < ½ LOQ.	If ICB fail to meet criteria, the analysis should be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified.	Eurofins Houston Analyst	MET-18-001
ICP-AES (CEC)	LLICV (a.k.a PQL standard)	Daily at the beginning of the analytical run,	The PQL check standard for 6010 D is considered in control if the analytes of interest recover within +/- 35 % of the known true value.	If the PQL check standard fails to meet criteria and the associated sample concentrations are at or near the PQL level, the analyses should be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified through successful analyses of the PQL check standard. If associated sample target analyte concentrations are near or above the ICV/CCV levels than analysis may continue since the results are held in control by the ICV/CCV recoveries when the PQL check standard is out of control. The PQL sample is carried through the entire preparation and analytical procedure.	Eurofins Houston Analyst	MET-18-001
ICP-AES (CEC)	ICP-AES[4]	ICS (also called Spectral Interference Checks)	After ICAL and prior to sample analysis.	ICS-A: Absolute value of concentration for all non-spiked project analytes < LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ± 20% of true value.	Eurofins Houston Analyst	MET-18-001

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
ICP-AES (CEC)	CCV	After every 10 field samples and at the end of each run sequence.	%R must be within 90-110% for all project analytes.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since the last CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV. If reanalysis cannot be performed, data must be qualified and explained in the case narrative.	Eurofins Houston Analyst	MET-18-001
ICP-AES (CEC)	CCB	Immediately after each CCV	The CCB result should be less than ½ of the reporting limit (LOQ)	If associated sample concentrations, that are bracketed by a CCB that shows analyte concentrations greater than the RL, are less than the RL or greater than 10X the CCB value the sample results may still be reported	Eurofins Houston Analyst	MET-18-001
CVAA (Mercury and TCLP Mercury)	LOD	Quarterly	Analyte detected	Re-prep and reanalyze LOD	Eurofins Analyst	T-MET-WI7965
CVAA (Mercury and TCLP Mercury)	ICAL consists of a Blank and 5 points	Each new run prior to sample analysis.	Correlation coefficient (r) >0.995	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	Eurofins Analyst	T-MET-WI7965

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
CVAA (Mercury and TCLP Mercury)	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Analyte within ± 10% of true value.	Correct problem. Rerun ICV. If that fails, repeat ICAL. No samples shall be analyzed until calibration has been verified with a second source.	Eurofins Analyst	T-MET-WI7965
CVAA (Mercury and TCLP Mercury)	ICB	Immediately after the ICV.	No analytes > LOD	Correct problem and repeat ICV/ICB analysis. If that fails, rerun ICAL. Results may not be reported without valid calibration blanks.	Eurofins Analyst	T-MET-WI7965
CVAA (Mercury and TCLP Mercury)	LLCCV	Immediately after the ICB	Analyte within ± 20% of the true value (%R within 80% to 120%) LLCCV concentration should be ≤ the LOQ.	Correct problem, then repeat ICAL No samples shall be analyzed without a valid LLCCV. If the concentration of the lowest calibration standard is less than or equal to the LOQ, the lowest standard may be re-quantified against the calibration curve as a LLCCV. Otherwise, a separate standard must be analyzed as the LLCCV prior to the analysis of any samples.	Eurofins Analyst	T-MET-WI7965

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
CVAA (Mercury and TCLP Mercury)	CCV	After every 10 field samples and at the end of the analysis sequence.	Analyte within ± 10% of true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all affected samples since the last acceptable CCV. or Recalibrate, then reanalyze all associated samples since the last acceptable CCV. Results may not be reported without valid CCVs. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable CCV.	Eurofins Analyst	T-MET-WI7965

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
CVAA (Mercury and TCLP Mercury)	CCB	Immediately after every CCV.	The absolute values of the analyte must be < ½ LOQ or <1/10th the amount measured in any sample.	All samples following the last acceptable CCB must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s). Sample results may not be reported without valid calibration blanks. Non-detects associated with positive blank infractions may be reported. Samples results >10X the LOQ associated with negative blanks may be reported. For CCBs, failures due to carryover may not require ICAL.	Eurofins Analyst	T-MET-WI7965
Grain Size	Sieve – Visual inspection	Every use	No clogging or tears in mesh	Remove from service	Eurofins Analyst	T-WC-WI146354
TOC Analyzer (TOC)	ICAL – Minimum of a 4-point calibration curve.	Initially, when the daily CCV does not pass, but no longer than monthly.	Correlation coefficient ≤ 0.995	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards	Eurofins Analyst	T-WC-WI11627
TOC Analyzer (TOC)	ICV (NOTE: LCS can serve as the ICV)	Once per prep batch of 15 samples (EPA 9060A) and after the ICAL, prior to beginning a sample run.	EPA 9060A: %R must be within 80%-120%	Investigate the source of the problem. If the ICV fails high, report samples that are non-detected and reanalyze samples with detections.	Eurofins Analyst	T-WC-WI11627

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
TOC Analyzer (TOC)	CCV	At the beginning of the analytical run, after every 10 field samples, and at the end of the analytical run	%R must within 90%-110%	If the CCV fails high, report samples that are non-detected. Recalibrate and/or reanalyze samples analyzed after the last acceptable CCV.	Eurofins Analyst	T-WC-WI11627
TOC Analyzer (TOC)	CCB	Immediately after every CCV.	The absolute values of the analyte must be < ½ LOQ or <1/10th the amount measured in any sample.	All samples following the last acceptable CCB must be reanalyzed. CCBs may not be reanalyzed without reanalysis of the associated samples and CCV(s). Sample results may not be reported without valid calibration blanks. Non-detects associated with positive blank infractions may be reported. Samples results >10X the LOQ associated with negative blanks may be reported. For CCBs, failures due to carryover may not require ICAL.	Eurofins Analyst	T-WC-WI11627
pH Meter (Water)	3-point calibration with pH buffers	Continuing calibration per 10 samples	Continuing calibration verification (CCV) within ±10%	Perform instrument maintenance if calibration cannot conform to criteria, recalibrate.	Eurofins Analyst	T-WC-WI11475
pH meter (solid)	3-point calibration with pH buffers	Each new run and continuing calibration per 10 samples	Independent and continuing calibration verification (CCV) within ±10%. CCB < RL.	Recalibrate and reanalyze samples back to last acceptable continuing calibration.	Eurofins Analyst	T-WC-WI11475

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
Reactive cyanide and Total Cyanide	6 point calibration ranging from 0.010 to 0.350 mg/L	Each new run and CCV and CCB per 10 samples	Correlation coefficient ≥0.995, continuing calibration within ±10%. CCB < RL	Recalibrate, perform instrument maintenance if calibration cannot conform to criteria, recalibrate	Eurofins Analyst	T-WC-WI11629
Flow analyzer with Spectrophoto meter (Hexavalent Chromium 7196A)	Initial calibration with a minimum of 7 points plus a reagent blank ranging from 0.01 ppm to 1.25 ppm	Daily	r >0.995	Perform more aggressive instrument maintenance and recalibrate	Eurofins Analyst	T-WC-WI11501
Spectrophoto meter (Hexavalent Chromium 7196A)	LOD	Quarterly	Detect the compound	Reanalyze the LOD	Eurofins Analyst	T-WC-WI11501
Spectrophoto meter (Hexavalent Chromium 7196A)	ICV	After each initial calibration	Within +/- 10% of the nominal concentration	If ICV fails again do system maintenance and recalibrate	Eurofins Analyst	T-WC-WI11501

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
Spectrophotometer (Hexavalent Chromium 7196A)	Reagent Blank	After each ICV and CCV	No analytes detected > 1/2 LOQ	Correct problem and reanalyze the blank; recalibrate if needed	Eurofins Analyst	T-WC-WI11501
Spectrophotometer (Hexavalent Chromium 7196A)	CCV	Prior to sample analysis, after every 10 field samples, and at the end of the sequence	Within +/- 10% of the nominal concentration	Reanalyze the CCV in duplicate. If both pass, continue with analysis. If either fails again take corrective action and recalibrate	Eurofins Analyst	T-WC-WI11501
EOX	Calibration Verification Standard (CVS) 10 µg (1000 ppm trichloro-phenol standard)	Daily at the beginning of batch, every 10 determinations, and at the end of the run.	Within +/- 10% of true value	Recalibrate, and reanalyzed all affected samples since the last acceptable CVS or immediately analyzed two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action and recalibrated; then reanalyze all affected samples since the last acceptable CVS.	ALS Analyst	07-TOC-S
EOX	Check standard 20 µg (2000 ppm trichloro-phenol standard)	Daily at the beginning of the batch	Within +/- 10% of true value	Rerun CVS or prepare fresh and run again. If fails again, recalibrate and rerun.	ALS Analyst	07-TOC-S

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
EOX	Solvent blank	In duplicate with each newly prepared solvent standard.	< 0.1 µg	Rerun until methanol contamination is confirmed. Prepared solvent standard from new methanol source. Re-prepare anything made from the bad methanol.	ALS Analyst	07-TOC-S
EOX	Sample matrix blank	In duplicate at the beginning of each new batch and after 10 determinations.	< 0.05 µg.	If blank contamination affects the sample results per the method or project of program requirement (i.e., a "J" value in the blank will affect the results when "J" values are reported for a sample. If the matrix blank concentration is ≥ LOQ and > 1/10th the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected samples reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.	ALS Analyst	07-TOC-S

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/FID (NJDEP EPH)	ICAL (5-point for each aliphatic and aromatic standard)	Initially and when the daily calibration standard fails criteria.	%RSD of the calibration factor (CF) for each individual hydrocarbon component, surrogate, and each carbon range must be ≤25%.	1. Inspect the data points to see if one or more calibration levels appear to have been mis-injected or mis-prepared. Reinject or remake the standard if this is the cause. 2. Alternate calibration curves are not recommended for this analysis, therefore if the acceptance criteria are not met, perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.	Eurofins Analyst	T-WC-WI11501
GC/FID (NJDEP EPH)	ICV (second source standard)	Analyze immediately following ICAL and before sample analysis.	1. The recovery of each carbon range must be ±25 %D. 2. The recovery of the individual components must be ±30 %D.	1. If the acceptance criteria cannot be met, analysis cannot continue. **Exception:** If the ICV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. Reinject or remake the standard. 3. Perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.	Eurofins Analyst	T-WC-WI11501

WORKSHEET #24 ANALYTICAL INSTRUMENT CALIBRATION (CONTINUED)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Title/Position Responsible for CA	SOP Reference[1]
GC/FID (NJDEP EPH)	CCV	Analyze immediately following an ICAL and before sample analysis. Analyze every 20 injections or every 24 hours, whichever comes first. Samples must be bracketed by compliant CCV samples.	1. The recovery of each carbon range must be ±25% D. 2. The recovery of the individual components and surrogates must be ±30% D. 3. For non-#2 Fuel/Diesel analyses, the mass discrimination of C30/C20 shall be >0.8. Calculation: AR C30/AR C20. This must be performed on the first CCV of each day.	1. If the acceptance criteria cannot be met, reinject or remake the standard. **Exception:** If the CCV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. If method criteria cannot be met in two consecutive/sequential CCVs, corrective action must be taken, which can include instrument maintenance. Two consecutive/sequential CCVs must meet method criteria in order for analysis to continue. 3. Perform instrument maintenance as outlined in T-GC-WI9689 and re-calibrate.	Eurofins Analyst	T-WC-WI11501

Notes:
[1] Analytical SOPs are provided in **Appendix D.**

[2] DoD QSM ver. 5.4 Table B-3. Nitroaromatics, Nitramines, and Nitrate Esters Analysis by High-Performance Liquid Chromatography (Method 8330B)
[3] DoD QSM ver. 5.4, Table B-9, Inorganic Analysis by ICP/MS

[4] DoD QSM ver. 5.4, Table B-9, Inorganic Analysis by ICP/AES (exceptions: TCLP samples for IDW Solids and Cation Exchange Capacity)

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria[1]	Corrective Action	Responsible Person	Reference[1]
GC/MS (SVOC full scan)	As needed, replacement of components (Injection port; column, ion source; other)	Continuing calibration verification and DFTPP per 12 hour tune period	Visual inspection of components	As needed maintenance	DFTPP tunes passes method criteria/ Initial calibration or continuing calibration verification passes method criteria	Perform maintenance again; re- calibration if necessary	Eurofins Analyst	T-SVOA-WI9617
GC/MS (SIM) (PAHs and 1,4-Dioxane)	As needed, replacement of components (Injection port; column, ion source; other)	Continuing calibration verification (CCV) and DFTPP per 12 hour tune period	Visual inspection of components	Daily routine maintenance (injection port); as needed for other components	Initial calibration or continuing calibration verification passes method criteria	Perform maintenance again; re- calibration if necessary	Eurofins Analyst	T-SVOA-WI9995
HPLC (Explosives)	Replacing frits and check valves	Calibration checks every 10 injections	Visual inspection of components	As needed maintenance	Initial calibration or continuing calibration verification passes method criteria	Perform maintenance again; re- calibration if necessary	Eurofins Analyst	T-PEST-WI9981
GC/ECD (Pesticides)	Injection port maintenance; ECD maintenance	Calibration checks every 20 injections or 12 hours Breakdown checks before initial calibration then every 12 hours	Visual inspection of components	As needed maintenance	Initial calibration or continuing calibration verification passes method criteria	Perform maintenance again; re- calibration if necessary	Eurofins Analyst	T-PEST-WI9998 (groundwater) T-PEST-WI9232 (soil)

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION (CONTINUED)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria[1]	Corrective Action	Responsible Person	Reference[1]
GC/ECD (PCBs)	Injection port maintenance; ECD maintenance.	Calibration checks	Visual inspection of components	As needed	ICAL after maintenance is within specifications	Perform maintenance again	Eurofins Analyst	WI10004
GC/MS (VOCs and TCLP VOCs)	As needed, replacement of components.	Calibration Check	Visual inspection of components	As needed	ICAL or CCV passes method criteria	Perform additional maintenance prior to instrument calibration or CCV	Eurofins Analyst	T-VOA-WI8194 T-VOA-WI8236 T-VOA-WI8544
ICP-AES (Total Metals)	Clean torch assembly and spray chamber when as needed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed.	Calibration checks every 10 injections	Visual inspection of components	As needed maintenance	90-110% for the calibration checks	Recalibration	Eurofins Analyst	T-MET-WI11931

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION (CONTINUED)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria[1]	Corrective Action	Responsible Person	Reference[1]
ICP-MS (TAL Metals by ICP-MS)	Replace disposables, clean/change nebulizer, torch, and cones. Check coolant water level weekly, check waste container level daily.	Calibration checks every 10 injections	Visual inspection of components	As needed maintenance	Tune passes; 90-110% for the calibration checks	Recalibration	Eurofins Analyst	T-MET-WI11933
CVAA (Total Mercury and TCLP Mercury)	As needed replacement of components.	Calibration checks	Visual inspection of components	As needed maintenance/ calibration checks every 10 injections	90-110% for the calibration checks	Recalibration	Eurofins Analyst	WI7965
pH/ISE Meter (pH)	As needed replacement of components	Calibration checks	Visual inspection of components	As needed maintenance/calibration checks every 10 injections	90-110% for calibration checks	Recalibration	Eurofins Analyst	T-WC-WI11518 T-WC-WI11475
Pensky Marten Closed Cup Tester (Flashpoint)	As needed replacement of components	Visual inspection of components	Visual inspection of components	As needed	N/A	Perform maintenance again	Eurofins Analyst	T-WC-WI10437

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION (CONTINUED)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria[1]	Corrective Action	Responsible Person	Reference[1]
Flow Analyzer (Cyanide)	As needed replacement of components, tubing	Calibration checks	Visual inspection of components	As needed maintenance/calibration checks every 10 injections	90-110% for calibration checks	Recalibration	Eurofins Analyst	T-WC-WI11629
Analytical balance	Assure the balance is in a vibration-free area, is level, and the interior housing is clean.	Verification with ASTM certified weights	Visual inspection and weight verification	Each day of use	The reading must be ±0.1% or ±0.5mg, whichever is greater.	1) verify cleanliness of weights 2) remove balance from service and place a call to service firm 3) management must evaluate data generated since last acceptable reading to determine any potential impacts to data quality	Eurofins analyst	SOP11880
Analytical balance	Annual calibration and maintenance	Annual calibration and maintenance	Annual calibration and maintenance	Annual	As per vendor's specifications in compliance with ISO certification	As per vendor's specifications in compliance with ISO certification	Professional calibration vendor (ISO 17025 certified)	SOP11880
Gas Chromatograph with Flame Ionization Detector (FID)	Injection port maintenance; column; FID maintenance	Continuing Calibration Check	Visual Inspection	As needed	Initial Calibration or continuing calibration verification passes method criteria	Perform maintenance again; recalibrate if necessary	Eurofins Analyst	T-GC-WI9736 and T-GC-WI9786: both SOPs reference Maintenance SOP *T-GC-WI9689*

WORKSHEET #25 ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION (CONTINUED)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria[1]	Corrective Action	Responsible Person	Reference[1]
Mitsubishi TOX-100 Analyzer (EOX)	As needed replacement of components	Continuing Calibration Check	Visual Inspection	As needed	Initial Calibration or continuing calibration verification passes method criteria	Perform maintenance in accordance with the manufacturers Instruction Manual; recalibrate if necessary	ALS Analyst	07-TOX-S
ICP-AES used for CEC (Eurofins Houston)	Clean torch assembly and spray chamber when as needed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed.	Calibration checks every 10 injections	Visual inspection of components	As needed maintenance	90-110% for the calibration checks	Recalibration	Eurofins Houston Analyst	MET-18-001

Notes:

[1] Analytical SOPs are provided in **Appendix D.** Maintenance SOPs are available upon request.

Test parameters that do not require instrument maintenance include Grain Size, Reactive Sulfide (titration), Solid Ignitability, and Paint Filter test.

WORKSHEET #26 & #27 SAMPLE HANDLING, CUSTODY, AND DISPOSAL

This worksheet lists primary responsibility for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery, to sample disposal.

Sampling Organization: Renova-Sovereign Joint Venture
Laboratory: Eurofins Lancaster Laboratories Environmental Testing, LLC
Method of Sample Delivery (shipper/carrier): Federal Express
Number of days from reporting until sample disposal: 6 months

Activity	Organization and Title or Position of the Person Responsible for the Activity	Standard Operating Procedure (SOPs)/ Location of Information
SAMPLE COLLECTION, PACKAGING, AND SHIPMENT		
Sample Collection	Field Sampling Personnel	
Sample Packaging	Field Sampling Personnel	
Coordination of Shipment	Field Sampling Personnel	
Chain of Custody	Field Sampling Personnel	
Type of Shipment/Carrier	Federal Express – Priority Overnight as needed. Field personnel will track samples and notify the Project Manager and laboratory if shipping errors occur.	
SAMPLE RECEIPT AND ANALYSIS		
Sample Receipt	Sample Receiving Supervisor, Eurofins	The laboratory will notify Project Manager of sample receipt electronically. Eurofins' sample custody procedures are described in Section 7 of their Quality Assurance Manual (QAM). Sample receipt is described in Section 7.5; sample subcontracting/shipping is described in Section 7.11; sample storage and archiving in Section 7.7; and sample disposal in Section 7.8.
Sample Custody and Storage	Sample Custodian, Eurofins	
Sample Preparation	Organic and/or Inorganic Prep Supervisor, Eurofins	
Sample Determinative Analysis	Organic and/or Inorganic Laboratory Analyst, Eurofins	
Sample disposal	Eurofins	

Notes:
QAM = Quality Assurance Manual
SOP = Standard Operating Procedure

WORKSHEET #28 ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTIONS

WORKSHEET #28.1: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—SEMIVOLATILE ORGANIC COMPOUNDS (SVOC) FULL SCAN

Matrix: Groundwater[1]/ Soil and Sediment /TCLP /TCLP SVOCs for IDW Solid
Analytical Group: SVOCs full scan
Analytical Method/SOP: EPA 8270E/ T-SVOA-WI9617

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, if required, reprep and reanalyze the method blank and all QC samples and field samples processed with the contaminated blank, if sufficient sample material is available. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. If sufficient sample is not available, B-qualify sample data for affected analyte in the preparation batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).
LCS/LCSD*	One per preparatory batch	Within DoD LCS Recovery limits listed in Table C-25 (SVOC Soil) and Table C-26 (SVOC Water). If not listed, laboratory limits may be used.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If sufficient sample is not available, Q-flag data for affected analyte in the preparation batch and discuss in the case narrative. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	Within DoD LCS Recovery limits listed in Table C-25 (SVOC Soil) and Table C-26 (SVOC Water). If not listed, laboratory limits may be used.

WORKSHEET #28.1: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—SEMIVOLATILE ORGANIC COMPOUNDS (SVOC) FULL SCAN (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Surrogates	Added to every field and QC sample	Within DoD Recovery limits in QSM 5.4 for all matrices. **SVOC Soil including IDW Solid-QSM 5.4 Table C-25:** 2,4,6-Tribromophenol: 39-132%R 2-fluorobiphenyl: 44-115%R 2-fluorophenol: 35-115%R Nitrobenzene-d5: 37-122%R p-Terphenyl-d14: 54-127%R Phenol-d5: 33-122%R **SVOC Groundwater including IDW Water and TCLP SVOCs -QSM 5.4 Table C-26:** 2,4,6-Tribromophenol: 43-140%R 2-fluorobiphenyl: 44-119%R 2-fluorophenol: 19-119%R Nitrobenzene-d5: 44-120%R p-Terphenyl-d14: 50-134%R Phenol-d5: 10-120%R (lab limits) *NOTE: Phenol-d5 is listed in Table C-25 but not in Table C-26.*	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Eurofins Analyst	Within DoD LCS Recovery limits listed in Table C-25 (SVOC Soil) and Table C-26 (SVOC Water). If not listed, laboratory limits may be used. (Recoveries listed in the Method/SOP Acceptance Criteria column are the recoveries to be reported.)

WORKSHEET #28.1: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—SEMIVOLATILE ORGANIC COMPOUNDS (SVOC) FULL SCAN (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Internal Standards	Each field and QC sample	-50% to + 100% of internal standard area of 12-hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.	Check the instrument for possible problems and then reanalyze samples. If reinject confirms, flag analytes associated with the non-compliant IS and discuss in the case narrative.	Eurofins Analyst	-50% to + 100% of internal standard area of 12 hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.
MS/MSD	1 per prep batch of up to 20 samples	Within DoD LCS Recovery limits listed in Table C-25 (SVOC Soil) and Table C-26 (SVOC Water). If not listed in QSM, laboratory limits will be used. RPD ≤30%	Flag outliers	Eurofins Analyst	Within DoD LCS Recovery limits listed in Table C-25 (SVOC Soil) and Table C-26 (SVOC Water). If not listed in QSM, laboratory limits will be used. RPD ≤30%

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown will be used to evaluate sample data.
[1] Water may include groundwater and equipment (rinsate) blanks. For equipment blanks, required QC samples are method blanks and LCS results. The laboratory will not prepare MS/MSD from any equipment blank samples.

WORKSHEET #28.2: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—PAHS AND 1,4-DIOXANE ANALYSES BY SELECTIVE ION MONITORING (SIM)

Matrix: Groundwater[1]/ Soil and Sediment
Analytical Group: PAHs and 1,4-Dioxane by SIM
Analytical Method / SOP: EPA 8270E SIM/ T-SVOA-WI9995

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Surrogate Spike	Per sample (including MS/MSD, LCS, and Blanks)	Laboratory surrogates used for this test include the following with the laboratory's statistically-derived limits; **Water:** Fluoranthene-d10: 47-128%R Benzo(a)pyrene-d12: 10-110%R 1-methylnaphthalene-d10: 36-111%R **Soil:** Fluoranthene-d10: 22-152%R Benzo(a)pyrene-d12: 19-133%R 1-methylnaphthalene-d10: 26-123%R NOTE: The recoveries for the list of surrogates will be used for soil, sediment, and groundwater samples.	If obvious matrix interference report data with a comment. Otherwise, re-extract and re-analyze.	ELLE Analyst	Laboratory surrogates used for this test include the following with the laboratory's statistically-derived limits; **Water:** Fluoranthene-d10: 47-128%R Benzo(a)pyrene-d12: 10-110%R 1-methylnaphthalene-d10: 36-111%R **Soil:** Fluoranthene-d10: 22-152%R Benzo(a)pyrene-d12: 19-133%R 1-methylnaphthalene-d10: 26-123%R.
Method blanks	1 per prep batch of up to 20 samples	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater	Reanalyze to confirm detections. If detects confirm re-extract samples that are not ND or not >10x the blank value	ELLE Analyst	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater

WORKSHEET #28.2: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—PAHS AND 1,4-DIOXANE ANALYSES BY SELECTIVE ION MONITORING (SIM) (CONTINUED)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MS/MSD	1 per prep batch of up to 20 samples	Recovery limits per QSM 5.4 if available Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤20%	Flag outliers	ELLE Analyst	Recovery limits per QSM 5.4 if available. Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤20%
LCS/LCSD*	1 per prep batch of up to 20 samples	Recovery limits per QSM 5.4 if available. Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤20%	Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-extracted.	ELLE Analyst	Recovery limits per QSM 5.4 if available. Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤20%
Internal standards	Per sample (including MS/MSD, LCS, and blanks)	-50% to +100% of internal standard area of 12-hour STD. RT within ±10 sec. of midpoint standard in the ICAL	Flag data	ELLE Analyst	Results within acceptance limits

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown will be used to evaluate sample data.
[1] Water may include groundwater and equipment (rinsate) blanks. For equipment blanks, required QC samples are method blanks and LCS results. The laboratory will not prepare MS/MSD from any equipment blank samples.

WORKSHEET #28.3: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—PESTICIDES ANALYSES

Matrix: Groundwater[1]/ Soil and Sediment
Analytical Group: Organochlorine Pesticides
Analytical Method / SOP: EPA 8081B/ T-PEST-WI9232 (soil/sediment) and T-PEST-WI9998 (water)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, if required, reprep and reanalyze the method blank and all QC samples and field samples processed with the contaminated blank, if sufficient sample material is available. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. If sufficient sample is not available, B-qualify sample data for affected analyte in the preparation batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).
LCS/LCSD*	One per preparatory batch	Within DoD Recovery limits listed in: Table C-15 (Soil) Table C-16 (Water) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If sufficient sample is not available, Q-flag data for affected analyte in the preparation batch and discuss in the case narrative. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	Within DoD Recovery limits listed in: Table C-15 (Soil) Table C-16 (Water) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%

WORKSHEET #28.3: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—PESTICIDES ANALYSES (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Surrogates	Added to every field and QC sample	Laboratory statistical limits for surrogates: **Soil Recoveries:** Decachlorobiphenyl:46-152%R Tetrachloro-m-xylene: 42-136%R **Water Recoveries:** Decachlorobiphenyl: 32-149%R Tetrachloro-m-xylene: 44-124%R NOTE: Lab Limits for TCMX are more stringent limits than QSM5.4 limits. DCB is not listed in the QSM Table C-15 and C-16.	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Eurofins Analyst	Laboratory statistical limits for surrogates: **Soil Recoveries:** Decachlorobiphenyl:46-152%R Tetrachloro-m-xylene: 42-136%R **Water Recoveries:** Decachlorobiphenyl: 32-149%R Tetrachloro-m-xylene: 44-124%R
MS/MSD	One per preparatory batch	Within DoD Recovery limits listed in: Table C-15 (Soil) Table C-16 (Water) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%	Flag outliers	Eurofins Analyst	Within DoD Recovery limits listed in: Table C-15 (Soil) Table C-16 (Water) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown will be used to evaluate sample data.
[1] Water may include groundwater and equipment (rinsate) blanks. For equipment blanks, required QC samples are method blanks and LCS results. The laboratory will not prepare MS/MSD from any equipment blank samples.

WORKSHEET #28.4: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—EXPLOSIVES ANALYSES

Matrix: Groundwater[1]/ Soil and Sediment
Analytical Group: Explosives
Analytical Method / SOP: EPA 8330B/ T-PEST-WI9981

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, if required, reprep and reanalyze the method blank and all QC samples and field samples processed with the contaminated blank, if sufficient sample material is available. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. If sufficient sample is not available, B-qualify sample data for affected analyte in the preparation batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).
LCS/LCSD*	One per preparatory batch	Within DoD Recovery limits in Table C-36 (Water) Table C-37 (Soil) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If sufficient sample is not available, Q-flag data for affected analyte in the preparation batch and discuss in the case narrative. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	Within DoD Recovery limits in Table C-36 (Water) Table C-37 (Soil) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%

WORKSHEET #28.4: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—EXPLOSIVES ANALYSES (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Surrogates	Added to every field and QC sample	Laboratory statistical limits for surrogate 2-Nitro-m-xylene (not in QSM 5.4). **Water Limit:** 2-Nitro-m-xylene: 68-122%R **Soil Limit:** 2-Nitro-m-xylene: 79-149%R	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Eurofins Analyst	Laboratory statistical limits for surrogate 2-Nitro-m-xylene (not in QSM 5.4). **Water Limit:** 2-Nitro-m-xylene: 68-122%R **Soil Limit:** 2-Nitro-m-xylene: 79-149%R
Internal Standards	Each field and QC sample	-50% to + 100% of internal standard area of 12 hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.	Check the instrument for possible problems and then reanalyze samples. If reinject confirms, flag analytes associated with the non-compliant IS and discuss in the case narrative.	Eurofins Analyst	-50% to + 100% of internal standard area of 12-hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.
MS/MSD	One per preparatory batch	Within DoD Recovery limits in Table C-36 (Water) Table C-37 (Soil) Laboratory statistical limits for compounds not in QSM 54.; RPD ≤30%	Flag outliers	Eurofins Analyst	Within DoD Recovery limits in Table C-36 (Water) Table C-37 (Soil) Laboratory statistical limits for compounds not in QSM 5.4; RPD ≤30%

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown will be used to evaluate sample data.
[1] Water may include groundwater and equipment (rinsate) blanks. For equipment blanks, required QC samples are method blanks and LCS results. The laboratory will not prepare MS/MSD from any equipment blank samples.

WORKSHEET #28.5: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—ICP-MS METALS

Matrix: Groundwater/ Soil and Sediment
Analytical Group: ICP-MS Metals
Analytical Method / SOP: EPA 6020B / T-MET-WI11933

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of Person Responsible for Corrective Action	Project-Specific MPC
Method Blank	One per preparatory batch.	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample.	Correct problem. If required, re-prep and reanalyze method blank and all samples processed with the contaminated blank.	Eurofins Analyst	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample.
LCS	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Eurofins Analyst	QC limits listed in Table C-5 (soil) and C-6 (water) will be used.
Matrix Spike (MS)	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Examine the project-specific requirements. Contact the client regarding additional measures to be taken.	Eurofins Analyst	QC limits listed in Table C-5 (soil) and C-6 (water) will be used.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified. MSD or MD: RPD ≤ 20% (between MS and MSD or sample and MD)	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Eurofins Analyst	QC Recovery limits listed in Table C-5 (soil) and C-6 (water) will be used. RPD ≤ 20%

WORKSHEET #28.5: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—ICP-MS METALS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of Person Responsible for Corrective Action	Project-Specific MPC
Post-Digestion Spike (PDS)	One per preparatory batch if the MS or MSD fails (using the same sample as used for the MS/MSD if possible)	Recovery within 80-120%.	If PDS recovery is outside control limits, then J-flag the result in the parent sample and explain in the case narrative.	Eurofins Analyst	Recovery within 80-120%.
ICP Serial Dilution	One per preparatory batch if MS or MSD fails	Five-fold dilution must agree within ± 10% of the original measurement if analyte concentration > 50 LOQ (prior to dilution).	If PDS recovery is outside control limits, then J-flag the result in the parent sample and explain in the case narrative.	Eurofins Analyst	Five-fold dilution must agree within ± 10% of the original measurement if analyte concentration > 50 LOQ (prior to dilution).
Internal Standard (IS)	Every field sample, standard and QC sample	IS intensity in the samples within 30-120% if intensity of the IS in the ICAL blank.	If recoveries are acceptable for QC samples, but not field samples, the field samples may be considered to suffer from a matrix effect. Reanalyze sample at 5-fold dilutions until criteria is met. For failed QC samples, correct problem and rerun all associated failed field samples.	Eurofins Analyst	IS intensity in the samples within 30-120% if intensity of the IS in the ICAL blank.
Results between DL and LOQ	N/A	Apply "J" qualifier to results between DL and LOQ.	N/A	Eurofins Analyst	Same as Method/SOP QC acceptance criteria

Notes:
[1] Water may include groundwater and equipment (rinsate) blanks. For equipment blanks, required QC samples are method blanks and LCS results. The laboratory will not prepare MS/MSD, PDS, or serial dilution samples from any equipment blank samples.

WORKSHEET #28.6: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—ICP-AES METALS ANALYSIS

Matrix: IDW Water[1] and IDW Solid[1] (Total Metals plus TCLP Metals)
Analytical Group: Metals and TCLP Metals
Analytical Method / SOP: EPA 6010D / T-MET-WI11931

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch.	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, If required, reprep and reanalyze the method blank and all QC samples and field samples processed with the contaminated blank, if sufficient sample material is available. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. If sufficient sample is not available, B-qualify sample data for affected analyte in the preparation batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).

WORKSHEET #28.6: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION— ICP-AES METALS ANALYSIS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
LCS/LCSD*	One per preparatory batch.	A laboratory must use the QSM Appendix C Table C-3 (solid) and Table C-4 (water) recovery limits for batch control if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If sufficient sample is not available, Q-flag data for affected analyte in the preparation batch and discuss in the case narrative. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	QSM Appendix C Table C-3 (solid) and Table C-4 (water) recovery limits.
Matrix Spike	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Examine the project-specific requirements. Contact the client regarding additional measures to be taken.	Eurofins Analyst	Not applicable. IDW samples MS samples will not be prepared.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified. MSD or MD: RPD ≤ 20% (between MS and MSD or sample and MD)	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Eurofins Analyst	Not applicable. IDW samples MS and MSD samples will not be prepared.

WORKSHEET #28.6: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION— ICP-AES METALS ANALYSIS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Post-Digestion Spike (PDS) – ICP-AES only	One per preparatory batch if the MS or MSD fails (using the same sample as used for the MS/MSD if possible)	Recovery within 80-120%.	If PDS recovery is outside control limits, then J-flag the result in the parent sample and explain in the case narrative.	Eurofins Analyst	Not applicable. IDW samples MS and MSD samples will not be prepared.
ICP Serial Dilution – ICP-AES only	One per preparatory batch if MS or MSD fails	Five-fold dilution must agree within ± 10% of the original measurement. If analyte concentration > 50 LOQ (prior to dilution).	If PDS recovery is outside control limits, then J-flag the result in the parent sample and explain in the case narrative.	Eurofins Analyst	Not applicable. IDW samples MS and MSD samples will not be prepared.
Results between DL and LOQ	N/A	Apply "J" qualifier to results between DL and LOQ.	N/A	Eurofins Analyst	Same as Method/SOP QC acceptance criteria

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown could be used to evaluate sample data if LCSD is performed.
[1] IDW samples will not require an associated equipment blank and will not be used to prepare MS and MSD samples.

WORKSHEET #28.7: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—MERCURY ANALYSIS

Matrix: Groundwater, Soil, and Sediment
Analytical Group: Mercury
Analytical Method/SOP: EPA 7470A (water) or EPA 7471B (solid) / T-MET-WI11931 and T-MET-WI7965
Matrix: IDW Water[1] and IDW Soil[1]
Analytical Group: Mercury (including TCLP mercury)
Analytical Method/SOP: EPA 7470A (water) or EPA 7471B (solid) / T-MET-WI11931 and T-MET-WI7965

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch.	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, If required, reprep and reanalyze the method blank and all QC samples and field samples processed with the contaminated blank, if sufficient sample material is available. Non-detects associated with positive blank infractions may be reported. Sample results >10X the LOQ associated with negative blanks may be reported. If sufficient sample is not available, B-qualify sample data for affected analyte in the preparation batch. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).

WORKSHEET #28.7: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—MERCURY ANALYSIS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
LCS/LCSD*	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If sufficient sample is not available, Q-flag data for affected analyte in the preparation batch and discuss in the case narrative. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	QSM Appendix C Table C-11 (solid) and Table C-12 (water) recovery limits.
Matrix Spike	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified.	Examine the project-specific requirements. Contact the client regarding additional measures to be taken.	Eurofins Analyst	QSM Appendix C Table C-11 (solid) and Table C-12 (water) recovery limits.
Matrix Spike Duplicate (MSD) or Matrix Duplicate (MD)	One per preparatory batch.	A laboratory must use the QSM Appendix C Limits for batch control if project limits are not specified. MSD or MD: RPD ≤ 20% (between MS and MSD or sample and MD)	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Eurofins Analyst	QSM Appendix C Table C-11 (solid) and Table C-12 (water) recovery limits.
Results between DL and LOQ	N/A	Apply "J" qualifier to results between DL and LOQ.	N/A	Eurofins Analyst	Same as Method/SOP QC acceptance criteria

Notes:
* LCSD is not required, however, if analyzed, the RPD criteria shown could be used to evaluate sample data if LCSD is performed.
[1] Investigative samples (Groundwater, Soil and Sediment) will require an associated equipment blank and MS/MSD analysis. IDW samples will not require an associated equipment blank and will not be used to prepare MS and MSD samples.

WORKSHEET #28.8: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION -TOTAL ORGANIC CARBON

Matrix: Soil[1] and Sediment[1] and IDW Solid
Analytical Group: Total Organic Carbon (TOC)
Analytical Method / SOP: EPA 9060A / T-WC-WI11627

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Method Blank	One per analytical batch of 20 or fewer samples.	No target analytes > LOQ or > 1/10 the amount measured in any sample.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Re-prepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Eurofins Analyst	No target analytes > LOQ or > 1/10 the amount measured in any sample.
LCS (same as ICV)	One per analytical batch of 15 samples.	%R must be within 80-120	(1) Investigate source of problem. (2) If the LCS recovery is high but the sample results are <PQL, narrate. Otherwise, reprep a blank and the remaining samples.	Eurofins Analyst	Same as Method/SOP Acceptance Limits.
MS and MSD[1]	One pair for every set 10 samples	%R must be within 75-125% RPD ≤30%	(1) Evaluate the samples and associated QC: i.e., If the LCS results are acceptable, narrate. (2) If both the LCS and MS are unacceptable, reprep and reanalyze the samples and QC. (3) Notate sample result in raw data if matrix interference suspected.	Eurofins Analyst	Same as Method/SOP Acceptance Limits.
Sample Quadruplicate[1]	Each sample analyzed in quadruplicate	RPD ≤30% for samples >3X the PQL, <100% RPD for samples <3X the PQL.	(1) If lab QC is within criteria and matrix interference is suspected, flag data. Otherwise, reanalyze sample.	Eurofins Analyst	Samples for this project will not be analyzed in quadruplicate.

Notes:
[1] Matrix Spike (MS) and Matrix Spike Duplicates (MS/MSD) will not be required for project samples; however, if a project sample is selected for laboratory quality control (QC), the laboratory will use the acceptance limits in the table above to evaluate the data.

WORKSHEET #28.9: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – HEXAVALENT CHROMIUM IN WATER

Matrix: Groundwater and IDW Water
Analytical Group: Hexavalent Chromium
Analytical Method / SOP[1]: EPA 7196A / T-WC-WI11501

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
MB	1 per prep batch of up to 10 samples	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample	Reanalyze blank to confirm detections. If detects confirm, reprep samples that are not ND or not >10x the blank value.	Eurofins Analyst	No analytes detected > 1/2 LOQ or >1/10 the amount measured in any sample
Sample Blank	1 per sample	Used for background correction	N/A	Eurofins Analyst	N/A
MS/MSD	1 per prep batch of up to 10 samples	Recovery limits per QSM 5.4	Dilute sample and reanalyze to confirm matrix interference. Report with qualification if still out of specification.	Eurofins Analyst	Recovery limit: 90-111%R RPD ≤ 20%
LCS and LCSD	1 set per batch of up to 20 samples	Recovery limits per QSM 5.4; RPD ≤ 20%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-prepped or re-digested.	Eurofins Analyst	Recovery limit: 90-111%R RPD ≤ 20%
Laboratory Duplicate	1 per prep batch of up to 10 samples	RPD ≤20%	Flag data	Eurofins Analyst	RPD ≤20%

Notes:
[1] SOPs are reviewed/ revised on an annual schedule. The current version will be followed at the time of sample receipt.
IDW Water will not require an MS/MSD.

WORKSHEET #28.10: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – HEXAVALENT CHROMIUM IN SOIL

Matrix: Soil, Sediment and IDW Solid
Analytical Group: Hexavalent Chromium
Analytical Method/SOP[1]: EPA 7196A / T-WC-WI11501 (preparation by EPA 3060A)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
MB	1 per prep batch of up to 20 samples	No analytes detected > ½ LOQ or >1/10 the amount measured in any sample	Reanalyze blank to confirm detections. If detects confirm, reprep samples that are not ND or not >10x the blank value.	Eurofins Analyst	No analytes detected > ½ LOQ or >1/10 the amount measured in any sample
Sample Blank	1 per sample	Use for background correction	N/A	Eurofins Analyst	N/A
MS soluble (MSS) and MSD soluble (MSSD)	1 per prep batch of up to 10 samples	Recovery limits per QSM 5.4	Dilute sample and reanalyze to confirm matrix interference. Report with qualification if still out of specification.	Eurofins Analyst	Recovery limit: 80-120%R RPD ≤ 20%
MS insoluble (MSI) and MSD insoluble (MSID)	1 per prep batch of up to 10 samples	Recovery limits per QSM 5.4	Dilute sample and reanalyze	Eurofins Analyst	Recovery limit: 75-125%R RPD ≤ 20%
LCS soluble (LCSS) and LCSD soluble (LCSSD)	1 per prep batch of up to 10 samples	Recovery limits per QSM 5.4; RPD ≤ 20%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-prepped or re-digested.	Eurofins Analyst	Recovery limit: 80-120%R RPD ≤ 20%
LCS insoluble (LCSIS) and LCSD insoluble (LCSID)	1 per prep batch of up to 20 samples	Recovery limits per QSM 5.4; RPD ≤ 20%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-prepped or re-digested.	Eurofins Analyst	Recovery limit: 80-120%R RPD ≤ 20%
Laboratory Duplicate	1 per prep batch of up to 20 samples	RPD ≤20%	Flag data	Eurofins Analyst	RPD ≤20%

WORKSHEET #28.10: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – HEXAVALENT CHROMIUM IN SOIL (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Post Digestion Spike (PDS)	1 per prep batch of up to 20 samples	85-115%	The entire batch must be redigested and reanalyzed.	Eurofins Analyst	Recovery limit: 85-115%R

Notes:
[1] SOPs are reviewed/ revised on an annual schedule. The current version will be followed at the time of sample receipt.
IDW Solid will not require a MS/MSD.

WORKSHEET #28.11: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – CATION EXCHANGE CAPACITY

Matrix: Soil and Sediment
Analytical Group: Cation Exchange Capacity (CEC)
Preparation Method / SOP[1]: EPA 9081 / WC-22-007 (CEC prep) and MET-17-001 (acid digestion)
Analytical Method / SOP[1]: EPA 6010D / MET-18-001

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
MB	1/20 samples in batch	No analytes detected > ½ RL or >1/10 the amount measured in any sample	Samples associated with MBs that contain analyte concentrations greater than the RL shall be re-digested if the sample concentrations are not greater than 10X the PB value or below the RL.	Eurofins Houston analyst	No analytes detected > ½ RL (LOQ) or >1/10 the amount measured in any sample
MS	1/20 samples in batch	MS/MSD recovery criteria are ± 25% (75-125%R)	Flag outlier recoveries and report.	Eurofins Houston analyst	Not required
MSD	1/20 samples in batch	MS/MSD recovery criteria are ± 25% (75-125%R) and ≤ 20% for relative percent difference	Flag outlier recoveries RPD then report.	Eurofins Houston analyst	Not required
LCS and LCSD if no MS/MSD	1/20 samples in batch, only required if MS fails	Recovery Limits: 80-120%R RPD ≤ 20%	If the LCS recovery for any analyte of interest is below the lower acceptance criteria all associated samples shall be re-digested. If the LCS recovers greater than the upper acceptance criteria and the sample concentrations are less than the RL, the data may be reported.	Eurofins Houston analyst	Recovery: 80-120 %R RPD ≤ 20%

Notes:
[1] CEC is a preparation method that relies on analysis of sodium by EPA 6010D to determine the CEC of a soil.

WORKSHEET #28.12: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – PH (CORROSIVITY)

Matrix: IDW Solid and IDW Liquid
Analytical Group: pH (Corrosivity)
Analytical Method / SOP: EPA 9045D (solid) / T-WC-WI11518
Analytical Method / SOP: EPA 9045D (water) / T-WC-WI11475

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
LCS	1 per batch	Laboratory statistical window	Correct problem, re-prepare and reanalyze the LCS and all sample associated	Eurofins Analyst	LCS within ± 0.1 pH units of 7.0 (i.e., 6.9 – 7.1 pH units)
Lab Duplicate	1 per 10 samples	Laboratory statistical RPD	No corrective action, matrix related	Eurofins Analyst	95-105% Recovery

WORKSHEET #28.13: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – FLASHPOINT IN LIQUID

Matrix: IDW Water
Analytical Group: Flashpoint
Analytical Method / SOP: EPA 1010A /T-WC-WI10437

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
LCS prepared from o-xylene flashes	1 per batch	LCS between 78.5 and 83.49°F	Correct problem, re-prepare and reanalyze the LCS and all sample associated	Eurofins Analyst	LCS flashes between 78.5 and 83.49°F
Duplicate	1 per 20 samples	Laboratory statistical RPD	No corrective action, matrix related	Eurofins Analyst	Results within acceptance limits

WORKSHEET #28.14: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – REACTIVE SULFIDE

Matrix: IDW Water and IDW Solid
Analytical Group: Reactive Sulfide
Analytical Method / SOP: EPA 9034 / T-WC-WI11572

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
MB	1 per prep batch of up to 20 samples	No analytes detected > LOQ or >1/10 the amount measured in any sample	Reanalyze blank to confirm detections. If detects confirm, reanalyze samples that are not ND or not >10x the blank value.	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample
MS/MSD	1 per 20 samples	Laboratory statistical windows	Flag outliers	Eurofins Analyst	None required for this project
LCS	1 per prep batch of up to 20 samples	Laboratory statistical windows	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-analyzed.	Eurofins Analyst	56-104%R for LCS associated with both IDW water and IDW solid matrices

WORKSHEET #28.15: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – REACTIVE CYANIDE AND TOTAL CYANIDE

Matrix: IDW Water and IDW Solid
Analytical Group: Reactive Cyanide
Analytical Method / SOP: EPA 9012A / T-WC-WI11629
Matrix: IDW Solid only
Analytical Group: Total Cyanide
Analytical Method / SOP: EPA 9012A / T-WC-WI11629

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
MB	1 per prep batch of up to 20 samples	No analytes detected > LOQ or >1/10 the amount measured in any sample.	Reanalyze blank to confirm detections. If detects confirm, reanalyze samples that are not ND or not >10x the blank value.	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample
MS/MSD	1 per 20 samples	Laboratory statistical windows	Flag outliers	Eurofins Analyst	None required for this project
LCS Reactive Cyanide	1 per prep batch of up to 20 samples	Laboratory statistical windows	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-analyzed.	Eurofins Analyst	0-5.14%R for LCS associated with both IDW water and IDW solid matrices
LCS Total Cyanide	1 per prep batch of up to 20 samples	Laboratory statistical windows	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported. All others are re-analyzed.	Eurofins Analyst	76-120%R for LCS associated with IDW solid matrix

Note:
The disposal facility requires both total cyanide and reactive cyanide for IDW solid samples and reactive cyanide for both IDW water and IDW solid samples.

WORKSHEET #28.16: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – NJEPH

Matrix: IDW Solid
Analytical Group: NJDEP EPH (fractionation of aliphatic and aromatic ranges only, no target analytes required)
Analytical Method / SOP: NJDEP EPH / T-GC-WI9736

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Surrogate Spike	Every sample including blanks and QC samples	Method specific: 40-140%R for all surrogates	Reanalyze if outside limits, if confirmed, report	Eurofins Analyst	40-140%R for all surrogates: 1-chlorooctadecane 2-bromonaphthalene 2-fluorobiphenyl o-terphenyl
Method Blanks	1 per 20 samples or every 24 hours, whichever is less	No analytes detected > LOQ or >1/10 the amount measured in any sample.	Reanalyze to confirm detections	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample.
MS/MSD	1 per 20 samples or every 24 hours, whichever is less	Method specific: 40 - 140%; RPD ≤50%	Evaluation in conjunction with LCS results	Eurofins Analyst	Not required for IDW samples
LCS LCSD	1 per 20 samples or every 24 hours, whichever is less	Method specific: 40 - 140%; (RPD ≤30% for LCSD individual components; 25% for ranges if applicable)	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	Eurofins Analyst	40-140%R for all aliphatic and aromatic fractions RPD ≤ 25%

Note:
Disposal facility requires only aliphatic and aromatic fractions to be reported by laboratory.

WORKSHEET #28.17: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – TOTAL PETROLEUM HYDROCARBONS AS DIESEL RANGE ORGANICS (DRO)

Matrix: IDW Water
Analytical Group: TPH-DRO (C10-C28)
Analytical Method / SOP: EPA 8015D / T-GC-WI9786

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Surrogate Spike	Every sample including blanks and QC samples	Recovery	Review chromatogram for possible interferences. If interference does not affect surrogate quantitation, re-extract and reanalyze field sample. If still fails, flag data and discuss in case narrative.	Eurofins Analyst	56-125%R for surrogate o-terphenyl
Method Blanks	1 per 20 samples	No analytes detected > LOQ or >1/10 the amount measured in any sample.	Correct problem, reprep and reanalyze all affected samples associated with a contaminated blank.	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample.
MS/MSD	1 per 20 samples	Recovery 36 - 132% and RPD ≤20%	Evaluation in conjunction with LCS results	Eurofins Analyst	Not required for IDW samples
LCS LCSD	1 per 20 samples	Recovery 36 - 132% and RPD ≤20%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	Eurofins Analyst	36-132%R RPD ≤ 20%

Note:
Disposal facility requires only IDW water to be run for TPH-DRO.

WORKSHEET #28.18: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – POLYCHLORINATED BIPHENYL (PCBS)

Matrix: IDW Solid
Analytical Group: PCBs
Analytical Method / SOP: EPA 8082A / T-GC-WI10004
Matrix: IDW Water
Analytical Group: PCBs
Analytical Method / SOP: EPA 8082A / T-GC-WI9238

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Surrogate Spike	Every sample including blanks and QC samples	Recovery per QSM if available, otherwise laboratory limits.	Review chromatogram for possible interferences. If interference does not affect surrogate quantitation, re-extract and reanalyze field sample. If still fails, flag data and discuss in case narrative.	Eurofins Analyst	**Solid surrogate limits:** Decachlorobiphenyl: 66-130%R Tetrachloro-m-xylene: 44-130%R **Water surrogate limits:** Decachlorobiphenyl: 10-148%R Tetrachloro-m-xylene: 33-137%R
Method Blanks	1 per 20 samples	No analytes detected > LOQ or >1/10 the amount measured in any sample.	Correct problem, reprep and reanalyze all affected samples associated with a contaminated blank.	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample.
MS/MSD	1 per 20 samples	Recovery 36 - 132% and RPD ≤20%	Evaluation in conjunction with LCS results	Eurofins Analyst	Not required for IDW samples
LCS LCSD	1 per 20 samples	Recovery per QSM limits and RPD ≤30%	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	Eurofins Analyst	**Solid LCS limits:** PCB-1016: 47-134%R PCB-1260: 53-140%R **Water LCS limits:** PCB-1016: 46-129%R PCB-1260: 45-134%R RPD ≤ 30%

Note:
Disposal facility requires PCBs to be run for both IDW water and IDW solid samples.

WORKSHEET #28.19: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – EXTRACTABLE ORGANIC HALIDES (EOX)

Matrix: IDW Solid
Analytical Group: EOXs
Analytical Method / SOP: EPA 9023 / 07-TOX-S

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Method Blanks (matrix blank)	1 per batch of 10 samples and after 10 determinations	Concentration < 0.05 µg	If the matrix blank concentration is ≥ RL (LOQ) and is > 1/10th the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected sample reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.	Eurofins Analyst	No analytes detected > LOQ or >1/10 the amount measured in any sample.
LCS (Sample Matrix LCS)	Daily at the beginning of a batch or 1 per 10 samples	Recovery within ± 10% of true value (90-110%R)	Reanalyze LCS and associated samples. Analytes in the LCS that fail high and are ND in the samples can be reported.	Eurofins Analyst	Recovery within ± 10% of true value (90-110%R)
MS	Daily and every 10 samples	Recovery within ± 20% of true value (80-120%R)	Evaluation in conjunction with LCS results	Eurofins Analyst	Not required for IDW samples
Laboratory Duplicate	Every sample	RPD ≤ 20%	Rerun, if fails again, report with a comment.	Eurofins Analyst	RPD ≤ 20%

Note:
Disposal facility requires EOX to be run for only for IDW solid samples.

WORKSHEET #28.20: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION—VOLATILE ORGANIC COMPOUNDS (VOCS) AND TCLP VOCS

Matrix: IDW Water
Analytical Group: VOCs full list
Analytical Method/SOP: EPA 8260D / T-VOA-WI8194
Matrix: IDW Solid
Analytical Group: VOCs full list
Analytical Method/SOP: EPA 8260D / T-VOA-WI8236
Matrix: IDW Solid
Analytical Group: TCLP VOCs (TCLP Volatile list)
Analytical Method/SOP: EPA 8260D / T-VOA-WI8544

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Method blank	One per preparatory batch	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank. If sufficient sample is available, reanalyze samples. If reanalysis cannot be performed, data must be explained in case narrative and results for the affected analyte for samples in the sample batch must be B-flagged.	Eurofins Analyst	No target analytes > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).
TCLP Leachate Blank (applies to TCLP VOCs only)	1 per TCLP preparatory batch	<½ LOQ or <1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem, reprep and reanalyze all affected samples associated with a contaminated blank.	Eurofins Analyst	<½ LOQ or <1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).

WORKSHEET #28.20 ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION— VOLATILE ORGANIC COMPOUNDS (VOCS) AND TCLP VOCS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
LCS and LCSD*	1 per preparation batch per matrix	Recovery limits per QSM 5.4. Laboratory statistical limits for compounds not in QSM 5.4 RPD ≤20%	Correct problem. If required, reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If insufficient sample remains for reanalysis, apply the Q-flag to the affected analyte in associated samples. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	Eurofins Analyst	Recovery limits per QSM 5.4. Laboratory statistical limits for compounds not in QSM 5.4 RPD ≤20%
Surrogates	Added to every field and QC sample	Within DoD Recovery limits in QSM 5.4 for all matrices. **VOC IDW Solid-QSM 5.4 Table C-23:** 1,2-Dichloroethane-d4: 71-136%R Dibromofluoromethane: 78-119%R 4-Bromofluorobenzene: 79-119%R Toluene-d8: 85-116%R **VOC IDW Water and TCLP VOCs of IDW Solid -QSM 5.4 Table C-24:** 1,2-Dichloroethane-d4: 81-118%R Dibromofluoromethane: 85-114%R 4-Bromofluorobenzene: 80-119%R Toluene-d8: 89-112%R	Correct problem, then reprep and reanalyze all failed samples for all surrogates in the associated preparatory batch, if sufficient sample is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. Apply Q-flag to all associated analytes if acceptance criteria are not met and explain in the case narrative.	Eurofins Analyst	Within DoD Recovery limits in QSM 5.4 for all matrices. **VOC IDW Solid-QSM 5.4 Table C-23:** 1,2-Dichloroethane-d4: 71-136%R Dibromofluoromethane: 78-119%R 4-Bromofluorobenzene: 79-119%R Toluene-d8: 85-116%R **VOC IDW Water and TCLP VOCs of IDW Solid -QSM 5.4 Table C-24:** 1,2-Dichloroethane-d4: 81-118%R Dibromofluoromethane: 85-114%R 4-Bromofluorobenzene: 80-119%R Toluene-d8: 89-112%R

WORKSHEET #28.20 ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION— VOLATILE ORGANIC COMPOUNDS (VOCS) AND TCLP VOCS (CONTINUED)

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of person responsible for CA	Project-Specific MPC
Internal Standards	Each field and QC sample	-50% to + 100% of internal standard area of 12-hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.	Check the instrument for possible problems and then reanalyze samples. If reinject confirms, flag analytes associated with the non-compliant IS and discuss in the case narrative.	Eurofins Analyst	-50% to + 100% of internal standard area of 12-hour CCV standard. Retention time within ±10 sec. of midpoint standard in the ICAL or daily CCV.
MS/MSD*	1 per prep batch of up to 20 samples	Within DoD QSM limits. If not listed in QSM, laboratory limits will be used. RPD ≤20%	Flag outliers	Eurofins Analyst	Not required for project samples.

Notes:
* LCSD and MS/MSD are not required; however, if analyzed, the recovery and RPD criteria shown will be used to evaluate sample data.
The disposal facility requires full list VOC analysis for IDW Solid and IDW Water samples plus TCLP VOCs for only the IDW Solid samples.

WORKSHEET #28.21: ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION – SIEVE AND HYDROMETER ANALYSIS

Matrix: Soil and Sediment (investigative samples only)
Analytical Group: Sieve and Hydrometer Analysis
Analytical Method / SOP: ASTM D422 / T-WC-WI46354

QC Sample	Number/ Frequency	Method/SOP Acceptance Criteria	Corrective Action (CA)	Title/position of Person Responsible for CA	Project-Specific MPC
Laboratory Duplicate	1 per 20 samples if sufficient sample volume is available	Laboratory statistical RPD	No corrective action, matrix related	Eurofins Analyst	Results within acceptance limits

Note:
This test is not amenable to traditional laboratory QC (i.e., method blanks, LCS, and MS/MSD).
The laboratory will not be required to perform a laboratory duplicate on a project sample.

Acronyms for all Worksheet #28 Tables:
% = percent
%R = percent recovery
> = greater than
< = less than
± = plus or minus
≥ = greater than or equal to
≤ = less than or equal to
µg = micrograms
ASTM = ASTM International
CA = corrective action
CCV = continuing calibration verification
CEC = cation exchange capacity
DoD = Department of Defense
EOX = extractable organic halide
EPA = U.S. Environmental Protection Agency
EPH = extractable petroleum hydrocarbon
ICAL = initial calibration
ICP-MS = inductively coupled plasma mass spectroscopy
IDW = investigation-derived waste
IS = internal standard
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LCSID = laboratory control sample duplicate insoluble
LCSIS = laboratory control sample insoluble
LOD = limit of detection
LOQ = limit of quantitation
MD = matrix duplicate
MPC = measurement performance criteria
MS/MSD = matrix spike/matrix spike duplicate
N/A = not applicable
ND = nondetect
NJDEP = New Jersey Department of Environmental Protection
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PDS = post-digestion spike
pH = corrosivity
QC = quality control
QSM = Quality Systems Manual
RL = reporting limit
RPD = relative percent difference
SIM = selected ion monitoring
SOP = Standard Operating Procedure
SVOC = semivolatile organic compound
TCLP = Toxicity Characteristic Leachate Procedure
TPH-DRO = total petroleum hydrocarbons-diesel range organics
VOC = volatile organic compound

WORKSHEET #29 PROJECT DOCUMENTS AND RECORDS

This worksheet identifies project documents and records that will be generated for every aspect of the project. Quality control forms are provided in **Appendix E**, and copies of selected forms/logs are provided in **Appendix F**.

Record	Generation	Verification	Storage Location
RI Field Work			
Project UFP-QAPP	Technical Staff	Project Manager	Project File
Photographic Log	Technical Staff	Project Manager/Site Manager	Project File
APP/SSHP	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Safety Meeting Attendance Log	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Weekly Vehicle Inspection	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Incident Report	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Activity Hazard Analysis	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Safety Inspection Log	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Near Miss Report Form	SSHO/**Appendix F**	Project Manager/ Safety & Health Manager	Project File
Deficiency Notice	Field QC Manager	Project Manager	Project File
Quality Control Inspection Report	Field QC Manager	Project Manager	Project File
Preparatory Inspection	Field QC Manager	Project Manager	Project File
Daily Operator Test Report	Field QC Manager	Project Manager	Project File
Field Change Request Form	Field QC Manager	Project Manager	Project File

WORKSHEET #29 PROJECT DOCUMENTS AND RECORDS (CONTINUED)

Record	Generation	Verification	Storage Location
Site Specific Training Forms	Field QC Manager	Project Manager	Project File
Corrective Action Request Form	Field QC Manager	Project Manager	Project File
Daily Equipment Log/Equipment Calibration Log	Technical Lead	Project Manager/ Field QC Manager	Project File
Field Notebooks	Technical Lead	Project Manager Field QC Manager	Project File
Groundwater Sampling Form	Technical Lead	Project Manager	Project File
Site Maps	GIS Specialist	Project Manager	Project File
Laboratory Forms and Documents			
Sample Receipt, Sample Condition, Custody, and Internal Tracking Records	Laboratory Sample Receiving	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Laboratory Information Management System Login	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Run Logs/Sample Chronology	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Standard Traceability Logs	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Calibration Logs	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
QC Sample Identification (Blanks, Replicates, Duplicates, LCS, MS/MSD)	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Laboratory Data Qualifiers	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Instrument Calibration Logs	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File

WORKSHEET #29 PROJECT DOCUMENTS AND RECORDS (CONTINUED)

Record	Generation	Verification	Storage Location
Instrument Maintenance Logs	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Electronic Data Deliverables	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Project File/FUDSCHEM
Case Narrative	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Laboratory Sample Identification	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Quality Assurance/Quality Control Forms	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
LOD/LOQ Studies	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Laboratory Accreditation Certificates	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Quality Assurance Manual	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Analytical SOPs	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File
Sample Disposal Records	Laboratory Technician/ Quality Manager	Laboratory Project Manager/Quality Manager	Laboratory and Project File

Notes:

APP = Accident Prevention Plan

GIS = Geographic Information System

LCS: laboratory control sample

LOD = limit of Detection

LOQ = limit of quantitation

MS = matrix spike

MSD = matrix spike duplicate

QC = quality control

SOP = standard operating procedure

SSHO = Site Safety and Health Officer

SSHP = Site Safety and Health Plan

UFP-QAPP = Uniform Federal Policy – Quality Assurance Project Plan

WORKSHEET #29 PROJECT DOCUMENTS AND RECORDS (CONTINUED)

The following table summarizes the requirements for the laboratory deliverable.

Laboratory Data Deliverables[1, 2]					
Record	**SVOCs**	**Explosives**	**Pesticides**	**Metals**	**Other**
Narrative	X	X	X	X	X
Summary Results	X	X	X	X	X
QC Results	X	X	X	X	X
Chromatograms	X		X		
Tentatively Identified Compounds	X				
Chain of Custody	X	X	X	X	X

Notes:
[1] The Laboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness.
[2] The Laboratory Data Deliverable is a Staged EDD Stage2a deliverable to include a pdf file of the laboratory's final report that includes applicable chromatographs and instrument calibration QC documentation.

WORKSHEET #31, #32, & #33 PLANNED PROJECT ASSESSMENTS

This worksheet identifies the assessments/audits planned for the project.

WORKSHEET #31.1 ASSESSMENT

Assessment Type	Frequency	Internal/ External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Action	Person(s) Responsible for Monitoring Effectiveness of Corrective Action
Review field procedures	Daily	Internal		Technical Lead/SSHO	Field Team Members	Technical Lead	Project Manager
Review field notes/logbook	Weekly	Internal		Technical Lead	Field Team Members	Technical Lead	Project Manager
Review field instrument calibration sheets	Daily	Internal		Technical Lead	Field Team Members	Technical Lead	Project Manager
Review chain-of-custody forms	Daily	Internal		Project Chemist	Field QC Manager	Technical Lead/Field QC Manager	Project Manager
Laboratory system audit	Laboratory performs annually	Internal/ External	Eurofins	QA Manager / Project Chemist	Laboratory	Laboratory QA Manager	Laboratory QA Manager

Notes:
SSHO = Site Safety and Health Officer
QA = Quality Assurance
QC = Quality Control

WORKSHEET #32.1 ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

Assessment Type	Nature of Deficiencies Documentation	Individual Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Review field procedures	Verbal communication/ logbook record	Project Manager	24 hours after audit	Letter or email	Project Manager	24 hours after notification
Review field notes/logbook	Logbook record	Technical Lead/Field QC Manager	24 hours after audit	Logbook entry	Project Manager	24 hours after notification
Review field instrument calibration sheets	Logbook record	Technical Lead/Field QC Manager	24 hours after audit	Logbook entry	Technical Lead/Field QC Manager	24 hours after notification
Review chain-of-custody forms	Logbook record	Technical Lead/Field QC Manager	24 hours after audit	Letter or email	Technical Lead/Field QC Manager	24 hours after notification
Field audit	Written audit report	Quality Manager	24 hours after audit	Letter or email	Project Manager	24 hours after notification

WORKSHEET #33.1 QUALITY ASSURANCE MANAGEMENT REPORTS TABLE

Type of Report	Frequency	Projected Delivery Date	Person Responsible for Report Preparation	Report Recipients
Data Validation Report	Once after submission of each sampling delivery group from the analytical laboratory	Within 2 months of data receipt	Third Party Data Validator	Project Manager/FUDSCHEM
Field Audit Report	Once during the initial field work	TBD	Quality Manager	Project Manager/Technical Lead/Field QC Manager

Notes:
TBD = to be determined

WORKSHEET #34 DATA VERIFICATION AND VALIDATION INPUTS

This worksheet presents the inputs that will be used during data verification and validation. Data verification is a completeness check that is performed before the data review process in order to determine whether the required measurements are collected, and all data deliverables (the complete data package) are present. Data validation is the evaluation of conformance to stated requirements and includes evaluation of data against the project-specific MPCs (Worksheet #12). Data verification and validation procedures and responsibilities are described on Worksheets #35 and #36, respectively.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved UFP-QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	X	
6	Laboratory Certifications	X	
Field Records			
7	Field Logbooks	X	X
8	Water Monitoring Forms	X	X
9	Field Sampling Reports	X	X
10	Water Sampling Reports	X	X
11	Photograph Logs	X	X
12	Sample Logs	X	X
13	Waste Logs	X	X
14	Equipment Calibration Records	X	X
15	Inspection Logs	X	X
16	Chain-of-Custody Forms	X	X
17	Safety Documents	X	X
18	Sampling Diagrams/Surveys	X	X
19	Relevant Correspondence	X	X
20	Change Orders/Deviations	X	X
21	Field Audit Reports	X	X
22	Field Corrective Action Reports	X	X

WORKSHEET #34 DATA VERIFICATION AND VALIDATION INPUTS (CONTINUED)

Item	Description	Verification (completeness)	Validation (conformance to specifications)
23	Sample Location Verification	X	X
Analytical Data Package			
24	Cover Sheet (laboratory identifying information)	X	X
25	Case Narrative	X	X
26	Internal Laboratory Chain-of-Custody	X	X
27	Sample Receipt Records	X	X
28	Sample Chronology (i.e., dates and times of receipt, preparation, & analysis)	X	X
29	Communication Records	X	X
30	Project-Specific PT Sample Results (if any)	X	X
31	LOD/LOQ Establishment and Verification	X	X
32	Standards Traceability	X	X
33	Instrument Calibration Records	X	X
34	Definition of Laboratory Qualifiers	X	X
35	Results Reporting Forms	X	X
36	QC Sample Results	X	X
37	Corrective Action Reports	X	X
38	Raw Data	X	X
39	EDD	X	X

Notes:

EDD = Electronic Data Deliverable

LOD = limit of detection

LOQ = limit of quantitation

PT = proficiency testing

QA = quality assurance

QC = quality control

SOP = standard operating procedure

UFP-QAPP = Uniform Federal Policy–Quality Assurance Project Plan

WORKSHEET #35 DATA VERIFICATION PROCEDURE

Verification is a completeness check that is performed before the data review process is conducted to determine if the required information is available for data validation. It involves a review of all data inputs to ensure they are present. The following table summarizes the methods for data verification.

Records Reviewed	Required Documents	Process Description	Responsible Person
Approved UFP-QAPP	UFP-QAPP	Verify completeness, correctness, and contractual compliance of all project QA/QC and data set against the methods, SOPs, and contract requirements conforms.	Project Manager
Field SOPs	UFP-QAPP	Ensure that all field sampling SOPs were followed.	Project Manager Technical Lead Field QC Manager
Analytical SOPs	UFP-QAPP	Ensure that all laboratory analytical SOPs were followed.	Laboratory Project Manager
Laboratory QA Manual	UFP-QAPP	Verify that applicable laboratory SOPs included in the laboratory QA manual were followed.	Project Chemist Laboratory Project Manager
Laboratory Certifications	UFP-QAPP	Ensure that laboratory performing analytical sample analyses has current State, National Environmental Laboratory Accreditation Program, National Voluntary Laboratory Accreditation Program, or American Industrial Hygiene Association certifications as required by the project.	Project Chemist Quality Manager Laboratory Project Manager
Field Logbook, Field Sheets	UFP-QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed, and results are documented.	Technical Lead Field QC Manager
Equipment Calibration Records	UFP-QAPP	Ensure that all field analytical instrumentation SOPs and laboratory analytical SOPs for equipment calibration were followed.	Technical Lead Field QC Manager Laboratory Project Manager

WORKSHEET #35 DATA VERIFICATION PROCEDURE (CONTINUED)

Records Reviewed	Required Documents	Process Description	Responsible Person
Chain-of-Custody Forms	UFP-QAPP	Verify the completeness of Chain-of-Custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Technical Lead Field QC Manager Laboratory Project Manager
Relevant reports, and correspondence	UFP-QAPP, Work Plan	Verify that reports are present and complete for each day of field activities. Verify that correspondences are documented and were reported in accordance with requirements.	Project Manager Quality Manager
Laboratory Deliverable	UFP-QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with Chain-of Custody forms to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Project Chemist

Notes:
MS = matrix spike
MSD = matrix spike duplicate
QA = quality assurance
QC = quality control
SOP = standard operating procedure
UFP-QAPP = Uniform Federal Policy–Quality Assurance Project Plan

WORKSHEET #36 DATA VALIDATION PROCEDURES

Validation is performed to identify and qualify data that do not meet the MPCs specified on Worksheets #12 and 28 and Analytical Calibration specifications in Worksheet # 24. The data validator is responsible for conducting automated reviews against the automated data review (ADR) project library in conjunction with manual review of the data packages for compliance with the established QC criteria. The data validator will perform validation in accordance with method-specific Data Validation Evaluation Sheets, which are based on guidance from the DoD QSM v5.4, and the DoD Modules 1, 2, 4 including the Revised Table for Sample Qualification in the Presence of Blank Contamination (DoD EDQW, February 2022), and, for hexavalent chromium, the EPA National Functional Guidelines (EPA, 2020). The data validator will be a chemist unaffiliated with the project to satisfy the requirements for independent review of analytical data.

Data Validator: Laboratory Data Consultants (LDC) of Carlsbad, California

Analytical Group/ Method	Data Deliverable Requirements (Lab/DV)	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/ Version
Investigative Samples Soil, Sediment, and Groundwater: SVOCs (EPA 8270E) SIM PAHs and 1,4-Dioxane (EPA 8270E SIM) Pesticides (EPA 8082A) Explosives (EPA 8330B) TAL Metals (EPA 6020B and EPA 7470A or 7471B) Grain Size TOC (EPA 9060A) CEC (EPA 9081/6010D) *Hexavalent Chromium (contingent analysis)*	**Lab:** Level 4 pdf report and SEDD Stage 2a **Data Validation:** ADR deliverable in pdf format	Worksheet #24 plus MPC	Worksheet #12, 28	100	0	0	UFP-QAPP, QSM, DoD DV Modules 1, 2, and 4	S2aVEM	ADR function in FUDSChem

WORKSHEET #36 DATA VALIDATION PROCEDURES (CONTINUED)

Analytical Group/ Method	Data Deliverable Requirements (Lab/DV)	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/ Version
IDW Water: VOCs (EPA 8260D) SVOCs (EPA 8270E) PCBs (EPA 8082A) TPH-DRO (EPA 8015C) Total RCRA Metals + Cu, Ni, Zn (EPA 6010D and 7470A) Flashpoint (EPA 1010A) Hexavalent Chromium (EPA 7196A) pH (EPA 9040C) Reactive Cyanide and Reactive Sulfide (EPA 9012B and 9034)	**Lab:** Level 4 pdf report Excel or EnviroData format EDD **Data Validation:** FUDSCHEM Checklist report*	Worksheet #24 plus MPC	Worksheet #12, 28	100	0	0	UFP-QAPP, QSM, DoD DV Modules 1, 2, and 4 where applicable. Hexavalent Chromium: EPA NFG (2020)	S2aVM	none

WORKSHEET #36 DATA VALIDATION PROCEDURES (CONTINUED)

Excel or EnviroData format EDD

Analytical Group/ Method	Data Deliverable Requirements (Lab/DV)	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code[1]	Electronic Validation Program/ Version
IDW Solid: VOCs and TCLP VOCs (EPA 8260D) SVOCs and TCLP VOCs (EPA 8270E) PCBs (EPA 8082A) NJ EPH (NJDEP EPH) EOX (EPA 9023) Total RCRA Metals + Cu, Ni, V, Zn (EPA 6010D and 7471B) TCLP Metals + Cu, Ni, Zn (EPA 6010D and 7470A) Ignitability (40 CFR Part 261.21) Hexavalent Chromium (EPA 7196A) pH (EPA 9045D) Total Cyanide (EPA 9012B) Reactive Cyanide and Reactive Sulfide (EPA 9012B and 9034) TOC (EPA 9060A) Paint Filter (EPA 9095A)	**Lab:** Level 4 pdf report Excel or EnviroData format EDD **Data Validation:** FUDSCHEM Checklist report*	Worksheet #24 plus MPC	Worksheet #12, 28	100	0	0	UFP-QAPP, QSM, DoD DV Modules 1, 2, and 4 where applicable. Hexavalent Chromium: EPA NFG (2020)	S2aVM	none

WORKSHEET #36 DATA VALIDATION PROCEDURES (CONTINUED)

Notes:
* A simple checklist report similar to the example listed on page 49 of 58 of the DoD General Data Validation Guidelines (EDQW, 2018) would be acceptable for IDW samples.

Although data validation is requested for some test parameters with limited available data deliverables like bench sheets (e.g., pH, Ignitability, Grain Size), the validator will adjust data validation to the method.

EPA = U.S. Environmental Protection Agency
MPC = Measurement Performance Criteria
NFG = National Functional Guidelines
QSM = Department of Defense Quality Systems Manual
SEDD = Staged Electronic Data Deliverable
UFP-QAPP = Uniform Federal Policy–Quality Assurance Project Plan

Based on evaluation results, qualifiers will be added to reported analyte concentrations to indicate uncertainty, potential bias, or interferences. Specific data qualifiers which will be applied to sample concentration include the following:

Data Validation Qualifiers	Definition
U	The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
NJ	The analyte has been “tentatively identified” or “presumptively” as present and the associated numerical value is the estimated concentration in the sample.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
X	The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a project chemist), but exclusion of the data is recommended.

WORKSHEET #37 USABILITY ASSESSMENT

The usability assessment is an evaluation of data based upon the results of data validation and verification for the decisions being made. In the usability step, reviewers assess whether the process execution and resulting data meet quality objectives based on criteria established in this UFP-QAPP. The usability assessment will consider data from sampling activity, analytical laboratory, and validation reports. The usability assessment will be performed by the data assessment team and documented in the RI Report by the Project Chemist. Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- Project Manager
- Quality Manager
- Technical Lead
- Data Validator

Based on the current oversight responsibilities and analytical scope, this data usability assessment worksheet outlines the approach that will be taken. The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

- Step 1 – Review the project's objectives and sampling design
- Step 2 – Review the data verification and data validation outputs
- Step 3 – Verify the assumptions of the selected statistical method
- Step 4 – Implement the statistical method
- Step 5 – Document data usability and draw conclusions

Data assessment is considered the final step in the data evaluation process and can be performed only on data of known and documented quality. As described in Worksheets #34, #35, and #36, data generated for this project will undergo a formalized evaluation/validation process, using the following hierarchy: the UFP-QAPP; DoD QSM v5.4; the DoD Data Validation Guidelines; EPA National Functional Guidelines; and the analytical laboratory SOPs. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs. The results of the data usability assessment, and any changes to the DQOs necessitated by the data not meeting usability criteria, will be included in each final report.

The assessment of the usability will follow procedures described in appropriate EPA guidance documents, particularly Guidance for Data Usability in Risk Assessment (Publication No. 9285.7-05FS, September 1992), and will be conducted according to the process below.

1. **Sampling and Analysis Activities Evaluation**: The first part of the data usability evaluation will include a review of the sampling and analysis activities in comparison to project-specific DQIs and this UFP-QAPP. Specific limitations to the data (i.e., results that

are qualified as estimated [J/UJ], or rejected [R], will be determined and documented in the database).

2. **Achievement of DQIs**: The second part of data usability pertains to the achievement of the program-specific DQIs. Each investigator will compare the performance achieved for each data quality criterion against the expected and planned performance. This comparison will follow from the DQIs used to define each DQO. This comparison is the most critical component of the assessment process. Any deviation from planned performance will be documented and evaluated to determine whether corrective action is advisable. Potential corrective actions will range from re-sampling and/or reanalysis of data, to qualification or exclusion of the data for use in the data interpretation. In the event that corrective action is not possible, the limitations, if any, of the data with regard to achieving the DQOs will be noted.

   In conjunction with the DQI achievement review, the investigators will need to make decisions for the use of qualified values, which are a consequence of the formalized evaluation/validation process. Data qualifiers will be applied to individual data results. Data usability decisions will be made based on the assessment of the usability of each of these results for the intended purpose. Evaluation will describe the uncertainty (bias, imprecision, etc.) of the qualified results. Cumulative QC exceedances from the DQIs may require technical judgment to determine the overall effect on the usability of the data. Finally, data users may choose to determine final data usability qualifiers as a result of this overall examination and decision process.

3. **Achievement of DQOs**: The final part in the data usability process concerns achievement of the DQOs. Once the data set has been assessed to be of known quality, data limitations have been documented, and overall result applicability/usability for its intended purpose has been determined, the final data assessment can be initiated by considering the answers to the following questions:

   - Are the data adequate to determine the extent to which hazardous substances have migrated or to what extent they were expected to migrate from potential hazardous substance source areas?
   - Do the data collected adequately characterize the nature and extent of potential hazardous substance source areas at the Site?
   - Are the data statistically adequate to evaluate on a per chemical and per media basis?
   - Do the data collected allow assessment of hydrogeologic factors, which may influence contaminant migration/distribution?
   - Do laboratory reporting limits attain the applicable state and/or federal standards and/or screening levels?
   - Is the sample set sufficient to develop Site-specific removal and disposal treatment methodologies?

- Have sufficient data been collected to evaluate how factors including physical characteristics of the Site and climate and water table fluctuations affect contaminant fate and transport?
- Have sufficient data been collected to determine the toxicity, environmental fate, and other significant characteristics of each hazardous substance present?
- Is the data set sufficient to evaluate the potential extent and risk of future releases of hazardous substances, which may remain as residual contamination at the source facility?

Principal investigators, in conjunction with the project team, will formulate solutions if data gaps are found as a result of problems, biases, trends, etc., in the analytical data, or if conditions exist that were not anticipated in the development of the DQOs. It is particularly important that each data usability evaluation specifically address any limitations on the use of the data that may result from a failure to achieve the stipulated DQO. If the project scope changes, the DQOs will be expanded. The DQOs will address the specific action limits and measurable performance criteria, in order to make appropriate decisions on the analytical data.

DQIs, such as precision, accuracy, completeness, representativeness, and comparability measurements, aid in the evaluation process and are discussed below.

37.1 PRECISION

For each field duplicate and laboratory duplicate pair (including LCS/LCSD and MS/MSD), the RPD will be calculated for each analyte whose original and duplicate values are both greater than, or equal to, the LOQ. The RPDs will be checked against the measurement performance criteria presented in Worksheet #12. The RPDs exceeding criteria will be identified in the RI Report. Conclusions about the precision of the analyses and limitations on the use of the data will be described in each report. Precision is most often expressed in terms of RPD:

$$RPD = 100 \times \left(\frac{C_R - C_D}{[C_R + C_D]/_2} \right);$$

Where:

RPD = Relative Percent Difference
CR = Measured concentration of the original sample result
CD = Measured concentration of the duplicate sample result

37.2 ACCURACY/BIAS

Results for all laboratory method blanks and field blanks (e.g., trip blanks and field equipment rinsate blanks) will be reviewed by the data validator. In addition, LCS/LCSDs, MS/MSDs, surrogates, post-digestion spikes, and serial dilutions will be reviewed. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12. Results for analytes that exceed criteria will be identified in the data validation report. A discussion will

summarize the results of the laboratory accuracy/bias. Conclusions about the accuracy/bias of the analyses based on contamination or outlying recoveries and limitations on the use of the data will be described in the RI Report.

Bias values are commonly expressed as %R, which is calculated as follows:

$$\%R = \frac{C_S - C_R}{C_{Sknown}} \times 100;$$

Where:

%R = Percent Recovery
CR = Measured concentration of the original sample result
CS = Measured concentration of the spiked sample result
C_{Sknown} = Known concentration of the spike added

37.3 REPRESENTATIVENESS

As described by the IDQTF Uniform Federal Policy for Quality Assurance Project Plans (IDQTF, 2012), representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental condition of the Site, and takes into consideration the magnitude of the Site area represented by one sample and indicates the feasibility and reasonableness of that design rationale. Representativeness also reflects the ability of the sampling team to collect samples and the ability of the laboratory to analyze those samples so that the generated data accurately and precisely reflect Site conditions.

Field and laboratory sampling and subsampling techniques will follow sampling and laboratory SOPs that specify premixing/homogenization procedures to ensure that all sub-samples taken from a given sample or sampling point are representative of the sample as a whole. Representativeness will be assessed by a review of the precision obtained by analysis of field and laboratory duplicate samples. Representativeness will also be assessed through documentation of proper sample handling techniques and the use of field blanks (e.g., equipment rinsate blanks and trip blanks) and laboratory method blanks. Previous project data may be employed to assess the representativeness of a population by defining the continuity of data from point to point.

37.4 COMPARABILITY

Sample data will be comparable for similar samples and sample conditions. This goal will be achieved using standard techniques to collect representative samples, consistent application of analytical method protocols, and reporting analytical results with appropriate units.

37.5 COMPLETENESS

A completeness check will be done on all of the data generated by the laboratory. Completeness criteria are presented in Worksheet #12. As described by the IDQTF (IDQTF, 2012), completeness is a measure of the amount of valid data collected using a measurement system and is expressed as a percentage of the number of measurements that are specified in the UFP-QAPP.

The percentage of valid data points will be calculated by dividing the number of valid (i.e., non-rejected) data points by the total number of data points expected. Analytical results qualified as rejected during data validation are not considered "valid." A discussion summarizing data completeness will be included in the RI Report.

37.6 SENSITIVITY

As defined by the IDQTF (IDQTF, 2012), sensitivity is the ability of the method or instrument to detect target analytes at the level of interest. As defined by DoD QSM v5.4, the LOQ is the smallest concentration that produces a quantitative result with known and recorded precision and bias. The DoD LOQ is set at or above the concentration of the lowest initial calibration standard and is within the calibration range. The DoD QSM v5.4 defines the LOD as the smallest concentration that must be present in order to be detected with 99% confidence. Non-detections are reported at the LOD.

Worksheet #15 includes the LODs and LOQs as well as the Site PALs for each analyte. The project team will compare the LODs against the Site PALs for each analyte to ensure, wherever possible, that the selected analytical method will achieve the Site PALs. In the event that the PAL cannot be achieved by the method, the RI Report will discuss the limitations on the use of the data with respect to laboratory sensitivity.

In accordance with DoD QSM v5.4 requirements, the laboratory is required to run quarterly LOQ standards and quarterly LOD standards except for analyses that are used on an infrequent basis, for which LOQ and LOD verification may be performed on a batch basis. The results of the LOQ and LOD verification standards are typically not included in the data packages, but results are retained by the laboratory and are available for review upon request. A discussion in the RI Report will summarize the results and conclusions of the laboratory sensitivity.

37.7 NON-CHEMISTRY DATA

Non-chemistry data sets will not undergo that same type of usability analysis as analytical data (e.g., PARCCS analysis) but will be evaluated for usability. This includes but not limited to geospatial (field GPS and surveying), physical testing, hydraulic testing and surface geophysics location and measurement. The results of which will be included in the remedial investigation report.

REFERENCES

ASTM International (ASTM). 2001. Method D6429-20, Standard Guide for Selecting Surface Geophysical Methods.

ASTM. 2017. ASTM Method D2487-17 Standard Practice for Classification of Soils for Engineering Purposes – Unified Soil Classification System.

ASTM. 2011. ASTM Method D6429 Standard Guide for Selecting Surface Geophysical Methods.

Bluestone Environmental Group, Inc. (Bluestone). 2019. Expanded Technical Memorandum, Former Naval Air Station (NAS), Cape May, New Jersey, Formerly Used Defense Site (FUDS) Project Number C02NJ0951. February.

U.S. Army Corps of Engineers New England District (CENAE). 2019. Performance Work Statement for the Remedial Investigation, Feasibility Study, Proposed Plan, and Decision Document for Former Naval Air Station Cape May, New Jersey. 24 June 2019.

Department of Defense (DoD). 2021. Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.4.

DoD Environmental Data Quality Workgroup. 2020. *Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS.* Revision 1. May.

DoD Environmental Data Quality Workgroup. 2020. *Data Validation Guidelines Module 2: Data Validation Procedure for Metals by ICP-OES.* Revision 1. May.

DoD Environmental Data Quality Workgroup. 2021. *Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC.* March.

DoD Data Quality Workgroup. 2022. *Data Validation Guidelines Modules 1, 2,3, and 4 Revised Table for Sample Qualification in the Presence of Blank Contamination.* February.

DuBois & Associates (Dubois). 2021. Endangered and Threatened Wildlife and Plant Species Habitat Evaluation. Former Cape May Naval Air Station, Cape May City, Cape May County, New Jersey. 19 February 2021.

Engineering-Environmental Management, Inc. (e2M). 2003. Integrated Natural Resources Management Plan and Environmental Assessment, USGC Training Center, Cape May, New Jersey. Prepared for USCG Training Center, Cape May, New Jersey and USCG Headquarters, Washington, DC.

U.S Environmental Protection Agency (EPA). 1990. Basic Concepts of Contaminant Sorption at Hazardous Waste Sites. EPA/540/4-90/053. October.

EPA. 1992. Guidance for Data Usability in Risk Assessment. Publication 9285.7-05FS. September.

EPA. 1996. Soil Screening Guidance: User's Guide. Publication 9355.4-23. July.

EPA. 2002. Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS. December.

EPA. 2003a. Ecological Soil Screening Level for Aluminum, Interim Final. OSWER Directive 9285.7-60. November.

EPA. 2003b. Region 5, RCRA Ecological Screening Levels. 22 August 2003.

EPA. 2005a. Uniform Federal Policy for Quality Assurance Project Plans Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual. EPA-505-B-04-900A. March.

EPA. 2005b. Workbook for Uniform Federal Policy for Quality Assurance Project Plans Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs Part 2A: UFP-QAPP Workbook. EPA-505-B-04-900C. March.

EPA. 2005c. Uniform Federal Policy for Quality Assurance Project Plans. Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities. EPA-505-B-04-900B. March.

EPA. 2005d. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver, and Zinc). EPA/600/R-02/011. January.

EPA. 2006. Guidance on Systematic Planning using the Data Quality Objective Process EPA QA/G-4. February.

EPA. 2009a. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA-540-R-08-005. January.

EPA. 2009b. Evaluating Ecological Risk to Invertebrate Receptors from PAHs in Sediments at Hazardous Waste Sites. EPA/600/R-06/162F. October.

EPA. 2012. Uniform Federal Policy for Quality Assurance Project Plans Optimized UFP-QAPP Worksheets. March.

EPA. 2017. Field Measurement of Oxidation-Reduction Potential (ORP). Region 4 Science and Ecosystem Support Division, SESDPROC-113-R2. 26 April 2017.

EPA. 2020. Contract Laboratory Program (CLP) National Functional Guidelines. November.

Fetter. 2001. Applied Hydrogeology, 4th Addition, CW Fetter. 2001.

Intergovernmental Data Quality Task Force (IDQTF). 2012. Uniform Federal Policy for Quality Assurance Project Plans. March.

Ogden Environmental and Energy Services Co., Inc. (Ogden). 1998. Final Report: Data Collection at Defense Environmental Restoration Program – Formerly Used Defense Sites (DERP-FUDS) Naval Air Station Cape May, Cape May, New Jersey. Prepared for Northern Ecological Associates, Inc., under contract with USACE New York District. DERP-FUDS Site No. C02NJ0951. Contract No. DACW51-97-D-0010, Delivery Order 0008.

Sovereign. 2020. Site Safety and Health Plan and Accident Prevention Plan, AOC-1, Former Naval Air Station, Cape May, New Jersey.

U.S. Army Corps of Engineers (USACE). 1994a. Memorandum for Commander: Baltimore District, ATTN: CENAB-EN-HN, Subject: DERP-FUDS Inventory Project Report for Site No. C02NJ0951, Naval Air Station, Cape May, New Jersey.

USACE. 1994b. Risk Assessment Procedures for Ordnance and Explosive Waste Sites, Naval Air Station Cape May, Cape May, New Jersey.

USACE. 1995. Engineering Manual (EM) 1110-1-1802 Geophysical Exploration for Engineering and Environmental Investigations, 31 August 1995.

USACE. 1998. EM 1110-1-4000, Monitoring Well Design, Installation, and Documentation at Hazardous Toxic and Radioactive Waste Sites.

USACE. 1995. EM 1110-1-1802, Geophysical Exploration for Engineering and Environmental Investigations. 31 August 2005.

USACE. 2001. EM 200-1-3, Waste Sampling Instructions.

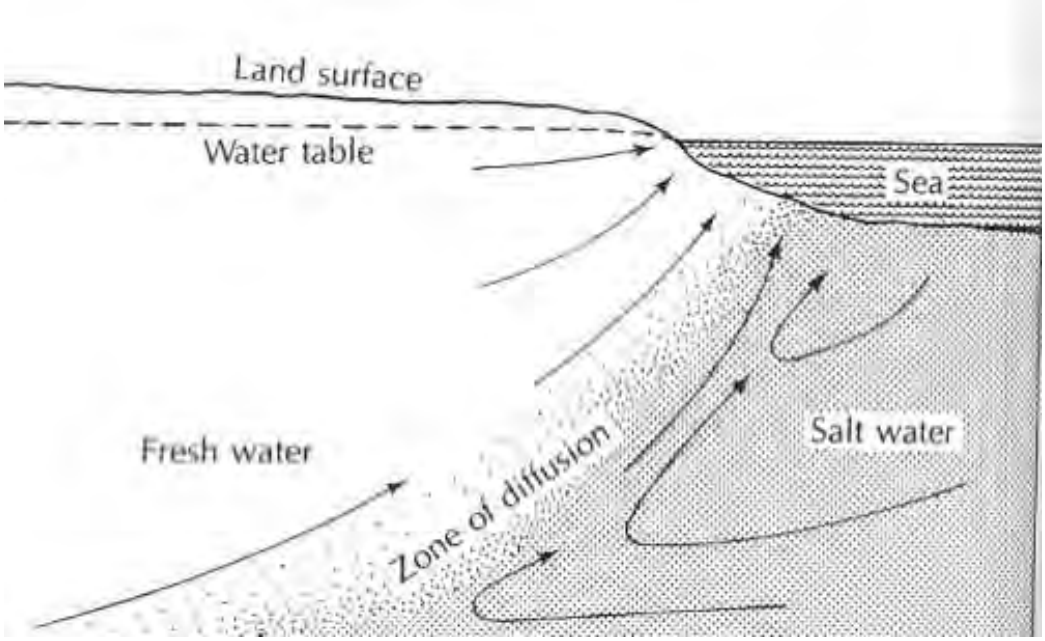
USACE. 2003. EM 1110-2-2907, Remote Sensing. 1 October 2003.

USACE. 2007. EM 1110-1-1005, Control and Topographic Survey. 1 January 2007

USACE. 2014. 385-1. EM 385-1-1, Safety and Health Requirements.

USACE. 2018. EC 1110-1-106. Acquisition and Operation of Unmanned Aircraft Systems (UAS) Technology. 31 August 2018.

FIGURES



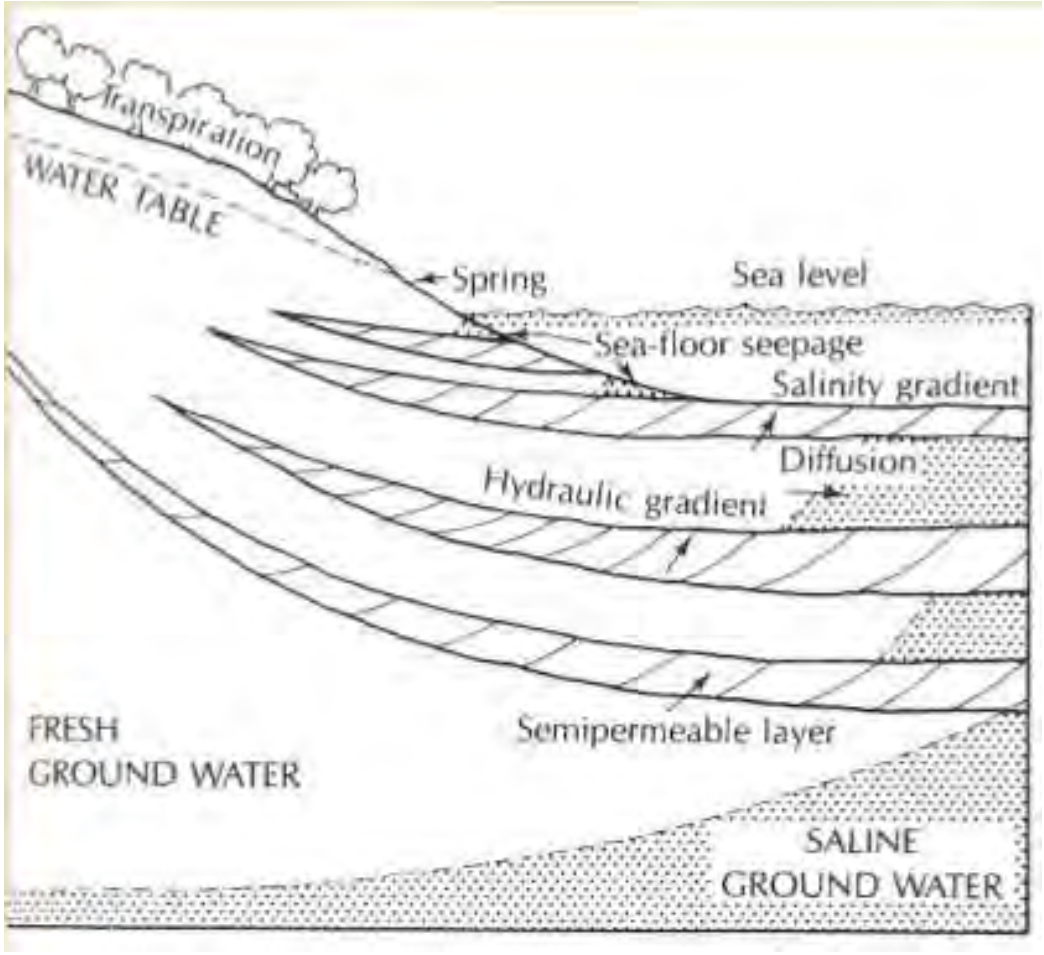
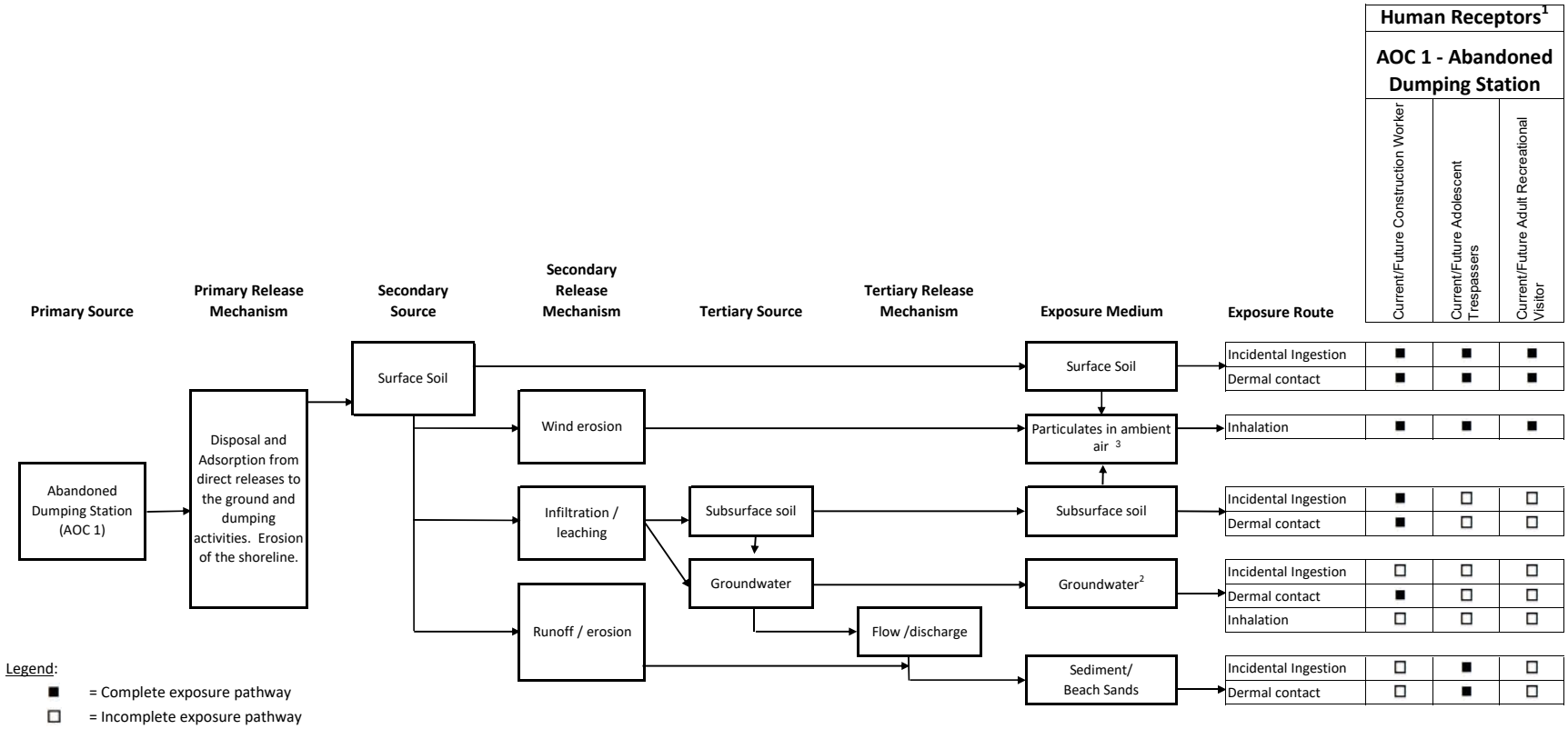


FIGURE 10-1 TYPICAL FRESH WATER – SALT WATER INTERFACES (FETTER, 2001)

Figure 10-2. Former NAS Cape May
Preliminary Conceptual Site Model - Human Receptors



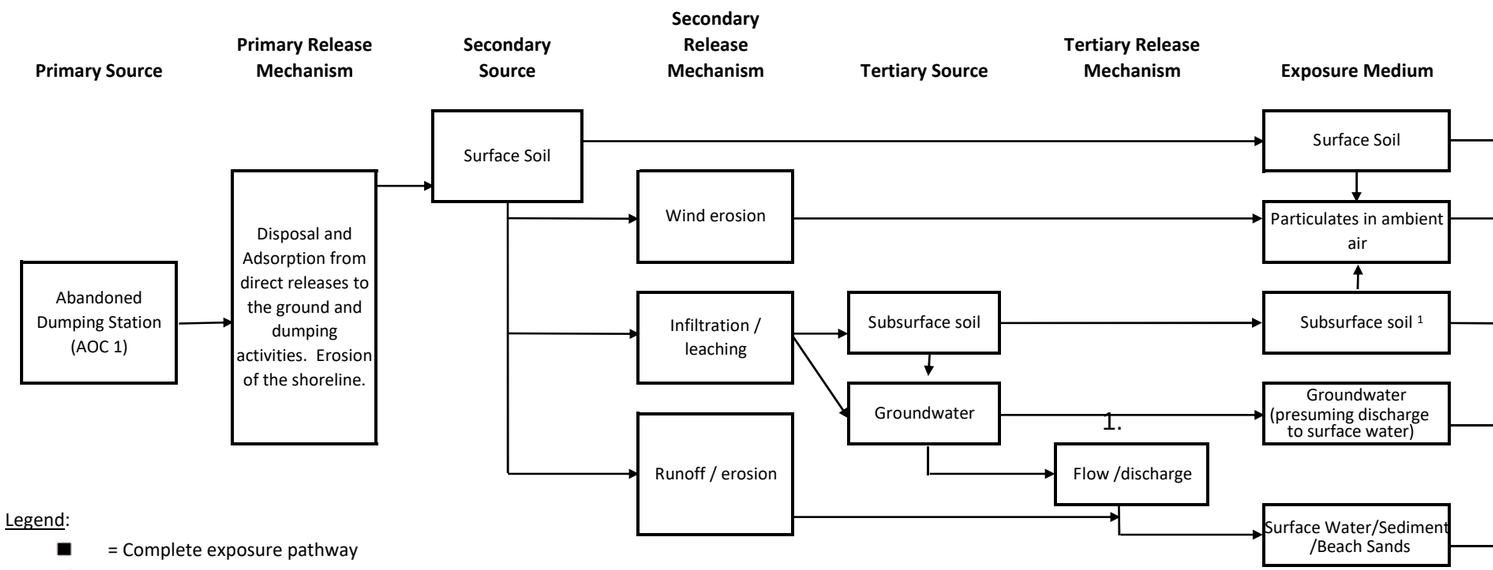
Notes:

1 No buildings are located on site and construction of buildings on site is not feasible because of the location along the shoreline within the intertidal zone and within the area commonly inundated during storms. Therefore, there is no potential for either current or future residential or industrial land-use. The Site is remote and has no public access. Therefore, potential receptors are limited to recreational visitors, adolescent trespassers, and construction workers who may make reparis to the existing roadway or may install erosion control measures.

2 Groundwater is not currently used as a drinking water source and is not expected to be used as drinking water in the future due to tidal intrusion and resulting salinity; therefore, groundwater is considered an incomplete exposure pathway for potable use of water. No buildings are located on site and construction of buildings on site is not feasible beause of the location along the shoreline within the intertidal zone and within the area commonly inundated during storms. Therefore, there is no potential for either current or future vapor intrusion. Groundwater is shallow; therefore, potential contact with shallow groundwater during excavation projects would be possible.

3 Inhalation of volatiles in trench may occur for construction worker if volatiles are detected in groundwater.

Figure 10-3. Former NAS Cape May
Preliminary Conceptual Site Model - Ecological Receptors



AOC 1 - Abandoned Dumping Station					
Terrestrial Receptors				Inter-tidal Zone Receptors	
Plants	Invertebrates	Small Mammals (herbivorous, invertivorous, carnivorous)	Birds (herbivorous, invertivorous, carnivorous)	Benthic invertebrates/ Aquatic organisms	Wading Birds
Surface Soil					
Incidental Ingestion/ food chain	☐	☒	■	☒	☐	☐
Dermal/direct contact	■	☒	☒	☒	☐	☐
Particulates in ambient air					
Inhalation	☐	☐	☒	☒	☐	☐
Subsurface soil 1					
Incidental Ingestion	☐	☒	☐	☐	☐	☐
Dermal/direct contact	☒	☒	☐	☐	☐	☐
Groundwater (presuming discharge to surface water)					
Incidental Ingestion	☐	☐	☐	☐	☐	■
Dermal/direct contact	☐	☐	☐	☐	■	☐
Inhalation	☐	☐	☐	☐	☐	☐
Surface Water/Sediment /Beach Sands					
Incidental Ingestion/ food chain	☐	☐	☐	☐	☒	■
Dermal/direct contact	☐	☐	☐	☐	■	☒

Legend:

■ = Complete exposure pathway

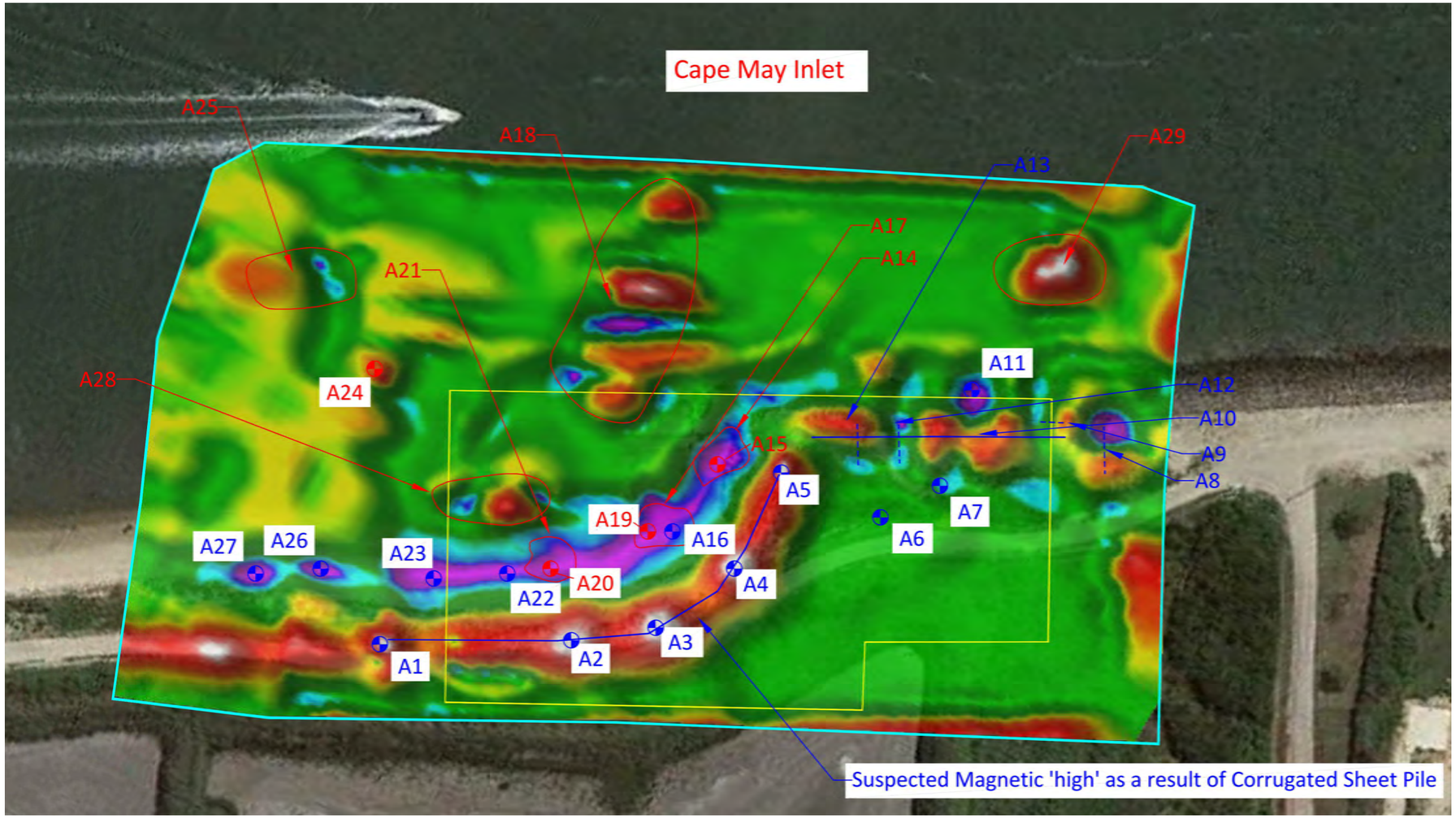
☐ = Incomplete exposure pathway

☒ = Complete but insignificant exposure pathway

1. Burrowing mammals not expected at shoreline site. While evidence of red fox digging was observed at the Site during the Site habitat evaluation, this wide-ranging receptor is anticipated to have limited exposure to subsurface soil at this small (<0.5 acre) site.

REFERENCE:

MASER CONSULTING P.A. GEOPHYSICAL EVALUATION FOR FORMER NAS CAPE MAP SITE. FIGURE 4. AEROMAG ANOMALY MAP. DATED 12/20/2019



Legend:

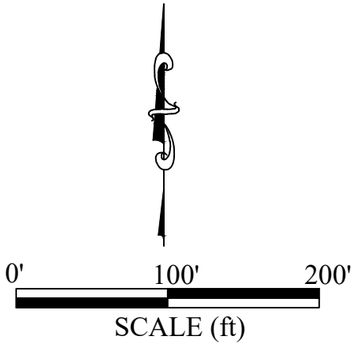
- Subject Area
- Geophysical Survey Area
- Magnetic Dipole Anomaly
- Lineament / Area of Anomalies

Magnetic Pole Anomaly

Anomaly Priority Color Code

A1: High Priority A1: Low Priority

Residual Magnetic Intensity (nT)



FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAP, CAPE MAY COUNTY, NEW JERSEY

AEROMAG ANOMALY MAP

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 10-4

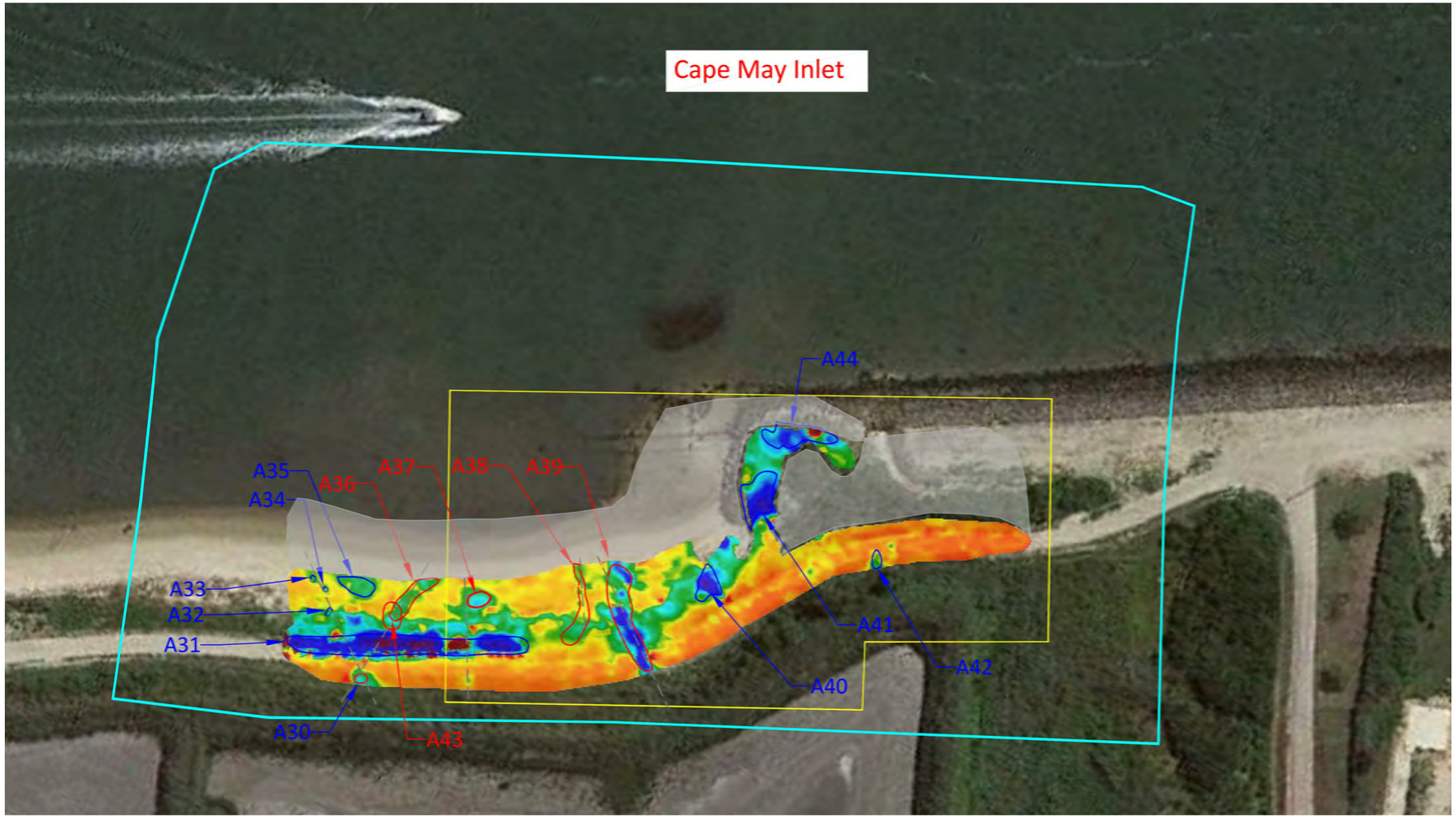
CREATED BY : PM
DATE: 02/16/2022

REVISED BY : PM
DATE:2/16/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0222_NAS_CapeMay.dwg; F10-4_Anomaly February 16, 2022

REFERENCE:

MASER CONSULTING P.A. GEOPHYSICAL EVALUATION FOR FORMER NAS CAPE MAP SITE. FIGURE 10. TERRESTRIAL GEOPHYSICAL ANOMALY MAP. DATED 12/20/2019



Legend:

- Subject Area
- Geophysical Survey Area
- Suspected Linear Feature(s)
- Lineament / Area of Anomalies
- Obstructed Survey Area

Anomaly Priority Color Code

A1: High Priority **A1: Low Priority**

-200 -185 -170 -155 -140 -125 -110 -95 -80 -65 -50 -35 -20 -5 10 25 40 55 70 85 100

Anomaly Response in Millivolts

0' 100' 200'

SCALE (ft)

FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAP, CAPE MAY COUNTY, NEW JERSEY

TERRESTRIAL GEOPHYSICAL ANOMALY MAP

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 10-5

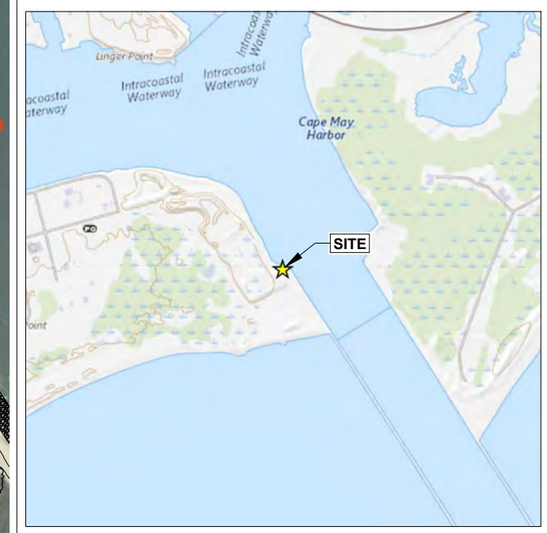
CREATED BY : PM
DATE: 02/16/2022

REVISED BY : PM
DATE:2/16/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0222_NAS_CapeMay.dwg; F10-5_Anomaly February 16, 2022

REFERENCE:

DIGITAL OVERLAY PROVIDED BY U.S. COAST GUARD. TRAINING CENTER UTILITY DRAWINGS. TRANSMITTED 12/17/2019.



FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAY, CAPE MAY COUNTY, NEW JERSEY

SITE LOCATION MAP

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 18-1

CREATED BY : PM
DATE: 03/25/2021

REVISED BY : PM
DATE:7/12/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0722_NAS_CapeMay.dwg; F18-1_SLM July 12, 2022

LEGEND:

- Geophysical Survey Area
- Magnetic Pole Anomaly
- Magnetic Dipole Anomaly
- Lineament / Area of Anomalies
- Approximate Former Shoreline
- Test Pit Location
- Mean High Water Line
- Mean Low Water Line
- Approx. High Tide Line/ Spring High Water Line

Note:
Tide Line Elevations:
Coordinate System : NAD 1983 State Plane New Jersey, FIPS 2900 Feet. Projection: Transverse Mercator.
Plotted from CDM Smith, June 2016.

0' 120' 240'
SCALE (ft)

FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAY, CAPE MAY COUNTY, NEW JERSEY

TEST PIT LOCATIONS

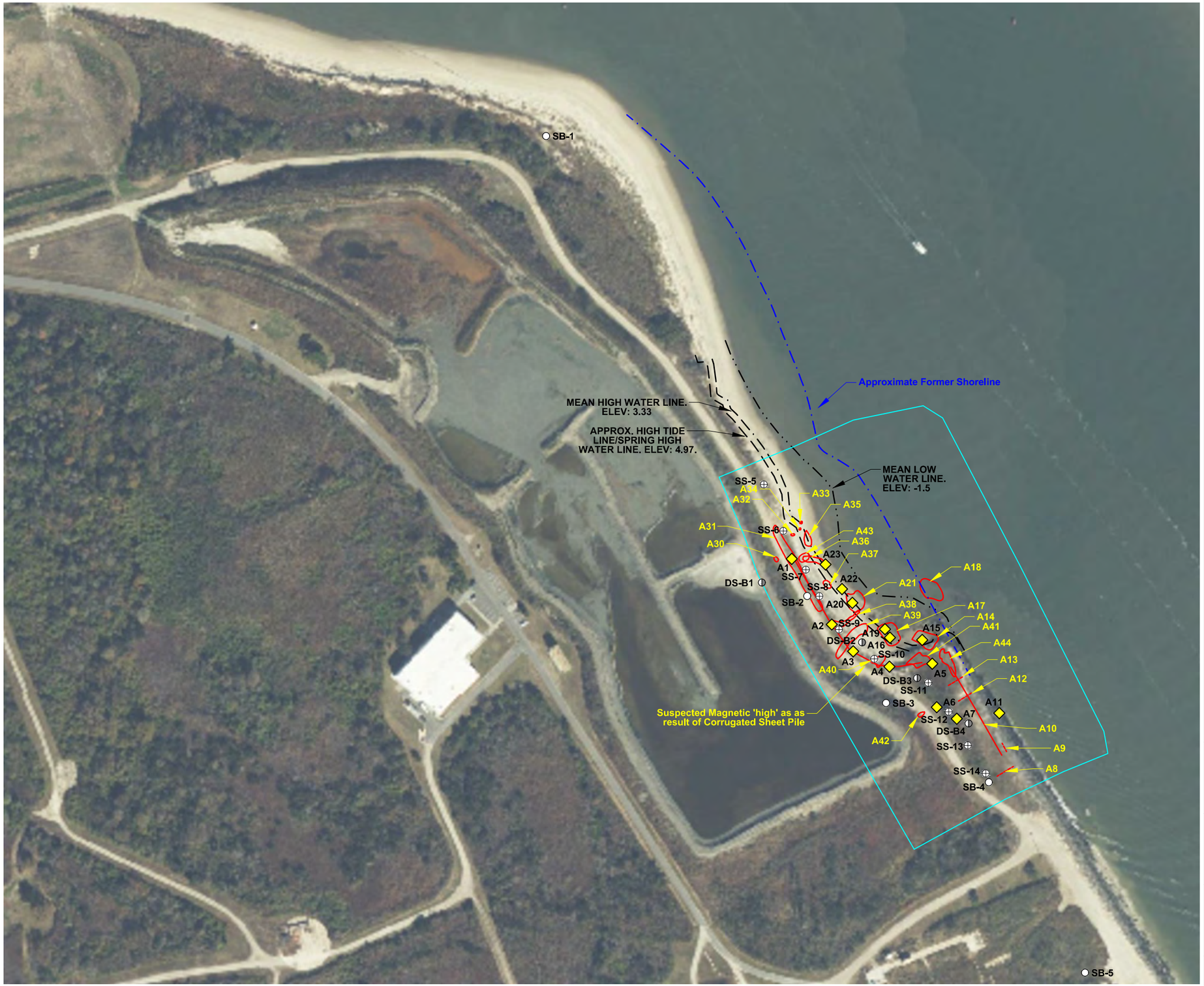
SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 18-2

CREATED BY : PM
DATE: 03/25/2021

REVISED BY : PM
DATE:7/12/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0722_NAS_CapeMay.dwg; F18-2_TestPits July 12, 2022



LEGEND:

- Geophysical Survey Area
- Magnetic Pole Anomaly
- Magnetic Dipole Anomaly
- Lineament / Area of Anomalies
- Approximate Former Shoreline
- 1997 Soil Boring
- Soil Boring
- Surface Soil Sample
- Mean High Water Line
- Mean Low Water Line
- Approx. High Tide Line/ Spring High Water Line

Note:
Tide Line Elevations:
Coordinate System : NAD 1983 State Plane New Jersey, FIPS 2900 Feet. Projection: Transverse Mercator.
Plotted from CDM Smith, June 2016.

0' 120' 240'
SCALE (ft)

FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAY, CAPE MAY COUNTY, NEW JERSEY

SURFACE SOIL AND SOIL BORING LOCATIONS

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 18-3

CREATED BY : PM
DATE: 03/25/2021

REVISED BY : PM
DATE:7/12/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0722_NAS_CapeMay.dwg; F18-3_Surface_Soil July 12, 2022

LEGEND:

- Geophysical Survey Area
- Magnetic Pole Anomaly
- Magnetic Dipole Anomaly
- Lineament / Area of Anomalies
- Approximate Former Shoreline
- Sediment Sample
- Mean High Water Line
- Mean Low Water Line
- Approx. High Tide Line/ Spring High Water Line

Note:
Tide Line Elevations:
Coordinate System : NAD 1983 State Plane New Jersey, FIPS 2900 Feet. Projection: Transverse Mercator.
Plotted from CDM Smith, June 2016.

0' 120' 240'
SCALE (ft)

FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAY, CAPE MAY COUNTY, NEW JERSEY

SEDIMENT SAMPLE LOCATIONS

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 18-4

CREATED BY : PM
DATE: 03/25/2021

REVISED BY : PM
DATE:7/12/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0722_NAS_CapeMay.dwg; F18-4_Sediment July 12, 2022

LEGEND:

- Geophysical Survey Area
- Magnetic Pole Anomaly
- Magnetic Dipole Anomaly
- Lineament / Area of Anomalies
- Approximate Former Shoreline
- Monitoring Well

Note: Monitoring Well Locations to be co-located with soil boring locations

- Mean High Water Line
- Mean Low Water Line
- Approx. High Tide Line/ Spring High Water Line

Note:
Tide Line Elevations:
Coordinate System : NAD 1983 State Plane New Jersey, FIPS 2900 Feet. Projection: Transverse Mercator.
Plotted from CDM Smith, June 2016.

0' 200' 400'
SCALE (ft)

FORMER NAVAL AIR STATION
BLOCK 1218, LOT 2
CAPE MAY, CAPE MAY COUNTY, NEW JERSEY

MONITORING WELL LOCATIONS

SOVEREIGN CONSULTING INC.
4 Open Square Way, Suite 307
Holyoke, NJ 01040
Ph:(413) 540-0650 Fax:(413) 540-0656
www.sovcon.com

Figure: 18-5

CREATED BY : PM
DATE: 03/25/2021

REVISED BY : PM
DATE:7/12/2022

X:\SOVEREGN\CapeMay_NJ\FormalNavalAirBase\Drawings\0722_NAS_CapeMay.dwg; F18-5_MWLocations July 12, 2022

APPENDICES

APPENDIX A

SUMMARY OF ECOLOGICAL AND HUMAN HEALTH SCREENING LEVEL HIERARCHY

Worksheet 15, Cape May QAPP/SAP – Screening Level Hierarchy

Hierarchy of Ecological Screening Levels - if a value is available from a higher priority source, any values in lower priority sources is not considered, even if its value is lower. Surrogate screening levels may be used for certain chemicals as necessary, with the rationale discussed in the text and shown in screening table footnotes.

Soil:

1. USEPA Ecological Soil Screening Levels (EcoSSLs) (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.

2. USEPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.

3. LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.

Sediment:

1. USEPA Region 3 Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values

2. USEPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Table 2a, minimum Ecological Screening Value for freshwater and marine/estuarine

3. LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms

Surface Water:

1. USEPA NRWQC: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table, Minimum of freshwater and marine chronic criteria, assume hardness of 50 mg/L

2. USEPA Region 3. Freshwater and Marine Surface Water Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values

3. USEPA Region 4 ESV: https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf, Table 1, minimum of freshwater and saltwater chronic screening level

Hierarchy of Human Health Screening Levels - if a value is available from a higher priority source, any values in lower priority sources is not considered, even if its value is lower.

Soil and Sediment

1. USEPA (November 2019 or most recent) Resident Soil Regional Screening Level (RSL), based on target hazard quotient=0.1; target cancer risk=1×10^{-6}
2. USEPA Region 2 residential lead screening level of 200 mg/kg (also discuss USEPA residential lead screening value)

Groundwater and Surface Water

1. USEPA (November 2019 or most recent) tap water RSL, based on target hazard quotient=0.1; target cancer risk=1×10^{-6}

APPENDIX B

ANALYTICAL LABORATORY CERTIFICATIONS

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

ALS - Middletown

301 Fulling Mill Road, Middletown, PA 17057

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2017) General Requirements for the competence of Testing and Calibration Laboratories and the United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) requirements identified within the DoD/DOE Quality Systems Manual (DoD/DOE QSM) Version 5.3 May 2019 and is accredited is accordance with the

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
August 22, 2017	December 17, 2021	February 29, 2024

Accreditation No.:	*Certificate No.:*
74618	L21-781

Tracy Szerszen
President

Perry Johnson Laboratory
Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 218.6	IC	Hexavalent Chromium
Aqueous	EPA 410.4	Colorimetric	Chemical Oxygen Demand (COD)
Aqueous	EPA 5540C	Spectrophotometric	MBAS (Surfactants)
Aqueous	EPA 245.1	CVAA	Mercury
Aqueous	EPA 1631E	CVAFS	Mercury
Aqueous	Kelada-01	Spectrophotometric	Amenable Cyanide
Aqueous	Kelada-01	Spectrophotometric	Total Cyanide
Aqueous	SM2130B	Turbidimetric	Turbidity
Aqueous	EPA 7470A	CVAA	Mercury
Aqueous	EPA 8011	GC-ECD	1,2-Dibromo-3-Chloropropane (DBCP)
Aqueous	EPA 8011	GC-ECD	1,2-Dibromoethane (EDB)
Aqueous	EPA 8011	GC-ECD	1,2,3-Trichloropropane
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Ethanol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Ethyl Acetate
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Ethylene Glycol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Isoamyl Alcohol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Isobutyl Alcohol (2 methyl-1-propanol)
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Isopropyl Alcohol (2-propanol) (Isopropanol)
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Methanol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Methyl Ethyl Ketone (2-butanone)
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Methyl Isobutyl Ketone (MIBK)
Aqueous	EPA 8015C, EPA 8015D	GC/FID	n-Butanol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	n-Propanol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	Propylene Glycol
Aqueous	EPA 8015C, EPA 8015D	GC/FID	tert-Butyl Alcohol
Aqueous	EPA 8260C, EPA 8260D	GC/MS	2-Chloroethylvinylether
Aqueous	EPA 9040C	Electrode	pH, Corrosivity, Hydrogen Ion
Aqueous	EPA 9050A	Probe	Specific Conductance
Aqueous	EPA 9060A, SM5310B-2000	Combustion	Total Organic Carbon
Aqueous	RSK 175	GC-FID	Methane, Ethane, and Ethene
Aqueous	SM 2320B	Titrimetric	Alkalinity
Aqueous	SM 2540C	Gravimetric	Total Dissolved Solids
Aqueous	SM 2540D	Gravimetric	Total Suspended Solids
Aqueous	SM 3500 Fe B	Colorimetric	Ferrous Iron
Aqueous	SM 4500-S2 F	Titrimetric	Sulfide
Aqueous	SM 5210B	Probe	Biochemical Oxygen Demand (BOD)

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	SM 5210B	Probe	Carbonaceous BOD (CBOD)
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Aluminum
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Antimony
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Arsenic
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Barium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Beryllium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Cadmium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Calcium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Chromium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Cobalt
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Copper
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Iron
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Lead
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Magnesium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Manganese
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Molybdenum
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Nickel
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Potassium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Selenium
Aqueous	EPA 200.7	ICP/ ICP-MS	Silica as SiO2
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Silver
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Sodium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Strontium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Thallium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Tin
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Titanium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Vanadium
Aqueous	EPA 200.7, EPA 200.8	ICP/ ICP-MS	Zinc
Aqueous	EPA 522	GC/MS	1,4-Dioxane
Aqueous	EPA 608.3	GC/ECD	Aldrin
Aqueous	EPA 608.3	GC/ECD	Alpha-BHC
Aqueous	EPA 608.3	GC/ECD	Beta-BHC
Aqueous	EPA 608.3	GC/ECD	Delta-BHC
Aqueous	EPA 608.3	GC/ECD	Gamma-BHC (Lindane)
Aqueous	EPA 608.3	GC/ECD	Chlordane
Aqueous	EPA 608.3	GC/ECD	Alpha-Chlordane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 608.3	GC/ECD	Gamma-Chlordane
Aqueous	EPA 608.3	GC/ECD	4-4'-DDD
Aqueous	EPA 608.3	GC/ECD	4-4'-DDE
Aqueous	EPA 608.3	GC/ECD	4-4'-DDT
Aqueous	EPA 608.3	GC/ECD	Dieldrin
Aqueous	EPA 608.3	GC/ECD	Endosulfan I
Aqueous	EPA 608.3	GC/ECD	Endosulfan II
Aqueous	EPA 608.3	GC/ECD	Endosulfan Sulfate
Aqueous	EPA 608.3	GC/ECD	Endrin
Aqueous	EPA 608.3	GC/ECD	Endrin Aldehyde
Aqueous	EPA 608.3	GC/ECD	Endrin Ketone
Aqueous	EPA 608.3	GC/ECD	Heptachlor
Aqueous	EPA 608.3	GC/ECD	Heptachlor Epoxide
Aqueous	EPA 608.3	GC/ECD	Methoxychlor
Aqueous	EPA 608.3	GC/ECD	Mirex
Aqueous	EPA 608.3	GC/ECD	Toxaphene
Aqueous	EPA 608.3	GC/ECD	PCB-1016
Aqueous	EPA 608.3	GC/ECD	PCB-1221
Aqueous	EPA 608.3	GC/ECD	PCB-1232
Aqueous	EPA 608.3	GC/ECD	PCB-1242
Aqueous	EPA 608.3	GC/ECD	PCB-1248
Aqueous	EPA 608.3	GC/ECD	PCB-1254
Aqueous	EPA 608.3	GC/ECD	PCB-1260
Aqueous	EPA 608.3	GC/ECD	PCB-1262
Aqueous	EPA 608.3	GC/ECD	PCB-1268
Aqueous	EPA 624.1	GC/MS	Benzene
Aqueous	EPA 624.1	GC/MS	Bromobenzene
Aqueous	EPA 624.1	GC/MS	Bromochloromethane
Aqueous	EPA 624.1	GC/MS	Bromodichloromethane
Aqueous	EPA 624.1	GC/MS	Bromoform
Aqueous	EPA 624.1	GC/MS	n-Butylbenzene
Aqueous	EPA 624.1	GC/MS	Sec-Butylbenzene
Aqueous	EPA 624.1	GC/MS	Tert-Butylbenzene
Aqueous	EPA 624.1	GC/MS	Carbon tetrachloride
Aqueous	EPA 624.1	GC/MS	Chlorobenzene
Aqueous	EPA 624.1	GC/MS	Chloroform

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 624.1	GC/MS	2-Chlorotoluene (o)
Aqueous	EPA 624.1	GC/MS	4-Chlorotoluene (p)
Aqueous	EPA 624.1	GC/MS	Dibromochloromethane
Aqueous	EPA 624.1	GC/MS	1,2-Dibromo-3-chloropropane
Aqueous	EPA 624.1	GC/MS	1,2-Dibromoethane (EDB)
Aqueous	EPA 624.1	GC/MS	Dibromomethane
Aqueous	EPA 624.1	GC/MS	1,2-Dichlorobenzene
Aqueous	EPA 624.1	GC/MS	1,3-Dichlorobenzene
Aqueous	EPA 624.1	GC/MS	1,4-Dichlorobenzene
Aqueous	EPA 624.1	GC/MS	1,1-Dichloroethene
Aqueous	EPA 624.1	GC/MS	Cis-1,2-Dichloroethene
Aqueous	EPA 624.1	GC/MS	Trans-1,2-Dichloroethene
Aqueous	EPA 624.1	GC/MS	1,2-Dichloropropane
Aqueous	EPA 624.1	GC/MS	1,3-Dichloropropane
Aqueous	EPA 624.1	GC/MS	2,2-Dichloropropane
Aqueous	EPA 624.1	GC/MS	1,1-Dichloropropene
Aqueous	EPA 624.1	GC/MS	Cis-1,3-Dichloropropene
Aqueous	EPA 624.1	GC/MS	Trans-1,3-Dichloropropene
Aqueous	EPA 624.1	GC/MS	Ethylbenzene
Aqueous	EPA 624.1	GC/MS	Hexachlorobutadiene
Aqueous	EPA 624.1	GC/MS	Isopropylbenzene (Cumene)
Aqueous	EPA 624.1	GC/MS	p-Isopropyltoluene
Aqueous	EPA 624.1	GC/MS	Methylene Chloride
Aqueous	EPA 624.1	GC/MS	Naphthalene
Aqueous	EPA 624.1	GC/MS	n-Propylbenzene
Aqueous	EPA 624.1	GC/MS	Styrene
Aqueous	EPA 624.1	GC/MS	1,1,1,2-Tetrachloroethane
Aqueous	EPA 624.1	GC/MS	1,1,2,2-Tetrachloroethane
Aqueous	EPA 624.1	GC/MS	Tetrachloroethene
Aqueous	EPA 624.1	GC/MS	Toluene
Aqueous	EPA 624.1	GC/MS	1,2,3-Trichlorobenzene
Aqueous	EPA 624.1	GC/MS	1,2,4-Trimethylbenzene
Aqueous	EPA 624.1	GC/MS	1,3,5-Trimethylbenzene
Aqueous	EPA 624.1	GC/MS	m-xylene
Aqueous	EPA 624.1	GC/MS	p-xylene
Aqueous	EPA 624.1	GC/MS	o-xylene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 624.1	GC/MS	1,1-Dichloroethane
Aqueous	EPA 624.1	GC/MS	1,1,1-Trichloroethane
Aqueous	EPA 624.1	GC/MS	1,2-Dichloroethane
Aqueous	EPA 624.1	GC/MS	1,2,3-Trichloropropane
Aqueous	EPA 624.1	GC/MS	1,2,4-Trichlorobenzene
Aqueous	EPA 624.1	GC/MS	1,1,2-Trichloroethane
Aqueous	EPA 624.1	GC/MS	Trichloroethene
Aqueous	EPA 624.1	GC/MS	Vinyl Acetate
Aqueous	EPA 624.1	GC/MS	Methyl acetate
Aqueous	EPA 624.1	GC/MS	Ethyl acetate
Aqueous	EPA 624.1	GC/MS	Acetone
Aqueous	EPA 624.1	GC/MS	2-Butanone
Aqueous	EPA 624.1	GC/MS	4-Methyl-2-pentanone
Aqueous	EPA 624.1	GC/MS	2-Hexanone
Aqueous	EPA 624.1	GC/MS	1,1-Dichloro-2-propanone
Aqueous	EPA 624.1	GC/MS	Pentane
Aqueous	EPA 624.1	GC/MS	3-Chloroprene (allyl chloride)
Aqueous	EPA 624.1	GC/MS	Di-isobutylene
Aqueous	EPA 624.1	GC/MS	1-Chlorohexane
Aqueous	EPA 624.1	GC/MS	Methyl-tert-butyl ether
Aqueous	EPA 624.1	GC/MS	Ethyl ether
Aqueous	EPA 624.1	GC/MS	Freon 113 (1,1,2-TCTFE)
Aqueous	EPA 624.1	GC/MS	Hexane
Aqueous	EPA 624.1	GC/MS	Heptane
Aqueous	EPA 624.1	GC/MS	Cyclohexane
Aqueous	EPA 624.1	GC/MS	Benzyl chloride
Aqueous	EPA 624.1	GC/MS	Iodomethane
Aqueous	EPA 624.1	GC/MS	Carbon Disulfide
Aqueous	EPA 624.1	GC/MS	Chloroprene
Aqueous	EPA 624.1	GC/MS	Octane
Aqueous	EPA 624.1	GC/MS	Acrylonitrile
Aqueous	EPA 624.1	GC/MS	2-Nitropropane
Aqueous	EPA 624.1	GC/MS	Tetrahydrofuran
Aqueous	EPA 624.1	GC/MS	Tert-Butyl alcohol
Aqueous	EPA 624.1	GC/MS	Trans-1,4-Dichloro-2-butene
Aqueous	EPA 624.1	GC/MS	Methyl methacrylate

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 624.1	GC/MS	Isobutyl alcohol
Aqueous	EPA 624.1	GC/MS	Hexachloroethane
Aqueous	EPA 624.1	GC/MS	Ethyl methacrylate
Aqueous	EPA 624.1	GC/MS	2-Propanol
Aqueous	EPA 624.1	GC/MS	1-Propanol
Aqueous	EPA 624.1	GC/MS	Propionitrile
Aqueous	EPA 624.1	GC/MS	Methacrylonitrile
Aqueous	EPA 624.1	GC/MS	Pentachloroethane
Aqueous	EPA 624.1	GC/MS	Nitrobenzene
Aqueous	EPA 624.1	GC/MS	Methyl acrylate
Aqueous	EPA 624.1	GC/MS	Chloroacetonitrile
Aqueous	EPA 624.1	GC/MS	1-Chlorobutane
Aqueous	EPA 624.1	GC/MS	tert-amyl methyl ether
Aqueous	EPA 624.1	GC/MS	Ethyl tert-butyl ether
Aqueous	EPA 624.1	GC/MS	Di-isopropyl ether
Aqueous	EPA 624.1	GC/MS	Methyl cyclohexane
Aqueous	EPA 624.1	GC/MS	Acetonitrile
Aqueous	EPA 624.1	GC/MS	Acrolein
Aqueous	EPA 624.1	GC/MS	2-Chloroethyl vinyl ether
Aqueous	EPA 624.1	GC/MS	Bromomethane
Aqueous	EPA 624.1	GC/MS	Chloroethane
Aqueous	EPA 624.1	GC/MS	Chloromethane
Aqueous	EPA 624.1	GC/MS	Dichlorodifluoromethane
Aqueous	EPA 624.1	GC/MS	Trichlorofluoromethane
Aqueous	EPA 624.1	GC/MS	Vinyl Chloride
Aqueous	EPA 624.1	GC/MS	N-propyl bromide
Aqueous	EPA 624.1	GC/MS	Dichlorofluoromethane
Aqueous	EPA 625.1	GC/MS	1,1'-Biphenyl
Aqueous	EPA 625.1	GC/MS	1,2,4,5-Tetrachlorobenzene
Aqueous	EPA 625.1	GC/MS	1,2,4-Trichlorobenzene
Aqueous	EPA 625.1	GC/MS	1,2-Dichlorobenzene
Aqueous	EPA 625.1	GC/MS	1,2-Dinitrobenzene
Aqueous	EPA 625.1	GC/MS	1,2-Diphenylhydrazine
Aqueous	EPA 625.1	GC/MS	1,3-Dichlorobenzene
Aqueous	EPA 625.1	GC/MS	1,3-Dinitrobenzene
Aqueous	EPA 625.1	GC/MS	1,4-Dichlorobenzene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 625.1	GC/MS	1,4-Dinitrobenzene
Aqueous	EPA 625.1	GC/MS	1,4-Dioxane
Aqueous	EPA 625.1	GC/MS	1-Methylnaphthalene
Aqueous	EPA 625.1	GC/MS	2,3,4,6-Tetrachlorophenol
Aqueous	EPA 625.1	GC/MS	2,3,5,6-Tetrachlorophenol
Aqueous	EPA 625.1	GC/MS	2,3-Dichloroaniline
Aqueous	EPA 625.1	GC/MS	2,4,5-Trichlorphenol
Aqueous	EPA 625.1	GC/MS	2,4,6-Trichlorophenol
Aqueous	EPA 625.1	GC/MS	2,4-Dichlorophenol
Aqueous	EPA 625.1	GC/MS	2,4-Dimethylphenol
Aqueous	EPA 625.1	GC/MS	2,4-Dinitrophenol
Aqueous	EPA 625.1	GC/MS	2,4-Dinitrotoluene
Aqueous	EPA 625.1	GC/MS	2,6-Dichlorophenol
Aqueous	EPA 625.1	GC/MS	2,6-Dinitrotoluene
Aqueous	EPA 625.1	GC/MS	2-Chloronaphthalene
Aqueous	EPA 625.1	GC/MS	2-Chlorophenol
Aqueous	EPA 625.1	GC/MS	2-Methylnaphthalene
Aqueous	EPA 625.1	GC/MS	2-Methylphenol
Aqueous	EPA 625.1	GC/MS	2-Naphthylamine
Aqueous	EPA 625.1	GC/MS	2-Nitroaniline
Aqueous	EPA 625.1	GC/MS	2-Nitrophenol
Aqueous	EPA 625.1	GC/MS	3 & 4-Methylphenols
Aqueous	EPA 625.1	GC/MS	3,3'-Dichlorobenzidine
Aqueous	EPA 625.1	GC/MS	3-Nitroaniline
Aqueous	EPA 625.1	GC/MS	4,6-Dinitro-2-methylphenol
Aqueous	EPA 625.1	GC/MS	4-Bromophenyl-Phenylether
Aqueous	EPA 625.1	GC/MS	4-Chloro-3-Methylphenol
Aqueous	EPA 625.1	GC/MS	4-Chloroaniline
Aqueous	EPA 625.1	GC/MS	4-Chlorophenyl-phenylether
Aqueous	EPA 625.1	GC/MS	4-Nitroaniline
Aqueous	EPA 625.1	GC/MS	4-Nitrophenol
Aqueous	EPA 625.1	GC/MS	Acenaphthene
Aqueous	EPA 625.1	GC/MS	Acenaphthylene
Aqueous	EPA 625.1	GC/MS	Acetophenone
Aqueous	EPA 625.1	GC/MS	alpha-Terpineol
Aqueous	EPA 625.1	GC/MS	Aniline

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 625.1	GC/MS	Anthracene
Aqueous	EPA 625.1	GC/MS	Atrazine
Aqueous	EPA 625.1	GC/MS	Azobenzene
Aqueous	EPA 625.1	GC/MS	Benzaldehyde
Aqueous	EPA 625.1	GC/MS	Benzidine
Aqueous	EPA 625.1	GC/MS	Benzo(a)Anthracene
Aqueous	EPA 625.1	GC/MS	Benzo(a)Pyrene
Aqueous	EPA 625.1	GC/MS	Benzo(b)Fluoranthene
Aqueous	EPA 625.1	GC/MS	Benzo(g,h,i)Perylene
Aqueous	EPA 625.1	GC/MS	Benzo(k)Fluoranthene
Aqueous	EPA 625.1	GC/MS	Benzyl Alcohol
Aqueous	EPA 625.1	GC/MS	bis (2-ethylhexyl)adipate
Aqueous	EPA 625.1	GC/MS	Bis(2-Chloroethoxy)Methane
Aqueous	EPA 625.1	GC/MS	Bis(2-Chloroethyl)Ether
Aqueous	EPA 625.1	GC/MS	bis(2-Chloroisopropyl)ether
Aqueous	EPA 625.1	GC/MS	bis(2-ethylhexyl)Phthalate
Aqueous	EPA 625.1	GC/MS	Butylbenzylphthalate
Aqueous	EPA 625.1	GC/MS	Caprolactam
Aqueous	EPA 625.1	GC/MS	Carbazole
Aqueous	EPA 625.1	GC/MS	Chrysene
Aqueous	EPA 625.1	GC/MS	Dibenzo(a,h)anthracene
Aqueous	EPA 625.1	GC/MS	Dibenzofuran
Aqueous	EPA 625.1	GC/MS	Diethylphthalate
Aqueous	EPA 625.1	GC/MS	Dimethoate
Aqueous	EPA 625.1	GC/MS	Dimethylphthalate
Aqueous	EPA 625.1	GC/MS	Di-n-Butylphthalate
Aqueous	EPA 625.1	GC/MS	Di-n-Octylphthalate
Aqueous	EPA 625.1	GC/MS	Diphenylamine
Aqueous	EPA 625.1	GC/MS	Fluoranthene
Aqueous	EPA 625.1	GC/MS	Fluorene
Aqueous	EPA 625.1	GC/MS	Hexachlorobenzene
Aqueous	EPA 625.1	GC/MS	Hexachlorobutadiene
Aqueous	EPA 625.1	GC/MS	Hexachlorocyclopentadiene
Aqueous	EPA 625.1	GC/MS	Hexachloroethane
Aqueous	EPA 625.1	GC/MS	Indeno(1,2,3-cd)Pyrene
Aqueous	EPA 625.1	GC/MS	Isophorone

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 625.1	GC/MS	Naphthalene
Aqueous	EPA 625.1	GC/MS	n-Decane
Aqueous	EPA 625.1	GC/MS	n-Heptadecane
Aqueous	EPA 625.1	GC/MS	Nitrobenzene
Aqueous	EPA 625.1	GC/MS	N-Nitrosodiethylamine
Aqueous	EPA 625.1	GC/MS	N-Nitrosodimethylamine
Aqueous	EPA 625.1	GC/MS	N-Nitroso-di-n-butylamine
Aqueous	EPA 625.1	GC/MS	N-Nitrosodinpropylamine
Aqueous	EPA 625.1	GC/MS	N-Nitrosodiphenylamine
Aqueous	EPA 625.1	GC/MS	N-Nitrosopyrrolidine
Aqueous	EPA 625.1	GC/MS	n-Octadecane
Aqueous	EPA 625.1	GC/MS	Pentachlorobenzene
Aqueous	EPA 625.1	GC/MS	Pentachlorophenol
Aqueous	EPA 625.1	GC/MS	Phenanthrene
Aqueous	EPA 625.1	GC/MS	Phenol
Aqueous	EPA 625.1	GC/MS	Pyrene
Aqueous	EPA 625.1	GC/MS	Pyridine
Aqueous	SM4500P E	Spectrophotometric	Orthophosphate
Solid	EPA 7471B	CVAA/CVAF	Mercury
Solid	EPA 8270D, EPA 8270E	GC/MS	Resorcinol
Solid	EPA 9045D	Electrode	pH, Corrosivity, Hydrogen Ion
Solid	EPA 9030B/9034	Titrimetric	Sulfide
Solid	EPA 9060A	Combustion	Total Organic Carbon (TOC)
Solid	EPA 9071B	Gravimetric	Hexane Extractable Materials (HEM)
Solid	EPA 9071B	Gravimetric	Total Petroleum Hydrocarbons (TPH)
Solid	EPA 9095B	Gravimetric	Paint Filter Test
Solid	SM 2320B	Titrimetric	Alkalinity
Solid	SM 2540G	Gravimetric	Total Solids
Aqueous/Solid	EPA 314.0	IC	Perchlorate
Aqueous/Solid	EPA 365.1	Spectrophotometric	Phosphorus
Aqueous/Solid	SM4500NH3 G (TKN)	Spectrophotometric	Total Kjeldahl Nitrogen (TKN)
Aqueous/Solid	ASTM D6919-09	IC	Ammonia
Aqueous	EPA 1664B	Gravimetric	Hexane Extractable Materials (HEM)
Aqueous/Solid	EPA 1664B	Gravimetric	Total Petroleum Hydrocarbons (TPH)
Aqueous/Solid	NJEPH (C8-C44)	GC/FID	EPH
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Bromide

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Chloride
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Fluoride
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Nitrate
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Nitrite
Aqueous/Solid	EPA 300.0, EPA 9056A	IC	Sulfate
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Bismuth
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Boron
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Calcium Hardness (CaCO3)
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Hardness-Total as CaCO3
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Lithium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Sulfur
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Aluminum
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Antimony
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Arsenic
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Barium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Beryllium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Cadmium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Calcium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Chromium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Cobalt
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Copper
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Iron
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Lead
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Magnesium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Manganese
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Molybdenum
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Nickel
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Potassium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Selenium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Silica as SiO2
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Silver
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Sodium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Strontium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Thallium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Tin
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Titanium

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Vanadium
Aqueous/Solid	EPA 6010D, EPA 6010C	ICP	Zinc
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Aluminum
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Antimony
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Arsenic
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Barium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Beryllium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Cadmium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Calcium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Calcium Hardness (calculation Ca)
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Chromium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Cobalt
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Copper
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Iron
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Lead
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Magnesium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Manganese
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Molybdenum
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Mercury
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Nickel
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Potassium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Selenium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Silver
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Sodium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Strontium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Thallium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Tin
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Titanium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Total Hardness (calculation Ca and Mg)
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Uranium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Vanadium
Aqueous/Solid	EPA 6020B, EPA 6020A	ICP-MS	Zinc
Aqueous/Solid	EPA 7.3.3.2, EPA 9012B	Colorimetric	Reactive Cyanide
Aqueous/Solid	EPA 7196A	Spectrophotometric	Hexavalent Chromium
Aqueous/Solid	EPA 8015D	GC/FID	Oil Range Organics (ORO)
Aqueous/Solid	EPA 8015D	GC/FID	TPH Diesel (DRO)

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8015D	GC/FID	TPH Gasoline (GRO)
Aqueous/Solid	EPA 8081B	GC-ECD	4,4'-DDD
Aqueous/Solid	EPA 8081B	GC-ECD	4,4'DDE
Aqueous/Solid	EPA 8081B	GC-ECD	4,4'-DDT
Aqueous/Solid	EPA 8081B	GC-ECD	Aldrin (HHDN)
Aqueous/Solid	EPA 8081B	GC-ECD	alpha-BHC
Aqueous/Solid	EPA 8081B	GC-ECD	alpha-Chlordane
Aqueous/Solid	EPA 8081B	GC-ECD	beta-BHC
Aqueous/Solid	EPA 8081B	GC-ECD	Chlordane (tech.)
Aqueous/Solid	EPA 8081B	GC-ECD	delta-BHC
Aqueous/Solid	EPA 8081B	GC-ECD	Dieldrin
Aqueous/Solid	EPA 8081B	GC-ECD	Endosulfan I
Aqueous/Solid	EPA 8081B	GC-ECD	Endosulfan II
Aqueous/Solid	EPA 8081B	GC-ECD	Endosulfan Sulfate
Aqueous/Solid	EPA 8081B	GC-ECD	Endrin
Aqueous/Solid	EPA 8081B	GC-ECD	Endrin Aldehyde
Aqueous/Solid	EPA 8081B	GC-ECD	Endrin Ketone
Aqueous/Solid	EPA 8081B	GC-ECD	gamma-BHC (Lindane)
Aqueous/Solid	EPA 8081B	GC-ECD	gamma-Chlordane
Aqueous/Solid	EPA 8081B	GC-ECD	Heptachlor
Aqueous/Solid	EPA 8081B	GC-ECD	Heptachlor Epoxide
Aqueous/Solid	EPA 8081B	GC-ECD	Methoxychlor
Aqueous/Solid	EPA 8081B	GC-ECD	Mirex
Aqueous/Solid	EPA 8081B	GC-ECD	Toxaphene (Chlorinated Camphene)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1016 (PCB-1016)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1221 (PCB-1221)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1232 (PCB-1232)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1242 (PCB-1242)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1248 (PCB-1248)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1254 (PCB-1254)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1260 (PCB-1260)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1262 (PCB-1262)
Aqueous/Solid	EPA 8082A	GC-ECD	Aroclor-1268 (PCB-1268)
Aqueous/Solid	EPA 8151A	GC-ECD	2,4,5,-TP (Silvex)
Aqueous/Solid	EPA 8151A	GC-ECD	2,4,5-T
Aqueous/Solid	EPA 8151A	GC-ECD	2,4-D

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8151A	GC-ECD	2,4-DB
Aqueous/Solid	EPA 8151A	GC-ECD	Dalapon
Aqueous/Solid	EPA 8151A	GC-ECD	Dicamba
Aqueous/Solid	EPA 8151A	GC-ECD	Dichloroprop
Aqueous/Solid	EPA 8151A	GC-ECD	Pentachlorophenol
Aqueous/Solid	EPA 8151A	GC-ECD	4-Nitrophenol
Aqueous/Solid	EPA 8151A	GC-ECD	Dinoseb
Aqueous/Solid	EPA 8151A	GC-ECD	MCPA
Aqueous/Solid	EPA 8151A	GC-ECD	MCPP
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1,1,2-Tetrachloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1,1-Trichloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1,2,2-Tetrachloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1,2-Trichloro-1,2,2-Trifluoroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1,2-Trichloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1-Dichloro-2-Propanone
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1-Dichloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1-Dichloroethene (1,1-Dichloroethylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,1-Dichloropropene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2,3-Trichlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2,4-Trichlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2,4-Trimethylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2-Dibromo-3-Chloropropane (DBCP)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2-Dichlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2-Dichloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2-Dichloroethene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,2-Dichloropropane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,3,5-Trimethylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,3-Dichlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,3-Dichloropropane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,3-Dichloropropene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1,4-Dichlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1-Chlorobutane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1-Chlorohexane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	1-Propanol
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2,2-Dichloropropane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2-Butanone (MEK)

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2-Chlorotoluene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2-Hexanone (MBK)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2-Nitropropane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	2-Propanol (Isopropyl Alcohol)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	4-Isopropyltoluene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	4-Methyl-2-Pentanone (MIBK)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Acetone
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Acetonitrile
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Acrolein
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Acrylonitrile
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Allyl Chloride (3-Chloropropene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Benzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Benzyl Chloride
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Bromobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Bromochloromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Bromodichloromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Bromoform
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Bromomethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Carbon Disulfide
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Carbon Tetrachloride
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chloroacetonitrile
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chlorobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chloroethane (Ethyl Chloride)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chloroform
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chloromethane (methyl chloride)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Chloroprene (2-Chloro-1,3-butadiene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	cis-1,2-Dichloroethene Draf(cis-1,2-Dichloroethylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	cis-1,3-Dichloropropene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Cyclohexane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Dibromochloromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Dibromomethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Dichlorodifluoromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Dichlorofluoromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Diethyl Ether
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Diisobutylene (2,4,4-Trimethyl-l-pentene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Diisopropyl Ether (Propane)

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Ethyl Acetate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Ethyl Benzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Ethyl Methacrylate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Ethyl-tert-butylether (ETBE)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Heptane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Hexachlorobutadiene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Hexachloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Hexane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Idomethane (Methyl Iodide)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Isobutyl Alcohol (2 methyl-1-propanol)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Isopropylbenzene (Cumene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	m + p Xylene (1,3 + 1,4 Xylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methacrylonitrile
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methyl Acetate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methyl Acrylate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methyl Methacrylate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methylcyclohexane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methylene Chloride
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Methyl-tert-butylether (MTBE)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Naphthalene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	n-Butylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Nitrobenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	n-Propylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Octane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	o-Xylene (1,2-Xylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Pentachloroethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Pentane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Propionitrile (Ethyl Cyanide)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	sec-Butylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Styrene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	tert-Amyl Alcohol (2-methyl-2-but)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	tert-Amyl ethyl Ether
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	tert-Amyl Methyl Ether (TAME)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	tert-Butyl Alcohol
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	tert-Butylbenzene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Tetrachloroethene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Tetrahydrofuran (THF)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Toluene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	trans 1,3-Dichloropropene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	trans 1,4-Dichloro-2-butene
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	trans-1,2-Dichloroethene (trans-1,2 Dichloroethylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Trichloroethene (Trichloroethylene)
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Trichlorofluoromethane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Vinyl Acetate
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Vinyl Chloride
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS	Xylenes-Total
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS / GC-ECD	1,2,3-Trichloropropane
Aqueous/Solid	EPA 8260C, EPA 8260D	GC/MS / GC-ECD	1,2-Dibromoethane (EDB)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,1-Biphenyl
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,2,4,5-Tetrachlorobezene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,2,4-Trichlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,2-Dichlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,2-Dinitrobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,2-Diphenylhydrazine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,3-Dichlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,3-Dinitrobenzene (1,3-DNB)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,4-Dichlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	1,4-Dinitrobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,3,4,6-Tetrachlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,3,5,6-Tetrachlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,3-Dichloroaniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,4,5-Trichlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,4,6-Trichlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,4-Dichlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,6-Dichlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Chloronaphthalene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Chlorophenol (o-Cresol)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Methylphenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Naphthylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Nitroaniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2-Nitrophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,4-Dimethylphenol

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	2,4-Dinitrophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	3&4-Methylphenol (m&p-Cresol)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	3-3'-Dichlorobenzidine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	3-Nitroaniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4,6-Dinitro-2-Methylphenol (2-Methyl-4,6-dinitrophenol)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Bromophenyl-Phenyl Ether
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Chloro-3-Methylphenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Chloroaniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Chlorophenyl-Phenyl Ether
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Nitroaniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	4-Nitrophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Acetophenone
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Alpha-Terpineol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Aniline
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Atrazine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Azobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Benzaldehyde
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Benzidine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Benzoic Acid
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Benzyl Alcohol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Bis(2-chloroethoxy) Ether
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Bis(2-chloroethoxy) Methane
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Bis(2-Chloroisopropyl) Ether
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Bis(2-Ethylhexyl) Adipate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Bis(2-Ethylhexyl) Phthalate(DEHP)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Butyl Benzyl Phthalate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Caprolactam
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Carbazole
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Dibenzofuran
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Diethyl Phthalate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Dimethoate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Dimethyl Phthalate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Di-n-Butyl Phthalate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Di-n-Octyl Phthalate
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Dioxin Screen (2,3,7,8-TCDD)
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Diphenylamine

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Hexachlorethane
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Hexachlorobutadiene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Hexachlorocyclopentadiene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Isophorone
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Decane
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Heptadecane
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Nitrobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitrosodiethylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitrosodimethylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitrosodiphenylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitroso-di-n-Butylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitrosodi-n-Propylamine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Nitrosopyrrolidine
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	n-Octadecane
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Pentachlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Pentachlorophenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Phenol
Aqueous/Solid	EPA 8270D, EPA 8270E	GC/MS	Pyridine
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	1-Methylnaphthalene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	1,4-Dioxane (1,4-Diethlyeneoxide)
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	2-Methylnaphthalene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	2,4-Dinitrotoluene (2,4-DNT)
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	2,6-Dinitrotoluene (2,6-DNT)
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Acenaphthene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Acenaphthylene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Anthracene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Benzo (k) Fluoranthene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Benzo(a)Anthracene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Benzo(a)Pyrene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Benzo(b)Fluoranthene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Benzo(ghi)Perylene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Bis(2-Chlorethyl) Ether
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Chrysene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Dibenzo(a,h)Anthracene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Fluoranthene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Fluorene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Hexachlorobenzene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Indeno (1,2,3-CD) Pyrene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Naphthalene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Phenanthrene
Aqueous/Solid	EPA 8270D, EPA 8270E, EPA 8270D SIM, EPA 8270E SIM	GC/MS/SIM	Pyrene
Aqueous/Solid	EPA 8330B	HPLC	1,3,5-Trinitrobenzene (1,3,5-TNB)
Aqueous/Solid	EPA 8330B	HPLC	1,3-Dinitrobenzene (1,3-DNB)
Aqueous/Solid	EPA 8330B	HPLC	2,4,6-Trinitrotoluene (2,4,6-TNT)
Aqueous/Solid	EPA 8330B	HPLC	2,4-Dinitrotoluene (2,4-DNT)
Aqueous/Solid	EPA 8330B	HPLC	2,6-Dinitrotoluene (2,6-DNT)
Aqueous/Solid	EPA 8330B	HPLC	2-Amino-4,6-Dinitrotoluene
Aqueous/Solid	EPA 8330B	HPLC	2-Nitrotoluene
Aqueous/Solid	EPA 8330B	HPLC	3,5-Dinitroaniline
Aqueous/Solid	EPA 8330B	HPLC	3-Nitrotoluene
Aqueous/Solid	EPA 8330B	HPLC	4-Amino-2,6-Dinitrotoluene
Aqueous/Solid	EPA 8330B	HPLC	4-Nitrotoluene
Aqueous/Solid	EPA 8330B	HPLC	HMX
Aqueous/Solid	EPA 8330B	HPLC	Nitrobenzene
Aqueous/Solid	EPA 8330B	HPLC	Nitroglycerin
Aqueous/Solid	EPA 8330B	HPLC	PETN
Aqueous/Solid	EPA 8330B	HPLC	RDX
Aqueous/Solid	EPA 8330B	HPLC	Tetryl

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous/Solid	EPA 9012B	Colorimetric	Total Cyanide
Aqueous/Solid	EPA 9020B/9023	Combustion	Total Organic Halides
Aqueous/Solid	EPA 9066	Colorimetric	Phenolic Substances
Aqueous/Solid	SM 2340B	ICP/ICP-MS	Calcium Hardness (calculation Ca)
Aqueous/Solid	SM 2340B	ICP/ICP-MS	Total Hardness (calculation Ca and Mg)
Aqueous/Solid	SW846 7.3.4.2	Colorimetric	Reactive Sulfide

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

ALS-Middletown

301 Fulling Mill Road, Middletown, PA 17057
Contact Name: Susan Magness Phone: 717-944-5541

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Aqueous	EPA 3510C	Sep Funnel Extraction	Semivolatiles, pesticides, PCBs
Aqueous	EPA 5030C & EPA 5030B	Purge and Trap	Volatile Organics Prep
Aqueous	EPA 3511	Micro Extraction	Semivolatiles, pesticides, PCBs
Solid	EPA 1030	Ignition	Ignitability
Solid	EPA 3050B	Acid Digestion Hot Plate	Metals
Solid	EPA 3535	Solid Phase Extraction	Prep Method (Explosives)
Solid	EPA 3546	Microwave Extraction	Semivolatiles, pesticides, PCBs
Solid	EPA 3580A	Waste Dilution	Semivolatiles, pesticides, PCBs
Solid	EPA 5035A	P&T closed	Volatiles
Aqueous/Solid	EPA 1010A	Pensky Martin	Flashpoint
Aqueous/Solid	EPA 1311	TCLP	Physical Extraction
Aqueous/Solid	EPA 1311	TCLP ZHE	Physical Extraction
Aqueous/Solid	EPA 1312	SPLP	Physical Extraction
Aqueous/Solid	ASTM D3987	ASTM Leachate Extraction	Physical Extraction
Aqueous/Solid	EPA 3015A, EPA 3051A	Acid Digestion Microwave	Metals
Aqueous/Solid	EPA 3620B	Florisil Clean-Up	Semivolatiles, pesticides, PCBs
Aqueous/Solid	EPA 3660B	Sulfur Cleanup	PCB's
Aqueous/Solid	EPA 3665A	Sulfuric Acid Cleanup	PCBs
Aqueous/Solid	SM 4500 Norg B+C	Kjeldahl Method	Total Kjeldahl Nitrogen (TKN)

State of New Jersey

Department of Environmental Protection

Certifies That

ALS ENVIRONMENTAL - MIDDLETOWN

Laboratory Certification ID # PA010

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing the Certification of Laboratories and Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the 2016 TNI Standard approved by the

The NELAC Institute

Expires June 30, 2023

Michele M. Potter
Manager

NJDEP is a NELAP Recognized Accreditation Body

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public. Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW01 --Microbiology

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Applied	No	DW01.00300	Fecal coliform/ E. coli	Membrane Filter, Enumeration	SM 9222 D/9222 G (mFC-NA plus MUG)	PA
Certified	Yes	DW01.00350	Heterotrophic bacteria	Pour Plate	SM 9215 B	PA
Certified	Yes	DW01.00500	Total coliform / E. coli	ONPG-MUG (Autoanalysis Colilert System) (P-A)	SM 9223 B	PA
Certified	Yes	DW01.00550	Total coliform / E. coli	ONPG-MUG (Colilert/Colilert-18), Enumeration	SM 9223 B, Multi-well Procedure	PA

Category: DW03 --Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW03.00050	Alkalinity	Electrometric Titration	SM 2320 B	PA
Certified	Yes	DW03.00200	Alkalinity	Titrimetric Indicator	SM 2320 B	PA
Certified	Yes	DW03.00350	Ammonia	Automated Phenate	SM 4500-NH3 G	PA
Dropped	No	DW03.00450	Ammonia	Electrode	SM 4500-NH3 D	PA
Certified	Yes	DW03.00750	Bromate	Ion Chromatography	EPA 300.1	PA
Certified	Yes	DW03.01100	Bromide	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.01150	Bromide	Ion Chromatography	EPA 300.1	PA
Certified	Yes	DW03.01550	Chlorate	Ion Chromatography	EPA 300.1	PA
Certified	Yes	DW03.01800	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.02450	Chlorite (monthly)	Ion Chromatography	EPA 300.1	PA
Certified	Yes	DW03.02550	Color	Platinum-Cobalt	SM 2120 B	PA
Certified	Yes	DW03.02700	Conductivity	Conductance	SM 2510 B	PA
Certified	Yes	DW03.03000	Cyanide	Spectrophotometric, Distill, Amenable	SM 4500-CN C, G	PA
Certified	Yes	DW03.03150	Cyanide	Spectrophotometric, Distill, Semi Automated	EPA 335.4	PA
Certified	Yes	DW03.03200	Cyanide	UV, Distillation, Spectrophotometric	Other Kelada-01	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW03 --Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW03.03300	Dissolved organic carbon (DOC)	High Temp. Combustion, Filtration	SM 5310 B	PA
Certified	Yes	DW03.03750	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.03950	Foaming agents	Methylene Blue	SM 5540 C	PA
Certified	Yes	DW03.04600	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	No	DW03.04950	Nitrate - nitrite	Automated Cadmium Reduction	User Defined EPA 353.2	PA
Certified	Yes	DW03.05450	Nitrite	Ion Chromatography	EPA 300.0	PA
Dropped	No	DW03.05800	Nitrite	Spectrophotometric	SM 4500-NO2 B	PA
Certified	Yes	DW03.05850	Odor	Consistent Series	SM 2150 B	PA
Certified	Yes	DW03.05950	Orthophosphate	Colorimetric	SM 4500-P E	PA
Certified	Yes	DW03.06450	Perchlorate	Ion Chromatography	EPA 314.0	PA
Certified	Yes	DW03.06600	Residue - nonfilterable (TSS)	Gravimetric, 103-105 Deg C, Post Washing - mining	SM 2540 D	PA
Certified	Yes	DW03.06900	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.07150	Total dissolved solids (TDS)	Gravimetric At 180	SM 2540 C	PA
Certified	Yes	DW03.07200	Total hardness	Hardness By Calculation	SM 2340 B	NJ
Certified	Yes	DW03.07250	Total hardness	Titrimetric, EDTA	SM 2340 C	PA
Certified	Yes	DW03.07400	Total organic carbon (TOC)	High Temp. Combustion	SM 5310 B	PA
Certified	Yes	DW03.08100	Turbidity	Nephelometric	SM 2130 B	PA
Certified	Yes	DW03.08300	UV-absorbing compounds	Spectrophotometric, Calculation	SM 5910 B	PA

Category: DW04 --Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW04 --Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW04.00300	Chlorine - total, free or combined	DPD, Colorimetric	SM 4500-Cl G	PA
Certified	Yes	DW04.01050	pH	Electrometric	SM 4500-H B	PA
Certified	Yes	DW04.01200	Temperature	Thermometric	SM 2550 B	PA

Category: DW06 --Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW06.01400	Chromium (VI)	Ion Chromatography	EPA 218.6	PA
Certified	Yes	DW06.01450	Chromium (VI)	Ion Chromatography	EPA 218.7	PA
Certified	Yes	DW06.01500	Mercury	Manual Cold Vapor	EPA 245.1	PA
Certified	Yes	DW06.03500	Silica	Molybdosilicate	SM 4500-SiO2 C	PA

Category: DW07 --Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW07.00950	Aluminum	ICP	EPA 200.7	PA
Certified	Yes	DW07.01000	Barium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01100	Boron	ICP	EPA 200.7	PA
Certified	Yes	DW07.01150	Cadmium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01200	Calcium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01250	Chromium	ICP	EPA 200.7	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW07 --Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW07.01300	Cobalt	ICP	EPA 200.7	PA
Certified	Yes	DW07.01350	Copper	ICP	EPA 200.7	PA
Certified	Yes	DW07.01400	Iron	ICP	EPA 200.7	PA
Certified	Yes	DW07.01450	Lithium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01500	Magnesium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01550	Manganese	ICP	EPA 200.7	PA
Certified	Yes	DW07.01600	Molybdenum	ICP	EPA 200.7	PA
Certified	Yes	DW07.01650	Nickel	ICP	EPA 200.7	PA
Certified	Yes	DW07.01700	Potassium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01800	Silver	ICP	EPA 200.7	PA
Certified	Yes	DW07.01850	Sodium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01900	Strontium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01950	Tin	ICP	EPA 200.7	PA
Certified	Yes	DW07.02000	Titanium	ICP	EPA 200.7	PA
Certified	Yes	DW07.02050	Vanadium	ICP	EPA 200.7	PA
Certified	Yes	DW07.02100	Zinc	ICP	EPA 200.7	PA
Certified	Yes	DW07.02150	Aluminum	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02200	Antimony	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02250	Arsenic	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02300	Barium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02350	Beryllium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02400	Cadmium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02450	Chromium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02500	Cobalt	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02550	Copper	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02600	Lead	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02650	Manganese	ICP/MS	EPA 200.8	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW07 --Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW07.02700	Mercury	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02750	Molybdenum	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02800	Nickel	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02850	Selenium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02900	Silver	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02950	Thallium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.03000	Uranium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.03050	Vanadium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.03100	Zinc	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.03150	Calcium-hardness	Ca as Carbonate, ICP	SM 2340 B	NJ
Certified	Yes	DW07.03200	Total hardness	Hardness By Calculation, ICP	SM 2340 B	NJ

Category: DW08 --Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW08.03550	Dibromo-3-chloropropane (1,2-)	Solvent Extract, GC	EPA 504.1	PA
Certified	Yes	DW08.03600	Dibromoethane (1,2-) (EDB)	Solvent Extract, GC	EPA 504.1	PA
Certified	Yes	DW08.03650	Trichloropropane (1,2,3-)	Solvent Extract, GC	EPA 504.1	PA
Certified	Yes	DW08.03700	Alachlor	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.03750	Aldrin	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.03850	Chlordane (alpha) (cis-)	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.03900	Chlordane (gamma) (trans-)	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.03950	Chlordane (technical)	Microextraction, GC	EPA 505	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW08 --Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW08.04000	Dieldrin	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04050	Endrin	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04100	Heptachlor	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04150	Heptachlor epoxide	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04200	Hexachlorobenzene	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04250	Hexachlorocyclopentadiene	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04300	Lindane (gamma BHC)	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04350	Methoxychlor	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04550	Toxaphene	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04600	PCB 1016	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04650	PCB 1221	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04700	PCB 1232	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04750	PCB 1242	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04800	PCB 1248	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04850	PCB 1254	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.04900	PCB 1260	Microextraction, GC	EPA 505	PA
Certified	Yes	DW08.11050	Acifluorfen	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11100	Bentazon	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11150	Chloramben	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11200	D (2,4-)	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11250	Dalapon	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11300	DB (2,4-)	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11350	DCPA (Dacthal) di acid degradate	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11400	DCPA (Dacthal) mono acid degradate	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11450	Dicamba	Liquid/Liquid Extraction/GC	EPA 515.3	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW08 --Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW08.11500	Dichlorobenzoic acid (3,5-)	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11550	Dichlorprop	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11600	Dinoseb	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11750	Pentachlorophenol	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11800	Picloram	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11850	T (2,4,5-)	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.11900	TP (2,4,5-) (Silvex)	Liquid/Liquid Extraction/GC	EPA 515.3	PA
Certified	Yes	DW08.12800	Aldicarb	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12850	Aldicarb sulfone	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12900	Aldicarb sulfoxide	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12950	Carbaryl	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13000	Carbofuran (furadan)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13050	Hydroxy carbofuran (3-)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13100	Methiocarb (mesurol)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13150	Methomyl (Lannate)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13200	Oxamyl	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13250	Propoxur	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13900	Glyphosate	HPLC	EPA 547	PA
Certified	Yes	DW08.14000	Diquat	HPLC	EPA 549.2	PA
Certified	Yes	DW08.14050	Paraquat	HPLC	EPA 549.2	PA
Certified	Yes	DW08.17550	Bromochloroacetic acid	Liquid/Liquid Extraction/GC	EPA 552.2	PA
Certified	Yes	DW08.17750	Dibromoacetic acid	Liquid/Liquid Extraction/GC	EPA 552.2	PA
Certified	Yes	DW08.17800	Dichloroacetic acid	Liquid/Liquid Extraction/GC	EPA 552.2	PA
Certified	Yes	DW08.17850	Monobromoacetic acid (MBAA)	Liquid/Liquid Extraction/GC	EPA 552.2	PA
Certified	Yes	DW08.17900	Monochloroacetic acid (MCAA)	Liquid/Liquid Extraction/GC	EPA 552.2	PA
Certified	Yes	DW08.18000	Trichloroacetic acid	Liquid/Liquid Extraction/GC	EPA 552.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.11400	Dioxane (1,4-)	SPE, GC/MS/SIM	EPA 522	PA
Certified	Yes	DW09.11450	Acetone	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11500	Acrylonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11550	Allyl chloride	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11600	Benzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11650	Bromobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11700	Bromochloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11750	Bromodichloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11800	Bromoform	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11850	Bromomethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11900	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11950	Butylbenzene (n-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12000	Carbon disulfide	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12050	Carbon tetrachloride	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12100	Chloroacetonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12150	Chlorobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12200	Chlorobutane (1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12250	Chloroethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12300	Chloroform	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12350	Chloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12400	Chlorotoluene (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12450	Chlorotoluene (4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12550	Dibromochloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12650	Dibromomethane	GC/MS, P & T	EPA 524.2	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.12700	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12750	Dichlorobenzene (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12800	Dichlorobenzene (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12850	Dichlorobenzene (1,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12900	Dichlorodifluoromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12950	Dichloroethane (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13000	Dichloroethane (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13050	Dichloroethene (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13100	Dichloroethene (cis-1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13150	Dichloroethene (trans-1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13200	Dichloropropane (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13250	Dichloropropane (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13300	Dichloropropane (2,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13350	Dichloropropanone (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13400	Dichloropropene (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13450	Dichloropropene (cis-1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13500	Dichloropropene (trans-1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13550	Diethyl ether (Ethyl ether)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13600	Diisopropyl Ether (DIPE)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13650	Ethyl methacrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13700	Ethylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13750	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13800	Hexachlorobutadiene (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13850	Hexachloroethane	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.13900	Hexane (n-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13950	Hexanone (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14000	Isopropylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14050	Isopropyltoluene (4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14100	Methacrylonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14150	Methyl acrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14200	Methyl iodide	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14250	Methyl methacrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14300	Methyl tert-butyl ether	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14350	Methylene chloride (Dichloromethane)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14400	Naphthalene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14450	Nitrobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14500	Nitropropane (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14550	Pentachloroethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14600	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14650	Propionitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14700	Propylbenzene (n-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14750	Sec-butylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14800	Styrene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14850	tert-Amylmethyl ether (TAME)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14900	Tert-butyl alcohol	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14950	Tert-butylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15000	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15050	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T	EPA 524.2	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.15100	Tetrachloroethene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15150	Tetrahydrofuran	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15200	Toluene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15250	Trichlorobenzene (1,2,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15300	Trichlorobenzene (1,2,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15400	Trichloroethane (1,1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15450	Trichloroethane (1,1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15500	Trichloroethene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15550	Trichlorofluoromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16000	Trichloropropane (1,2,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16050	Trimethylbenzene (1,2,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16100	Trimethylbenzene (1,3,5-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16150	Vinyl chloride	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16200	Xylene (m- + p-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16250	Xylene (o-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16300	Xylenes (total)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.22200	Acenaphthene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22250	Acenaphthylene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22300	Acetochlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22350	Alachlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22400	Aldrin	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22550	Anthracene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22600	Atrazine	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22650	Benzo(a)anthracene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22700	Benzo(a)pyrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22750	Benzo(b)fluoranthene	SPE, GC/MS	EPA 525.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.22800	Benzo(ghi)perylene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.22850	Benzo(k)fluoranthene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.23000	Butachlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.23100	Butylbenzylphthalate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.23550	Chrysene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.23800	DDE (4,4'-)	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.23950	Di(2-ethylhexyl)adipate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24000	Di(2-ethylhexyl)phthalate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24050	Dibenzo(a,h)anthracene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24150	Dieldrin	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24200	Diethyl phthalate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24250	Dimethyl phthalate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24300	Di-n-butyl phthalate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24350	Dinitrotoluene (2,4-)	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24400	Dinitrotoluene (2,6-)	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24650	Endrin	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24750	EPTC (s-ethyl-dipropyl thio carbamate)	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.24950	Fluorene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25050	Heptachlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25100	Heptachlor epoxide	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25150	Hexachlorobenzene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25200	Hexachlorocyclopentadiene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25300	Indeno(1,2,3-cd)pyrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25400	Lindane (gamma BHC)	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25450	Methoxychlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25600	Metolachlor	SPE, GC/MS	EPA 525.2	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.25650	Metribuzin	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.25800	Molinate	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26200	Phenanthrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26350	Propachlor	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26450	Pyrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26500	Simazine	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26650	Terbacil	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26900	Trifluralin	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.40000	Endothall	Extract, GC/MS	EPA 548.1	PA

Category: NPW01--Microbiology

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW01.00200	Enterococci	Multiple Tube/Mutiple Well - Enterolert	Other Enterolert	PA
Certified	Yes	NPW01.00750	Escherichia coli (E coli)	MPN/Multiple Tube/Multiple Well	Other Colilert	PA
Certified	Yes	NPW01.01300	Fecal coliform	Multiple Tube/Mutiple Well	Other Colilert 18	PA
Certified	Yes	NPW01.01650	Fecal coliform	Membrane Filter (MF), Single Step	SM 9222 D-15	PA
Certified	Yes	NPW01.02100	Heterotrophic plate count	Pour Plate	SM 9215 B-04	PA
Certified	Yes	NPW01.02900	Total coliform	P-A (Rec. Water Only)	Other Colilert	PA

Category: NPW03--Inorganic Parameters

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW03.00100	Acidity as CaCO3	Electrometric or Phenolphthalein	SM 2310 B-11	PA
Certified	Yes	NPW03.00350	Alkalinity as CaCO3	Electrometric Titration	SM 2320 B-11	PA
Certified	Yes	NPW03.00360	Alkalinity as CaCO3	Titrimetric Indicator	SM 2320B-11	PA
Certified	Yes	NPW03.01100	Ammonia	Distillation or Gas Diffusion, Semi-automated Phenate	EPA 350.1	PA
Certified	Yes	NPW03.01150	Ammonia	Distillation or Gas Diffusion, Semi-automated Phenate	SM 4500-NH3 B plus G-11	PA
Certified	Yes	NPW03.01350	Ammonia	Distillation, Ion Chromatography	ASTM D6919-17	PA
Certified	Yes	NPW03.01550	Biochemical oxygen demand	Dissolved Oxygen Depletion - Membrane Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.01700	Biochemical oxygen demand	Dissolved Oxygen Depletion - LDO Probe	SM 5210 B-16	PA
Certified	Yes	NPW03.02400	Bromide	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.02450	Bromide	Ion Chromatography	EPA 300.1	PA
Certified	Yes	NPW03.02500	Bromide	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.02850	Calcium-hardness	Titrimetric, EDTA	SM 3500-Ca B-11	PA
Certified	Yes	NPW03.02900	Carbonaceous BOD (CBOD)	Diss. Oxygen Depl., Nitrif. Inhib. - Membrane Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.02950	Carbonaceous BOD (CBOD)	Dissolved Oxygen Depl., Nitrif. Inhib., LDO Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.03500	Chemical oxygen demand	Spectrophotometric Manual/Auto	EPA 410.4	PA
Certified	Yes	NPW03.04900	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.05100	Chloride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.06000	Color	Colorimetric (Platinum-Cobalt)	SM 2120 B-11	PA
Certified	Yes	NPW03.06550	Cyanide	Auto UV digestion/distillation and colorimetry	Other Kelada-01	PA
Certified	Yes	NPW03.06750	Cyanide	Distillation, Spectrophotometric (Auto)	EPA 335.4	PA
Certified	Yes	NPW03.06850	Cyanide	Colorimetric, Automated	SW-846 9012B	PA
Certified	Yes	NPW03.07200	Cyanide	Distillation	SW-846 9010C	PA
Certified	Yes	NPW03.07300	Cyanide - amenable to Cl2	Manual Distillation, Titrimetr/Spectro	SM 4500-CN B-11 and G-11	PA
Certified	Yes	NPW03.07350	Cyanide - amenable to Cl2	Manual Distillation, Titrimetr/Spectro	SM 4500-CN B-16, C-16 plus G-16	PA
Certified	Yes	NPW03.07450	Cyanide - amenable to Cl2	Auto distillation and colorimetry	Other Kelada-01	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW03--Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW03.07850	Extractable organic halides (EOX)	Extraction	SW-846 9023	PA
Certified	Yes	NPW03.08500	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.08700	Fluoride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.09200	Hardness - total as CaCO3	Titrimetric, EDTA	SM 2340 C-11	PA
Certified	Yes	NPW03.09750	Kjeldahl nitrogen - total	Digestion, Dist. or Gas Diffusion, Semi-auto. phenate	SM 4500-N Org B-11 plus NH3 B plus G-11	PA
Certified	Yes	NPW03.09850	Kjeldahl nitrogen - total	Digestion, Dist. or Gas Diffusion, Semi-auto. phenate	SM 4500-N Org C-11 plus NH3 B plus G-11	PA
Certified	Yes	NPW03.10600	Kjeldahl nitrogen - total	Digestion, Semiauto. Digestor, Colorimetric	EPA 351.2	PA
Certified	Yes	NPW03.11050	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.11250	Nitrate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.11950	Nitrate - nitrite	Cadmium Reduction, Automated	EPA 353.2	PA
Certified	Yes	NPW03.12450	Nitrate - nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.12950	Nitrite	Spectrophotometric, Manual	SM 4500-NO2 B-11	PA
Certified	Yes	NPW03.13650	Nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.13900	Nitrite	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.14150	Oil & grease - hem-LL	Gravimetric, Hexane Extractable Material-LL	EPA 1664B	PA
Certified	Yes	NPW03.14300	Oil & grease - hem-SPE	Gravimetric, Hexane Extractable Material-SPE	EPA 1664B	PA
Certified	Yes	NPW03.14450	Oil & grease - sgt-non polar	Gravimetric, Silica Gel Treated-Hem-SPE	EPA 1664B	PA
Certified	Yes	NPW03.14600	Oil & grease - sgt-non polar	Gravimetric, Silica Gel Treated-Hem-LL	EPA 1664B	PA
Certified	Yes	NPW03.15350	Orthophosphate	Ascorbic Acid, Manual Single Reagent	SM 4500-P E-11	PA
Certified	Yes	NPW03.16450	Perchlorate	Ion Chromatography	EPA 314.0	PA
Certified	Yes	NPW03.16850	Phenols	Manual Distillation, Colorimetric Auto	EPA 420.4	PA
Certified	Yes	NPW03.16900	Phenols	Manual Distillation, Colorimetric Auto	SW-846 9066	PA
Certified	Yes	NPW03.17350	Phosphorus (total)	Auto Ascorbic Acid Reduction	EPA 365.1	PA
Certified	Yes	NPW03.17850	Residue - filterable (TDS)	Gravimetric, 180 Degrees C	SM 2540 C-15	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW03--Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW03.18000	Residue - nonfilterable (TSS)	Gravimetric, 103-105 Degrees C, Post Washing	SM 2540 D-15	PA
Certified	Yes	NPW03.18100	Residue - settleable	Volumetric (Imhoff Cone) or Gravimetric	SM 2540 F-15	PA
Certified	Yes	NPW03.18150	Residue - total	Gravimetric, 103-105 Degrees C	SM 2540 B-15	PA
Certified	Yes	NPW03.18300	Residue - volatile	Gravimetric, 550 Degrees C	SM 2540 E-15	PA
Dropped	No	NPW03.18400	Salinity	Electrical Conductivity	SM 2520 B	PA
Certified	Yes	NPW03.18800	Specific conductance	Wheatstone Bridge	SM 2510 B-11	PA
Certified	Yes	NPW03.18850	Specific conductance	Wheatstone Bridge	SW-846 9050A	PA
Certified	Yes	NPW03.19850	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.20050	Sulfate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.20450	Sulfides	Titrimetric, Iodine	SM 4500-S B, C plus F-11	PA
Certified	Yes	NPW03.20750	Surfactants	Colorimetric (Methylene Blue)	SM 5540 C-11	PA
Certified	Yes	NPW03.20800	Tannin and Lignin	Colorimetric	SM 5550 B	PA
Certified	Yes	NPW03.21110	Total organic carbon (TOC)	Combustion	SM 5310 B-14	PA
Certified	Yes	NPW03.21450	Total organic carbon (TOC)	Infrared Spectrometry or FID	SW-846 9060A	PA
Certified	Yes	NPW03.21700	Total organic halides (TOX)	Combustion, Titration	SW-846 9020B	PA
Certified	Yes	NPW03.21850	Total, fixed, and volatile solids (SQAR)	Gravimetric, 500 Degrees C	SM 2540 G SM 18th Ed.	PA
Certified	Yes	NPW03.22150	Turbidity	Nephelometric	SM 2130 B-11	PA

Category: NPW04--Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW04.00400	Chlorine	Spectrophotometric, DPD	SM 4500-Cl G-11	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW04--Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW04.00950	Oxygen (dissolved)	Membrane Electrode	SM 4500-O G-16	PA
Certified	Yes	NPW04.01650	pH	Electrometric	SM 4500-H B-11	PA
Certified	Yes	NPW04.01750	pH (corrosivity)	Aqueous, Electrometric	SW-846 9040C	PA
Certified	Yes	NPW04.01850	Sulfite - SO3	Titrimetric, Iodine-Iodate	SM 4500-SO3 B-11	PA

Category: NPW06--Metals - NPW Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW06.00050	Metals	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA
Certified	Yes	NPW06.00300	Metals	Microwave Acid Digestion/Aqueous	SW-846 3015A	PA

Category: NPW07--Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW07.02350	Mercury	Purge & Trap Atomic Fluorescence	EPA 1631E	PA
Certified	Yes	NPW07.03200	Chromium (VI)	0.45u Filter, Ion Chromatography	EPA 218.6	PA
Certified	Yes	NPW07.03350	Mercury	Manual Cold Vapor	EPA 245.1	PA
Certified	Yes	NPW07.08650	Chromium (VI)	0.45u Filter, Colorimetric DPC	SM 3500-Cr B-11	PA
Certified	Yes	NPW07.08850	Iron, Ferrous	Digestion, Colorimetric (Phenanthroline)	SM 3500-Fe B-11	PA
Certified	Yes	NPW07.09300	Silica - dissolved	0.45u Filtration + Colorimetric (Manual)	SM 4500-SiO2 C-11	PA
Certified	Yes	NPW07.11950	Chromium (VI)	Colorimetric	SW-846 7196A	PA
Certified	Yes	NPW07.12150	Mercury - liquid waste	AA, Manual Cold Vapor	SW-846 7470A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.04150	Aluminum	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04200	Antimony	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04250	Arsenic	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04300	Barium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04350	Beryllium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04400	Boron	ICP	EPA 200.7	PA
Certified	Yes	NPW08.04450	Cadmium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04500	Calcium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04550	Chromium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04600	Cobalt	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04650	Copper	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04700	Iron	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04750	Lead	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04800	Lithium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04850	Magnesium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04900	Manganese	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04950	Molybdenum	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05000	Nickel	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05100	Potassium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05150	Selenium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05250	Silver	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05300	Sodium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05350	Strontium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05400	Thallium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05450	Tin	Digestion, ICP	EPA 200.7	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.05500	Titanium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05550	Vanadium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05600	Zinc	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05650	Aluminum	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05700	Antimony	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05750	Arsenic	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05800	Barium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05850	Beryllium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05950	Cadmium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06050	Chromium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06100	Cobalt	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06150	Copper	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06300	Lead	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06400	Manganese	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06450	Molybdenum	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06500	Nickel	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06600	Selenium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06700	Silver	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06850	Thallium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07100	Uranium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07150	Vanadium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07200	Zinc	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.09800	Hardness - total as CaCO3	Ca + Mg Carbonates, ICP	SM 2340 B-11	NJ
Certified	Yes	NPW08.09850	Hardness - total as CaCO3	Ca + Mg Carbonates, ICP / MS	SM 2340 B-11	NJ
Certified	Yes	NPW08.12800	Aluminum	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.12850	Antimony	ICP	SW-846 6010D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.12900	Arsenic	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.12950	Barium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13000	Beryllium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13050	Boron	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13100	Cadmium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13150	Calcium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13200	Chromium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13250	Cobalt	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13300	Copper	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13350	Iron	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13400	Lead	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13450	Lithium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13500	Magnesium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13550	Manganese	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13600	Molybdenum	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13650	Nickel	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13750	Potassium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13800	Selenium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13850	Silver	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13900	Sodium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13950	Strontium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14000	Thallium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14050	Thorium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14100	Tin	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14150	Titanium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14250	Vanadium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14300	Zinc	ICP	SW-846 6010D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.14400	Aluminum	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14450	Antimony	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14500	Arsenic	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14550	Barium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14600	Beryllium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14700	Cadmium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14750	Calcium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14800	Chromium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14850	Cobalt	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14900	Copper	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14950	Iron	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15000	Lead	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15050	Magnesium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15100	Manganese	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15150	Molybdenum	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15200	Nickel	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15250	Potassium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15300	Selenium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15400	Silver	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15450	Sodium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15500	Strontium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15550	Thallium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15650	Tin	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15700	Titanium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15800	Uranium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15850	Vanadium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15900	Zinc	ICP/MS	SW-846 6020B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.19000	Sulfur	Closed Vessel Sample Preparation, ICP	User Defined SW-846 6010D	PA

Category: NPW09--Organics - NPW Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW09.00500	Semivolatile organics	Separatory Funnel Extraction	SW-846 3510C	PA
Certified	Yes	NPW09.00550	Semivolatile organics	Microscale Solvent Extraction - Aqueous	SW-846 3511	PA
Certified	Yes	NPW09.00650	Semivolatile organics	Solid Phase Extraction (SPE)	SW-846 3535A	PA
Applied	No	NPW09.00850	Semivolatile organics	Cleanup-Florisil	SW-846 3620C	PA
Certified	Yes	NPW09.00900	Semivolatile organics	Cleanup-Silica Gel	SW-846 3630C	PA
Certified	Yes	NPW09.01050	Semivolatile organics	Cleanup-Sulfur Removal	SW-846 3660B	PA
Certified	Yes	NPW09.01100	Semivolatile organics	Cleanup-Sulfuric Acid/KMnO4	SW-846 3665A	PA
Certified	Yes	NPW09.01550	Volatile organics	Purge & Trap Aqueous	SW-846 5030C	PA

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.01200	Amyl acetate (n-)	GC, Direct Injection, FID	ASTM D3695	PA
Certified	Yes	NPW10.01350	Butyl acetate (n-)	GC, Direct Injection, FID	ASTM D3695	PA
Certified	Yes	NPW10.01550	Ethanol	GC, Direct Injection, FID	ASTM D3695	PA
Certified	Yes	NPW10.01600	Ethyl acetate	GC, Direct Injection, FID	ASTM D3695	PA
Certified	Yes	NPW10.01750	Isopropyl acetate	GC, Direct Injection, FID	ASTM D3695	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.01950	Methyl alcohol (Methanol)	GC, Direct Injection, FID	ASTM D3695	PA
Certified	Yes	NPW10.19150	Aldrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19200	Alpha BHC	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19300	Beta BHC	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19650	Chlordane	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19700	Chlordane (alpha) (cis-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19750	Chlordane (gamma) (trans-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20050	DDD (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20100	DDE (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20150	DDT (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20200	Delta BHC	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20350	Dieldrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20400	Endosulfan I	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20450	Endosulfan II	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20500	Endosulfan sulfate	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20550	Endrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20600	Endrin aldehyde	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20650	Endrin ketone	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20800	Heptachlor	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20850	Heptachlor epoxide	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21000	Lindane (gamma BHC)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21050	Methoxychlor	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21200	Mirex	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21800	Toxaphene	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21900	PCB 1016	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21950	PCB 1221	Extract/GC (ECD)	EPA 608.3	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.22000	PCB 1232	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22050	PCB 1242	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22100	PCB 1248	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22150	PCB 1254	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22200	PCB 1260	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.27500	Azinphos methyl	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27550	Bolstar	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27600	Chlorpyrifos	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27700	Demeton (o-)	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27750	Demeton (s-)	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27800	Diazinon	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27900	Dichlorvos	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.27950	Dimethoate	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28000	Disulfoton	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28100	Ethoprop	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28150	Fensulfothion	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28200	Fenthion	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28300	Mevinphos	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28350	Naled	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28400	Parathion methyl	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28450	Phorate	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.28500	Stirofos	Extract/GC (NPD or FPD)	EPA 622	PA
Certified	Yes	NPW10.31350	Butane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31400	Ethane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31450	Ethene	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31500	Isobutane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31550	Methane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.31600	Propane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31650	Extractable Petroleum Hydrocarbons	Extraction, GC, FID	Other NJDEP EPH 10/08, Rev. 3	NJ
Certified	Yes	NPW10.39250	Dibromo-3-chloropropane (1,2-)	Extract/GC (ECD)	SW-846 8011	PA
Certified	Yes	NPW10.39300	Dibromoethane (1,2-) (EDB)	Extract/GC (ECD)	SW-846 8011	PA
Certified	Yes	NPW10.39350	Trichloropropane (1,2,3-)	Extract/GC (ECD)	SW-846 8011	PA
Certified	Yes	NPW10.39400	Acetone	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39450	Acetonitrile	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39550	Allyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39650	Butanol (1-)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39700	Butoxyethanol (2-)	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39800	Diesel range organic	Extraction, GC, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40000	Ethyl alcohol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40050	Ethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40200	Gasoline range organic	GC P&T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40250	Isoamyl alcohol (3-methyl-1-butanol)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40300	Iso-butyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40350	Isopropyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40400	Methyl alcohol (Methanol)	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40750	Propyl Alcohol (n-)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40800	Propylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.41000	Tert-butyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.44550	Alachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44600	Aldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44650	Alpha BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.44750	Beta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44800	Chlordane (alpha) (cis-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44850	Chlordane (gamma) (trans-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44900	Chlordane (technical)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45250	DDD (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45300	DDE (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45350	DDT (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45400	Delta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45450	Dieldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45500	Endosulfan I	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45550	Endosulfan II	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45600	Endosulfan sulfate	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45650	Endrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45700	Endrin aldehyde	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45750	Endrin ketone	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45850	Heptachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45900	Heptachlor epoxide	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46050	Lindane (gamma BHC)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46100	Methoxychlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46250	Mirex	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46450	Toxaphene	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.47600	PCB 1016	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47650	PCB 1221	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47700	PCB 1232	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47750	PCB 1242	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47800	PCB 1248	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47850	PCB 1254	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.47900	PCB 1260	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47950	PCB 1262	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.48000	PCB 1268	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.55350	D (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55400	Dalapon	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55450	DB (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55550	Dicamba	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55650	Dichlorprop	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55700	Dinoseb	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55800	MCPA	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55850	MCPP	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55900	Nitrophenol (4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55950	Pentachlorophenol	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56050	T (2,4,5-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56100	TP (2,4,5-) (Silvex)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.58650	Dinitrobenzene (1,3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58700	Dinitrotoluene (2,4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58750	Dinitrotoluene (2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58800	Dinitrotoluene (2-amino-4,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58850	Dinitrotoluene (4-amino-2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58900	HMX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58950	Nitrobenzene	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59000	Nitroglycerine	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59050	Nitrotoluene (2-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59100	Nitrotoluene (3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59150	Nitrotoluene (4-)	HPLC, UV Detector	SW-846 8330B	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.59200	PETN	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59250	RDX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59300	Tetryl	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59350	Trinitrobenzene (1,3,5-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59400	Trinitrotoluene (2,4,6-)	HPLC, UV Detector	SW-846 8330B	PA

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.33750	Dioxane (1,4-)	SPE, GC/MS/SIM	EPA 522	PA
Certified	Yes	NPW11.38400	Acetone	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38450	Acetonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38500	Acrolein	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38550	Acrylonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38600	Allyl chloride	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38750	Benzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38800	Bromobenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38850	Bromochloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38900	Bromodichloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39000	Bromoform	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39050	Bromomethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39100	Butadiene (2-chloro-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39200	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39400	Butylbenzene (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.39450	Carbon disulfide	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39500	Carbon tetrachloride	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39550	Chlorobenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39600	Chloroethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39650	Chloroethyl vinyl ether (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39700	Chloroform	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39750	Chloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39800	Chlorotoluene (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39850	Chlorotoluene (4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39950	Cyclohexane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40050	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40100	Dibromochloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40105	Dibromoethane (1,2-) (EDB)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40200	Dibromomethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40300	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40350	Dichlorobenzene (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40400	Dichlorobenzene (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40450	Dichlorobenzene (1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40500	Dichlorodifluoromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40550	Dichloroethane (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40600	Dichloroethane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40650	Dichloroethene (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40700	Dichloroethene (cis-1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40750	Dichloroethene (trans-1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.40800	Dichloropropane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40850	Dichloropropane (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40900	Dichloropropane (2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40950	Dichloropropene (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41000	Dichloropropene (cis-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41050	Dichloropropene (trans-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41100	Diethyl ether (Ethyl ether)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41150	Diisopropyl Ether (DIPE)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41350	Ethyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41400	Ethyl methacrylate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41450	Ethylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41500	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41550	Heptane (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41600	Hexachlorobutadiene (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41650	Hexane (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41700	Hexanone (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41750	Iso-butyl alcohol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41850	Isopropanol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42000	Isopropylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42100	Methacrylonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42150	Methyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42300	Methyl iodide	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42350	Methyl isobutyl ketone (MIBK)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42400	Methyl methacrylate	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.42450	Methyl tert-butyl ether	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42500	Methylcyclohexane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42550	Methylene chloride (Dichloromethane)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42600	Naphthalene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42650	Nitropropane (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42700	Octane (-n)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42750	Pentachloroethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42800	Propionitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42850	Propyl Alcohol (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42900	Propylbenzene (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43000	Styrene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43050	tert-Amylmethyl ether (TAME)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43150	Tert-butyl alcohol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43200	Tert-butylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43250	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43300	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43350	Tetrachloroethene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43400	Tetrahydrofuran	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43450	Toluene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43500	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43550	Trichlorobenzene (1,2,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43600	Trichlorobenzene (1,2,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43650	Trichloroethane (1,1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43700	Trichloroethane (1,1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.43750	Trichloroethene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43800	Trichlorofluoromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43850	Trichloropropane (1,2,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43950	Trimethylbenzene (1,2,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44000	Trimethylbenzene (1,3,5-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44050	Vinyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44100	Vinyl chloride	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44150	Xylene (m- + p-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44250	Xylene (o-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44350	Xylenes (total)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44400	Acenaphthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44450	Acenaphthylene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44500	Acetophenone	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44650	Alpha - terpineol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44800	Aniline	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44850	Anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45000	Atrazine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45200	Benzidine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45250	Benzo(a)anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45300	Benzo(a)pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45350	Benzo(b)fluoranthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45400	Benzo(ghi)perylene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45500	Benzo(k)fluoranthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45550	Benzoic acid	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45600	Benzyl alcohol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45700	Bis (2-chloroethoxy) methane	Extract, GC/MS	EPA 625.1	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.45750	Bis (2-chloroethyl) ether	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45800	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45850	Bis (2-ethylhexyl) phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46000	Bromophenyl-phenyl ether (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46050	Butylbenzylphthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46250	Carbazole	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46400	Chloroaniline (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46550	Chloronaphthalene (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46650	Chlorophenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46700	Chlorophenyl-phenyl ether (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46900	Chrysene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47050	Decane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47500	Dibenzo(a,h)anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47650	Dibenzofuran	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47700	Dichloroaniline (2,3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47750	Dichlorobenzidine (3,3'-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47800	Dichlorophenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47850	Dichlorophenol (2,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47950	Diethyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48000	Dimethoate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48100	Dimethyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48250	Dimethylphenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48300	Di-n-butyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48350	Dinitrobenzene (1,3-)	Extract, GC/MS	EPA 625.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.48400	Dinitrophenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48450	Dinitrophenol (2-methyl-4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48500	Dinitrotoluene (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48550	Dinitrotoluene (2,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48600	Di-n-octyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48700	Diphenylhydrazine / Azobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49250	Fluoranthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49300	Fluorene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49350	Hexachlorobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49400	Hexachlorobutadiene (1,3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49450	Hexachlorocyclopentadiene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49500	Hexachloroethane	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49700	Indeno(1,2,3-cd)pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49800	Isophorone	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50350	Methyl phenol (4-chloro-3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50430	Methylnaphthalene (1-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50450	Methylnaphthalene (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50550	Methylphenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50600	Methylphenol (3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50650	Methylphenol (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50950	Naphthalene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51100	Napththylamine (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51150	Nitroaniline (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51200	Nitroaniline (3-)	Extract, GC/MS	EPA 625.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.51250	Nitroaniline (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51300	Nitrobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51350	Nitrophenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51400	Nitrophenol (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51450	N-Nitrosodiethylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51500	N-Nitrosodimethylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51530	N-Nitroso-di-n-butylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51550	N-Nitroso-di-n-propylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51600	N-Nitrosodiphenylamine / Diphenylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51800	N-Nitrosopyrrolidine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51900	Octadecane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52500	Pentachloronitrobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52550	Pentachlorophenol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52700	Phenanthrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52750	Phenol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.53400	Pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.53450	Pyridine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55100	Tetrachlorobenzene (1,2,4,5-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55150	Tetrachlorophenol (2,3,4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55400	Trichlorobenzene (1,2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55500	Trichlorophenol (2,4,5-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55550	Trichlorophenol (2,4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.56650	TCDD (2,3,7,8-)	GC/MS	EPA 625.1 (screen only)	PA
Certified	Yes	NPW11.68750	Acetone	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68800	Acetonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.68850	Acrolein	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68900	Acrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68950	Allyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69050	Amyl alcohol (t-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69100	Benzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69150	Benzyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69200	Bromobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69250	Bromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69300	Bromodichloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69400	Bromoform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69450	Bromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69500	Butadiene (2-chloro-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69650	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69850	Butylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69900	Carbon disulfide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69950	Carbon tetrachloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70000	Chlorobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70050	Chloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70100	Chloroethyl vinyl ether (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70150	Chloroform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70200	Chloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70250	Chlorotoluene (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70300	Chlorotoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70400	Cyclohexane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70500	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70550	Dibromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.70600	Dibromoethane (1,2-) (EDB)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70650	Dibromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70750	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70800	Dichlorobenzene (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70850	Dichlorobenzene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70900	Dichlorobenzene (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70950	Dichlorodifluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71000	Dichloroethane (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71050	Dichloroethane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71100	Dichloroethene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71150	Dichloroethene (cis-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71200	Dichloroethene (trans-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71250	Dichloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71300	Dichloropropane (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71350	Dichloropropane (2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71400	Dichloropropene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71450	Dichloropropene (cis-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71500	Dichloropropene (trans-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71550	Diethyl ether (Ethyl ether)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71600	Diisopropyl Ether (DIPE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71650	Dioxane (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71800	Ethyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71850	Ethyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71900	Ethylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.71950	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72000	Heptane (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72050	Hexachlorobutadiene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72100	Hexachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72150	Hexane (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72200	Hexanone (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72250	Iso-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72300	Isopropanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72400	Isopropylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72450	Isopropyltoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72500	Methacrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72550	Methyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72600	Methyl acrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72650	Methyl iodide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72700	Methyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72750	Methyl tert-butyl ether	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72800	Methylcyclohexane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72850	Methylene chloride (Dichloromethane)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73000	Naphthalene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73050	Nitrobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73100	Nitropropane (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73200	Octane (-n)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73250	Pentachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73350	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73400	Propionitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.73450	Propylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73500	Sec-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73550	Styrene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73600	tert-Amylmethyl ether (TAME)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73700	Tert-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73750	Tert-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73800	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73850	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73900	Tetrachloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73950	Tetrahydrofuran	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74000	Toluene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74100	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74150	Trichlorobenzene (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74200	Trichlorobenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74250	Trichloroethane (1,1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74300	Trichloroethane (1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74350	Trichloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74400	Trichlorofluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74450	Trichloropropane (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74550	Trimethylbenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74600	Trimethylbenzene (1,3,5-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74700	Vinyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74750	Vinyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74800	Xylene (m-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.74850	Xylene (o-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74900	Xylene (p-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74950	Xylenes (total)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.75150	Acenaphthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75200	Acenaphthylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75250	Acetophenone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75300	Acetylaminofluorene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75400	Alpha - terpineol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75500	Aminobiphenyl (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75600	Aniline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75650	Anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75700	Aramite	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75750	Atrazine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75850	Benzaldehyde	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75950	Benzidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76000	Benzo(a)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76050	Benzo(a)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76100	Benzo(b)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76150	Benzo(ghi)perylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76250	Benzo(k)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76300	Benzoic acid	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76400	Benzyl alcohol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76550	Biphenyl (1,1'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76600	Bis (2-chloroethoxy) methane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76650	Bis (2-chloroethyl) ether	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.76700	Bis(2-chloroisopropyl) ether 2,2'-oxybis(1-chloropropane)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76750	Bis (2-ethylhexyl) phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76800	Bromophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76850	Butylbenzylphthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76900	Caprolactam	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76950	Carbazole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77150	Chloroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77200	Chlorobenzilate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77250	Chloronaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77300	Chloronaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77350	Chlorophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77400	Chlorophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77450	Chrysene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77650	Decane (n-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77750	Diallate (cis)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77800	Diallate (trans)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77900	Dibenz(a,j)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78000	Dibenzo(a,h)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78200	Dibenzofuran	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78250	Dichlorobenzene (1,2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78300	Dichlorobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78350	Dichlorobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78400	Dichlorobenzidine (3,3'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78450	Dichlorophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.78500	Dichlorophenol (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78600	Diethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78650	Dimethoate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78700	Dimethyl benzidine (3,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78750	Dimethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78800	Dimethylaminoazobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79050	Dimethylbenz(a) anthracene (7,12-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79100	Dimethylphenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79150	Di-n-butyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79200	Dinitrobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79250	Dinitrobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79300	Dinitrophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79350	Dinitrophenol (2-methyl-4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79400	Dinitrotoluene (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79450	Dinitrotoluene (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79500	Di-n-octyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Dropped	No	NPW11.79550	Dinoseb	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79600	Dioxane (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79650	Diphenylhydrazine / Azobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79700	Disulfoton	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80100	Famphur	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80150	Fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80200	Fluorene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80350	Hexachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.80400	Hexachlorobutadiene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80450	Hexachlorocyclopentadiene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80500	Hexachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80550	Hexachlorophene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80600	Hexachloropropene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80750	Indeno(1,2,3-cd)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80800	Isodrin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80850	Isophorone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80900	Isosafrole (cis-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80950	Isosafrole (trans-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81000	Kepone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81100	Methanesulfonate (Ethyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81150	Methanesulfonate (Methyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81200	Methapyrilene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81300	Methyl phenol (4-chloro-3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81350	Methylcholanthrene (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81400	Methylnaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81450	Methylnaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81500	Methylphenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81550	Methylphenol (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81600	Methylphenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81650	Naphthalene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81700	Napthoquinone (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81750	Napththylamine (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.81800	Napththylamine (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81850	Nitroaniline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81900	Nitroaniline (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81950	Nitroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82000	Nitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82100	Nitrophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82150	Nitrophenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82200	N-Nitrosodiethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82250	N-Nitrosodimethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82300	N-Nitroso-di-n-butylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82350	N-Nitroso-di-n-propylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82400	N-Nitrosodiphenylamine / Diphenylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82450	N-Nitrosomethylethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82500	N-Nitrosomorpholine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82550	N-Nitrosopiperidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82600	N-Nitrosopyrrolidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82650	Octadecane (n-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82700	Parathion	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82750	Parathion methyl	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83150	Pentachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83200	Pentachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83250	Pentachloronitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83300	Pentachlorophenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83350	Phenacetin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83400	Phenanthrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83450	Phenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.83500	Phenylenediamine (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83550	Phenylethylamine (alpha, alpha-Dimethyl)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83600	Phorate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83650	Phosphorothioate (O,O,O-triethyl)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83700	Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83750	Picoline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83800	Pronamide	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83850	Pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83900	Pyridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84000	Quinoline -1-Oxide (4-Nitro)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84100	Safrole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84150	Sulfotepp	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84350	Tetrachlorobenzene (1,2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84400	Tetrachlorophenol (2,3,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84450	Toluidine (2-) (2-Methylaniline)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84550	Toluidine (5-nitro-2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84650	Trichlorobenzene (1,2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84700	Trichlorophenol (2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84750	Trichlorophenol (2,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Applied	No	NPW11.84850	Trinitrobenzene (1,3,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84900	Acenaphthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84950	Acenaphthylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85000	Anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.85050	Benzo(a)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85100	Benzo(a)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85150	Benzo(b)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85200	Benzo(ghi)perylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85250	Benzo(k)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85300	Chrysene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85350	Dibenzo(a,h)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85550	Dioxane (1,4-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85600	Fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85650	Fluorene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85700	Hexachlorobenzene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85800	Hexachlorocyclopentadiene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85850	Indeno(1,2,3-cd)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85950	Methylnaphthalene (1-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86000	Methylnaphthalene (2-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86050	Naphthalene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86150	Pentachlorophenol	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86200	Phenanthrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86250	Pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.89700	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T, Capillary Column	User Defined SW 846 8015D	PA
Certified	Yes	NPW11.91750	Ethyl acetate	GC/MS, P & T, Capillary Column	User Defined SW 846 8015D	PA
Certified	Yes	NPW11.93400	Dinitrotoluene (2,4-)	GC/MS/SIM, Extract or Dir Inj, Capillary	User Defined SW-846 8270E	PA
Certified	Yes	NPW11.93450	Dinitrotoluene (2,6-)	GC/MS/SIM, Extract or Dir Inj, Capillary	User Defined SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: NPW16--NPW - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW16.04800	Perchlorate	Ion Chromatography	User Defined EPA 314.0	PA

Category: SCM01--Microbiology

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM01.00100	Fecal coliform	Multiple Tube LTB and EC	EPA 1680, 2010	PA
Certified	Yes	SCM01.00200	Fecal coliform	Membrane Filter	SM 9222 D-06 (Class B only) plus EPA 625/R-92/013 App. F	PA

Category: SCM02--Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM02.00200	Chlorine - total, petroleum	Combustion, Microcoulometry	SW-846 9076	PA
Certified	Yes	SCM02.00450	Free liquid	Flow-Through Paint Filter, Observation	SW-846 9095B	PA
Certified	Yes	SCM02.00560	Ignitability	Pensky-Martin	SW-846 1010B	PA
Certified	Yes	SCM02.00700	Ignitability of solids	Burn Rate	SW-846 1030	PA
Certified	Yes	SCM02.00800	pH - soil and waste	Mix with Water or Calcium Chlorides	SW-846 9045D	PA

Category: SCM03--Inorganic Parameters and Preparation

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Applied	No	SCM03.00100	Ammonia	Distillation, Electrode	SM 4500-NH3 B plus D-11	PA
Certified	Yes	SCM03.00500	Bromide	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.00550	Bromide	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.00650	Chemical oxygen demand	Spectrophotometric Manual/Auto	EPA 410.4	PA
Certified	Yes	SCM03.00850	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.00900	Chloride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.01150	Cyanide	Distillation	SW-846 9010C	PA
Certified	Yes	SCM03.01250	Cyanide	Colorimetric, Automated	SW-846 9012B	PA
Certified	Yes	SCM03.01750	Extractable organic halides (EOX)	Extraction	SW-846 9023	PA
Certified	Yes	SCM03.01900	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.01950	Fluoride	Ion Chromatography	SW-846 9056A	PA
Applied	No	SCM03.02100	Inorganics	Shake, Extraction with Water	ASTM D3987-12	PA
Applied	No	SCM03.02550	Kjeldahl nitrogen - total	Digestion, Distillation, Semi-auto., Phenate	SM 4500-N Org C-11 plus NH3 B plus NH3 G-11	PA
Certified	Yes	SCM03.02650	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.02700	Nitrate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.03050	Nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.03100	Nitrite	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.03200	Oil & grease - sludge-hem	Extraction & Gravimetric	SW-846 9071B	PA
Certified	Yes	SCM03.03250	Oil & grease - sludge-hem-npm	Extraction & Gravimetric	SW-846 9071B	PA
Certified	Yes	SCM03.03650	Phenols	Colorimetric, Auto, 4AAP Distillation	SW-846 9066	PA
Certified	Yes	SCM03.03800	Phosphorus (total)	Auto Ascorbic Acid Reduction	EPA 365.1	PA
Certified	Yes	SCM03.04150	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.04200	Sulfate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.04450	Sulfides, acid sol. & insol.	Redox Titration	SW-846 9030B	PA
Certified	Yes	SCM03.04500	Sulfides, acid sol. & insol.	Titration	SW-846 9034	PA
Certified	No	SCM03.04650	Total organic carbon (TOC)	Infrared Spectrometry or FID	Other NJ Modified SM-846 9060A	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM03--Inorganic Parameters and Preparation

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM03.05000	Total, fixed, and volatile solids (SQAR)	Gravimetric, 500 Degrees C	SM 2540 G SM 18th Ed.	PA

Category: SCM05--Metals - SCM Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM05.00050	Metals	Acid Digestion, Soil Sediment & Sludge	SW-846 3050B	PA
Certified	Yes	SCM05.00100	Metals	Chromium VI Digestion	SW-846 3060A	PA
Certified	Yes	SCM05.00350	Metals	Microwave Acid Digest: Soil Sediment & Sludge	SW-846 3051A	PA
Certified	Yes	SCM05.00550	Metals	Synthetic PPT Leachate Procedure	SW-846 1312	PA
Certified	Yes	SCM05.00600	Metals	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA

Category: SCM06--Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM06.02600	Chromium (VI)	Colorimetric	SW-846 7196A	PA
Certified	Yes	SCM06.02800	Mercury - solid waste	AA, Manual Cold Vapor	SW-846 7471B	PA

Category: SCM07--Metals - ICP, ICP/MS and DCP

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.00001	Aluminum	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00050	Antimony	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00100	Arsenic	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00150	Barium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00200	Beryllium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00250	Boron	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00300	Cadmium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00350	Calcium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00400	Chromium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00450	Cobalt	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00500	Copper	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00550	Iron	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00600	Lead	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00650	Lithium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00700	Magnesium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00750	Manganese	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00800	Molybdenum	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00850	Nickel	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00950	Potassium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01000	Selenium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01050	Silver	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01100	Sodium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01150	Strontium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01200	Thallium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01250	Thorium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01300	Tin	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01350	Titanium	ICP	SW-846 6010D	PA
Dropped	No	SCM07.01400	Uranium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01450	Vanadium	ICP	SW-846 6010D	PA

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM07--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.01500	Zinc	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01600	Aluminum	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01650	Antimony	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01700	Arsenic	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01750	Barium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01800	Beryllium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01900	Cadmium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01950	Calcium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02000	Chromium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02050	Cobalt	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02100	Copper	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02150	Iron	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02200	Lead	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02250	Magnesium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02300	Manganese	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02350	Molybdenum	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02400	Nickel	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02450	Potassium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02500	Selenium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02600	Silver	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02650	Sodium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02700	Strontium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02750	Thallium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02850	Tin	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02900	Titanium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.03000	Uranium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.03050	Vanadium	ICP/MS	SW-846 6020B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM07--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.03100	Zinc	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.04200	Sulfur	Closed Vessel Sample Preparation, ICP	User Defined SW-846 6010D	PA

Category: SCM08--Organics - SCM Prep. / Screening Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM08.00500	Organics	Waste Dilution	SW-846 3580A	PA
Certified	Yes	SCM08.00700	Semivolatile organics	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA
Certified	Yes	SCM08.00900	Semivolatile organics	Microwave Extraction	SW-846 3546	PA
Applied	No	SCM08.01350	Semivolatile organics	Cleanup-Florisil	SW-846 3620C	PA
Certified	Yes	SCM08.01400	Semivolatile organics	Cleanup-Silica Gel	SW-846 3630C	PA
Certified	Yes	SCM08.01550	Semivolatile organics	Cleanup-Sulfur Removal	SW-846 3660B	PA
Certified	Yes	SCM08.01600	Semivolatile organics	Cleanup-Sulfuric Acid/KMnO4	SW-846 3665A	PA
Certified	Yes	SCM08.01850	Volatile organics	TCLP, Toxicity Procedure, ZHE	SW-846 1311	PA
Certified	Yes	SCM08.02050	Volatile organics - high conc.	Methanol Extract, Closed System P & T	SW-846 5035A	PA
Certified	Yes	SCM08.02100	Volatile organics - low conc.	Closed System Purge & Trap	SW-846 5035A	PA

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.00150	Extractable Petroleum Hydrocarbons	Extraction, GC, FID	Other NJDEP EPH 10/08, Rev. 3	NJ
Certified	Yes	SCM09.00450	Diesel range organic	Extraction, GC, FID	SW-846 8015D	PA
Certified	Yes	SCM09.00500	Gasoline range organic	GC P&T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.00900	Acetonitrile	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01000	Allyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01200	Ethyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01300	Iso-butyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01400	Methyl alcohol (Methanol)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01700	Propyl Alcohol (n-)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01750	Tert-butyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01950	Ethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	SCM09.02050	Propylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	SCM09.05600	Alachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05650	Aldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05700	Alpha BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05800	Beta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05850	Chlordane (alpha) (cis-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05900	Chlordane (gamma) (trans-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05950	Chlordane (technical)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06300	DDD (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06350	DDE (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06400	DDT (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06450	Delta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06500	Dieldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06550	Endosulfan I	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06600	Endosulfan II	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.06650	Endosulfan sulfate	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06700	Endrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06750	Endrin aldehyde	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06800	Endrin ketone	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06900	Heptachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06950	Heptachlor epoxide	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07100	Lindane (gamma BHC)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07150	Methoxychlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07300	Mirex	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07500	Toxaphene	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.08700	PCB 1016	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08750	PCB 1221	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08800	PCB 1232	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08850	PCB 1242	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08900	PCB 1248	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08950	PCB 1254	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09000	PCB 1260	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09050	PCB 1262	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09100	PCB 1268	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09105	PCB 1016 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09110	PCB 1221 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09115	PCB 1232 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09120	PCB 1242 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09125	PCB 1248 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09130	PCB 1254 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09135	PCB 1260 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.15400	D (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.15450	Dalapon	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.15500	DB (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16000	Dicamba	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16100	Dichlorprop	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16150	Dinoseb	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16250	MCPA	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16300	MCPP	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16350	Nitrophenol (4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16400	Pentachlorophenol	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16500	T (2,4,5-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16550	TP (2,4,5-) (Silvex)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.18800	Dinitrobenzene (1,3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18850	Dinitrotoluene (2,4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18900	Dinitrotoluene (2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18950	Dinitrotoluene (2-amino-4,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19000	Dinitrotoluene (4-amino-2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19050	HMX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19100	Nitrobenzene	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19150	Nitroglycerine	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19200	Nitrotoluene (2-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19250	Nitrotoluene (3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19300	Nitrotoluene (4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19350	PETN	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19400	RDX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19450	Tetryl	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19500	Trinitrobenzene (1,3,5-)	HPLC, UV Detector	SW-846 8330B	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.19550	Trinitrotoluene (2,4,6-)	HPLC, UV Detector	SW-846 8330B	PA

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.22900	Acetone	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.22950	Acetonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23000	Acrolein	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23050	Acrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23100	Allyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23130	Amyl alcohol (t-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23200	Benzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23250	Benzyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23300	Bromobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23350	Bromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23400	Bromodichloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23500	Bromoform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23550	Bromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23600	Butadiene (2-chloro-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23650	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23800	Butylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23850	Carbon disulfide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23900	Carbon tetrachloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23950	Chlorobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.24000	Chloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24100	Chloroform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24150	Chloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24200	Chlorotoluene (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24250	Chlorotoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24330	Cyclohexane	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24400	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24450	Dibromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24500	Dibromoethane (1,2-) (EDB)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24550	Dibromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24650	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24700	Dichlorobenzene (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24750	Dichlorobenzene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24800	Dichlorobenzene (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24850	Dichlorodifluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24900	Dichloroethane (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24950	Dichloroethane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25000	Dichloroethene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25050	Dichloroethene (cis-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25100	Dichloroethene (trans-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25150	Dichloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25200	Dichloropropane (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25250	Dichloropropane (2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25300	Dichloropropene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.25350	Dichloropropene (cis-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25400	Dichloropropene (trans-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25450	Diethyl ether (Ethyl ether)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25500	Diisopropyl Ether (DIPE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25550	Dioxane (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25650	Ethyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25700	Ethyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25750	Ethylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25800	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25830	Heptane (n-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25850	Hexachlorobutadiene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25900	Hexachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25930	Hexane (n-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25950	Hexanone (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26000	Iso-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26050	Isopropanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26150	Isopropylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26200	Isopropyltoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26250	Methacrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26280	Methyl acetate	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26300	Methyl acrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26330	Methylcyclohexane	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26350	Methyl iodide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26400	Methyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26450	Methyl tert-butyl ether	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.26500	Methylene chloride (Dichloromethane)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26650	Naphthalene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26700	Nitrobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26730	Nitropropane (2-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26780	Octane (-n)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26800	Pentachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26850	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26900	Propionitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26950	Propylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27000	Sec-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27050	Styrene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27100	tert-Amylmethyl ether (TAME)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27200	Tert-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27250	Tert-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27300	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27350	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27400	Tetrachloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27450	Tetrahydrofuran	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27500	Toluene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27600	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27650	Trichlorobenzene (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27700	Trichlorobenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27750	Trichloroethane (1,1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27800	Trichloroethane (1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.27850	Trichloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27900	Trichlorofluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27950	Trichloropropane (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28000	Trimethylbenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28050	Trimethylbenzene (1,3,5-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28150	Vinyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28200	Vinyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28250	Xylene (m-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28300	Xylene (o-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28350	Xylene (p-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28400	Xylenes (total)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28900	Acenaphthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.28950	Acenaphthylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29000	Acetophenone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29050	Acetylaminofluorene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29200	Alpha - terpineol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29300	Aminobiphenyl (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29350	Aniline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29450	Anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29500	Aramite	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29550	Atrazine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29650	Benzaldehyde	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29750	Benzidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29800	Benzo(a)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29850	Benzo(a)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29900	Benzo(b)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.29950	Benzo(ghi)perylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30050	Benzo(k)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30100	Benzoic acid	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30200	Benzyl alcohol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30350	Biphenyl (1,1'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30400	Bis (2-chloroethoxy) methane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30450	Bis (2-chloroethyl) ether	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30500	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30550	Bis (2-ethylhexyl) phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30600	Bromophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30650	Butylbenzylphthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30700	Caprolactam	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30750	Carbazole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30950	Chloroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31000	Chlorobenzilate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31050	Chloronaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31100	Chloronaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31150	Chlorophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31200	Chlorophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31250	Chrysene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31450	Decane (n-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31550	Diallate (cis)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31600	Diallate (trans)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31700	Dibenz(a,j)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.31800	Dibenzo(a,h)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32000	Dibenzofuran	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32050	Dichlorobenzene (1,2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32100	Dichlorobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32150	Dichlorobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32200	Dichlorobenzidine (3,3'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32250	Dichlorophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32300	Dichlorophenol (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32400	Diethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32450	Dimethoate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32500	Dimethyl benzidine (3,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32550	Dimethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32600	Dimethylaminoazobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32850	Dimethylbenz(a) anthracene (7,12-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32900	Dimethylphenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32950	Di-n-butyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33000	Dinitrobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33050	Dinitrobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33100	Dinitrophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33150	Dinitrophenol (2-methyl-4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33200	Dinitrotoluene (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33250	Dinitrotoluene (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33300	Di-n-octyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33400	Dioxane (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33450	Diphenylhydrazine / Azobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.33950	Fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34000	Fluorene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34150	Hexachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34200	Hexachlorobutadiene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34250	Hexachlorocyclopentadiene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34300	Hexachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34400	Hexachloropropene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34550	Indeno(1,2,3-cd)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34600	Isodrin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34650	Isophorone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34700	Isosafrole (cis-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34750	Isosafrole (trans-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34800	Kepone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34900	Methanesulfonate (Ethyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34950	Methanesulfonate (Methyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35000	Methapyrilene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35100	Methyl phenol (4-chloro-3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35150	Methylcholanthrene (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35200	Methylnaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35250	Methylnaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35300	Methylphenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35350	Methylphenol (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35400	Methylphenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35450	Naphthalene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.35500	Napthoquinone (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35550	Napththylamine (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35600	Napththylamine (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35650	Nitroaniline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35700	Nitroaniline (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35750	Nitroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35800	Nitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35900	Nitrophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35950	Nitrophenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36000	N-Nitrosodiethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36050	N-Nitrosodimethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36100	N-Nitroso-di-n-butylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36150	N-Nitroso-di-n-propylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36200	N-Nitrosodiphenylamine / Diphenylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36250	N-Nitrosomethylethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36300	N-Nitrosomorpholine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36350	N-Nitrosopiperidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36400	N-Nitrosopyrrolidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36450	Octadecane (n-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36950	Pentachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37000	Pentachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37050	Pentachloronitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37100	Pentachlorophenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37150	Phenacetin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37200	Phenanthrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37250	Phenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Applied	No	SCM10.37300	Phenylenediamine (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37450	Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37500	Phosphorothioate (O,O,O-triethyl)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37550	Picoline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37600	Pronamide	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37650	Pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37700	Pyridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37800	Quinoline -1-Oxide (4-Nitro)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37850	Resorcinol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37900	Safrole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37950	Sulfotepp	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38150	Tetrachlorobenzene (1,2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38200	Tetrachlorophenol (2,3,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38250	Toluidine (2-) (2-Methylaniline)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38350	Toluidine (5-nitro-2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38450	Trichlorobenzene (1,2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38500	Trichlorophenol (2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38550	Trichlorophenol (2,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38700	Acenaphthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38750	Acenaphthylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38800	Anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38850	Benzo(a)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38900	Benzo(a)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.38950	Benzo(b)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39000	Benzo(ghi)perylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39050	Benzo(k)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39100	Chrysene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39150	Dibenzo(a,h)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39250	Dioxane (1,4-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39300	Fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39350	Fluorene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39400	Hexachlorobenzene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39550	Indeno(1,2,3-cd)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39600	Methylnaphthalene (1-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39650	Methylnaphthalene (2-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39700	Naphthalene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39800	Pentachlorophenol	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39850	Phenanthrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39900	Pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Category: SCM14--SCM - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM14.02450	Perchlorate	Ion Chromatography	User Defined EPA 314.0	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: ALS ENVIRONMENTAL - MIDDLETOWN Laboratory Number: PA010 Activity ID: NLC 220001
301 FULLING MILL RD
MIDDLETOWN PA 17057

Michele M. Potter, Manager

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

EUROFINS LANCASTER LABORATORIES ENVIRONMENT TESTING LLC
2425 New Holland Pike
Lancaster, PA 17601
Kenneth Boley Phone: 717-556-9413

ENVIRONMENTAL

Valid To: November 30, 2022 Certificate Number: 0001.01

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.4 of the DoD/DOE Quality Systems Manual for Environmental Laboratories, accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP-MS Spectrometry, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Misc.-Electronic Probes (pH, F^-, O_2), Oxygen Demand, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, TCLP, Total Organic Carbon, Turbidity, Liquid Chromatography/Mass Spectrometry/Mass Spectrometry, High Resolution Gas Chromatography/Mass Spectrometry

Parameter/Analyte	**Drinking Water**	**Non-Potable Water**	**Solid Hazardous Waste**	
			Aqueous	**Solid**
Demands				
COD	----------	EPA 410.4	----------	----------
Total Organic Carbon	----------	EPA 9060A SM 5310C-2011	EPA 9060A SM 5310C-2011	EPA 9060A SM 5310 B-2011
Anions				
Ammonia	----------	EPA 350.1	EPA 350.1	SM 4500-NH3 B/C-2011
Fluoride	----------	EPA 300.0 EPA 9056A	EPA 9056A	EPA 9056A EPA 300.0
Nitrate (as N)	----------	EPA 300.0 EPA 9056A	EPA 9056A	EPA 9056A EPA 300.0
Nitrite (as N)	----------	EPA 300.0 EPA 9056A	EPA 9056A	EPA 9056A EPA 300.0

5202 Presidents Court, Suite 220 | Frederick, MD 21703-8398 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Parameter/Analyte	Drinking Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Bromide	----------	EPA 300.0 EPA 9056A	EPA 9056A	
Chloride	----------	EPA 300.0 EPA 9056A	EPA 9056A	EPA 9056A EPA 300.0
Sulfate	----------	EPA 300.0 EPA 9056A	EPA 9056A	EPA 9056A EPA 300.0
Wet Chemistry				
Alkalinity	----------	SM 2320B-2011	----------	----------
Corrosivity	----------	----------	SW-846 Chapter 7	SW-846 Chapter 7
Cyanide	----------	EPA 9012B	EPA 9012B	EPA 9012B
Filterable Residue (TDS)	----------	SM 2540C-2011	----------	----------
Flashpoint	----------	----------	EPA1010A	EPA 1010A
Grain Size	----------	----------	----------	ASTM D422 MOD
Hexavalent Chromium Digestion	----------	----------	----------	EPA 3060A
Hexavalent Chromium	----------	EPA 7196A EPA 7199	EPA 7196A EPA 7199	EPA 7196A EPA 7199
Ignitability	----------	----------	40 CFR 261.21	40 CFR 261.21
Nitrate/Nitrite	----------	----------	EPA 353.2	----------
Non-filterable Residue (TSS)	----------	SM 2540D-2011	----------	----------
pH	----------	SM 4500 H+B-2011 EPA 9040B EPA 9040C	EPA 9040B EPA 9040C	EPA 9045C EPA 9045D
Phenol	----------	EPA 9066	EPA 9066	----------
Reactivity	----------	----------	SW-846 Chapter 7.3	SW-846 Chapter 7.3
Sulfide	----------	EPA 376.1 EPA 376.2 SM 4500 S2D-2011 SM 4500 S2F-2011	----------	----------
Total Residue	----------	SM 2540B-2011	----------	SM 2540G-2011
Metals				
Metals Digestion	----------	EPA 3005A EPA 3010A EPA 3020A	EPA 3010A EPA 3020A	EPA 3050B
Aluminum	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Antimony	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Arsenic	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B

Parameter/Analyte	Drinking Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Barium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Beryllium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Boron	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Cadmium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Calcium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Chromium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Cobalt	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Copper	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Iron	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Lead	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Lithium	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Molybdenum	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Magnesium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B

Parameter/Analyte	Drinking Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Manganese	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Mercury	----------	EPA 7470A	EPA 7470A	EPA 7471A EPA 7471B
Nickel	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Potassium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Selenium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Silicon	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Silver	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Sodium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Strontium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Sulfur	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Thallium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Thorium	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Tin	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Titanium	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Tungsten	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D

Parameter/Analyte	Drinking Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Uranium	----------	EPA 6020A EPA 6020B	EPA 6020A EPA 6020B	EPA 6020A EPA 6020B
Vanadium	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Zinc	----------	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B	EPA 6010C EPA 6010D EPA 6020A EPA 6020B
Zirconium	----------	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D	EPA 6010C EPA 6010D
Purgeable Organics (Volatiles)				
Volatile Preparation	----------	EPA 5030C	EPA 5030C	EPA 5035A
Acetone	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Acetonitrile	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Acrolein	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Acrylonitrile	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Allyl chloride	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
tert-Amyl Alcohol	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
tert-Amyl Methyl Ether	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
tert-Butyl Alcohol	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
tert-Butyl Formate	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Benzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Bromobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Bromochloromethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Bromodichloromethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Bromoform	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Bromomethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Butanone	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
n-Butylbenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
sec-Butylbenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
tert-Butylbenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Carbon disulfide	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Carbon tetrachloride	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Chloro-1,3-butadiene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chloroacetonitrile	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chlorobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1-Chlorobutane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chlorodifluoromethane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Chloroethyl Vinyl Ether	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chloroform	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D

Parameter/Analyte	Drinking Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
1-Chlorohexane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Chloromethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Chlorotoluene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
4-Chlorotoluene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Cyclohexane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Cyclohexanone	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Di-Isopropyl ether	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Dibromochloromethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2-Dibromo-3-chloropropane	EPA 524.2	EPA 8260C/D EPA 8011	EPA 8260C/D EPA 8011	EPA 8260C/D
Dibromomethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2-Dibromoethane (EDB)	----------	EPA 8260C/D EPA 8011	EPA 8260C/D EPA 8011	EPA 8260C/D
1,2-Dichlorobenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,3-Dichlorobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,4-Dichlorobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
trans-1,4-dichloro-2-butene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Dichlorodi-fluoromethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1-Dichloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2-Dichloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1-Dichloroethene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
cis-1,2-Dichloroethene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
trans-1,2-Dichloroethene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Dichlorofluoromethane	EPA 524.2	----------	----------	----------
1,2-Dichloropropane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,3-Dichloropropane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2,2-Dichloropropane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1-Dichloropropene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
cis-1,3-Dichloropropene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
trans-1,3-Dichloropropene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,4-Dioxane	----------	EPA 8260C/D EPA 8260C/D SIM	EPA 8260C/D EPA 8260C/D SIM	EPA 8260C/D EPA 8260C/D SIM
Ethanol	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Ethylbenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Ethyl ether	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Ethyl Methacrylate	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Ethyl Tert-Butyl Ether	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Freon-113	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Gasoline Range Organics (GRO) [Volatile Petroleum Hydrocarbons (VPH)]	----------	EPA 8015C EPA 8015D EPA 8260C/D NW TPH-Gx MA VPH AK101	EPA 8015C EPA 8015D EPA 8260C/D NW TPH-Gx MA VPH AK101	EPA 8015C EPA 8015D EPA 8260C/D NW TPH-Gx MA VPH AK101
Heptane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Hexane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Hexanone	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Hexachlorobutadiene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Hexachloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Isobutyl Alcohol	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Isopropyl Alcohol	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Isopropylbenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,4-Isopropyltoluene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methylacrylonitrile	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methyl Acetate		EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methyl Acrylate	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methyl Iodide	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methylene Chloride	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methyl Methacrylate	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methyl Tert-Butyl Ether	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
4-Methyl-2-pentanone	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Methylcyclohexane		EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
2-Nitropropane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Naphthalene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Pentachloroethane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Propionitrile	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
n-Propylbenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Styrene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Tert-Amyl Ethyl Ether		EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1,1,2-Tetrachloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1,2,2-Tetrachloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Tetrachloroethene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Tetrahydrofuran	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Toluene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2,3-Trichlorobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2,4-Trichlorobenzene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1,1-Trichloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,1,2-Trichloroethane	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Trichloroethene	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Trichlorofluoromethane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2,3-Trichloropropane	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2,4-Trimethylbenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,3,5-Trimethylbenzene	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Vinyl Acetate	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Vinyl Chloride	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
Xylenes, Total	----------	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,2-Xylene (o-Xylene)	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D
1,3+1,4-Xylene (m+p Xylene)	EPA 524.2	EPA 8260C/D	EPA 8260C/D	EPA 8260C/D

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Extractable Organics (Semivolatiles)				
Acenaphthene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Acenaphthylene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Acetophenone	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Acetylaminofluorene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Alkylated PAHs	----------	EPA 8270D/E SIM	EPA 8270D/E SIM	EPA 8270D/E SIM
4-Aminobiphenyl	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Amino-4,6-dinitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
4-Amino-2,6-dinitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
Aniline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Anthracene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Atrazine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Benzaldehyde	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Benzidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Benzoic acid	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Benzo (a) anthracene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Benzo (b) fluoranthene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Benzo (k) fluoranthene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Benzo (ghi) perylene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Benzo (a) pyrene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Benzo (e) pyrene	----------	EPA 8270D/E SIM	EPA 8270D/E SIM	EPA 8270D/E SIM
Benzyl Alcohol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Biphenyl	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
bis (2-Chloroethoxy) Methane	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
bis (2-Chloroethyl) Ether	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
bis (2-Chloroisopropyl) Ether	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
bis (2-Ethylhexyl) Phthalate	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
4-Bromophenylphenyl Ether	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Butyl benzyl Phthalate	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Caprolactam	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Carbazole	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Carbon Range Organics C8-C44 (including subsets of this range i.e. HRO, MRO, ORO, RRO)	----------	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D
4-Chloroaniline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Chloro-3-methylphenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Chlorobenzilate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1-Chloronaphthalene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Chloronaphthalene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Chlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Chlorophenyl phenyl ether	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Chrysene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Cresols (Methyl phenols)	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
cis-/trans-Diallate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4-Diamino-6-nitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
2,6-Diamino-4-nitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
Dibenzo (a,h) acridine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Dibenzo (a,h) anthracene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Dibenzofuran	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
1,2-Dichlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,3-Dichlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,4-Dichlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
3,3-Dichlorobenzidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Diesel Range Organics (DRO) [Extractable Petroleum Hydrocarbons (EPH)]	----------	EPA 8015C EPA 8015D NWTPH DX MA EPH TX1005/1006 AK102/103 AK102/103-SV	EPA 8015C EPA 8015D NWTPH DX MA EPH TX1005/1006 AK102/103 AK102/103-SV	EPA 8015C EPA 8015D NWTPH DX MA EPH TX1005/1006 AK102/103
2,4-Dichlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,6-Dichlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Diethyl Phthalate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Dimethoate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
p-Dimethylaminoazobenze	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
7,12-Dimethylbenz (a) anthracene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4-Dimethylphenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Dimethyl Phthalate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
3,3'-Dimethylbenzidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Di-n-butyl Phthalate	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Di-n-octyl phthalate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
3,5-Dinitroaniline	----------	EPA 8330B	EPA 8330B	EPA 8330B
1,3-Dinitrobenzene	----------	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B
1,4-Dinitrobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4-Dinitrophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4-Dinitrotoluene	----------	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B
2,6-Dinitrotoluene	----------	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B
1,4-Dioxane	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Diphenylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Diphenyl ether	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,2-Diphenylhydrazine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Ethyl Methane Sulfonate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Fluoroanthene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Fluorene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Hexachlorobenzene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Hexachlorobutadiene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Hexachlorocyclo-pentadiene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Hexachloroethane	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Hexachloropropene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	----------	EPA 8330B	EPA 8330B	EPA 8330B
Indeno (1,2,3-cd) Pyrene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Isodrin	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Isophorone	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Isosafrole	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
3-Methycholanthrene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Methyl-4,6-dinitrophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Methyl methane sulfonate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1-Methylnaphthalene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
2-Methylnaphthalene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
2-Methylphenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Methylphenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Naphthalene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
1,4-Naphthoquinone	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1-Naphthylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Naphthylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Nitroquinoline-1-oxide	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Nitroaniline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
3-Nitroaniline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Nitroaniline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Nitrobenzene	----------	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B	EPA 8270D/E EPA 8330B
Nitroglycerin	----------	EPA 8330B	EPA 8330B	EPA 8330B
2-Nitrophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
4-Nitrophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Nitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
3-Nitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
4-Nitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
5-Nitro-o-toluidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitroso-di-n-butylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosodiethylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosodimethylamine	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
n-Nitrosomethylethylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosomorpholine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosodi-n-propylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosodiphenylamine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosopiperidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
n-Nitrosopyrrolidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	----------	EPA 8330B	EPA 8330B	EPA 8330B

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
2,2-Oxybis (1-chloropropane)	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pentachlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pentachloronitrobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pentachlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pentaerythritol Tetranitrate (PETN)	----------	EPA 8330B	EPA 8330B	EPA 8330B
Perylene	----------	EPA 8270D/E SIM	EPA 8270D/E SIM	EPA 8270D/E SIM
Phenacetin	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Phenanthrene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Phenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2-Picoline	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pronamide	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Pyrene	----------	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM	EPA 8270D/E EPA 8270D/E SIM
Pyridine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Safrole	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,2,4,5- Tetrachlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,3,4,6-Tetrachlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Tetraethyl dithiopyrophosphate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Tetraethy lead	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Tetryl	----------	EPA 8330B	EPA 8330B	EPA 8330B
Thionazin	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
o-Toluidine	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,2,4-Trichlorobenzene	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
1,3,5-Trinitrobenzene	----------	EPA 8330B	EPA 8330B	EPA 8330B
2,4,5-Trichlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4,6-Trichlorophenol	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
O,O,O-Tri-ethylphosphorothioate	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
2,4,6-Trinitrotoluene	----------	EPA 8330B	EPA 8330B	EPA 8330B
Organochlorine Pesticides				
Aldrin	----------	EPA 8081B	EPA 8081B	EPA 8081B
alpha-BHC	----------	EPA 8081B	EPA 8081B	EPA 8081B
beta-BHC	----------	EPA 8081B	EPA 8081B	EPA 8081B
delta-BHC	----------	EPA 8081B	EPA 8081B	EPA 8081B
gamma-BHC (Lindane)	----------	EPA 8081B	EPA 8081B	EPA 8081B

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
alpha-Chlordane	----------	EPA 8081B	EPA 8081B	EPA 8081B
Chlordane (Technical)	----------	EPA 8081B	EPA 8081B	EPA 8081B
2,4'-DDD	----------	EPA 8081B	EPA 8081B	EPA 8081B
2,4'-DDE	----------	EPA 8081B	EPA 8081B	EPA 8081B
2,4'-DDT	----------	EPA 8081B	EPA 8081B	EPA 8081B
4,4'-DDD	----------	EPA 8081B	EPA 8081B	EPA 8081B
4,4'-DDE	----------	EPA 8081B	EPA 8081B	EPA 8081B
4,4'-DDT	----------	EPA 8081B	EPA 8081B	EPA 8081B
Dieldrin	----------	EPA 8081B	EPA 8081B	EPA 8081B
Dinoseb	----------	EPA 8270D/E	EPA 8270D/E	EPA 8270D/E
Endosulfan I (alpha)	----------	EPA 8081B	EPA 8081B	EPA 8081B
Endosulfan II (beta)	----------	EPA 8081B	EPA 8081B	EPA 8081B
Endosulfan Sulfate	----------	EPA 8081B	EPA 8081B	EPA 8081B
Endrin	----------	EPA 8081B	EPA 8081B	EPA 8081B
Endrin Aldehyde	----------	EPA 8081B	EPA 8081B	EPA 8081B
Endrin Ketone	----------	EPA 8081B	EPA 8081B	EPA 8081B
gamma-Chlordane	----------	EPA 8081B	EPA 8081B	EPA 8081B
Heptachlor	----------	EPA 8081B	EPA 8081B	EPA 8081B
Heptachlor Epoxide	----------	EPA 8081B	EPA 8081B	EPA 8081B
Hexachlorobenzene	----------	EPA 8081B	EPA 8081B	EPA 8081B
Hexachlorocyclopentadiene	----------	EPA 8081B	EPA 8081B	EPA 8081B
Methoxychlor	----------	EPA 8081B	EPA 8081B	EPA 8081B
Mirex	----------	EPA 8081B	EPA 8081B	EPA 8081B
Toxaphene	----------	EPA 8081B	EPA 8081B	EPA 8081B
PCBs (Aroclors)				
PCB-1016 (Arochlor)	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1221	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1232	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1242	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1248	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1254	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1260	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1262	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB-1268	----------	EPA 8082A	EPA 8082A	EPA 8082A
PCB congeners (209)	----------	EPA 1668A EPA 1668C	EPA 1668A EPA 1668C	EPA 1668A EPA 1668C

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Herbicides				
2,4,5-T	----------	EPA 8151A	EPA 8151A	EPA 8151A
2,4,5-TP (Silvex)	----------	EPA 8151A	EPA 8151A	EPA 8151A
2,4-D	----------	EPA 8151A	EPA 8151A	EPA 8151A
2,4-DB	----------	EPA 8151A	EPA 8151A	EPA 8151A
Dalapon	----------	EPA 8151A	EPA 8151A	EPA 8151A
Dicamba	----------	EPA 8151A	EPA 8151A	EPA 8151A
Dichlorprop	----------	EPA 8151A	EPA 8151A	EPA 8151A
Dinoseb	----------	EPA 8151A	EPA 8151A	EPA 8151A
MCPA	----------	EPA 8151A	EPA 8151A	EPA 8151A
MCPP	----------	EPA 8151A	EPA 8151A	EPA 8151A
Pentachlorophenol	----------	EPA 8151A	EPA 8151A	EPA 8151A
PCB Homologues				
Monochlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Dichlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Trichlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Tetrachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Pentachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Hexachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Heptachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Octachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Nonachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Decachlorobiphenyls	----------	EPA 680	EPA 680	EPA 680
Dioxins/Furans				
2,3,7,8-TCDD	EPA 1613B	EPA 8290A	EPA 8290A	EPA 8290A
2,3,7,8-TCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,7,8-PeCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
2,3,4,7,8-PeCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,7,8-PeCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,4,7,8-HxCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,6,7,8-HxCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
2,3,4,6,7,8-HxCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,7,8,9-HxCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,4,7,8,-HxCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,6,7,8-HxCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,7,8,9-HxCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,4,6,7,8-HpCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,4,7,8,9-HpCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
1,2,3,4,6,7,8-HpCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
OCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
OCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total HpCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total HpCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total HxCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total HxCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total PeCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A

Parameter/Analyte	Potable Water	Non-Potable Water	Solid Hazardous Waste	
			Aqueous	Solid
Total PeCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total TCDD	----------	EPA 8290A	EPA 8290A	EPA 8290A
Total TCDF	----------	EPA 8290A	EPA 8290A	EPA 8290A
Misc. Headspace Analysis				
Carbon dioxide	----------	RSK-175	RSK-175	----------
Ethane	----------	RSK-175	RSK-175	----------
Ethene	----------	RSK-175	RSK-175	----------
Methane	----------	RSK-175	RSK-175	----------
Acetylene	----------	RSK-175	RSK-175	----------
Propane	----------	RSK-175	RSK-175	----------
Hazardous Waste Characteristics				
Toxicity Characteristic Leaching Procedure	----------	----------	EPA 1311	EPA 1311
Synthetic Precipitation Leaching Procedure	----------	----------	EPA 1312	EPA 1312
ASTM Leaching Procedure	----------	----------	ASTM D3987-85	ASTM D3987-85
Other				
Perchlorate	----------	EPA 6850	EPA 6850	EPA 6850
Hydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Formaldehyde	----------	----------	EPA 8315A	EPA 8315A
Methylhydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
1,1-Dimethylhydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Acetic Acid	----------	EPA 8015D	EPA 8015D	----------
Butryic acid	----------	EPA 8015D	EPA 8015D	----------
Lactic Acid	----------	EPA 8015D	EPA 8015D	----------
Propionic Acid	----------	EPA 8015D	EPA 8015D	----------
Pyruvic Acid	----------	EPA 8015D	EPA 8015D	----------
Citric Acid	----------	EPA 8015D	EPA 8015D	----------
Formic Acid	----------	EPA 8015D	EPA 8015D	----------
Oxalic Acid	----------	EPA 8015D	EPA 8015D	----------
Quinic Acid	----------	EPA 8015D	EPA 8015D	----------
Succinic Acid	----------	EPA 8015D	EPA 8015D	----------
Tartaric Acid	----------	EPA 8015D	EPA 8015D	----------
Volatile Preparation	----------	EPA 5030C	EPA 5030C	EPA 5035 EPA 5035A
Organic Extraction/Cleanup	----------	EPA 3510C EPA 3511 EPA 3660B, 3620C, 3665A	EPA 3510C EPA 3511 EPA 3660B, 3620C, 3665A	EPA 3546 EPA 3550C EPA 3660B, 3620C, 3665A, 3640A

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
Per and Polyfluoroalkyl Substances			

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
(PFAS)			
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	EPA 537 EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
N-methyl perfluoroctanesulfonamidoacetic Acid (NMeFOSAA)	EPA 537 EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorobutanesulfonic Acid (PFBS)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorodecanoic Acid (PFDA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorododecanoic Acid (PFDoA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoroheptanoic Acid (PFHpA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorohexanesulfonic Acid (PFHxS)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorohexanoic Acid (PFHxA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorononanoic Acid (PFNA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorooctanesulfonic Acid (PFOS)	EPA 537 EPA 537.1	PFAS by LCMSMS Compliant with QSM	PFAS by LCMSMS Compliant with QSM

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
	EPA 533	5.3/5.4 Table B-15 EPA Draft Method 1633	5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorooctanoic Acid (PFOA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorotetradecanoic Acid (PFTeDA)	EPA 537 EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorotridecanoic Acid (PFTrDA)	EPA 537 EPA 537.1	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoroundecanoic Acid (PFUnA)	EPA 537 EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Hexafluoropropylene oxide dimer acid (HF-PODA)	EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
4,8-Dioxa-3*H*-perfluorononanoic acid (ADONA)	EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	EPA 537.1 EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorobutanoic Acid (PFBA)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
Perfluoropentanoic Acid (PFPeA)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2FTS)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid(8:2-FTS)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoropentanesulfonic Acid (PFPeS)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2-FTS)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoroheptanesulfonic Acid (PFHpS)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorononanesulfonic Acid (PFNS)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluorodecanesulfonic Acid (PFDS)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
10:2 Fluorotelomersulfonic Acid (10:2-FTS)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15
Perfluorododecanesulfonic Acid (PFDoS)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
Perfluorohexadecanoic Acid (PFHxDA)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15
Perfluorooctadecanoic Acid (PFODA)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15
Perfluorooctanesulfonamide (PFOSA)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
N-methyl perfluorooctanesulfonamide (NMeFOSA)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
N-ethylperfluorooctanesulfonamide (NEtFOSA)	----------	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoro-3-methoxypropanoic acid (PFMPA)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoro-4-methoxybutanoic acid (PFMBA)	EPA 533	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	EPA 533	PFAS by LCMSMS Compliant with QSM	PFAS by LCMSMS Compliant with QSM

Parameter/Analyte	Drinking Water	Nonpotable Water	Solid Haz.Waste
		5.3/5.4 Table B-15 EPA Draft Method 1633	5.3/5.4 Table B-15 EPA Draft Method 1633
3-Perfluoropropylpropanoic acid (3:3 FTCA)	---	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
2*H*,2*H*,3*H*,3*H*-Perfluorooctanoic acid (5:3 FTCA)	---	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	---	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633	PFAS by LCMSMS Compliant with QSM 5.3/5.4 Table B-15 EPA Draft Method 1633

End of DoD ELAP section of scope

Start of KY, WY, and ISO 17025 section of scope

In addition, in recognition of the successful completion of the A2LA evaluation process (including an assessment of the laboratory's compliance with ISO IEC 17025:2017, the 2009 TNI Environmental Testing Laboratory Standard, and for the test methods applicable to Kentucky Statute KRS 224.60-130(2)(a), and for the test methods applicable to the Wyoming Storage Tank Remediation Laboratory Accreditation Program), accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Atomic Absorption/ICP-AES Spectrometry, ICP-MS Spectrometry, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, High Performance Liquid Chromatography, Ion Chromatography, Misc.-Electronic Probes (pH, F^-, O_2), Oxygen Demand, Spectrophotometry (Visible), Spectrophotometry (Automated), Titrimetry, TCLP, Total Organic Carbon, Turbidity, Liquid Chromatography/Mass Spectrometry/Mass Spectrometry, High Resolution Gas Chromatography/Mass Spectrometry

Parameter/Analyte	Tissue	Nonpotable Water	Solid Hazardous Waste	
			Aqueous	Solid
Other				
Perchlorate	Food & Food Products EPA 6850	EPA 6850	EPA 6850	EPA 6850

Parameter/Analyte	Tissue	Nonpotable Water	Solid Hazardous Waste	
			Aqueous	Solid
Hydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Methylhydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
1,1-Dimethylhydrazine	----------	EPA 8315A MOD	EPA 8315A MOD	EPA 8315A MOD
Volatile Preparation	----------	EPA 5030A EPA 5030C	EPA 5030A EPA 5030C	EPA 5035 EPA 5035A
Organic Extraction/ Cleanup	EPA 3546 EPA 3550C EPA 3660B EPA 3620C EPA 3665A EPA 3640A	EPA 3510C EPA 3511 EPA 3660B EPA 3620C EPA 3665A	EPA 3510C EPA 3511 EPA 3660B EPA 3620C EPA 3665A	EPA 3546 EPA 3550C EPA 3660B EPA 3620C EPA 3665A EPA 3640A

Parameter/Analyte	Tissue	Nonpotable Water	Solid Hazardous Waste	
			Aqueous	Solid
Kentucky UST Program				
Metals				
Arsenic	----------	----------	EPA 6010B	EPA 6010B
Barium	----------	----------	EPA 6010B	EPA 6010B
Cadmium	----------	----------	EPA 6010B	EPA 6010B
Chromium	----------	----------	EPA 6010B	EPA 6010B
Lead	----------	----------	EPA 6010B	EPA 6010B
Mercury	----------	----------	EPA 7470A	EPA 7471A
Selenium	----------	----------	EPA 6010B	EPA 6010B
Silver	----------	----------	EPA 6010B	EPA 6010B
Purgeable Organics (Volatiles)				
Diesel Range Organics (DRO)	----------	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D
Gasoline Range Organics (GRO)	----------	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D	EPA 8015C EPA 8015D
Wyoming Storage Tank Program				
Metals				
Cadmium	----------	----------	EPA 6010C	EPA 6010C
Chromium	----------	----------	EPA 6010C	EPA 6010C
Chromium (Total, hexavalent)	----------	----------	EPA 7196A	EPA 7196A
Lead	----------	----------	EPA 6010C	EPA 6010C
Purgeable Organics (Volatiles)				
Volatile Preparation	----------	----------	EPA 5030C EPA 5030C	EPA 5035 EPA 5035A
Benzene	----------	----------	EPA 5030C EPA 8260D	EPA 8260D

Parameter/Analyte	Tissue	Nonpotable Water	Solid Hazardous Waste	
			Aqueous	Solid
1,2-Dichloroethane	----------	----------	EPA 8260D	EPA 8260D
1,2-Dibromoethane	----------	----------	EPA 8011	EPA 8011
Diisopropyl Ether	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Ethyl Benzene	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Ethyl tert-butyl Ether	----------	----------	EPA 8260D	EPA 8260D
Methyl tert-butyl Ether	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Naphthalene	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Toluene	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Tert-amyl Methyl Ether	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Tert-butyl Alcohol	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Xylenes, total	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Gasoline Range Organics (GRO C6-C10)	----------	----------	EPA 5030C EPA 8260D	EPA 8260D
Extractable Organics (Semivolatiles)				
Diesel Range Organics (DRO C10-C32)	----------	----------	EPA 8015C w/ EPA 3630 cleanup	EPA 8015C w/ EPA 3630 cleanup

Food and Feed (WHO 29)	Food/Feed
2,3,7,8-TCDD	EPA 1613B
2,3,7,8-TCDF	EPA 1613B
1,2,3,7,8-PeCDF	EPA 1613B
2,3,4,7,8-PeCDF	EPA 1613B
1,2,3,7,8-PeCDD	EPA 1613B
1,2,3,4,7,8-HxCDF	EPA 1613B
1,2,3,6,7,8-HxCDF	EPA 1613B
2,3,4,6,7,8-HxCDF	EPA 1613B
1,2,3,7,8,9-HxCDF	EPA 1613B
1,2,3,4,7,8-HxCDD	EPA 1613B
1,2,3,6,7,8-HxCDD	EPA 1613B
1,2,3,7,8,9-HxCDD	EPA 1613B
1,2,3,4,6,7,8-HpCDF	EPA 1613B
1,2,3,4,7,8,9-HpCDF	EPA 1613B
1,2,3,4,6,7,8-HpCDD	EPA 1613B
OCDF	EPA 1613B
OCDD	EPA 1613B

Food and Feed (WHO 29)	**Food/Feed**
Total HpCDD	EPA 1613B
Total HpCDF	EPA 1613B
Total HxCDD	EPA 1613B
Total HxCDF	EPA 1613B
Total PeCDD	EPA 1613B
Total PeCDF	EPA 1613B
Total TCDD	EPA 1613B
Total TCDF	EPA 1613B
6 marker PCBs (PCB28, PCB52, PCB101, PCB138, PCB153, and PCB180)	EPA 1668A EPA 1668C

Parameter/Analyte	**Tissue**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous	**Solid**
12 Dioxin-like PCBs (dl-PCBs)/coplanar PCBs (PCB77, PCB81, PCB105, PCB114, PCB118, PCB123, PCB126, PCB156, PCB157, PCB167, PCB169, and PCB189)	EPA 1668A EPA 1668C	----------	----------	----------

Parameter/Analyte	**Drinking Water**	**Nonpotable Water**	**Solid Haz.Waste**
Per and Polyfluoroalkyl Substances (PFAS)			
N-ethyl perfluorooctane-sulfonamidoacetic acid (NetFOSAA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
N-methyl perfluoroctane-sulfonamidoacetic acid (NMeFOSAA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorobutanesulfonic acid (PFBS)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorodecanoic acid (PFDA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorododecanoic acid (PFDoDA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoroheptanoic acid (PFHpA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorohexanesulfonic acid (PFHxS)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorohexanoic acid (PFHxA)	EPA 537 Ver. 1.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod

	EPA 537.1		
Perfluorononanoic acid (PFNA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorooctanesulfonic acid (PFOS)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorooctanoic acid (PFOA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorotetradecanoic acid (PFTeDA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorotridecanoic acid (PFTrDA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoroundecanoic acid (PFUnDA)	EPA 537 Ver. 1.1 EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (HFPODA)	EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod

Parameter/Analyte	**Drinking Water**	**Nonpotable Water**	**Solid Haz.Waste**
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	EPA 537.1	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoro-n-butanoic acid (PFBA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoro-n-pentanoic acid (PFPeA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
8:2 Fluorotelomersulfonic acid (8:2FTS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
4:2 Fluorotelomersulfonic acid (4:2-FTS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoropentanesulfonic acid (PFPeS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
6:2 Fluorotelomersulfonic acid (6:2-FTS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluoroheptanesulfonic acid (PFHpS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorononanesulfonic acid (PFNS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorodecanesulfonic acid (PFDS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
10:2 Fluorotelomersulfonic acid (10:2-FTS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorododecanesulfonic acid (PFDoDS)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorohexadecanoic acid (PFHxDA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorooctadecanoic acid (PFODA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
Perfluorooctanesulfonamide (PFOSA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
2-(N-methylperfluoro-1-	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod

octanesulfonamido)-ethanol (NMePFOSAE)			
N-methylperfluoro-1-octanesulfonamide (NMePFOSA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (NEtPFOSAE)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod
N-ethylperfluoro-1-octanesulfonamide (NEtPFOSA)	----------	EPA 537 Ver.1.1 Mod	EPA 537 Ver.1.1 Mod

End of KY, WY, and ISO 17025 section of scope

Accredited Laboratory

A2LA has accredited

EUROFINS LANCASTER LABORATORIES ENVIRONMENTAL, LLC

Lancaster, PA

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2017, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.4 of the DoD/DOE Quality System Manual for Environmental Laboratories (QSM), accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated *April 2017*).

Presented this 28th day of January 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1.01
Valid to November 30, 2022

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

State of New Jersey

Department of Environmental Protection

Certifies That

EUROFINS LANCASTER LABS ENVIRONMENT TESTING, LLC

Laboratory Certification ID # PA011

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List
which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing the Certification of
Laboratories and Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the 2016 TNI Standard approved by the

The NELAC Institute

Expires June 30, 2023

Michele M. Potter
Manager

NJDEP is a NELAP Recognized Accreditation Body

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public. Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: AE04 --Organics Analysis

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	AE04.01900	Volatile organics	GC	EPA 18	LA
Certified	Yes	AE04.03250	Non-Methane Organic Compounds	FID	EPA 25	LA
Certified	Yes	AE04.17950	Acetone	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18000	Acetonitrile	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18100	Acrolein	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18250	Acrylonitrile	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18300	Allyl chloride	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18400	Benzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18450	Benzyl chloride	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18600	Bromodichloromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18650	Bromoform	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18700	Bromomethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18750	Butadiene (1,3-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18850	Butylbenzene (n-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.18900	Carbon disulfide	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19000	Carbon tetrachloride	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19150	Chlorobenzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19200	Chloroethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19250	Chloroform	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19300	Chloromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19400	Chlorotoluene (2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19500	Cyclohexane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19600	Dibromo-3-chloropropane (1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19650	Dibromochloromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19700	Dibromoethane (1,2-) (EDB)	GC/MS, Canisters	EPA TO-15	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: AE04 --Organics Analysis

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	AE04.19750	Dichlorobenzene (1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19800	Dichlorobenzene (1,3-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19850	Dichlorobenzene (1,4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19900	Dichlorodifluoromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.19950	Dichloroethane (1,1-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20000	Dichloroethane (1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20050	Dichloroethene (1,1-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20100	Dichloroethene (cis-1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20150	Dichloroethene (trans-1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20200	Dichlorofluoromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20250	Dichloropropane (1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20300	Dichloropropene (cis-1,3-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20350	Dichloropropene (trans-1,3-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20400	Dichlorotetrafluoroethane (1,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20750	Dioxane (1,4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20900	Ethanol	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.20950	Ethyl acetate	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21000	Ethyl acrylate	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21100	Ethylbenzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21250	Ethyltoluene (4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21400	Heptane (n-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21450	Hexachlorobutadiene (1,3-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21500	Hexachloroethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21550	Hexane (n-)	GC/MS, Canisters	EPA TO-15	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: AE04 --Organics Analysis

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	AE04.21600	Hexanone (2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21700	Isopropanol	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21750	Isopropylbenzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21850	Methyl ethyl ketone (MEK)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21900	Methyl iodide	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.21950	Methyl isobutyl ketone (MIBK)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22050	Methyl methacrylate	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22100	Methyl tert-butyl ether	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22150	Methylene chloride (Dichloromethane)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22300	Naphthalene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22850	Propylbenzene (n-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.22950	Propylene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23100	Sec-butylbenzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23150	Styrene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23250	Tert-butyl alcohol	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23300	Tert-butylbenzene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23350	Tetrachloroethane (1,1,2,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23400	Tetrachloroethene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23450	Tetrahydrofuran	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23500	Toluene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23550	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23600	Trichlorobenzene (1,2,4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23650	Trichloroethane (1,1,1-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23700	Trichloroethane (1,1,2-)	GC/MS, Canisters	EPA TO-15	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: AE04 --Organics Analysis

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	AE04.23750	Trichloroethene	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.23800	Trichlorofluoromethane	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24050	Trimethylbenzene (1,2,4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24100	Trimethylbenzene (1,3,5-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24150	Trimethylpentane (2,2,4-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24200	Vinyl acetate	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24250	Vinyl bromide	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24300	Vinyl chloride	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24350	Xylene (m-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24400	Xylene (o-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24450	Xylene (p-)	GC/MS, Canisters	EPA TO-15	LA
Certified	Yes	AE04.24500	Xylenes (total)	GC/MS, Canisters	EPA TO-15	LA

Category: BT06 --Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT06.00220	Aldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00230	Alpha BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00240	Beta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00250	Chlordane (alpha) (cis-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00260	Chlordane (gamma) (trans-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00270	Chlordane (technical)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00280	DDD (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT06 --Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT06.00290	DDE (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00300	DDT (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00310	Delta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00320	Dieldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00330	Endosulfan I	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00340	Endosulfan II	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00350	Endosulfan sulfate	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00360	Endrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00370	Endrin aldehyde	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00380	Endrin ketone	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00390	Heptachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00400	Heptachlor epoxide	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00410	Lindane (gamma BHC)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00420	Methoxychlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00430	Toxaphene	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	LA
Certified	Yes	BT06.00510	PCB 1016	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00520	PCB 1221	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00530	PCB 1232	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00540	PCB 1242	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00550	PCB 1248	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00560	PCB 1254	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA
Certified	Yes	BT06.00570	PCB 1260	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	LA

Category: BT07 --Organic Parameters - Chromatography/MS

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00010	Acenaphthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.00020	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00030	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00040	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00050	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00060	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00070	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00080	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00090	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00100	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00110	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00120	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00130	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00140	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00150	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00160	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00170	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00180	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	LA
Certified	Yes	BT07.00190	Chlorobiphenyl (2-) (PCB 1)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00200	Chlorobiphenyl (3-) (PCB 2)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00210	Chlorobiphenyl (4-) (PCB 3)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00220	Dichlorobiphenyl (2,2'-) (PCB 4)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00230	Dichlorobiphenyl (2,3-) (PCB 5)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00240	Dichlorobiphenyl (2,3'-) (PCB 6)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00250	Dichlorobiphenyl (2,4-) (PCB 7)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00260	Dichlorobiphenyl (2,4'-) (PCB 8)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00270	Dichlorobiphenyl (2,5-) (PCB 9)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00280	Dichlorobiphenyl (2,6-) (PCB 10)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00290	Dichlorobiphenyl (3,3'-) (PCB 11)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00300	Dichlorobiphenyl (3,4-) (PCB 12)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00310	Dichlorobiphenyl (3,4'-) (PCB 13)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00320	Dichlorobiphenyl (3,5-) (PCB 14)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00330	Dichlorobiphenyl (4,4'-) (PCB 15)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00340	Trichlorobiphenyl (2,2',3-) (PCB 16)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00350	Trichlorobiphenyl (2,2',4-) (PCB 17)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00360	Trichlorobiphenyl (2,2',5-) (PCB 18)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00370	Trichlorobiphenyl (2,2',6-) (PCB 19)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00380	Trichlorobiphenyl (2,3,3'-) (PCB 20)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00390	Trichlorobiphenyl (2,3,4-) (PCB 21)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00400	Trichlorobiphenyl (2,3,4'-) (PCB 22)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00410	Trichlorobiphenyl (2,3,5-) (PCB 23)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00420	Trichlorobiphenyl (2,3,6-) (PCB 24)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00430	Trichlorobiphenyl (2,3',4-) (PCB 25)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00440	Trichlorobiphenyl (2,3',5-) (PCB 26)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00450	Trichlorobiphenyl (2,3',6-) (PCB 27)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00460	Trichlorobiphenyl (2,4,4'-) (PCB 28)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00470	Trichlorobiphenyl (2,4,5-) (PCB 29)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00480	Trichlorobiphenyl (2,4,6-) (PCB 30)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00490	Trichlorobiphenyl (2,4',5-) (PCB 31)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00500	Trichlorobiphenyl (2,4',6-) (PCB 32)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00510	Trichlorobiphenyl (2,3', 4'-) (PCB 33)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00520	Trichlorobiphenyl (2,3', 5'-) (PCB 34)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00530	Trichlorobiphenyl (3,3',4-) (PCB 35)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00540	Trichlorobiphenyl (3,3',5-) (PCB 36)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00550	Trichlorobiphenyl (3,4,4'-) (PCB 37)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00560	Trichlorobiphenyl (3,4,5-) (PCB 38)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00570	Trichlorobiphenyl (3,4',5-) (PCB 39)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00580	Tetrachlorobiphenyl (2,2', 3,3'-) (PCB 40)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00590	Tetrachlorobiphenyl (2,2', 3,4-) (PCB 41)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00600	Tetrachlorobiphenyl (2,2',3,4'-) (PCB 42)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00610	Tetrachlorobiphenyl (2,2',3,5-) (PCB 43)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00620	Tetrachlorobiphenyl (2,2',3,5'-) (PCB 44)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00630	Tetrachlorobiphenyl (2,2',3,6-) (PCB 45)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00640	Tetrachlorobiphenyl (2,2',3,6'-) (PCB 46)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00650	Tetrachlorobiphenyl (2,2',4,4'-) (PCB 47)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00660	Tetrachlorobiphenyl (2,2',4,5-) (PCB 48)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00670	Tetrachlorobiphenyl (2,2',4,5'-) (PCB 49)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00680	Tetrachlorobiphenyl (2,2',4,6-) (PCB 50)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00690	Tetrachlorobiphenyl (2,2',4,6'-) (PCB 51)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00700	Tetrachlorobiphenyl (2,2',5,5'-) (PCB 52)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00710	Tetrachlorobiphenyl (2,2',5,6'-) (PCB 53)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00720	Tetrachlorobiphenyl (2,2',6,6'-) (PCB 54)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00730	Tetrachlorobiphenyl (2,3,3',4-) (PCB 55)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00740	Tetrachlorobiphenyl (2,3,3',4'-) (PCB 56)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00750	Tetrachlorobiphenyl (2,3,3',5-) (PCB 57)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00760	Tetrachlorobiphenyl (2,3,3',5'-) (PCB 58)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00770	Tetrachlorobiphenyl (2,3,3',6-) (PCB 59)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00780	Tetrachlorobiphenyl (2,3,4,4'-) (PCB 60)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00790	Tetrachlorobiphenyl (2,3,4,5-) (PCB 61)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00800	Tetrachlorobiphenyl (2,3,4,6-) (PCB 62)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00810	Tetrachlorobiphenyl (2,3,4',5-) (PCB 63)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00820	Tetrachlorobiphenyl (2,3,4',6-) (PCB 64)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00830	Tetrachlorobiphenyl (2,3,5,6-) (PCB 65)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00840	Tetrachlorobiphenyl (2,3', 4,4'-) (PCB 66)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00850	Tetrachlorobiphenyl (2,3', 4,5-) (PCB 67)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00860	Tetrachlorobiphenyl (2,3', 4,5'-) (PCB 68)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00870	Tetrachlorobiphenyl (2,3', 4,6-) (PCB 69)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00880	Tetrachlorobiphenyl (2,3', 4',5-) (PCB 70)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00890	Tetrachlorobiphenyl (2,3', 4',6-) (PCB 71)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00900	Tetrachlorobiphenyl (2,3', 5,5'-) (PCB 72)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00910	Tetrachlorobiphenyl (2,3', 5',6-) (PCB 73)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00920	Tetrachlorobiphenyl (2,4,4',5-) (PCB 74)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00930	Tetrachlorobiphenyl (2,4,4',6-) (PCB 75)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.00940	Tetrachlorobiphenyl (2,3',4',5'-) (PCB 76)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00950	Tetrachlorobiphenyl (3,3',4,4'-) (PCB 77)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00960	Tetrachlorobiphenyl (3,3',4,5-) (PCB 78)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00970	Tetrachlorobiphenyl (3,3',4,5'-) (PCB 79)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00980	Tetrachlorobiphenyl (3,3',5,5'-) (PCB 80)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.00990	Tetrachlorobiphenyl (3,4,4',5-) (PCB 81)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01000	Pentachlorobiphenyl (2,2',3,3',4-) (PCB 82)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01010	Pentachlorobiphenyl (2,2',3,3',5-) (PCB 83)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01020	Pentachlorobiphenyl (2,2',3,3',6-) (PCB 84)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01030	Pentachlorobiphenyl (2,2',3,4,4'-) (PCB 85)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01040	Pentachlorobiphenyl (2,2',3,4,5-) (PCB 86)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01050	Pentachlorobiphenyl (2,2',3,4,5'-) (PCB 87)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01060	Pentachlorobiphenyl (2,2',3,4,6-) (PCB 88)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01070	Pentachlorobiphenyl (2,2',3,4,6'-) (PCB 89)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01080	Pentachlorobiphenyl (2,2',3,4',5-) (PCB 90)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01090	Pentachlorobiphenyl (2,2',3,4',6-) (PCB 91)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01100	Pentachlorobiphenyl (2,2',3,5,5'-) (PCB 92)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01110	Pentachlorobiphenyl (2,2',3,5,6-) (PCB 93)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01120	Pentachlorobiphenyl (2,2',3,5,6'-) (PCB 94)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01130	Pentachlorobiphenyl (2,2',3,5',6-) (PCB 95)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01140	Pentachlorobiphenyl (2,2',3,6,6'-) (PCB 96)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01150	Pentachlorobiphenyl (2,2',3,4',5'-) (PCB 97)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01160	Pentachlorobiphenyl (2,2',3,4',6'-) (PCB 98)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01170	Pentachlorobiphenyl (2,2',4,4',5-) (PCB 99)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01180	Pentachlorobiphenyl (2,2',4,4',6-) (PCB 100)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01190	Pentachlorobiphenyl (2,2',4,5,5'-) (PCB 101)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01200	Pentachlorobiphenyl (2,2',4,5,6'-) (PCB 102)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01210	Pentachlorobiphenyl (2,2',4,5',6-) (PCB 103)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01220	Pentachlorobiphenyl (2,2',4,6,6'-) (PCB 104)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01230	Pentachlorobiphenyl (2,3,3',4,4'-) (PCB 105)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01240	Pentachlorobiphenyl (2,3,3',4,5-) (PCB 106)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01250	Pentachlorobiphenyl (2,3,3',4',5-) (PCB 107)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01260	Pentachlorobiphenyl (2,3,3',4,5'-) (PCB 108)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01270	Pentachlorobiphenyl (2,3,3',4,6-) (PCB 109)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01280	Pentachlorobiphenyl (2,3,3',4',6-) (PCB 110)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01290	Pentachlorobiphenyl (2,3,3',5,5'-) (PCB 111)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01300	Pentachlorobiphenyl (2,3,3',5,6-) (PCB 112)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01310	Pentachlorobiphenyl (2,3,3',5',6-) (PCB 113)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01320	Pentachlorobiphenyl (2,3,4,4',5-) (PCB 114)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01330	Pentachlorobiphenyl (2,3,4,4',6-) (PCB 115)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01340	Pentachlorobiphenyl (2,3,4,5,6-) (PCB 116)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01350	Pentachlorobiphenyl (2,3,4',5,6-) (PCB 117)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01360	Pentachlorobiphenyl (2,3',4,4',5-) (PCB 118)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01370	Pentachlorobiphenyl (2,3',4,4',6-) (PCB 119)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01380	Pentachlorobiphenyl (2,3',4,5,5'-) (PCB 120)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01390	Pentachlorobiphenyl (2,3',4,5',6-) (PCB 121)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01400	Pentachlorobiphenyl (2,3,3',4',5'-) (PCB 122)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01410	Pentachlorobiphenyl (2,3',4,4',5'-) (PCB 123)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01420	Pentachlorobiphenyl (2,3',4',5,5'-) (PCB 124)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01430	Pentachlorobiphenyl (2,3',4',5',6-) (PCB 125)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01440	Pentachlorobiphenyl (3,3',4,4',5-) (PCB 126)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01450	Pentachlorobiphenyl (3,3',4,5,5'-) (PCB 127)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01460	Hexachlorobiphenyl (2,2', 3,3',4,4'-) (PCB 128)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01470	Hexachlorobiphenyl (2,2', 3,3',4,5-) (PCB 129)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01480	Hexachlorobiphenyl (2,2', 3,3',4,5'-) (PCB 130)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01490	Hexachlorobiphenyl (2,2', 3,3',4,6-) (PCB 131)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01500	Hexachlorobiphenyl (2,2', 3,3',4,6'-) (PCB 132)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01510	Hexachlorobiphenyl (2,2', 3,3',5,5'-) (PCB 133)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01520	Hexachlorobiphenyl (2,2', 3,3',5,6-) (PCB 134)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01530	Hexachlorobiphenyl (2,2', 3,3',5,6'-) (PCB 135)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01540	Hexachlorobiphenyl (2,2', 3,3',6,6'-) (PCB 136)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01550	Hexachlorobiphenyl (2,2', 3,4,4',5-) (PCB 137)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01560	Hexachlorobiphenyl (2,2', 3,4,4',5'-) (PCB 138)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01570	Hexachlorobiphenyl (2,2', 3,4,4',6-) (PCB 139)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01580	Hexachlorobiphenyl (2,2', 3,4,4',6'-) (PCB 140)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01590	Hexachlorobiphenyl (2,2', 3,4,5,5'-) (PCB 141)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01600	Hexachlorobiphenyl (2,2', 3,4,5,6-) (PCB 142)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01610	Hexachlorobiphenyl (2,2', 3,4,5,6'-) (PCB 143)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01620	Hexachlorobiphenyl (2,2',3,4,5',6-) (PCB 144)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01630	Hexachlorobiphenyl (2,2',3,4,6,6'-) (PCB 145)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01640	Hexachlorobiphenyl (2,2',3,4',5,5'-) (PCB 146)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01650	Hexachlorobiphenyl (2,2',3,4',5,6-) (PCB 147)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01660	Hexachlorobiphenyl (2,2',3,4',5,6'-) (PCB 148)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01670	Hexachlorobiphenyl (2,2',3,4',5',6-) (PCB 149)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01680	Hexachlorobiphenyl (2,2',3,4',6,6'-) (PCB 150)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01690	Hexachlorobiphenyl (2,2',3,5,5',6-) (PCB 151)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01700	Hexachlorobiphenyl (2,2',3,5,6,6'-) (PCB 152)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01710	Hexachlorobiphenyl (2,2',4,4',5,5'-) (PCB 153)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01720	Hexachlorobiphenyl (2,2',4,4',5,6'-) (PCB 154)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01730	Hexachlorobiphenyl (2,2',4,4',6,6'-) (PCB 155)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01740	Hexachlorobiphenyl (2,3,3',4,4',5-) (PCB 156)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01750	Hexachlorobiphenyl (2,3,3',4,4',5'-) (PCB 157)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01760	Hexachlorobiphenyl (2,3,3',4,4',6-) (PCB 158)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01770	Hexachlorobiphenyl (2,3,3',4,5,5'-) (PCB 159)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01780	Hexachlorobiphenyl (2,3,3',4,5,6-) (PCB 160)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01790	Hexachlorobiphenyl (2,3,3',4,5',6-) (PCB 161)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01800	Hexachlorobiphenyl (2,3,3',4',5,5'-) (PCB 162)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01810	Hexachlorobiphenyl (2,3,3',4',5,6-) (PCB 163)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01820	Hexachlorobiphenyl (2,3,3',4',5',6-) (PCB 164)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01830	Hexachlorobiphenyl (2,3,3',5,5',6-) (PCB 165)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01840	Hexachlorobiphenyl (2,3,4,4',5,6-) (PCB 166)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01850	Hexachlorobiphenyl (2,3', 4,4',5,5'-) (PCB 167)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01860	Hexachlorobiphenyl (2,3', 4,4',5',6-) (PCB 168)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01870	Hexachlorobiphenyl (3,3', 4,4',5,5'-) (PCB 169)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01880	Heptachlorobiphenyl (2,2',3,3',4,4',5-) (PCB 170)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01890	Heptachlorobiphenyl (2,2',3,3',4,4',6-) (PCB 171)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01900	Heptachlorobiphenyl (2,2',3,3',4,5,5'-) (PCB 172)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01910	Heptachlorobiphenyl (2,2',3,3',4,5,6-) (PCB 173)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01920	Heptachlorobiphenyl (2,2',3,3',4,5,6'-) (PCB 174)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.01930	Heptachlorobiphenyl (2,2',3,3',4,5',6-) (PCB 175)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01940	Heptachlorobiphenyl (2,2',3,3',4,6,6'-) (PCB 176)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01950	Heptachlorobiphenyl (2,2',3,3',4,5',6'-) (PCB 177)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01960	Heptachlorobiphenyl (2,2',3,3',5,5',6-) (PCB 178)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01970	Heptachlorobiphenyl (2,2',3,3',5,6,6'-) (PCB 179)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01980	Heptachlorobiphenyl (2,2',3,4,4',5,5'-) (PCB 180)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.01990	Heptachlorobiphenyl (2,2',3,4,4',5,6-) (PCB 181)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02000	Heptachlorobiphenyl (2,2',3,4,4',5,6'-) (PCB 182)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02010	Heptachlorobiphenyl (2,2',3,4,4',5',6-) (PCB 183)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02020	Heptachlorobiphenyl (2,2',3,4,4',6,6'-) (PCB 184)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02030	Heptachlorobiphenyl (2,2',3,4,5,5',6-) (PCB 185)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02040	Heptachlorobiphenyl (2,2',3,4,5,6,6'-) (PCB 186)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.02050	Heptachlorobiphenyl (2,2',3,4',5,5',6-) (PCB 187)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02060	Heptachlorobiphenyl (2,2',3,4',5,6,6'-) (PCB 188)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02070	Heptachlorobiphenyl (2,3,3',4,4',5,5'-) (PCB 189)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02080	Heptachlorobiphenyl (2,3,3',4,4',5,6-) (PCB 190)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02090	Heptachlorobiphenyl (2,3,3',4,4',5',6-) (PCB 191)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02100	Heptachlorobiphenyl (2,3,3',4,5,5',6-) (PCB 192)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02110	Heptachlorobiphenyl (2,3,3',4',5,5',6-) (PCB 193)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02120	Octachlorobiphenyl (2,2',3,3',4,4',5,5'-) (PCB 194)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02130	Octachlorobiphenyl (2,2',3,3',4,4',5,6-) (PCB 195)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02140	Octachlorobiphenyl (2,2',3,3',4,4',5,6'-) (PCB 196)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02150	Octachlorobiphenyl (2,2',3,3',4,4',6,6'-) (PCB 197)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02160	Octachlorobiphenyl (2,2',3,3',4,5,5',6-) (PCB 198)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02170	Octachlorobiphenyl (2,2',3,3',4,5,5',6'-) (PCB 199)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02180	Octachlorobiphenyl (2,2',3,3',4,5,6,6'-) (PCB 200)	Extraction, SIM, GC/MS	EPA 1668A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.02190	Octachlorobiphenyl (2,2',3,3',4,5',6,6'-) (PCB 201)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02200	Octachlorobiphenyl (2,2',3,3',5,5',6,6'-) (PCB 202)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02210	Octachlorobiphenyl (2,2',3,4,4',5,5',6-) (PCB 203)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02220	Octachlorobiphenyl (2,2',3,4,4',5,6,6'-) (PCB 204)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02230	Octachlorobiphenyl (2,3,3',4,4',5,5',6-) (PCB 205)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02240	Nonachlorobiphenyl (2,2',3,3',4,4',5,5',6-) (PCB 206)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02250	Nonachlorobiphenyl (2,2',3,3',4,4',5,6,6'-) (PCB 207)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02260	Nonachlorobiphenyl (2,2',3,3',4,5,5',6,6'-) (PCB 208)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.02270	Decachlorobiphenyl (PCB 209)	Extraction, SIM, GC/MS	EPA 1668A	LA
Certified	Yes	BT07.05090	Acenaphthylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05100	Anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05110	Benzaldehyde	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05120	Benzo(a)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05130	Benzo(a)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05140	Benzo(b)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05150	Benzo(ghi)perylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05160	Benzo(k)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05170	Biphenyl (1,1'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05172	Bis (2-chloroethoxy) methane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.05174	Bis (2-chloroethyl) ether	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05176	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05180	Bis (2-ethylhexyl) phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05182	Bromophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05190	Butylbenzylphthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05192	Carbazole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05194	Chloroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05200	Chloronaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05202	Chlorophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05204	Chlorophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05210	Chrysene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05230	Dibenzofuran	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05232	Dichlorobenzene (1,2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05233	Dichlorobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05234	Dichlorobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05236	Dichlorobenzidine (3,3'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05238	Dichlorophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05240	Diethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05250	Dimethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05252	Dimethylphenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05260	Di-n-butyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05262	Dinitrophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05263	Dinitrophenol (2-methyl-4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05264	Dinitrotoluene (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.05265	Dinitrotoluene (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05270	Di-n-octyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05280	Fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05290	Fluorene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05292	Hexachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05293	Hexachlorobutadiene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05294	Hexachlorocyclopentadiene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05295	Hexachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05300	Indeno(1,2,3-cd)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05302	Isophorone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05304	Methyl phenol (4-chloro-3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05310	Methylnaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05320	Methylnaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05322	Methylphenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05324	Methylphenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05330	Naphthalene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05332	Nitroaniline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05333	Nitroaniline (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05334	Nitroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05335	Nitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05336	Nitrophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05337	Nitrophenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05338	N-Nitroso-di-n-propylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05339	N-Nitrosodiphenylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05340	Pentachlorophenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.05350	Phenanthrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05352	Phenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05360	Pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05362	Pyridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05364	Trichlorobenzene (1,2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05365	Trichlorophenol (2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05366	Trichlorophenol (2,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05370	Acenaphthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05380	Acenaphthylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05390	Anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05400	Benzo(a)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05410	Benzo(a)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05420	Benzo(b)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05430	Benzo(ghi)perylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05440	Benzo(k)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05450	Dibenzo(a,h)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05460	Fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05470	Fluorene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05480	Indeno(1,2,3-cd)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05490	Methylnaphthalene (2-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05500	Naphthalene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05520	Phenanthrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05530	Pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	LA
Certified	Yes	BT07.05790	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05800	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05810	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05820	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: BT07 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	BT07.05830	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05840	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05850	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05860	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05870	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05880	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05890	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05900	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05910	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05920	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05930	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05940	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05950	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05960	Total HpCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05970	Total HpCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05980	Total HxCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.05990	Total HxCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.06000	Total PeCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.06010	Total PeCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.06020	Total TCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA
Certified	Yes	BT07.06030	Total TCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	LA

Category: DW03 --Inorganic Parameters

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW03.00050	Alkalinity	Electrometric Titration	SM 2320 B	PA
Certified	Yes	DW03.01800	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.02550	Color	Platinum-Cobalt	SM 2120 B	PA
Certified	Yes	DW03.02700	Conductivity	Conductance	SM 2510 B	PA
Certified	Yes	DW03.03150	Cyanide	Spectrophotometric, Distill, Semi Automated	EPA 335.4	PA
Certified	Yes	DW03.03750	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.03900	Fluoride	Manual Potentiometric Ion Select Electrode	SM 4500-F C	PA
Certified	Yes	DW03.03950	Foaming agents	Methylene Blue	SM 5540 C	PA
Certified	Yes	DW03.04000	Nitrate	Automated Cadmium Reduction	EPA 353.2	PA
Certified	Yes	DW03.04600	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	No	DW03.04950	Nitrate - nitrite	Automated Cadmium Reduction	User Defined EPA 353.2	PA
Certified	Yes	DW03.05000	Nitrite	Automated Cadmium Reduction	EPA 353.2	PA
Certified	Yes	DW03.05450	Nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.05950	Orthophosphate	Colorimetric	SM 4500-P E	PA
Certified	Yes	DW03.06600	Residue - nonfilterable (TSS)	Gravimetric, 103-105 Deg C, Post Washing - mining	SM 2540 D	PA
Certified	Yes	DW03.06900	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	DW03.07150	Total dissolved solids (TDS)	Gravimetric At 180	SM 2540 C	PA
Certified	Yes	DW03.07250	Total hardness	Titrimetric, EDTA	SM 2340 C	PA
Certified	Yes	DW03.07550	Total organic carbon (TOC)	Persulfate-UV	SM 5310 C	PA
Certified	Yes	DW03.07800	Turbidity	Nephelometric	EPA 180.1	PA
Certified	Yes	DW03.08100	Turbidity	Nephelometric	SM 2130 B	PA

Category: DW04 --Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW04 --Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW04.00350	Chlorine - total, free or combined	DPD, Ferrous Titrimetric	SM 4500-Cl F	PA
Certified	Yes	DW04.01050	pH	Electrometric	SM 4500-H B	PA
Certified	Yes	DW04.01200	Temperature	Thermometric	SM 2550 B	PA

Category: DW06 --Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW06.01500	Mercury	Manual Cold Vapor	EPA 245.1	PA
Certified	Yes	DW06.03500	Silica	Molybdosilicate	SM 4500-SiO2 C	PA

Category: DW07 --Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW07.01000	Barium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01200	Calcium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01250	Chromium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01300	Cobalt	ICP	EPA 200.7	PA
Certified	Yes	DW07.01350	Copper	ICP	EPA 200.7	PA
Certified	Yes	DW07.01400	Iron	ICP	EPA 200.7	PA
Certified	Yes	DW07.01450	Lithium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01500	Magnesium	ICP	EPA 200.7	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW07 --Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW07.01550	Manganese	ICP	EPA 200.7	PA
Certified	Yes	DW07.01650	Nickel	ICP	EPA 200.7	PA
Certified	Yes	DW07.01700	Potassium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01800	Silver	ICP	EPA 200.7	PA
Certified	Yes	DW07.01850	Sodium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01900	Strontium	ICP	EPA 200.7	PA
Certified	Yes	DW07.01950	Tin	ICP	EPA 200.7	PA
Certified	Yes	DW07.02050	Vanadium	ICP	EPA 200.7	PA
Certified	Yes	DW07.02100	Zinc	ICP	EPA 200.7	PA
Certified	Yes	DW07.02150	Aluminum	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02200	Antimony	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02250	Arsenic	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02300	Barium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02350	Beryllium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02400	Cadmium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02450	Chromium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02550	Copper	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02600	Lead	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02650	Manganese	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02800	Nickel	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02850	Selenium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.02950	Thallium	ICP/MS	EPA 200.8	PA
Certified	Yes	DW07.03100	Zinc	ICP/MS	EPA 200.8	PA

Category: DW08 --Organic Parameters - Chromatography

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW08.12800	Aldicarb	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12850	Aldicarb sulfone	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12900	Aldicarb sulfoxide	HPLC	EPA 531.1	PA
Certified	Yes	DW08.12950	Carbaryl	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13000	Carbofuran (furadan)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13050	Hydroxy carbofuran (3-)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13150	Methomyl (Lannate)	HPLC	EPA 531.1	PA
Certified	Yes	DW08.13200	Oxamyl	HPLC	EPA 531.1	PA

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.00750	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	DW09.11450	Acetone	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11500	Acrylonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11550	Allyl chloride	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11600	Benzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11650	Bromobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11700	Bromochloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11750	Bromodichloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11800	Bromoform	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11850	Bromomethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11900	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.11950	Butylbenzene (n-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12000	Carbon disulfide	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12050	Carbon tetrachloride	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.12100	Chloroacetonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12150	Chlorobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12200	Chlorobutane (1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12250	Chloroethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12300	Chloroform	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12350	Chloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12400	Chlorotoluene (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12450	Chlorotoluene (4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12500	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T	EPA 524.2	NJ
Certified	Yes	DW09.12550	Dibromochloromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12600	Dibromoethane (1,2-) (EDB)	GC/MS, P & T	EPA 524.2	NJ
Certified	Yes	DW09.12650	Dibromomethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12700	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12750	Dichlorobenzene (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12800	Dichlorobenzene (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12850	Dichlorobenzene (1,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12900	Dichlorodifluoromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.12950	Dichloroethane (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13000	Dichloroethane (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13050	Dichloroethene (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13100	Dichloroethene (cis-1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13150	Dichloroethene (trans-1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13200	Dichloropropane (1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13250	Dichloropropane (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13300	Dichloropropane (2,2-)	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.13350	Dichloropropanone (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13400	Dichloropropene (1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13450	Dichloropropene (cis-1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13500	Dichloropropene (trans-1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13550	Diethyl ether (Ethyl ether)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13600	Diisopropyl Ether (DIPE)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13650	Ethyl methacrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13700	Ethylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13750	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13800	Hexachlorobutadiene (1,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.13950	Hexanone (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14000	Isopropylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14050	Isopropyltoluene (4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14100	Methacrylonitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14150	Methyl acrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14200	Methyl iodide	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14250	Methyl methacrylate	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14300	Methyl tert-butyl ether	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14350	Methylene chloride (Dichloromethane)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14400	Naphthalene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14450	Nitrobenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14500	Nitropropane (2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14550	Pentachloroethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14600	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.14650	Propionitrile	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14700	Propylbenzene (n-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14750	Sec-butylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14800	Styrene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14850	tert-Amylmethyl ether (TAME)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14900	Tert-butyl alcohol	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.14950	Tert-butylbenzene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15000	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15050	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15100	Tetrachloroethene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15150	Tetrahydrofuran	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15200	Toluene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15250	Trichlorobenzene (1,2,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15300	Trichlorobenzene (1,2,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15400	Trichloroethane (1,1,1-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15450	Trichloroethane (1,1,2-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15500	Trichloroethene	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.15550	Trichlorofluoromethane	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16000	Trichloropropane (1,2,3-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16050	Trimethylbenzene (1,2,4-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16100	Trimethylbenzene (1,3,5-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16150	Vinyl chloride	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16200	Xylene (m- + p-)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.16250	Xylene (o-)	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.16300	Xylenes (total)	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	DW09.26200	Phenanthrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.26450	Pyrene	SPE, GC/MS	EPA 525.2	PA
Certified	Yes	DW09.28900	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.28950	1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29000	1H, 1H, 2H, 2H-Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29050	1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29100	4,8-dioxa-3H-perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29150	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29200	Hexafluoropropylene oxide dimer acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29250	Nonafluoro-3,6-dioxaheptanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29300	Perfluoro(2-ethoxyethane)sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29350	Perfluoro-3-methoxypropanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29400	Perfluoro-4-methoxybutanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29450	Perfluorobutanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.29500	Perfluorobutanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29550	Perfluorodecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29600	Perfluorododecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29650	Perfluoroheptanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29700	Perfluoroheptanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29750	Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29800	Perfluorohexanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29850	Perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29900	Perfluorooctanesulfonic acid (PFOS)	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.29950	Perfluorooctanoic acid (PFOA)	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.30000	Perfluoropentanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.30050	Perfluoropentanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.30100	Perfluoroundecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	EPA 533	PA
Certified	Yes	DW09.30150	N-ethylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30200	N-methylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30250	Perfluorobutanesulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30300	Perfluorodecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30350	Perfluorododecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30400	Perfluoroheptanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30450	Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30500	Perfluorohexanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.30550	Perfluorononanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30600	Perfluorooctanesulfonic acid (PFOS)	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30650	Perfluorooctanoic acid (PFOA)	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30700	Perfluorotetradecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30750	Perfluorotridecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30800	Perfluoroundecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537	PA
Certified	Yes	DW09.30850	N-ethylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.30900	N-methylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.30950	Perfluorobutanesulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31000	Perfluorodecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31050	Perfluorododecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31100	Perfluoroheptanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31200	Perfluorohexanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31250	Perfluorononanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31300	Perfluorooctanesulfonic acid (PFOS)	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31350	Perfluorooctanoic acid (PFOA)	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31400	Perfluorotetradecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31450	Perfluorotridecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31500	Perfluoroundecanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31550	Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: DW09 --Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	DW09.31600	Hexafluoropropylene oxide dimer acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31650	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31700	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA
Certified	Yes	DW09.31750	4,8-dioxa-3H-perfluorononanoic acid	LC MS/MS, Electrospray Ionization	EPA 537.1	PA

Category: NPW03--Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW03.00100	Acidity as CaCO3	Electrometric or Phenolphthalein	SM 2310 B-11	PA
Certified	Yes	NPW03.00350	Alkalinity as CaCO3	Electrometric Titration	SM 2320 B-11	PA
Certified	Yes	NPW03.00360	Alkalinity as CaCO3	Titrimetric Indicator	SM 2320B-11	PA
Certified	Yes	NPW03.00750	Ammonia	Distillation, Titration	SM 4500-NH3 B plus C-11	PA
Certified	Yes	NPW03.00850	Ammonia	Distillation, Electrode	SM 4500-NH3 B plus D-11	PA
Certified	Yes	NPW03.01100	Ammonia	Distillation or Gas Diffusion, Semi-automated Phenate	EPA 350.1	PA
Certified	Yes	NPW03.01550	Biochemical oxygen demand	Dissolved Oxygen Depletion - Membrane Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.01700	Biochemical oxygen demand	Dissolved Oxygen Depletion - LDO Probe	SM 5210 B-16	PA
Certified	Yes	NPW03.02400	Bromide	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.02500	Bromide	Ion Chromatography	SW-846 9056A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW03--Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW03.02900	Carbonaceous BOD (CBOD)	Diss. Oxygen Depl., Nitrif. Inhib. - Membrane Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.02950	Carbonaceous BOD (CBOD)	Dissolved Oxygen Depl., Nitrif. Inhib., LDO Electrode	SM 5210 B-16	PA
Certified	Yes	NPW03.03500	Chemical oxygen demand	Spectrophotometric Manual/Auto	EPA 410.4	PA
Certified	Yes	NPW03.04150	Chloride	Titrimetric, Mercuric Nitrate	SM 4500-Cl C-11	PA
Certified	Yes	NPW03.04900	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.05100	Chloride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.06000	Color	Colorimetric (Platinum-Cobalt)	SM 2120 B-11	PA
Certified	Yes	NPW03.06600	Cyanide	Seg. Flow Inj., In-Line UV Digest., Gas Diff. Amperometry	ASTM D7511-17	PA
Certified	Yes	NPW03.06750	Cyanide	Distillation, Spectrophotometric (Auto)	EPA 335.4	PA
Certified	Yes	NPW03.06850	Cyanide	Colorimetric, Automated	SW-846 9012B	PA
Certified	Yes	NPW03.07550	Cyanide - amenable to Cl2	Flow Inj., Ligand Exch., Gas Diff. + Amperometry	Other OIA 1677-09	PA
Certified	Yes	NPW03.07750	Dissolved organic carbon (DOC)	Filtration and Persulfate/UV	SM 5310 C-11	PA
Certified	Yes	NPW03.08150	Fluoride	Distillation + Electrode, Manual	SM 4500-F B plus C-11	PA
Certified	Yes	NPW03.08500	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.08700	Fluoride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.09000	Free Cyanide	Flow Injection, Gas Diffusion, Amperometry	Other OIA 1677-09	PA
Certified	Yes	NPW03.09200	Hardness - total as CaCO3	Titrimetric, EDTA	SM 2340 C-11	PA
Certified	Yes	NPW03.10600	Kjeldahl nitrogen - total	Digestion, Semiauto. Digestor, Colorimetric	EPA 351.2	PA
Certified	Yes	NPW03.11050	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.11250	Nitrate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.11950	Nitrate - nitrite	Cadmium Reduction, Automated	EPA 353.2	PA
Certified	Yes	NPW03.13100	Nitrite	Auto, bypass Cd reduction	EPA 353.2	PA
Certified	Yes	NPW03.13650	Nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.13900	Nitrite	Ion Chromatography	SW-846 9056A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW03--Inorganic Parameters

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Dropped	No	NPW03.14250	Oil & grease - hem-SPE	Gravimetric, Hexane Extractable Material-SPE	EPA 1664A	PA
Certified	Yes	NPW03.14300	Oil & grease - hem-SPE	Gravimetric, Hexane Extractable Material-SPE	EPA 1664B	PA
Dropped	No	NPW03.14500	Oil & grease - sgt-non polar	Gravimetric, Silica Gel Treated-Hem-SPE	EPA 1664A	PA
Certified	Yes	NPW03.14600	Oil & grease - sgt-non polar	Gravimetric, Silica Gel Treated-Hem-LL	EPA 1664B	PA
Certified	Yes	NPW03.15350	Orthophosphate	Ascorbic Acid, Manual Single Reagent	SM 4500-P E-11	PA
Certified	Yes	NPW03.15400	Orthophosphate	Ascorbic Acid, Manual Two Reagent	EPA 365.3	PA
Certified	Yes	NPW03.16850	Phenols	Manual Distillation, Colorimetric Auto	EPA 420.4	PA
Certified	Yes	NPW03.16900	Phenols	Manual Distillation, Colorimetric Auto	SW-846 9066	PA
Certified	Yes	NPW03.17350	Phosphorus (total)	Auto Ascorbic Acid Reduction	EPA 365.1	PA
Certified	Yes	NPW03.17400	Phosphorus (total)	Auto Ascorbic Acid Reduction	SM 4500-P B5-11 plus F-11	PA
Certified	Yes	NPW03.17850	Residue - filterable (TDS)	Gravimetric, 180 Degrees C	SM 2540 C-15	PA
Certified	Yes	NPW03.18000	Residue - nonfilterable (TSS)	Gravimetric, 103-105 Degrees C, Post Washing	SM 2540 D-15	PA
Certified	Yes	NPW03.18100	Residue - settleable	Volumetric (Imhoff Cone) or Gravimetric	SM 2540 F-15	PA
Certified	Yes	NPW03.18150	Residue - total	Gravimetric, 103-105 Degrees C	SM 2540 B-15	PA
Certified	Yes	NPW03.18800	Specific conductance	Wheatstone Bridge	SM 2510 B-11	PA
Certified	Yes	NPW03.18850	Specific conductance	Wheatstone Bridge	SW-846 9050A	PA
Certified	Yes	NPW03.19850	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	NPW03.20050	Sulfate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	NPW03.20450	Sulfides	Titrimetric, Iodine	SM 4500-S B, C plus F-11	PA
Certified	Yes	NPW03.20500	Sulfides	Colorimetric (Methylene Blue)	SM 4500-S B, C plus D-11	PA
Certified	Yes	NPW03.20750	Surfactants	Colorimetric (Methylene Blue)	SM 5540 C-11	PA
Certified	Yes	NPW03.21300	Total organic carbon (TOC)	Heated or UV	SM 5310 C-14	PA
Certified	Yes	NPW03.21450	Total organic carbon (TOC)	Infrared Spectrometry or FID	SW-846 9060A	PA
Certified	Yes	NPW03.22100	Turbidity	Nephelometric	EPA 180.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW04--Analyze-Immed. and Continuous Monitoring

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW04.00250	Chlorine	DPD-FAS	SM 4500-Cl F-11	PA
Certified	Yes	NPW04.00800	Oxygen (dissolved)	Luminescence Based Sensor	Other HACH 10360 (10-2011 Rev 1.2)	PA
Dropped	No	NPW04.00950	Oxygen (dissolved)	Membrane Electrode	SM 4500-O G-16	PA
Certified	Yes	NPW04.01650	pH	Electrometric	SM 4500-H B-11	PA
Certified	Yes	NPW04.01750	pH (corrosivity)	Aqueous, Electrometric	SW-846 9040C	PA
Certified	Yes	NPW04.01850	Sulfite - SO3	Titrimetric, Iodine-Iodate	SM 4500-SO3 B-11	PA
Certified	Yes	NPW04.01950	Temperature	Thermometric	SM 2550 B-10	PA

Category: NPW06--Metals - NPW Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW06.00050	Metals	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA
Certified	Yes	NPW06.00100	Metals	Synthetic PPT Leachate Procedure	SW-846 1312	PA
Certified	Yes	NPW06.00200	Metals, Total Rec and Dissolved	Acid Digestion/Surface and Groundwater	SW-846 3005A	PA
Certified	Yes	NPW06.00250	Metals, Total	Acid Digestion/Aqueous Samples	SW-846 3010A	PA
Certified	Yes	NPW06.00350	Metals	Acid Digestion/Aqueous	SW-846 3020A	PA

Category: NPW07--Metals

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW07.03200	Chromium (VI)	0.45u Filter, Ion Chromatography	EPA 218.6	PA
Certified	Yes	NPW07.03350	Mercury	Manual Cold Vapor	EPA 245.1	PA
Certified	Yes	NPW07.08650	Chromium (VI)	0.45u Filter, Colorimetric DPC	SM 3500-Cr B-11	PA
Certified	Yes	NPW07.08850	Iron, Ferrous	Digestion, Colorimetric (Phenanthroline)	SM 3500-Fe B-11	PA
Certified	Yes	NPW07.09300	Silica - dissolved	0.45u Filtration + Colorimetric (Manual)	SM 4500-SiO2 C-11	PA
Certified	Yes	NPW07.11950	Chromium (VI)	Colorimetric	SW-846 7196A	PA
Certified	Yes	NPW07.12100	Chromium (VI)	Ion Chromatography	SW-846 7199	PA
Certified	Yes	NPW07.12150	Mercury - liquid waste	AA, Manual Cold Vapor	SW-846 7470A	PA

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.04150	Aluminum	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04200	Antimony	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04250	Arsenic	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04300	Barium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04350	Beryllium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04400	Boron	ICP	EPA 200.7	PA
Certified	Yes	NPW08.04450	Cadmium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04500	Calcium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04550	Chromium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04600	Cobalt	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04650	Copper	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04700	Iron	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04750	Lead	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04800	Lithium	Digestion, ICP	EPA 200.7	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.04850	Magnesium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04900	Manganese	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.04950	Molybdenum	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05000	Nickel	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05100	Potassium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05150	Selenium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05250	Silver	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05300	Sodium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05350	Strontium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05400	Thallium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05450	Tin	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05500	Titanium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05550	Vanadium	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05600	Zinc	Digestion, ICP	EPA 200.7	PA
Certified	Yes	NPW08.05650	Aluminum	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05700	Antimony	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05750	Arsenic	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05800	Barium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05850	Beryllium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.05950	Cadmium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06000	Calcium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06050	Chromium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06100	Cobalt	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06150	Copper	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06250	Iron	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06300	Lead	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06350	Magnesium	Digestion, ICP/MS	EPA 200.8	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.06400	Manganese	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06450	Molybdenum	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06500	Nickel	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06550	Potassium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06600	Selenium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06700	Silver	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06750	Sodium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06800	Strontium	ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06850	Thallium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.06950	Tin	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07000	Titanium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07100	Uranium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07150	Vanadium	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.07200	Zinc	Digestion, ICP/MS	EPA 200.8	PA
Certified	Yes	NPW08.12800	Aluminum	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.12850	Antimony	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.12900	Arsenic	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.12950	Barium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13000	Beryllium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13050	Boron	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13100	Cadmium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13150	Calcium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13200	Chromium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13250	Cobalt	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13300	Copper	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13350	Iron	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13400	Lead	ICP	SW-846 6010D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.13450	Lithium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13500	Magnesium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13550	Manganese	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13600	Molybdenum	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13650	Nickel	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13750	Potassium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13800	Selenium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13850	Silver	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13900	Sodium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.13950	Strontium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14000	Thallium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14050	Thorium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14100	Tin	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14150	Titanium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14250	Vanadium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14300	Zinc	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14350	Zirconium	ICP	SW-846 6010D	PA
Certified	Yes	NPW08.14400	Aluminum	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14450	Antimony	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14500	Arsenic	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14550	Barium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14600	Beryllium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14700	Cadmium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14750	Calcium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14800	Chromium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14850	Cobalt	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.14900	Copper	ICP/MS	SW-846 6020B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW08--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW08.14950	Iron	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15000	Lead	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15050	Magnesium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15100	Manganese	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15150	Molybdenum	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15200	Nickel	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15250	Potassium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15300	Selenium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15400	Silver	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15450	Sodium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15500	Strontium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15550	Thallium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15650	Tin	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15700	Titanium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15800	Uranium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15850	Vanadium	ICP/MS	SW-846 6020B	PA
Certified	Yes	NPW08.15900	Zinc	ICP/MS	SW-846 6020B	PA

Category: NPW09--Organics - NPW Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW09.00250	Organics	Synthetic PPT Leachate Procedure	SW-846 1312	PA
Certified	Yes	NPW09.00450	Semivolatile organics	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA
Certified	Yes	NPW09.00500	Semivolatile organics	Separatory Funnel Extraction	SW-846 3510C	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW09--Organics - NPW Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW09.00550	Semivolatile organics	Microscale Solvent Extraction - Aqueous	SW-846 3511	PA
Dropped	No	NPW09.00600	Semivolatile organics	Continuous Liquid-Liquid Extraction	SW-846 3520C	PA
Certified	Yes	NPW09.00850	Semivolatile organics	Cleanup-Florisil	SW-846 3620C	PA
Certified	Yes	NPW09.00900	Semivolatile organics	Cleanup-Silica Gel	SW-846 3630C	PA
Certified	Yes	NPW09.00950	Semivolatile organics	Cleanup-Gel Permeation	SW-846 3640A	PA
Certified	Yes	NPW09.01050	Semivolatile organics	Cleanup-Sulfur Removal	SW-846 3660B	PA
Certified	Yes	NPW09.01350	Volatile organics	TCLP, Toxicity Procedure, ZHE	SW-846 1311	PA
Certified	Yes	NPW09.01550	Volatile organics	Purge & Trap Aqueous	SW-846 5030C	PA

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.10000	Acetonitrile	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10050	Diethylamine	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10100	Dimethyl sulfoxide	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10150	Ethanol	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10200	Methoxyethanol (2-) (methyl cellosolve)	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10250	Methyl alcohol (Methanol)	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10300	Propyl Alcohol (n-)	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.10350	Triethylamine	GC, Direct Injection, FID	EPA 1671A	PA
Certified	Yes	NPW10.19150	Aldrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19200	Alpha BHC	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19300	Beta BHC	Extract/GC (ECD)	EPA 608.3	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.19650	Chlordane	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19700	Chlordane (alpha) (cis-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.19750	Chlordane (gamma) (trans-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20050	DDD (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20100	DDE (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20150	DDT (4,4'-)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20200	Delta BHC	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20350	Dieldrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20400	Endosulfan I	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20450	Endosulfan II	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20500	Endosulfan sulfate	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20550	Endrin	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20600	Endrin aldehyde	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20650	Endrin ketone	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20800	Heptachlor	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.20850	Heptachlor epoxide	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21000	Lindane (gamma BHC)	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21050	Methoxychlor	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21200	Mirex	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21800	Toxaphene	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21900	PCB 1016	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.21950	PCB 1221	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22000	PCB 1232	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22050	PCB 1242	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22100	PCB 1248	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22150	PCB 1254	Extract/GC (ECD)	EPA 608.3	PA
Certified	Yes	NPW10.22200	PCB 1260	Extract/GC (ECD)	EPA 608.3	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.31350	Butane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31400	Ethane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31450	Ethene	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31500	Isobutane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31550	Methane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31600	Propane	GC, Headspace, FID	Other J. Chrom. Sci. RSK-175	PA
Certified	Yes	NPW10.31650	Extractable Petroleum Hydrocarbons	Extraction, GC, FID	Other NJDEP EPH 10/08, Rev. 3	NJ
Certified	Yes	NPW10.39250	Dibromo-3-chloropropane (1,2-)	Extract/GC (ECD)	SW-846 8011	PA
Certified	Yes	NPW10.39300	Dibromoethane (1,2-) (EDB)	Extract/GC (ECD)	SW-846 8011	PA
Certified	Yes	NPW10.39650	Butanol (1-)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39800	Diesel range organic	Extraction, GC, FID	SW-846 8015D	PA
Certified	Yes	NPW10.39850	Diethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40000	Ethyl alcohol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40050	Ethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40200	Gasoline range organic	GC P&T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40300	Iso-butyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40350	Isopropyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40400	Methyl alcohol (Methanol)	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40750	Propyl Alcohol (n-)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	NPW10.40800	Propylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.41100	Triethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	NPW10.44600	Aldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44650	Alpha BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44750	Beta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44800	Chlordane (alpha) (cis-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.44850	Chlordane (gamma) (trans-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.44900	Chlordane (technical)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45250	DDD (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45300	DDE (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45350	DDT (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45400	Delta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45450	Dieldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45500	Endosulfan I	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45550	Endosulfan II	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45600	Endosulfan sulfate	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45650	Endrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45700	Endrin aldehyde	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45750	Endrin ketone	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45850	Heptachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.45900	Heptachlor epoxide	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46050	Lindane (gamma BHC)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46100	Methoxychlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46250	Mirex	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.46450	Toxaphene	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	NPW10.47600	PCB 1016	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47650	PCB 1221	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47700	PCB 1232	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47750	PCB 1242	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47800	PCB 1248	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47850	PCB 1254	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47900	PCB 1260	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.47950	PCB 1262	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.48000	PCB 1268	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	NPW10.55350	D (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55400	Dalapon	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55450	DB (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55550	Dicamba	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55650	Dichlorprop	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55700	Dinoseb	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55800	MCPA	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55850	MCPP	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.55950	Pentachlorophenol	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56000	Picloram	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56050	T (2,4,5-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56100	TP (2,4,5-) (Silvex)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	NPW10.56950	Acetaldehyde	HPLC, Extraction, Derivatization	SW-846 8315A	PA
Certified	Yes	NPW10.57050	Formaldehyde	HPLC, Extraction, Derivatization	SW-846 8315A	PA
Certified	Yes	NPW10.58650	Dinitrobenzene (1,3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58700	Dinitrotoluene (2,4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58750	Dinitrotoluene (2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58800	Dinitrotoluene (2-amino-4,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58850	Dinitrotoluene (4-amino-2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58900	HMX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.58950	Nitrobenzene	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59000	Nitroglycerine	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59050	Nitrotoluene (2-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59100	Nitrotoluene (3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59150	Nitrotoluene (4-)	HPLC, UV Detector	SW-846 8330B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW10--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW10.59200	PETN	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59250	RDX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59300	Tetryl	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59350	Trinitrobenzene (1,3,5-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	NPW10.59400	Trinitrotoluene (2,4,6-)	HPLC, UV Detector	SW-846 8330B	PA

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.00300	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00350	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00400	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00450	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00500	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00550	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00600	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00650	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00700	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00750	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00800	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00850	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00900	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.00950	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.01000	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.01050	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.01100	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	NPW11.12050	Amyl acetate (n-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12100	Amyl alcohol (n-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12150	Butyl acetate (n-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12200	Ethyl acetate	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12250	Heptane (n-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12300	Hexane (n-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12350	Isobutyraldehyde	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12400	Isopropanol	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12450	Isopropyl acetate	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12500	Isopropyl ether	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12550	Methyl formate	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12600	Methyl isobutyl ketone (MIBK)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12650	Tert-butyl alcohol	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12700	Tetrahydrofuran	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12750	Xylene (m- + p-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12800	Xylene (o-)	P & T, GC/MS Isotope Dilution	EPA 1666A	PA
Certified	Yes	NPW11.12850	Chlorobiphenyl (2-) (PCB 1)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.12900	Chlorobiphenyl (3-) (PCB 2)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.12950	Chlorobiphenyl (4-) (PCB 3)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13000	Dichlorobiphenyl (2,2'-) (PCB 4)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13050	Dichlorobiphenyl (2,3-) (PCB 5)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.13100	Dichlorobiphenyl (2,3'-) (PCB 6)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13150	Dichlorobiphenyl (2,4-) (PCB 7)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13200	Dichlorobiphenyl (2,4'-) (PCB 8)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13250	Dichlorobiphenyl (2,5-) (PCB 9)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13300	Dichlorobiphenyl (2,6-) (PCB 10)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13350	Dichlorobiphenyl (3,3'-) (PCB 11)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13400	Dichlorobiphenyl (3,4-) (PCB 12)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13450	Dichlorobiphenyl (3,4'-) (PCB 13)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13500	Dichlorobiphenyl (3,5-) (PCB 14)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13550	Dichlorobiphenyl (4,4'-) (PCB 15)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13600	Trichlorobiphenyl (2,2',3-) (PCB 16)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13650	Trichlorobiphenyl (2,2',4-) (PCB 17)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13700	Trichlorobiphenyl (2,2',5-) (PCB 18)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13750	Trichlorobiphenyl (2,2',6-) (PCB 19)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13800	Trichlorobiphenyl (2,3,3'-) (PCB 20)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13850	Trichlorobiphenyl (2,3,4-) (PCB 21)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.13900	Trichlorobiphenyl (2,3,4'-) (PCB 22)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.13950	Trichlorobiphenyl (2,3,5-) (PCB 23)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14000	Trichlorobiphenyl (2,3,6-) (PCB 24)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14050	Trichlorobiphenyl (2,3',4-) (PCB 25)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14100	Trichlorobiphenyl (2,3',5-) (PCB 26)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14150	Trichlorobiphenyl (2,3',6-) (PCB 27)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14200	Trichlorobiphenyl (2,4,4'-) (PCB 28)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14250	Trichlorobiphenyl (2,4,5-) (PCB 29)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14300	Trichlorobiphenyl (2,4,6-) (PCB 30)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14350	Trichlorobiphenyl (2,4',5-) (PCB 31)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14400	Trichlorobiphenyl (2,4',6-) (PCB 32)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14450	Trichlorobiphenyl (2,3', 4'-) (PCB 33)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14500	Trichlorobiphenyl (2,3', 5'-) (PCB 34)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14550	Trichlorobiphenyl (3,3',4-) (PCB 35)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14600	Trichlorobiphenyl (3,3',5-) (PCB 36)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14650	Trichlorobiphenyl (3,4,4'-) (PCB 37)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14700	Trichlorobiphenyl (3,4,5-) (PCB 38)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14750	Trichlorobiphenyl (3,4',5-) (PCB 39)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.14800	Tetrachlorobiphenyl (2,2',3,3'-) (PCB 40)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14850	Tetrachlorobiphenyl (2,2',3,4-) (PCB 41)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14900	Tetrachlorobiphenyl (2,2',3,4'-) (PCB 42)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.14950	Tetrachlorobiphenyl (2,2',3,5-) (PCB 43)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15000	Tetrachlorobiphenyl (2,2',3,5'-) (PCB 44)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15050	Tetrachlorobiphenyl (2,2',3,6-) (PCB 45)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15100	Tetrachlorobiphenyl (2,2',3,6'-) (PCB 46)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15150	Tetrachlorobiphenyl (2,2',4,4'-) (PCB 47)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15200	Tetrachlorobiphenyl (2,2',4,5-) (PCB 48)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15250	Tetrachlorobiphenyl (2,2',4,5'-) (PCB 49)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15300	Tetrachlorobiphenyl (2,2',4,6-) (PCB 50)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15350	Tetrachlorobiphenyl (2,2',4,6'-) (PCB 51)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15400	Tetrachlorobiphenyl (2,2',5,5'-) (PCB 52)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15450	Tetrachlorobiphenyl (2,2',5,6'-) (PCB 53)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15500	Tetrachlorobiphenyl (2,2',6,6'-) (PCB 54)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15550	Tetrachlorobiphenyl (2,3,3',4-) (PCB 55)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15600	Tetrachlorobiphenyl (2,3,3',4'-) (PCB 56)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.15650	Tetrachlorobiphenyl (2,3,3',5-) (PCB 57)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15700	Tetrachlorobiphenyl (2,3,3',5'-) (PCB 58)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15750	Tetrachlorobiphenyl (2,3,3',6-) (PCB 59)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15800	Tetrachlorobiphenyl (2,3,4,4'-) (PCB 60)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15850	Tetrachlorobiphenyl (2,3,4,5-) (PCB 61)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15900	Tetrachlorobiphenyl (2,3,4,6-) (PCB 62)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.15950	Tetrachlorobiphenyl (2,3,4',5-) (PCB 63)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16000	Tetrachlorobiphenyl (2,3,4',6-) (PCB 64)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16050	Tetrachlorobiphenyl (2,3,5,6-) (PCB 65)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16100	Tetrachlorobiphenyl (2,3', 4,4'-) (PCB 66)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16150	Tetrachlorobiphenyl (2,3', 4,5-) (PCB 67)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16200	Tetrachlorobiphenyl (2,3', 4,5'-) (PCB 68)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16250	Tetrachlorobiphenyl (2,3', 4,6-) (PCB 69)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16300	Tetrachlorobiphenyl (2,3', 4',5-) (PCB 70)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16350	Tetrachlorobiphenyl (2,3', 4',6-) (PCB 71)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16400	Tetrachlorobiphenyl (2,3', 5,5'-) (PCB 72)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16450	Tetrachlorobiphenyl (2,3', 5',6-) (PCB 73)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.16500	Tetrachlorobiphenyl (2,4,4',5-) (PCB 74)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16550	Tetrachlorobiphenyl (2,4,4',6-) (PCB 75)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16600	Tetrachlorobiphenyl (2,3', 4',5'-) (PCB 76)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16650	Tetrachlorobiphenyl (3,3', 4,4'-) (PCB 77)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16700	Tetrachlorobiphenyl (3,3', 4,5-) (PCB 78)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16750	Tetrachlorobiphenyl (3,3', 4,5'-) (PCB 79)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16800	Tetrachlorobiphenyl (3,3', 5,5'-) (PCB 80)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16850	Tetrachlorobiphenyl (3,4,4',5-) (PCB 81)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16900	Pentachlorobiphenyl (2,2',3,3',4-) (PCB 82)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.16950	Pentachlorobiphenyl (2,2',3,3',5-) (PCB 83)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17000	Pentachlorobiphenyl (2,2',3,3',6-) (PCB 84)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17050	Pentachlorobiphenyl (2,2',3,4,4'-) (PCB 85)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17100	Pentachlorobiphenyl (2,2',3,4,5-) (PCB 86)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17150	Pentachlorobiphenyl (2,2',3,4,5'-) (PCB 87)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17200	Pentachlorobiphenyl (2,2',3,4,6-) (PCB 88)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17250	Pentachlorobiphenyl (2,2',3,4,6'-) (PCB 89)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17300	Pentachlorobiphenyl (2,2',3,4',5-) (PCB 90)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.17350	Pentachlorobiphenyl (2,2',3,4',6-) (PCB 91)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17400	Pentachlorobiphenyl (2,2',3,5,5'-) (PCB 92)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17450	Pentachlorobiphenyl (2,2',3,5,6-) (PCB 93)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17500	Pentachlorobiphenyl (2,2',3,5,6'-) (PCB 94)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17550	Pentachlorobiphenyl (2,2',3,5',6-) (PCB 95)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17600	Pentachlorobiphenyl (2,2',3,6,6'-) (PCB 96)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17650	Pentachlorobiphenyl (2,2',3,4',5'-) (PCB 97)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17700	Pentachlorobiphenyl (2,2',3,4',6'-) (PCB 98)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17750	Pentachlorobiphenyl (2,2',4,4',5-) (PCB 99)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17800	Pentachlorobiphenyl (2,2',4,4',6-) (PCB 100)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17850	Pentachlorobiphenyl (2,2',4,5,5'-) (PCB 101)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17900	Pentachlorobiphenyl (2,2',4,5,6'-) (PCB 102)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.17950	Pentachlorobiphenyl (2,2',4,5',6-) (PCB 103)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18000	Pentachlorobiphenyl (2,2',4,6,6'-) (PCB 104)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18050	Pentachlorobiphenyl (2,3,3',4,4'-) (PCB 105)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18100	Pentachlorobiphenyl (2,3,3',4,5-) (PCB 106)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18150	Pentachlorobiphenyl (2,3,3',4',5-) (PCB 107)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.18200	Pentachlorobiphenyl (2,3,3',4,5'-) (PCB 108)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18250	Pentachlorobiphenyl (2,3,3',4,6-) (PCB 109)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18300	Pentachlorobiphenyl (2,3,3',4',6-) (PCB 110)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18350	Pentachlorobiphenyl (2,3,3',5,5'-) (PCB 111)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18400	Pentachlorobiphenyl (2,3,3',5,6-) (PCB 112)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18450	Pentachlorobiphenyl (2,3,3',5',6-) (PCB 113)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18500	Pentachlorobiphenyl (2,3,4,4',5-) (PCB 114)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18550	Pentachlorobiphenyl (2,3,4,4',6-) (PCB 115)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18600	Pentachlorobiphenyl (2,3,4,5,6-) (PCB 116)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18650	Pentachlorobiphenyl (2,3,4',5,6-) (PCB 117)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18700	Pentachlorobiphenyl (2,3',4,4',5-) (PCB 118)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18750	Pentachlorobiphenyl (2,3',4,4',6-) (PCB 119)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18800	Pentachlorobiphenyl (2,3',4,5,5'-) (PCB 120)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18850	Pentachlorobiphenyl (2,3',4,5',6-) (PCB 121)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18900	Pentachlorobiphenyl (2,3,3',4',5'-) (PCB 122)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.18950	Pentachlorobiphenyl (2,3',4,4',5'-) (PCB 123)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19000	Pentachlorobiphenyl (2,3',4',5,5'-) (PCB 124)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.19050	Pentachlorobiphenyl (2,3',4',5',6-) (PCB 125)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19100	Pentachlorobiphenyl (3,3',4,4',5-) (PCB 126)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19150	Pentachlorobiphenyl (3,3',4,5,5'-) (PCB 127)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19200	Hexachlorobiphenyl (2,2', 3,3',4,4'-) (PCB 128)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19250	Hexachlorobiphenyl (2,2', 3,3',4,5-) (PCB 129)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19300	Hexachlorobiphenyl (2,2', 3,3',4,5'-) (PCB 130)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19350	Hexachlorobiphenyl (2,2', 3,3',4,6-) (PCB 131)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19400	Hexachlorobiphenyl (2,2', 3,3',4,6'-) (PCB 132)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19450	Hexachlorobiphenyl (2,2', 3,3',5,5'-) (PCB 133)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19500	Hexachlorobiphenyl (2,2', 3,3',5,6-) (PCB 134)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19550	Hexachlorobiphenyl (2,2', 3,3',5,6'-) (PCB 135)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19600	Hexachlorobiphenyl (2,2', 3,3',6,6'-) (PCB 136)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19650	Hexachlorobiphenyl (2,2', 3,4,4',5-) (PCB 137)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19700	Hexachlorobiphenyl (2,2', 3,4,4',5'-) (PCB 138)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19750	Hexachlorobiphenyl (2,2', 3,4,4',6-) (PCB 139)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19800	Hexachlorobiphenyl (2,2', 3,4,4',6'-) (PCB 140)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19850	Hexachlorobiphenyl (2,2', 3,4,5,5'-) (PCB 141)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.19900	Hexachlorobiphenyl (2,2',3,4,5,6-) (PCB 142)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.19950	Hexachlorobiphenyl (2,2',3,4,5,6'-) (PCB 143)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20000	Hexachlorobiphenyl (2,2',3,4,5',6-) (PCB 144)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20050	Hexachlorobiphenyl (2,2',3,4,6,6'-) (PCB 145)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20100	Hexachlorobiphenyl (2,2',3,4',5,5'-) (PCB 146)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20150	Hexachlorobiphenyl (2,2',3,4',5,6-) (PCB 147)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20200	Hexachlorobiphenyl (2,2',3,4',5,6'-) (PCB 148)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20250	Hexachlorobiphenyl (2,2',3,4',5',6-) (PCB 149)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20300	Hexachlorobiphenyl (2,2',3,4',6,6'-) (PCB 150)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20350	Hexachlorobiphenyl (2,2',3,5,5',6-) (PCB 151)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20400	Hexachlorobiphenyl (2,2',3,5,6,6'-) (PCB 152)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20450	Hexachlorobiphenyl (2,2',4,4',5,5'-) (PCB 153)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20500	Hexachlorobiphenyl (2,2',4,4',5,6'-) (PCB 154)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20550	Hexachlorobiphenyl (2,2',4,4',6,6'-) (PCB 155)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20600	Hexachlorobiphenyl (2,3,3',4,4',5-) (PCB 156)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20650	Hexachlorobiphenyl (2,3,3',4,4',5'-) (PCB 157)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20700	Hexachlorobiphenyl (2,3,3',4,4',6-) (PCB 158)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.20750	Hexachlorobiphenyl (2,3,3',4,5,5'-) (PCB 159)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20800	Hexachlorobiphenyl (2,3,3',4,5,6-) (PCB 160)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20850	Hexachlorobiphenyl (2,3,3',4,5',6-) (PCB 161)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20900	Hexachlorobiphenyl (2,3,3',4',5,5'-) (PCB 162)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.20950	Hexachlorobiphenyl (2,3,3',4',5,6-) (PCB 163)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21000	Hexachlorobiphenyl (2,3,3',4',5',6-) (PCB 164)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21050	Hexachlorobiphenyl (2,3,3',5,5',6-) (PCB 165)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21100	Hexachlorobiphenyl (2,3,4,4',5,6-) (PCB 166)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21150	Hexachlorobiphenyl (2,3', 4,4',5,5'-) (PCB 167)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21200	Hexachlorobiphenyl (2,3', 4,4',5',6-) (PCB 168)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21250	Hexachlorobiphenyl (3,3', 4,4',5,5'-) (PCB 169)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21300	Heptachlorobiphenyl (2,2',3,3',4,4',5-) (PCB 170)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21350	Heptachlorobiphenyl (2,2',3,3',4,4',6-) (PCB 171)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21400	Heptachlorobiphenyl (2,2',3,3',4,5,5'-) (PCB 172)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21450	Heptachlorobiphenyl (2,2',3,3',4,5,6-) (PCB 173)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.21500	Heptachlorobiphenyl (2,2',3,3',4,5,6'-) (PCB 174)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21550	Heptachlorobiphenyl (2,2',3,3',4,5',6-) (PCB 175)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21600	Heptachlorobiphenyl (2,2',3,3',4,6,6'-) (PCB 176)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21650	Heptachlorobiphenyl (2,2',3,3',4,5',6'-) (PCB 177)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21700	Heptachlorobiphenyl (2,2',3,3',5,5',6-) (PCB 178)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21750	Heptachlorobiphenyl (2,2',3,3',5,6,6'-) (PCB 179)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21800	Heptachlorobiphenyl (2,2',3,4,4',5,5'-) (PCB 180)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21850	Heptachlorobiphenyl (2,2',3,4,4',5,6-) (PCB 181)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21900	Heptachlorobiphenyl (2,2',3,4,4',5,6'-) (PCB 182)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.21950	Heptachlorobiphenyl (2,2',3,4,4',5',6-) (PCB 183)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22000	Heptachlorobiphenyl (2,2',3,4,4',6,6'-) (PCB 184)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22050	Heptachlorobiphenyl (2,2',3,4,5,5',6-) (PCB 185)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.22100	Heptachlorobiphenyl (2,2',3,4,5,6,6'-) (PCB 186)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22150	Heptachlorobiphenyl (2,2',3,4',5,5',6-) (PCB 187)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22200	Heptachlorobiphenyl (2,2',3,4',5,6,6'-) (PCB 188)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22250	Heptachlorobiphenyl (2,3,3',4,4',5,5'-) (PCB 189)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22300	Heptachlorobiphenyl (2,3,3',4,4',5,6-) (PCB 190)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22350	Heptachlorobiphenyl (2,3,3',4,4',5',6-) (PCB 191)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22400	Heptachlorobiphenyl (2,3,3',4,5,5',6-) (PCB 192)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22450	Heptachlorobiphenyl (2,3,3',4',5,5',6-) (PCB 193)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22500	Octachlorobiphenyl (2,2',3,3',4,4',5,5'-) (PCB 194)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22550	Octachlorobiphenyl (2,2',3,3',4,4',5,6-) (PCB 195)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22600	Octachlorobiphenyl (2,2',3,3',4,4',5,6'-) (PCB 196)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22650	Octachlorobiphenyl (2,2',3,3',4,4',6,6'-) (PCB 197)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22700	Octachlorobiphenyl (2,2',3,3',4,5,5',6-) (PCB 198)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22750	Octachlorobiphenyl (2,2',3,3',4,5,5',6'-) (PCB 199)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.22800	Octachlorobiphenyl (2,2',3,3',4,5,6,6'-) (PCB 200)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22850	Octachlorobiphenyl (2,2',3,3',4,5',6,6'-) (PCB 201)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22900	Octachlorobiphenyl (2,2',3,3',5,5',6,6'-) (PCB 202)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.22950	Octachlorobiphenyl (2,2',3,4,4',5,5',6-) (PCB 203)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23000	Octachlorobiphenyl (2,2',3,4,4',5,6,6'-) (PCB 204)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23050	Octachlorobiphenyl (2,3,3',4,4',5,5',6-) (PCB 205)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23100	Nonachlorobiphenyl (2,2',3,3',4,4',5,5',6-) (PCB 206)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23150	Nonachlorobiphenyl (2,2',3,3',4,4',5,6,6'-) (PCB 207)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23200	Nonachlorobiphenyl (2,2',3,3',4,5,5',6,6'-) (PCB 208)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.23250	Decachlorobiphenyl (PCB 209)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	NPW11.33800	Acetone [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.33850	Benzene [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.33900	Chlorobenzene [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.33950	Chloroform [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.34000	Dichlorobenzene (1,2-) [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.34050	Dichloroethane (1,2-) [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.34100	Methylene chloride [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.34150	Pentanone (4-methyl-2-) (MIBK) [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.34200	Tetrahydrofuran [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.34250	Toluene [40CFR136, Table 1F]	GC/MS, P & T	EPA 524.2	PA
Certified	Yes	NPW11.38400	Acetone	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38450	Acetonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38500	Acrolein	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38550	Acrylonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38750	Benzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38800	Bromobenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38850	Bromochloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.38900	Bromodichloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39000	Bromoform	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39050	Bromomethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39100	Butadiene (2-chloro-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39200	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39250	Butyl acetate (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39400	Butylbenzene (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39450	Carbon disulfide	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39500	Carbon tetrachloride	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39550	Chlorobenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39600	Chloroethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.39650	Chloroethyl vinyl ether (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39700	Chloroform	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39750	Chloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39800	Chlorotoluene (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39850	Chlorotoluene (4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.39950	Cyclohexane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40050	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40100	Dibromochloromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40105	Dibromoethane (1,2-) (EDB)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40200	Dibromomethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40250	Dichloro-2-butene (cis-1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40300	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40350	Dichlorobenzene (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40400	Dichlorobenzene (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40450	Dichlorobenzene (1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40500	Dichlorodifluoromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40550	Dichloroethane (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40600	Dichloroethane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40650	Dichloroethene (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40700	Dichloroethene (cis-1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40750	Dichloroethene (trans-1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40800	Dichloropropane (1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40850	Dichloropropane (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.40900	Dichloropropane (2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.40950	Dichloropropene (1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41000	Dichloropropene (cis-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41050	Dichloropropene (trans-1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41150	Diisopropyl Ether (DIPE)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41200	Dioxane (1,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41350	Ethyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41400	Ethyl methacrylate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41450	Ethylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41500	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41550	Heptane (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41600	Hexachlorobutadiene (1,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41650	Hexane (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41700	Hexanone (2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41750	Iso-butyl alcohol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41850	Isopropanol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.41900	Isopropyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42000	Isopropylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42050	Isopropyltoluene (4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42100	Methacrylonitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42300	Methyl iodide	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42350	Methyl isobutyl ketone (MIBK)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42400	Methyl methacrylate	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42450	Methyl tert-butyl ether	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42550	Methylene chloride (Dichloromethane)	GC/MS, P & T, Capillary Column	EPA 624.1	PA

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.42600	Naphthalene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42800	Propionitrile	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42900	Propylbenzene (n-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.42950	Sec-butylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43000	Styrene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43050	tert-Amylmethyl ether (TAME)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43150	Tert-butyl alcohol	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43200	Tert-butylbenzene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43250	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43300	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43350	Tetrachloroethene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43400	Tetrahydrofuran	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43450	Toluene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43500	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43550	Trichlorobenzene (1,2,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43600	Trichlorobenzene (1,2,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43650	Trichloroethane (1,1,1-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43700	Trichloroethane (1,1,2-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43750	Trichloroethene	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43800	Trichlorofluoromethane	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43850	Trichloropropane (1,2,3-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.43950	Trimethylbenzene (1,2,4-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44000	Trimethylbenzene (1,3,5-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44050	Vinyl acetate	GC/MS, P & T, Capillary Column	EPA 624.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.44100	Vinyl chloride	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44150	Xylene (m- + p-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44250	Xylene (o-)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44350	Xylenes (total)	GC/MS, P & T, Capillary Column	EPA 624.1	PA
Certified	Yes	NPW11.44400	Acenaphthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44450	Acenaphthylene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44500	Acetophenone	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44650	Alpha - terpineol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44800	Aniline	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.44850	Anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45200	Benzidine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45250	Benzo(a)anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45300	Benzo(a)pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45350	Benzo(b)fluoranthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45400	Benzo(ghi)perylene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45500	Benzo(k)fluoranthene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45550	Benzoic acid	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45600	Benzyl alcohol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45700	Bis (2-chloroethoxy) methane	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45750	Bis (2-chloroethyl) ether	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45800	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.45850	Bis (2-ethylhexyl) phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46000	Bromophenyl-phenyl ether (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46050	Butylbenzylphthalate	Extract, GC/MS	EPA 625.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.46250	Carbazole	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46400	Chloroaniline (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46550	Chloronaphthalene (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46650	Chlorophenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46700	Chlorophenyl-phenyl ether (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.46900	Chrysene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47050	Decane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47500	Dibenzo(a,h)anthracene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47650	Dibenzofuran	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47700	Dichloroaniline (2,3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47750	Dichlorobenzidine (3,3'-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47800	Dichlorophenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47850	Dichlorophenol (2,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.47950	Diethyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48100	Dimethyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48250	Dimethylphenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48300	Di-n-butyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48400	Dinitrophenol (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48450	Dinitrophenol (2-methyl-4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48500	Dinitrotoluene (2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48550	Dinitrotoluene (2,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48600	Di-n-octyl phthalate	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48700	Diphenylhydrazine / Azobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.48800	Docosane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49000	Eicosane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49250	Fluoranthene	Extract, GC/MS	EPA 625.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.49300	Fluorene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49350	Hexachlorobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49400	Hexachlorobutadiene (1,3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49450	Hexachlorocyclopentadiene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49500	Hexachloroethane	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49650	Hexadecane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49700	Indeno(1,2,3-cd)pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.49800	Isophorone	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50350	Methyl phenol (4-chloro-3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50430	Methylnaphthalene (1-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50450	Methylnaphthalene (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50500	Methylphenanthrene (1-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50550	Methylphenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50600	Methylphenol (3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50650	Methylphenol (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.50950	Naphthalene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51150	Nitroaniline (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51200	Nitroaniline (3-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51250	Nitroaniline (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51300	Nitrobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51350	Nitrophenol (2-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51400	Nitrophenol (4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51450	N-Nitrosodiethylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51500	N-Nitrosodimethylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51530	N-Nitroso-di-n-butylamine	Extract, GC/MS	EPA 625.1	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.51550	N-Nitroso-di-n-propylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51600	N-Nitrosodiphenylamine / Diphenylamine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51800	N-Nitrosopyrrolidine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.51900	Octadecane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52400	Pentachlorobenzene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52550	Pentachlorophenol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52700	Phenanthrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.52750	Phenol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.53400	Pyrene	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.53450	Pyridine	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55100	Tetrachlorobenzene (1,2,4,5-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55150	Tetrachlorophenol (2,3,4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55200	Tetradecane (n-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55250	Toluidine (2-) (2-Methylaniline)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55400	Trichlorobenzene (1,2,4-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55500	Trichlorophenol (2,4,5-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.55550	Trichlorophenol (2,4,6-)	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.56550	Pentachlorophenol	Extract, GC/MS	EPA 625.1	PA
Certified	Yes	NPW11.68750	Acetone	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68800	Acetonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68850	Acrolein	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68900	Acrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.68950	Allyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69100	Benzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.69150	Benzyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69200	Bromobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69250	Bromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69300	Bromodichloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69400	Bromoform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69450	Bromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69500	Butadiene (2-chloro-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69550	Butanol (1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69650	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69850	Butylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69900	Carbon disulfide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.69950	Carbon tetrachloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70000	Chlorobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70050	Chloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70100	Chloroethyl vinyl ether (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70150	Chloroform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70200	Chloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70250	Chlorotoluene (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70300	Chlorotoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70400	Cyclohexane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70500	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70550	Dibromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70600	Dibromoethane (1,2-) (EDB)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70650	Dibromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.70750	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70800	Dichlorobenzene (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70850	Dichlorobenzene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70900	Dichlorobenzene (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.70950	Dichlorodifluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71000	Dichloroethane (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71050	Dichloroethane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71100	Dichloroethene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71150	Dichloroethene (cis-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71200	Dichloroethene (trans-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71250	Dichloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71300	Dichloropropane (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71350	Dichloropropane (2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71400	Dichloropropene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71450	Dichloropropene (cis-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71500	Dichloropropene (trans-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71550	Diethyl ether (Ethyl ether)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71600	Diisopropyl Ether (DIPE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71650	Dioxane (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71700	Ethanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71800	Ethyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71850	Ethyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71900	Ethylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.71950	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.72000	Heptane (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72050	Hexachlorobutadiene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72150	Hexane (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72200	Hexanone (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72250	Iso-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72300	Isopropanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72400	Isopropylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72450	Isopropyltoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72500	Methacrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72550	Methyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72650	Methyl iodide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72700	Methyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72750	Methyl tert-butyl ether	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72800	Methylcyclohexane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.72850	Methylene chloride (Dichloromethane)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73000	Naphthalene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73100	Nitropropane (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73250	Pentachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73350	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73400	Propionitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73450	Propylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73500	Sec-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73550	Styrene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73600	tert-Amylmethyl ether (TAME)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73700	Tert-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.73750	Tert-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73800	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73850	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73900	Tetrachloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.73950	Tetrahydrofuran	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74000	Toluene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74100	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74150	Trichlorobenzene (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74200	Trichlorobenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74250	Trichloroethane (1,1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74300	Trichloroethane (1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74350	Trichloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74400	Trichlorofluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74450	Trichloropropane (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74500	Trimethylbenzene (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74550	Trimethylbenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74600	Trimethylbenzene (1,3,5-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74700	Vinyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74750	Vinyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74800	Xylene (m-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74850	Xylene (o-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74900	Xylene (p-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.74950	Xylenes (total)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	NPW11.75150	Acenaphthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.75200	Acenaphthylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75250	Acetophenone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75300	Acetylaminofluorene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75500	Aminobiphenyl (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75600	Aniline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75650	Anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75750	Atrazine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75850	Benzaldehyde	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.75950	Benzidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76000	Benzo(a)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76050	Benzo(a)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76100	Benzo(b)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76150	Benzo(ghi)perylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76250	Benzo(k)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76300	Benzoic acid	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76400	Benzyl alcohol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76550	Biphenyl (1,1'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76600	Bis (2-chloroethoxy) methane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76650	Bis (2-chloroethyl) ether	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76700	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76750	Bis (2-ethylhexyl) phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76800	Bromophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76850	Butylbenzylphthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.76900	Caprolactam	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.76950	Carbazole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77150	Chloroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77200	Chlorobenzilate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77250	Chloronaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77300	Chloronaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77350	Chlorophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77400	Chlorophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77450	Chrysene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77750	Diallate (cis)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77800	Diallate (trans)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77850	Dibenz(a,h)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.77900	Dibenz(a,j)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78000	Dibenzo(a,h)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78200	Dibenzofuran	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78250	Dichlorobenzene (1,2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78300	Dichlorobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78350	Dichlorobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78400	Dichlorobenzidine (3,3'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78450	Dichlorophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78500	Dichlorophenol (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78600	Diethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78650	Dimethoate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78700	Dimethyl benzidine (3,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78750	Dimethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.78800	Dimethylaminoazobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79050	Dimethylbenz(a) anthracene (7,12-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.79100	Dimethylphenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79150	Di-n-butyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79200	Dinitrobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79250	Dinitrobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79300	Dinitrophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79350	Dinitrophenol (2-methyl-4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79400	Dinitrotoluene (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79450	Dinitrotoluene (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79500	Di-n-octyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79550	Dinoseb	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79600	Dioxane (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.79650	Diphenylhydrazine / Azobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80150	Fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80200	Fluorene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80350	Hexachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80400	Hexachlorobutadiene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80450	Hexachlorocyclopentadiene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80500	Hexachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80600	Hexachloropropene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80700	Indene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80750	Indeno(1,2,3-cd)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80800	Isodrin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80850	Isophorone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80900	Isosafrole (cis-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.80950	Isosafrole (trans-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.81100	Methanesulfonate (Ethyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81150	Methanesulfonate (Methyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81300	Methyl phenol (4-chloro-3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81350	Methylcholanthrene (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81400	Methylnaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81450	Methylnaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81500	Methylphenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81550	Methylphenol (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81600	Methylphenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81650	Naphthalene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81700	Napthoquinone (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81750	Napththylamine (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81800	Napththylamine (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81850	Nitroaniline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81900	Nitroaniline (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.81950	Nitroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82000	Nitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82100	Nitrophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82150	Nitrophenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82200	N-Nitrosodiethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82250	N-Nitrosodimethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82300	N-Nitroso-di-n-butylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82350	N-Nitroso-di-n-propylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82400	N-Nitrosodiphenylamine / Diphenylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.82450	N-Nitrosomethylethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82500	N-Nitrosomorpholine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82550	N-Nitrosopiperidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82600	N-Nitrosopyrrolidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82700	Parathion	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.82750	Parathion methyl	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83150	Pentachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83250	Pentachloronitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83300	Pentachlorophenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83350	Phenacetin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83400	Phenanthrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83450	Phenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83600	Phorate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83650	Phosphorothioate (O,O,O-triethyl)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83700	Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83750	Picoline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83800	Pronamide	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83850	Pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83900	Pyridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.83950	Quinoline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84000	Quinoline -1-Oxide (4-Nitro)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84100	Safrole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84150	Sulfotepp	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84350	Tetrachlorobenzene (1,2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.84400	Tetrachlorophenol (2,3,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84450	Toluidine (2-) (2-Methylaniline)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84650	Trichlorobenzene (1,2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84700	Trichlorophenol (2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84750	Trichlorophenol (2,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84900	Acenaphthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.84950	Acenaphthylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85000	Anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85050	Benzo(a)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85100	Benzo(a)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85150	Benzo(b)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85200	Benzo(ghi)perylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85250	Benzo(k)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85300	Chrysene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85350	Dibenzo(a,h)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85550	Dioxane (1,4-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85600	Fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85650	Fluorene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85850	Indeno(1,2,3-cd)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.85950	Methylnaphthalene (1-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86000	Methylnaphthalene (2-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86050	Naphthalene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86200	Phenanthrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86250	Pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	NPW11.86350	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86400	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW11--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW11.86450	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86500	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86550	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86600	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86650	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86700	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86750	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86800	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86850	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86900	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.86950	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87000	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87050	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87100	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87150	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87200	Total HpCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87250	Total HpCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87300	Total HxCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87350	Total HxCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87400	Total PeCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87450	Total PeCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87500	Total TCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.87550	Total TCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	NPW11.89000	Perchlorate	LC/MS or LC/MS/MS	SW-846 6850	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW16--NPW - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW16.05000	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05050	1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05100	1H, 1H, 2H, 2H-Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05150	1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05200	4,8-dioxa-3H-perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05250	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05300	Hexafluoropropylene oxide dimer acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05350	Perfluorobutanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05400	Perfluorobutanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05450	Perfluorodecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05500	Perfluorododecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05550	Perfluorodecanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05600	Perfluoroheptanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05650	Perfluoroheptanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: NPW16--NPW - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	NPW16.05700	Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05750	Perfluorohexanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05800	Perfluorooctanesulfonic acid (PFOS)	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05850	Perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05900	Perfluorononanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.05950	Perfluorooctanoic acid (PFOA)	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06000	Perfluorooctanesulfonamide	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06050	Perfluoropentanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06100	Perfluoropentanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06150	Perfluoroundecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06200	Perfluorotetradecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06250	Perfluorotridecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06300	N-ethylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ
Certified	Yes	NPW16.06350	N-methylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP# T-PFAS-WI21398, Ver7	NJ

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM02--Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM02.00450	Free liquid	Flow-Through Paint Filter, Observation	SW-846 9095B	PA
Certified	Yes	SCM02.00560	Ignitability	Pensky-Martin	SW-846 1010B	PA
Certified	Yes	SCM02.00800	pH - soil and waste	Mix with Water or Calcium Chlorides	SW-846 9045D	PA

Category: SCM03--Inorganic Parameters and Preparation

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM03.00300	Ammonia	Distillation, Titration	SM 4500-NH3 B plus C-11	PA
Dropped	No	SCM03.00500	Bromide	Ion Chromatography	EPA 300.0	PA
Dropped	No	SCM03.00550	Bromide	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.00850	Chloride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.00900	Chloride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.01250	Cyanide	Colorimetric, Automated	SW-846 9012B	PA
Certified	Yes	SCM03.01900	Fluoride	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.01950	Fluoride	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.02100	Inorganics	Shake, Extraction with Water	ASTM D3987-12	PA
Certified	Yes	SCM03.02450	Kjeldahl nitrogen - total	Digestion, Semi-automated	EPA 351.2	PA
Certified	Yes	SCM03.02650	Nitrate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.02700	Nitrate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.03050	Nitrite	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.03100	Nitrite	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.03200	Oil & grease - sludge-hem	Extraction & Gravimetric	SW-846 9071B	PA
Certified	Yes	SCM03.03250	Oil & grease - sludge-hem-npm	Extraction & Gravimetric	SW-846 9071B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM03--Inorganic Parameters and Preparation

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM03.03800	Phosphorus (total)	Auto Ascorbic Acid Reduction	EPA 365.1	PA
Certified	Yes	SCM03.03950	Specific conductance	Wheatstone Bridge	SW-846 9050A	PA
Certified	Yes	SCM03.04150	Sulfate	Ion Chromatography	EPA 300.0	PA
Certified	Yes	SCM03.04200	Sulfate	Ion Chromatography	SW-846 9056A	PA
Certified	Yes	SCM03.04700	Total organic carbon (TOC)	Pyrolytic	Other Lloyd Kahn	PA
Certified	Yes	SCM03.05000	Total, fixed, and volatile solids (SQAR)	Gravimetric, 500 Degrees C	SM 2540 G SM 18th Ed.	PA

Category: SCM05--Metals - SCM Preparation Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM05.00050	Metals	Acid Digestion, Soil Sediment & Sludge	SW-846 3050B	PA
Certified	Yes	SCM05.00100	Metals	Chromium VI Digestion	SW-846 3060A	PA
Certified	Yes	SCM05.00500	Metals	Shake, Extraction with Water	ASTM D3987-12	PA
Certified	Yes	SCM05.00550	Metals	Synthetic PPT Leachate Procedure	SW-846 1312	PA
Certified	Yes	SCM05.00600	Metals	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA

Category: SCM06--Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM06.02600	Chromium (VI)	Colorimetric	SW-846 7196A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM06--Metals

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM06.02750	Chromium (VI)	Ion Chromatography	SW-846 7199	PA
Certified	Yes	SCM06.02800	Mercury - solid waste	AA, Manual Cold Vapor	SW-846 7471B	PA

Category: SCM07--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.00001	Aluminum	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00050	Antimony	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00100	Arsenic	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00150	Barium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00200	Beryllium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00250	Boron	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00300	Cadmium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00350	Calcium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00400	Chromium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00450	Cobalt	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00500	Copper	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00550	Iron	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00600	Lead	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00650	Lithium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00700	Magnesium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00750	Manganese	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00800	Molybdenum	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.00850	Nickel	ICP	SW-846 6010D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM07--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.00950	Potassium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01000	Selenium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01050	Silver	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01100	Sodium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01150	Strontium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01200	Thallium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01250	Thorium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01300	Tin	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01350	Titanium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01450	Vanadium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01500	Zinc	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01550	Zirconium	ICP	SW-846 6010D	PA
Certified	Yes	SCM07.01600	Aluminum	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01650	Antimony	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01700	Arsenic	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01750	Barium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01800	Beryllium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01900	Cadmium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.01950	Calcium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02000	Chromium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02050	Cobalt	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02100	Copper	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02150	Iron	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02200	Lead	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02250	Magnesium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02300	Manganese	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02350	Molybdenum	ICP/MS	SW-846 6020B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM07--Metals - ICP, ICP/MS and DCP

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM07.02400	Nickel	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02450	Potassium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02500	Selenium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02600	Silver	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02650	Sodium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02700	Strontium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02750	Thallium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02850	Tin	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.02900	Titanium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.03000	Uranium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.03050	Vanadium	ICP/MS	SW-846 6020B	PA
Certified	Yes	SCM07.03100	Zinc	ICP/MS	SW-846 6020B	PA

Category: SCM08--Organics - SCM Prep. / Screening Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM08.00400	Organics	Synthetic PPT Leachate Procedure	SW-846 1312	PA
Certified	Yes	SCM08.00500	Organics	Waste Dilution	SW-846 3580A	PA
Certified	Yes	SCM08.00700	Semivolatile organics	TCLP, Toxicity Procedure, Shaker	SW-846 1311	PA
Certified	Yes	SCM08.00750	Semivolatile organics	Soxhlet Extraction	SW-846 3540C	PA
Certified	Yes	SCM08.00900	Semivolatile organics	Microwave Extraction	SW-846 3546	PA
Certified	Yes	SCM08.00950	Semivolatile organics	Ultrasonic Extraction	SW-846 3550C	PA
Certified	Yes	SCM08.01350	Semivolatile organics	Cleanup-Florisil	SW-846 3620C	PA
Certified	Yes	SCM08.01400	Semivolatile organics	Cleanup-Silica Gel	SW-846 3630C	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM08--Organics - SCM Prep. / Screening Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM08.01450	Semivolatile organics	Cleanup-Gel Permeation	SW-846 3640A	PA
Certified	Yes	SCM08.01550	Semivolatile organics	Cleanup-Sulfur Removal	SW-846 3660B	PA
Certified	Yes	SCM08.01600	Semivolatile organics	Cleanup-Sulfuric Acid/KMnO4	SW-846 3665A	PA
Certified	Yes	SCM08.01850	Volatile organics	TCLP, Toxicity Procedure, ZHE	SW-846 1311	PA
Certified	Yes	SCM08.02050	Volatile organics - high conc.	Methanol Extract, Closed System P & T	SW-846 5035A	PA
Certified	Yes	SCM08.02100	Volatile organics - low conc.	Closed System Purge & Trap	SW-846 5035A	PA

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.00150	Extractable Petroleum Hydrocarbons	Extraction, GC, FID	Other NJDEP EPH 10/08, Rev. 3	NJ
Certified	Yes	SCM09.00300	Dibromo-3-chloropropane (1,2-)	Microextraction, GC, ECD	SW-846 8011	PA
Certified	Yes	SCM09.00350	Dibromoethane (1,2-) (EDB)	Microextraction, GC, ECD	SW-846 8011	PA
Certified	Yes	SCM09.00450	Diesel range organic	Extraction, GC, FID	SW-846 8015D	PA
Certified	Yes	SCM09.00500	Gasoline range organic	GC P&T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01200	Ethyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01350	Isopropyl alcohol	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01400	Methyl alcohol (Methanol)	GC, Direct Injection or P & T, FID	SW-846 8015D	PA
Certified	Yes	SCM09.01950	Ethylene glycol	GC, Direct Injection, FID	SW-846 8015D	PA
Certified	Yes	SCM09.05650	Aldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05700	Alpha BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.05800	Beta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05850	Chlordane (alpha) (cis-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05900	Chlordane (gamma) (trans-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.05950	Chlordane (technical)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06300	DDD (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06350	DDE (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06400	DDT (4,4'-)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06450	Delta BHC	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06500	Dieldrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06550	Endosulfan I	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06600	Endosulfan II	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06650	Endosulfan sulfate	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06700	Endrin	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06750	Endrin aldehyde	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06800	Endrin ketone	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06900	Heptachlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.06950	Heptachlor epoxide	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07100	Lindane (gamma BHC)	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07150	Methoxychlor	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07300	Mirex	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.07500	Toxaphene	GC, Extraction, ECD or HECD, Capillary	SW-846 8081B	PA
Certified	Yes	SCM09.08700	PCB 1016	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08750	PCB 1221	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08800	PCB 1232	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08850	PCB 1242	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08900	PCB 1248	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.08950	PCB 1254	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.09000	PCB 1260	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09050	PCB 1262	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09100	PCB 1268	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09105	PCB 1016 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09110	PCB 1221 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09115	PCB 1232 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09120	PCB 1242 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09125	PCB 1248 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09130	PCB 1254 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.09135	PCB 1260 (Oil)	GC, Extraction, ECD or HECD, Capillary	SW-846 8082A	PA
Certified	Yes	SCM09.15400	D (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.15450	Dalapon	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.15500	DB (2,4-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16000	Dicamba	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16100	Dichlorprop	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16150	Dinoseb	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16250	MCPA	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16300	MCPP	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16400	Pentachlorophenol	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16450	Picloram	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16500	T (2,4,5-)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.16550	TP (2,4,5-) (Silvex)	GC, Extraction, ECD, Capillary	SW-846 8151A	PA
Certified	Yes	SCM09.17400	Acetaldehyde	HPLC, Extraction, Derivatization	SW-846 8315A	PA
Certified	Yes	SCM09.17500	Formaldehyde	HPLC, Extraction, Derivatization	SW-846 8315A	PA
Certified	Yes	SCM09.17750	Aldicarb	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.17800	Aldicarb sulfone	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.17850	Carbaryl	HPLC, Extraction, Derivatization	SW-846 8318A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM09--Organic Parameters - Chromatography

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM09.17900	Carbofuran (furadan)	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.17950	Hydroxy carbofuran (3-)	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.18000	Methiocarb (mesurol)	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.18050	Methomyl (Lannate)	HPLC, Extraction, Derivatization	SW-846 8318A	PA
Certified	Yes	SCM09.18800	Dinitrobenzene (1,3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18850	Dinitrotoluene (2,4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18900	Dinitrotoluene (2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.18950	Dinitrotoluene (2-amino-4,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19000	Dinitrotoluene (4-amino-2,6-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19050	HMX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19100	Nitrobenzene	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19150	Nitroglycerine	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19200	Nitrotoluene (2-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19250	Nitrotoluene (3-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19300	Nitrotoluene (4-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19350	PETN	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19400	RDX	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19450	Tetryl	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19500	Trinitrobenzene (1,3,5-)	HPLC, UV Detector	SW-846 8330B	PA
Certified	Yes	SCM09.19550	Trinitrotoluene (2,4,6-)	HPLC, UV Detector	SW-846 8330B	PA

Category: SCM10--Organic Parameters - Chromatography/MS

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.00150	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00200	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00250	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00300	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00350	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00400	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00450	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00500	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00550	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00600	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00650	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00700	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00750	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00800	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00850	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00900	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.00950	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	EPA 1613B	PA
Certified	Yes	SCM10.01050	Chlorobiphenyl (2-) (PCB 1)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01100	Chlorobiphenyl (3-) (PCB 2)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01150	Chlorobiphenyl (4-) (PCB 3)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01200	Dichlorobiphenyl (2,2'-) (PCB 4)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01250	Dichlorobiphenyl (2,3-) (PCB 5)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01300	Dichlorobiphenyl (2,3'-) (PCB 6)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01350	Dichlorobiphenyl (2,4-) (PCB 7)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01400	Dichlorobiphenyl (2,4'-) (PCB 8)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.01450	Dichlorobiphenyl (2,5-) (PCB 9)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01500	Dichlorobiphenyl (2,6-) (PCB 10)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01550	Dichlorobiphenyl (3,3'-) (PCB 11)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01600	Dichlorobiphenyl (3,4-) (PCB 12)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01650	Dichlorobiphenyl (3,4'-) (PCB 13)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01700	Dichlorobiphenyl (3,5-) (PCB 14)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01750	Dichlorobiphenyl (4,4'-) (PCB 15)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01800	Trichlorobiphenyl (2,2',3-) (PCB 16)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01850	Trichlorobiphenyl (2,2',4-) (PCB 17)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01900	Trichlorobiphenyl (2,2',5-) (PCB 18)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.01950	Trichlorobiphenyl (2,2',6-) (PCB 19)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02000	Trichlorobiphenyl (2,3,3'-) (PCB 20)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02050	Trichlorobiphenyl (2,3,4-) (PCB 21)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02100	Trichlorobiphenyl (2,3,4'-) (PCB 22)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02150	Trichlorobiphenyl (2,3,5-) (PCB 23)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02200	Trichlorobiphenyl (2,3,6-) (PCB 24)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02250	Trichlorobiphenyl (2,3',4-) (PCB 25)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.02300	Trichlorobiphenyl (2,3',5-) (PCB 26)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02350	Trichlorobiphenyl (2,3',6-) (PCB 27)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02400	Trichlorobiphenyl (2,4,4'-) (PCB 28)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02450	Trichlorobiphenyl (2,4,5-) (PCB 29)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02500	Trichlorobiphenyl (2,4,6-) (PCB 30)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02550	Trichlorobiphenyl (2,4',5-) (PCB 31)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02600	Trichlorobiphenyl (2,4',6-) (PCB 32)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02650	Trichlorobiphenyl (2,3', 4'-) (PCB 33)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02700	Trichlorobiphenyl (2,3', 5'-) (PCB 34)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02750	Trichlorobiphenyl (3,3',4-) (PCB 35)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02800	Trichlorobiphenyl (3,3',5-) (PCB 36)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02850	Trichlorobiphenyl (3,4,4'-) (PCB 37)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02900	Trichlorobiphenyl (3,4,5-) (PCB 38)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.02950	Trichlorobiphenyl (3,4',5-) (PCB 39)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03000	Tetrachlorobiphenyl (2,2', 3,3'-) (PCB 40)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03050	Tetrachlorobiphenyl (2,2', 3,4-) (PCB 41)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03100	Tetrachlorobiphenyl (2,2', 3,4'-) (PCB 42)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.03150	Tetrachlorobiphenyl (2,2', 3,5-) (PCB 43)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03200	Tetrachlorobiphenyl (2,2', 3,5'-) (PCB 44)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03250	Tetrachlorobiphenyl (2,2', 3,6-) (PCB 45)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03300	Tetrachlorobiphenyl (2,2', 3,6'-) (PCB 46)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03350	Tetrachlorobiphenyl (2,2', 4,4'-) (PCB 47)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03400	Tetrachlorobiphenyl (2,2', 4,5-) (PCB 48)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03450	Tetrachlorobiphenyl (2,2', 4,5'-) (PCB 49)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03500	Tetrachlorobiphenyl (2,2', 4,6-) (PCB 50)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03550	Tetrachlorobiphenyl (2,2', 4,6'-) (PCB 51)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03600	Tetrachlorobiphenyl (2,2', 5,5'-) (PCB 52)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03650	Tetrachlorobiphenyl (2,2', 5,6'-) (PCB 53)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03700	Tetrachlorobiphenyl (2,2', 6,6'-) (PCB 54)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03750	Tetrachlorobiphenyl (2,3,3',4-) (PCB 55)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03800	Tetrachlorobiphenyl (2,3,3',4'-) (PCB 56)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03850	Tetrachlorobiphenyl (2,3,3',5-) (PCB 57)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03900	Tetrachlorobiphenyl (2,3,3',5'-) (PCB 58)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.03950	Tetrachlorobiphenyl (2,3,3',6-) (PCB 59)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.04000	Tetrachlorobiphenyl (2,3,4,4'-) (PCB 60)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04050	Tetrachlorobiphenyl (2,3,4,5-) (PCB 61)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04100	Tetrachlorobiphenyl (2,3,4,6-) (PCB 62)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04150	Tetrachlorobiphenyl (2,3,4',5-) (PCB 63)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04200	Tetrachlorobiphenyl (2,3,4',6-) (PCB 64)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04250	Tetrachlorobiphenyl (2,3,5,6-) (PCB 65)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04300	Tetrachlorobiphenyl (2,3', 4,4'-) (PCB 66)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04350	Tetrachlorobiphenyl (2,3', 4,5-) (PCB 67)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04400	Tetrachlorobiphenyl (2,3', 4,5'-) (PCB 68)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04450	Tetrachlorobiphenyl (2,3', 4,6-) (PCB 69)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04500	Tetrachlorobiphenyl (2,3', 4',5-) (PCB 70)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04550	Tetrachlorobiphenyl (2,3', 4',6-) (PCB 71)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04600	Tetrachlorobiphenyl (2,3', 5,5'-) (PCB 72)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04650	Tetrachlorobiphenyl (2,3', 5',6-) (PCB 73)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04700	Tetrachlorobiphenyl (2,4,4',5-) (PCB 74)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04750	Tetrachlorobiphenyl (2,4,4',6-) (PCB 75)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04800	Tetrachlorobiphenyl (2,3', 4',5'-) (PCB 76)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.04850	Tetrachlorobiphenyl (3,3',4,4'-) (PCB 77)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04900	Tetrachlorobiphenyl (3,3',4,5-) (PCB 78)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.04950	Tetrachlorobiphenyl (3,3',4,5'-) (PCB 79)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05000	Tetrachlorobiphenyl (3,3',5,5'-) (PCB 80)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05050	Tetrachlorobiphenyl (3,4,4',5-) (PCB 81)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05100	Pentachlorobiphenyl (2,2',3,3',4-) (PCB 82)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05150	Pentachlorobiphenyl (2,2',3,3',5-) (PCB 83)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05200	Pentachlorobiphenyl (2,2',3,3',6-) (PCB 84)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05250	Pentachlorobiphenyl (2,2',3,4,4'-) (PCB 85)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05300	Pentachlorobiphenyl (2,2',3,4,5-) (PCB 86)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05350	Pentachlorobiphenyl (2,2',3,4,5'-) (PCB 87)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05400	Pentachlorobiphenyl (2,2',3,4,6-) (PCB 88)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05450	Pentachlorobiphenyl (2,2',3,4,6'-) (PCB 89)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05500	Pentachlorobiphenyl (2,2',3,4',5-) (PCB 90)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05550	Pentachlorobiphenyl (2,2',3,4',6-) (PCB 91)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05600	Pentachlorobiphenyl (2,2',3,5,5'-) (PCB 92)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05650	Pentachlorobiphenyl (2,2',3,5,6-) (PCB 93)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.05700	Pentachlorobiphenyl (2,2',3,5,6'-) (PCB 94)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05750	Pentachlorobiphenyl (2,2',3,5',6-) (PCB 95)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05800	Pentachlorobiphenyl (2,2',3,6,6'-) (PCB 96)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05850	Pentachlorobiphenyl (2,2',3,4',5'-) (PCB 97)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05900	Pentachlorobiphenyl (2,2',3,4',6'-) (PCB 98)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.05950	Pentachlorobiphenyl (2,2',4,4',5-) (PCB 99)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06000	Pentachlorobiphenyl (2,2',4,4',6-) (PCB 100)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06050	Pentachlorobiphenyl (2,2',4,5,5'-) (PCB 101)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06100	Pentachlorobiphenyl (2,2',4,5,6'-) (PCB 102)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06150	Pentachlorobiphenyl (2,2',4,5',6-) (PCB 103)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06200	Pentachlorobiphenyl (2,2',4,6,6'-) (PCB 104)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06250	Pentachlorobiphenyl (2,3,3',4,4'-) (PCB 105)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06300	Pentachlorobiphenyl (2,3,3',4,5-) (PCB 106)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06350	Pentachlorobiphenyl (2,3,3',4',5-) (PCB 107)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06400	Pentachlorobiphenyl (2,3,3',4,5'-) (PCB 108)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06450	Pentachlorobiphenyl (2,3,3',4,6-) (PCB 109)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06500	Pentachlorobiphenyl (2,3,3',4',6-) (PCB 110)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.06550	Pentachlorobiphenyl (2,3,3',5,5'-) (PCB 111)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06600	Pentachlorobiphenyl (2,3,3',5,6-) (PCB 112)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06650	Pentachlorobiphenyl (2,3,3',5',6-) (PCB 113)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06700	Pentachlorobiphenyl (2,3,4,4',5-) (PCB 114)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06750	Pentachlorobiphenyl (2,3,4,4',6-) (PCB 115)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06800	Pentachlorobiphenyl (2,3,4,5,6-) (PCB 116)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06850	Pentachlorobiphenyl (2,3,4',5,6-) (PCB 117)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06900	Pentachlorobiphenyl (2,3',4,4',5-) (PCB 118)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.06950	Pentachlorobiphenyl (2,3',4,4',6-) (PCB 119)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07000	Pentachlorobiphenyl (2,3',4,5,5'-) (PCB 120)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07050	Pentachlorobiphenyl (2,3',4,5',6-) (PCB 121)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07100	Pentachlorobiphenyl (2,3,3',4',5'-) (PCB 122)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07150	Pentachlorobiphenyl (2,3',4,4',5'-) (PCB 123)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07200	Pentachlorobiphenyl (2,3',4',5,5'-) (PCB 124)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07250	Pentachlorobiphenyl (2,3',4',5',6-) (PCB 125)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07300	Pentachlorobiphenyl (3,3',4,4',5-) (PCB 126)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07350	Pentachlorobiphenyl (3,3',4,5,5'-) (PCB 127)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.07400	Hexachlorobiphenyl (2,2',3,3',4,4'-) (PCB 128)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07450	Hexachlorobiphenyl (2,2',3,3',4,5-) (PCB 129)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07500	Hexachlorobiphenyl (2,2',3,3',4,5'-) (PCB 130)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07550	Hexachlorobiphenyl (2,2',3,3',4,6-) (PCB 131)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07600	Hexachlorobiphenyl (2,2',3,3',4,6'-) (PCB 132)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07650	Hexachlorobiphenyl (2,2',3,3',5,5'-) (PCB 133)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07700	Hexachlorobiphenyl (2,2',3,3',5,6-) (PCB 134)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07750	Hexachlorobiphenyl (2,2',3,3',5,6'-) (PCB 135)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07800	Hexachlorobiphenyl (2,2',3,3',6,6'-) (PCB 136)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07850	Hexachlorobiphenyl (2,2',3,4,4',5-) (PCB 137)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07900	Hexachlorobiphenyl (2,2',3,4,4',5'-) (PCB 138)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.07950	Hexachlorobiphenyl (2,2',3,4,4',6-) (PCB 139)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08000	Hexachlorobiphenyl (2,2',3,4,4',6'-) (PCB 140)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08050	Hexachlorobiphenyl (2,2',3,4,5,5'-) (PCB 141)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08100	Hexachlorobiphenyl (2,2',3,4,5,6-) (PCB 142)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08150	Hexachlorobiphenyl (2,2',3,4,5,6'-) (PCB 143)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08200	Hexachlorobiphenyl (2,2',3,4,5',6-) (PCB 144)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.08250	Hexachlorobiphenyl (2,2',3,4,6,6'-) (PCB 145)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08300	Hexachlorobiphenyl (2,2',3,4',5,5'-) (PCB 146)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08350	Hexachlorobiphenyl (2,2',3,4',5,6-) (PCB 147)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08400	Hexachlorobiphenyl (2,2',3,4',5,6'-) (PCB 148)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08450	Hexachlorobiphenyl (2,2',3,4',5',6-) (PCB 149)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08500	Hexachlorobiphenyl (2,2',3,4',6,6'-) (PCB 150)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08550	Hexachlorobiphenyl (2,2',3,5,5',6-) (PCB 151)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08600	Hexachlorobiphenyl (2,2',3,5,6,6'-) (PCB 152)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08650	Hexachlorobiphenyl (2,2',4,4',5,5'-) (PCB 153)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08700	Hexachlorobiphenyl (2,2',4,4',5,6'-) (PCB 154)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08750	Hexachlorobiphenyl (2,2',4,4',6,6'-) (PCB 155)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08800	Hexachlorobiphenyl (2,3,3',4,4',5-) (PCB 156)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08850	Hexachlorobiphenyl (2,3,3',4,4',5'-) (PCB 157)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08900	Hexachlorobiphenyl (2,3,3',4,4',6-) (PCB 158)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.08950	Hexachlorobiphenyl (2,3,3',4,5,5'-) (PCB 159)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09000	Hexachlorobiphenyl (2,3,3',4,5,6-) (PCB 160)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09050	Hexachlorobiphenyl (2,3,3',4,5',6-) (PCB 161)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.09100	Hexachlorobiphenyl (2,3,3',4',5,5'-) (PCB 162)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09150	Hexachlorobiphenyl (2,3,3',4',5,6-) (PCB 163)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09200	Hexachlorobiphenyl (2,3,3',4',5',6-) (PCB 164)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09250	Hexachlorobiphenyl (2,3,3',5,5',6-) (PCB 165)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09300	Hexachlorobiphenyl (2,3,4,4',5,6-) (PCB 166)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09350	Hexachlorobiphenyl (2,3', 4,4',5,5'-) (PCB 167)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09400	Hexachlorobiphenyl (2,3', 4,4',5',6-) (PCB 168)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09450	Hexachlorobiphenyl (3,3', 4,4',5,5'-) (PCB 169)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09500	Heptachlorobiphenyl (2,2',3,3',4,4',5-) (PCB 170)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09550	Heptachlorobiphenyl (2,2',3,3',4,4',6-) (PCB 171)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09600	Heptachlorobiphenyl (2,2',3,3',4,5,5'-) (PCB 172)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09650	Heptachlorobiphenyl (2,2',3,3',4,5,6-) (PCB 173)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09700	Heptachlorobiphenyl (2,2',3,3',4,5,6'-) (PCB 174)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09750	Heptachlorobiphenyl (2,2',3,3',4,5',6-) (PCB 175)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.09800	Heptachlorobiphenyl (2,2',3,3',4,6,6'-) (PCB 176)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09850	Heptachlorobiphenyl (2,2',3,3',4,5',6'-) (PCB 177)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09900	Heptachlorobiphenyl (2,2',3,3',5,5',6-) (PCB 178)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.09950	Heptachlorobiphenyl (2,2',3,3',5,6,6'-) (PCB 179)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10000	Heptachlorobiphenyl (2,2',3,4,4',5,5'-) (PCB 180)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10050	Heptachlorobiphenyl (2,2',3,4,4',5,6-) (PCB 181)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10100	Heptachlorobiphenyl (2,2',3,4,4',5,6'-) (PCB 182)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10150	Heptachlorobiphenyl (2,2',3,4,4',5',6-) (PCB 183)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10200	Heptachlorobiphenyl (2,2',3,4,4',6,6'-) (PCB 184)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10250	Heptachlorobiphenyl (2,2',3,4,5,5',6-) (PCB 185)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10300	Heptachlorobiphenyl (2,2',3,4,5,6,6'-) (PCB 186)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10350	Heptachlorobiphenyl (2,2',3,4',5,5',6-) (PCB 187)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.10400	Heptachlorobiphenyl (2,2',3,4',5,6,6'-) (PCB 188)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10450	Heptachlorobiphenyl (2,3,3',4,4',5,5'-) (PCB 189)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10500	Heptachlorobiphenyl (2,3,3',4,4',5,6-) (PCB 190)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10550	Heptachlorobiphenyl (2,3,3',4,4',5',6-) (PCB 191)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10600	Heptachlorobiphenyl (2,3,3',4,5,5',6-) (PCB 192)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10650	Heptachlorobiphenyl (2,3,3',4',5,5',6-) (PCB 193)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10700	Octachlorobiphenyl (2,2',3,3',4,4',5,5'-) (PCB 194)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10750	Octachlorobiphenyl (2,2',3,3',4,4',5,6-) (PCB 195)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10800	Octachlorobiphenyl (2,2',3,3',4,4',5,6'-) (PCB 196)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10850	Octachlorobiphenyl (2,2',3,3',4,4',6,6'-) (PCB 197)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10900	Octachlorobiphenyl (2,2',3,3',4,5,5',6-) (PCB 198)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.10950	Octachlorobiphenyl (2,2',3,3',4,5,5',6'-) (PCB 199)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11000	Octachlorobiphenyl (2,2',3,3',4,5,6,6'-) (PCB 200)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11050	Octachlorobiphenyl (2,2',3,3',4,5',6,6'-) (PCB 201)	Extraction, SIM, GC/MS	EPA 1668A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.11100	Octachlorobiphenyl (2,2',3,3',5,5',6,6'-) (PCB 202)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11150	Octachlorobiphenyl (2,2',3,4,4',5,5',6-) (PCB 203)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11200	Octachlorobiphenyl (2,2',3,4,4',5,6,6'-) (PCB 204)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11250	Octachlorobiphenyl (2,3,3',4,4',5,5',6-) (PCB 205)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11300	Nonachlorobiphenyl (2,2',3,3',4,4',5,5',6-) (PCB 206)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11350	Nonachlorobiphenyl (2,2',3,3',4,4',5,6,6'-) (PCB 207)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11400	Nonachlorobiphenyl (2,2',3,3',4,5,5',6,6'-) (PCB 208)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.11450	Decachlorobiphenyl (PCB 209)	Extraction, SIM, GC/MS	EPA 1668A	PA
Certified	Yes	SCM10.22800	Perchlorate	LC/MS or LC/MS/MS	SW-846 6850	PA
Certified	Yes	SCM10.22900	Acetone	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.22950	Acetonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23000	Acrolein	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23050	Acrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23100	Allyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23200	Benzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23250	Benzyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23300	Bromobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23350	Bromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23400	Bromodichloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23500	Bromoform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.23550	Bromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23600	Butadiene (2-chloro-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23610	Butanol (1-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23650	Butanone (2-) (Methyl ethyl ketone)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23800	Butylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23850	Carbon disulfide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23900	Carbon tetrachloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.23950	Chlorobenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24000	Chloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24050	Chloroethyl vinyl ether (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24100	Chloroform	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24150	Chloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24200	Chlorotoluene (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24250	Chlorotoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24330	Cyclohexane	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24350	Cyclohexanone	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24400	Dibromo-3-chloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24450	Dibromochloromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24500	Dibromoethane (1,2-) (EDB)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24550	Dibromomethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24650	Dichloro-2-butene (trans-1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24700	Dichlorobenzene (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24750	Dichlorobenzene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24800	Dichlorobenzene (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.24850	Dichlorodifluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24900	Dichloroethane (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.24950	Dichloroethane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25000	Dichloroethene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25050	Dichloroethene (cis-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25100	Dichloroethene (trans-1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25150	Dichloropropane (1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25200	Dichloropropane (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25250	Dichloropropane (2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25300	Dichloropropene (1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25350	Dichloropropene (cis-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25400	Dichloropropene (trans-1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25500	Diisopropyl Ether (DIPE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25550	Dioxane (1,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25600	Ethanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25650	Ethyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25700	Ethyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25750	Ethylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25800	Ethyl-tert-butyl Ether (ETBE)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25850	Hexachlorobutadiene (1,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25930	Hexane (n-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.25950	Hexanone (2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26000	Iso-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26050	Isopropanol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.26150	Isopropylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26200	Isopropyltoluene (4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26250	Methacrylonitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26280	Methyl acetate	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26330	Methylcyclohexane	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26350	Methyl iodide	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26400	Methyl methacrylate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26450	Methyl tert-butyl ether	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26500	Methylene chloride (Dichloromethane)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26650	Naphthalene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26730	Nitropropane (2-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26800	Pentachloroethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26850	Pentanone (4-methyl-2-) (MIBK)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26900	Propionitrile	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.26950	Propylbenzene (n-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27000	Sec-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27050	Styrene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27100	tert-Amylmethyl ether (TAME)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27200	Tert-butyl alcohol	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27250	Tert-butylbenzene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27300	Tetrachloroethane (1,1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27350	Tetrachloroethane (1,1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27400	Tetrachloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27450	Tetrahydrofuran	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.27500	Toluene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27600	Trichloro (1,1,2-) trifluoroethane (1,2,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27650	Trichlorobenzene (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27700	Trichlorobenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27750	Trichloroethane (1,1,1-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27800	Trichloroethane (1,1,2-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27850	Trichloroethene	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27900	Trichlorofluoromethane	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27950	Trichloropropane (1,2,3-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.27980	Trimethylbenzene (1,2,3-)	GC/MS, P & T, or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28000	Trimethylbenzene (1,2,4-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28050	Trimethylbenzene (1,3,5-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28150	Vinyl acetate	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28200	Vinyl chloride	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28250	Xylene (m-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28300	Xylene (o-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28350	Xylene (p-)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28400	Xylenes (total)	GC/MS, P & T or Direct Injection, Capillary	SW-846 8260D	PA
Certified	Yes	SCM10.28900	Acenaphthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.28950	Acenaphthylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29000	Acetophenone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29050	Acetylaminofluorene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29300	Aminobiphenyl (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29350	Aniline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29450	Anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.29550	Atrazine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29650	Benzaldehyde	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29750	Benzidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29800	Benzo(a)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29850	Benzo(a)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29900	Benzo(b)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.29950	Benzo(ghi)perylene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30050	Benzo(k)fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30100	Benzoic acid	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30200	Benzyl alcohol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30350	Biphenyl (1,1'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30400	Bis (2-chloroethoxy) methane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30450	Bis (2-chloroethyl) ether	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30500	Bis(2-chloroisopropyl) ether|2,2'-oxybis(1-chloropropane)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30550	Bis (2-ethylhexyl) phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30600	Bromophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30650	Butylbenzylphthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30700	Caprolactam	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30750	Carbazole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.30950	Chloroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31000	Chlorobenzilate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31050	Chloronaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31100	Chloronaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31150	Chlorophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.31200	Chlorophenyl-phenyl ether (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31250	Chrysene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31550	Diallate (cis)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31600	Diallate (trans)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31650	Dibenz(a,h)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31700	Dibenz(a,j)acridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.31800	Dibenzo(a,h)anthracene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32000	Dibenzofuran	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32050	Dichlorobenzene (1,2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32100	Dichlorobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32150	Dichlorobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32200	Dichlorobenzidine (3,3'-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32250	Dichlorophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32300	Dichlorophenol (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32400	Diethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32450	Dimethoate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32500	Dimethyl benzidine (3,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32550	Dimethyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32600	Dimethylaminoazobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32850	Dimethylbenz(a) anthracene (7,12-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32900	Dimethylphenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.32950	Di-n-butyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33000	Dinitrobenzene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33050	Dinitrobenzene (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33100	Dinitrophenol (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.33150	Dinitrophenol (2-methyl-4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33200	Dinitrotoluene (2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33250	Dinitrotoluene (2,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33300	Di-n-octyl phthalate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33400	Dioxane (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33450	Diphenylhydrazine / Azobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.33950	Fluoranthene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34000	Fluorene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34150	Hexachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34200	Hexachlorobutadiene (1,3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34250	Hexachlorocyclopentadiene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34300	Hexachloroethane	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34400	Hexachloropropene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34500	Indene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34550	Indeno(1,2,3-cd)pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34600	Isodrin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34650	Isophorone	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34700	Isosafrole (cis-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34750	Isosafrole (trans-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34900	Methanesulfonate (Ethyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.34950	Methanesulfonate (Methyl-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35100	Methyl phenol (4-chloro-3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35150	Methylcholanthrene (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.35200	Methylnaphthalene (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35250	Methylnaphthalene (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35300	Methylphenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35350	Methylphenol (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35400	Methylphenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35450	Naphthalene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35500	Napthoquinone (1,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35550	Napththylamine (1-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35600	Napththylamine (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35650	Nitroaniline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35700	Nitroaniline (3-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35750	Nitroaniline (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35800	Nitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35900	Nitrophenol (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.35950	Nitrophenol (4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36000	N-Nitrosodiethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36050	N-Nitrosodimethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36100	N-Nitroso-di-n-butylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36150	N-Nitroso-di-n-propylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36200	N-Nitrosodiphenylamine / Diphenylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36250	N-Nitrosomethylethylamine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36300	N-Nitrosomorpholine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36350	N-Nitrosopiperidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36400	N-Nitrosopyrrolidine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36500	Parathion	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.36550	Parathion methyl	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.36950	Pentachlorobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37050	Pentachloronitrobenzene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37100	Pentachlorophenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37150	Phenacetin	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37200	Phenanthrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37250	Phenol	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37400	Phorate	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37450	Phosphorothioate (diethyl-O-2-pyrazinyl) [Thionazin]	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37500	Phosphorothioate (O,O,O-triethyl)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37550	Picoline (2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37600	Pronamide	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37650	Pyrene	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37700	Pyridine	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37750	Quinoline	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37800	Quinoline -1-Oxide (4-Nitro)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37900	Safrole	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.37950	Sulfotepp	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38150	Tetrachlorobenzene (1,2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38200	Tetrachlorophenol (2,3,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38250	Toluidine (2-) (2-Methylaniline)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38350	Toluidine (5-nitro-2-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38450	Trichlorobenzene (1,2,4-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38500	Trichlorophenol (2,4,5-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM10--Organic Parameters - Chromatography/MS

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM10.38550	Trichlorophenol (2,4,6-)	GC/MS, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38700	Acenaphthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38750	Acenaphthylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38800	Anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38850	Benzo(a)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38900	Benzo(a)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.38950	Benzo(b)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39000	Benzo(ghi)perylene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39050	Benzo(k)fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39100	Chrysene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39150	Dibenzo(a,h)anthracene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39250	Dioxane (1,4-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39300	Fluoranthene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39350	Fluorene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39550	Indeno(1,2,3-cd)pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39600	Methylnaphthalene (1-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39650	Methylnaphthalene (2-)	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39700	Naphthalene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39850	Phenanthrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA
Certified	Yes	SCM10.39900	Pyrene	GC/MS/SIM, Extract or Dir Inj, Capillary	SW-846 8270E	PA

Category: SCM11--PCDD / PCDF

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM11--PCDD / PCDF

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM11.00001	HpCDD (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00050	HpCDF (1,2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00100	HpCDF (1,2,3,4,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00150	HxCDD (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00200	HxCDD (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00250	HxCDD (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00300	HxCDF (1,2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00350	HxCDF (1,2,3,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00400	HxCDF (1,2,3,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00450	HxCDF (2,3,4,6,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00500	OCDD (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00550	OCDF (1,2,3,4,6,7,8,9-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00600	PeCDD (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00650	PeCDF (1,2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00700	PeCDF (2,3,4,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00750	TCDD (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00800	TCDF (2,3,7,8-)	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00850	Total HpCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00900	Total HpCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.00950	Total HxCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.01000	Total HxCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.01050	Total PeCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.01100	Total PeCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.01150	Total TCDD	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA
Certified	Yes	SCM11.01200	Total TCDF	GC/Hi-Res MS, Selected Ion Monitoring	SW-846 8290A	PA

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM14--SCM - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM14.02650	Perfluorobutanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02700	Perfluorobutanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02750	Perfluorodecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02800	Perfluorododecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02850	Perfluoroheptanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02900	Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.02950	Perfluorohexanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03000	Perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03050	Perfluorooctanesulfonic acid (PFOS)	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03100	Perfluorooctanoic acid (PFOA)	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03150	Perfluoropentanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03200	Perfluorotetradecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03250	Perfluorotridecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03300	Perfluoroundecanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03350	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03400	1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Category: SCM14--SCM - Lab Developed/Non-Std Methods

Status	Eligible to Report NJ Data	Code	Parameter	Technique	Approved Methods	Primary State
Certified	Yes	SCM14.03450	1H, 1H, 2H, 2H-Perfluorohexanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03500	1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03550	4,8-dioxa-3H-perfluorononanoic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03600	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03650	Hexafluoropropylene oxide dimer acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03700	N-ethylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03750	N-methylperfluorooctanesulfonamidoacetic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03800	Perfluorodecanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03850	Perfluoropentanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03900	Perfluoroheptanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.03950	Perfluorononanesulfonic acid	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ
Certified	Yes	SCM14.04000	Perfluorooctanesulfonamide	LC MS/MS, Electrospray Ionization, Isotope Dilution	User Defined SOP T-PFAS-WI43626, Ver 1, Eff 2/16/22	NJ

New Jersey Department of Environment Protection
Environmental Laboratory Certification Program

Annual Certified Parameter List and Current Status

Effective as of 07/01/2022 until 6/30/2023

Laboratory Name: EUROFINS LANCASTER LABS ENVIRONMENT TESTING Laboratory Number: PA011 Activity ID: NLC 220001
2425 NEW HOLLAND PK
LANCASTER PA 176015994

Michele M. Potter, Manager

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Jon Niermann, *Chairman*
Emily Lindley, *Commissioner*
Bobby Janecka, *Commissioner*
Toby Baker, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

July 18, 2022

Ms. Stephanie Coch
Eurofins Houston
4141-4147 Greenbriar Dr.
Stafford, TX 77477

Subject: Amendment application

Dear Ms. Coch:

Based on the amendment request submitted on March 15, 2022, I am enclosing an updated NELAP accreditation certificate and Fields of Accreditation listing. They replace the previous ones issued on July 01, 2022.

Please review the enclosures for accuracy and completeness. Your laboratory's accreditation is valid until the expiration date on the certificate and scope, contingent on continued compliance with the standards for accreditation and requirements of the state of Texas.

Please contact me by electronic mail at frank.jamison@tceq.texas.gov if I can provide any additional information or assistance.

Sincerely,

Frank Jamison
Data and Records Specialist

Enclosures

Texas Commission on Environmental Quality

NELAP-Recognized Laboratory Accreditation is hereby awarded to

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

in accordance with Texas Water Code Chapter 5, Subchapter R, Title 30 Texas Administrative Code Chapter 25, and the National Environmental Laboratory Accreditation Program.

The laboratory's scope of accreditation includes the fields of accreditation that accompany this certificate. Continued accreditation depends upon successful ongoing participation in the program. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current location(s) and accreditation status for particular methods and analyses (www.tceq.texas.gov/goto/lab). Accreditation does not imply that a product, process, system or person is approved by the Texas Commission on Environmental Quality.

Certificate Number: T104704215-22-47
Effective Date: 7/18/2022
Expiration Date: 6/30/2023

Executive Director Texas Commission on Environmental Quality

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate: T104704215-22-47
Expiration Date: 6/30/2023
Issue Date: 7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Drinking Water***

Method EPA 200.7

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10013806
Antimony	TX	1005	10013806
Arsenic	TX	1010	10013806
Barium	TX	1015	10013806
Beryllium	TX	1020	10013806
Boron	TX	1025	10013806
Cadmium	TX	1030	10013806
Chromium	TX	1040	10013806
Cobalt	TX	1050	10013806
Copper	TX	1055	10013806
Iron	TX	1070	10013806
Lead	TX	1075	10013806
Lithium	TX	1080	10013806
Magnesium	TX	1085	10013806
Manganese	TX	1090	10013806
Molybdenum	TX	1100	10013806
Nickel	TX	1105	10013806
Potassium	TX	1125	10013806
Selenium	TX	1140	10013806
Silica as SiO2	TX	1990	10013806
Silver	TX	1150	10013806
Sodium	TX	1155	10013806
Strontium	TX	1160	10013806
Tin	TX	1175	10013806
Titanium	TX	1180	10013806
Vanadium	TX	1185	10013806
Zinc	TX	1190	10013806

Method EPA 200.8

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Drinking Water***

Aluminum	TX	1000	10014605
Antimony	TX	1005	10014605
Arsenic	TX	1010	10014605
Barium	TX	1015	10014605
Beryllium	TX	1020	10014605
Cadmium	TX	1030	10014605
Chromium	TX	1040	10014605
Copper	TX	1055	10014605
Lead	TX	1075	10014605
Manganese	TX	1090	10014605
Nickel	TX	1105	10014605
Selenium	TX	1140	10014605
Silver	TX	1150	10014605
Thallium	TX	1165	10014605
Uranium	TX	3035	10014605
Zinc	TX	1190	10014605

Method EPA 245.1

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10036609

Method EPA 300.0

Analyte	AB	Analyte ID	Method ID
Bromide	TX	1540	10053200
Chloride	TX	1575	10053200
Chlorite	TX	1595	10053200
Fluoride	TX	1730	10053200
Nitrate as N	TX	1810	10053200
Nitrite as N	TX	1840	10053200
Sulfate	TX	2000	10053200

Method EPA 300.0 B

Analyte	AB	Analyte ID	Method ID
Chlorate	TX	1570	10275408

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	**T104704215-22-47**
Expiration Date:	**6/30/2023**
Issue Date:	**7/18/2022**

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Drinking Water***

Method EPA 335.4

Analyte	AB	Analyte ID	Method ID
Total cyanide	TX	1645	10061402

Method EPA 353.2

Analyte	AB	Analyte ID	Method ID
Nitrate as N	TX	1810	10067604
Nitrite as N	TX	1840	10067604

Method Kelada-01

Analyte	AB	Analyte ID	Method ID
Total cyanide	TX	1635	60005303

Method SM 2510 B

Analyte	AB	Analyte ID	Method ID
Conductivity	TX	1610	20048004

Method SM 2540 C

Analyte	AB	Analyte ID	Method ID
Residue-filterable (TDS)	TX	1955	20049803

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 1010

Analyte	AB	Analyte ID	Method ID
Ignitability	TX	1780	10116606

Method EPA 1311

Analyte	AB	Analyte ID	Method ID
TCLP	TX	849	10118806

Method EPA 1312

Analyte	AB	Analyte ID	Method ID
SPLP	TX	850	10119003

Method EPA 160.4

Analyte	AB	Analyte ID	Method ID
Residue-volatile	TX	1970	10010409

Method EPA 1664

Analyte	AB	Analyte ID	Method ID
n-Hexane Extractable Material (HEM) (O&G)	TX	1803	10127807
Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)	TX	10220	10127807

Method EPA 180.1

Analyte	AB	Analyte ID	Method ID
Turbidity	TX	2055	10011606

Method EPA 200.7

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10013806
Antimony	TX	1005	10013806
Arsenic	TX	1010	10013806
Barium	TX	1015	10013806
Beryllium	TX	1020	10013806
Boron	TX	1025	10013806
Cadmium	TX	1030	10013806
Calcium	TX	1035	10013806
Chromium	TX	1040	10013806
Cobalt	TX	1050	10013806

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Copper	TX	1055	10013806
Iron	TX	1070	10013806
Lead	TX	1075	10013806
Lithium	TX	1080	10013806
Magnesium	TX	1085	10013806
Manganese	TX	1090	10013806
Molybdenum	TX	1100	10013806
Nickel	TX	1105	10013806
Potassium	TX	1125	10013806
Selenium	TX	1140	10013806
Silica as SiO2	TX	1990	10013806
Silver	TX	1150	10013806
Sodium	TX	1155	10013806
Strontium	TX	1160	10013806
Thallium	TX	1165	10013806
Tin	TX	1175	10013806
Titanium	TX	1180	10013806
Vanadium	TX	1185	10013806
Zinc	TX	1190	10013806

Method EPA 200.8

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10014605
Antimony	TX	1005	10014605
Arsenic	TX	1010	10014605
Barium	TX	1015	10014605
Beryllium	TX	1020	10014605
Boron	TX	1025	10014605
Cadmium	TX	1030	10014605
Chromium	TX	1040	10014605
Cobalt	TX	1050	10014605

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Copper	TX	1055	10014605
Iron	TX	1070	10014605
Lead	TX	1075	10014605
Magnesium	TX	1085	10014605
Manganese	TX	1090	10014605
Molybdenum	TX	1100	10014605
Nickel	TX	1105	10014605
Potassium	TX	1125	10014605
Selenium	TX	1140	10014605
Silver	TX	1150	10014605
Sodium	TX	1155	10014605
Strontium	TX	1160	10014605
Thallium	TX	1165	10014605
Tin	TX	1175	10014605
Titanium	TX	1180	10014605
Uranium	TX	3035	10014605
Vanadium	TX	1185	10014605
Zinc	TX	1190	10014605

Method EPA 245.1

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10036609

Method EPA 300.0

Analyte	AB	Analyte ID	Method ID
Bromide	TX	1540	10053200
Chloride	TX	1575	10053200
Fluoride	TX	1730	10053200
Nitrate as N	TX	1810	10053200
Nitrate-nitrite	TX	1820	10053200
Nitrite as N	TX	1840	10053200
Orthophosphate as P	TX	1870	10053200
Sulfate	TX	2000	10053200

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method EPA 335.4

Analyte	AB	Analyte ID	Method ID
Total cyanide	TX	1645	10061402

Method EPA 350.1

Analyte	AB	Analyte ID	Method ID
Ammonia as N	TX	1515	10063408

Method EPA 351.2

Analyte	AB	Analyte ID	Method ID
Kjeldahl Nitrogen (Total Kjeldahl Nitrogen-TKN)	TX	1790	10065404

Method EPA 353.2

Analyte	AB	Analyte ID	Method ID
Nitrate as N	TX	1810	10067400
Nitrate-nitrite	TX	1820	10067400
Nitrite as N	TX	1840	10067400

Method EPA 360.1

Analyte	AB	Analyte ID	Method ID
Oxygen, dissolved	TX	1880	10069008

Method EPA 365.1

Analyte	AB	Analyte ID	Method ID
Orthophosphate as P	TX	1870	10070005
Phosphorus	TX	1910	10070005

Method EPA 420.4

Analyte	AB	Analyte ID	Method ID
Total phenolics	TX	1905	10080203

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10155609
Antimony	TX	1005	10155609
Arsenic	TX	1010	10155609
Barium	TX	1015	10155609
Beryllium	TX	1020	10155609

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Boron	TX	1025	10155609
Cadmium	TX	1030	10155609
Calcium	TX	1035	10155609
Chromium	TX	1040	10155609
Cobalt	TX	1050	10155609
Copper	TX	1055	10155609
Iron	TX	1070	10155609
Lead	TX	1075	10155609
Lithium	TX	1080	10155609
Magnesium	TX	1085	10155609
Manganese	TX	1090	10155609
Molybdenum	TX	1100	10155609
Nickel	TX	1105	10155609
Phosphorus	TX	1910	10155609
Potassium	TX	1125	10155609
Selenium	TX	1140	10155609
Silica as SiO2	TX	1990	10155609
Silver	TX	1150	10155609
Sodium	TX	1155	10155609
Strontium	TX	1160	10155609
Thallium	TX	1165	10155609
Tin	TX	1175	10155609
Titanium	TX	1180	10155609
Vanadium	TX	1185	10155609
Zinc	TX	1190	10155609

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10156419
Antimony	TX	1005	10156419
Arsenic	TX	1010	10156419

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Barium	TX	1015	10156419
Beryllium	TX	1020	10156419
Boron	TX	1025	10156419
Cadmium	TX	1030	10156419
Chromium	TX	1040	10156419
Cobalt	TX	1050	10156419
Copper	TX	1055	10156419
Iron	TX	1070	10156419
Lead	TX	1075	10156419
Magnesium	TX	1085	10156419
Manganese	TX	1090	10156419
Molybdenum	TX	1100	10156419
Nickel	TX	1105	10156419
Potassium	TX	1125	10156419
Selenium	TX	1140	10156419
Silver	TX	1150	10156419
Sodium	TX	1155	10156419
Strontium	TX	1160	10156419
Thallium	TX	1165	10156419
Tin	TX	1175	10156419
Titanium	TX	1180	10156419
Vanadium	TX	1185	10156419
Zinc	TX	1190	10156419

Method EPA 608.3

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10296625
4,4'-DDE	TX	7360	10296625
4,4'-DDT	TX	7365	10296625
Aldrin	TX	7025	10296625
alpha-BHC (alpha-Hexachlorocyclohexane)	TX	7110	10296625

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

alpha-Chlordane	TX	7240	10296625
Aroclor-1016 (PCB-1016)	TX	8880	10296625
Aroclor-1221 (PCB-1221)	TX	8885	10296625
Aroclor-1232 (PCB-1232)	TX	8890	10296625
Aroclor-1242 (PCB-1242)	TX	8895	10296625
Aroclor-1248 (PCB-1248)	TX	8900	10296625
Aroclor-1254 (PCB-1254)	TX	8905	10296625
Aroclor-1260 (PCB-1260)	TX	8910	10296625
beta-BHC (beta-Hexachlorocyclohexane)	TX	7115	10296625
Chlordane (tech.)	TX	7250	10296625
delta-BHC (delta-Hexachlorocyclohexane)	TX	7105	10296625
Dieldrin	TX	7470	10296625
Endosulfan I	TX	7510	10296625
Endosulfan II	TX	7515	10296625
Endosulfan sulfate	TX	7520	10296625
Endrin	TX	7540	10296625
Endrin aldehyde	TX	7530	10296625
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	TX	7120	10296625
gamma-Chlordane	TX	7245	10296625
Heptachlor	TX	7685	10296625
Heptachlor epoxide	TX	7690	10296625
Methoxychlor	TX	7810	10296625
Toxaphene (Chlorinated camphene)	TX	8250	10296625

Method EPA 615

Analyte	AB	Analyte ID	Method ID
2,4,5-T	TX	8655	10298201
2,4-D	TX	8545	10298201
2,4-DB	TX	8560	10298201
Dalapon	TX	8555	10298201
Dicamba	TX	8595	10298201

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Dichloroprop (Dichlorprop, Weedone)	TX	8605	10298201
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10298201
MCPA	TX	7775	10298201
MCPP	TX	7780	10298201
Silvex (2,4,5-TP)	TX	8650	10298201

Method EPA 624.1

Analyte	AB	Analyte ID	Method ID
1,1,1-Trichloroethane	TX	5160	10298121
1,1,2,2-Tetrachloroethane	TX	5110	10298121
1,1,2-Trichloroethane	TX	5165	10298121
1,1-Dichloroethane	TX	4630	10298121
1,1-Dichloroethylene	TX	4640	10298121
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10298121
1,2-Dichlorobenzene	TX	4610	10298121
1,2-Dichloroethane (Ethylene dichloride)	TX	4635	10298121
1,2-Dichloropropane	TX	4655	10298121
1,3-Dichlorobenzene	TX	4615	10298121
1,4-Dichlorobenzene	TX	4620	10298121
2-Butanone (Methyl ethyl ketone, MEK)	TX	4410	10298121
2-Chloroethyl vinyl ether	TX	4500	10298121
Acetone (2-Propanone)	TX	4315	10298121
Acrolein (Propenal)	TX	4325	10298121
Acrylonitrile	TX	4340	10298121
Benzene	TX	4375	10298121
Bromodichloromethane	TX	4395	10298121
Bromoform	TX	4400	10298121
Carbon tetrachloride	TX	4455	10298121
Chlorobenzene	TX	4475	10298121
Chlorodibromomethane	TX	4575	10298121
Chloroethane (Ethyl chloride)	TX	4485	10298121

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Chloroform	TX	4505	10298121
cis-1,2-Dichloroethylene	TX	4645	10298121
cis-1,3-Dichloropropene	TX	4680	10298121
Ethylbenzene	TX	4765	10298121
m+p-xylene	TX	5240	10298121
Methyl bromide (Bromomethane)	TX	4950	10298121
Methyl chloride (Chloromethane)	TX	4960	10298121
Methyl tert-butyl ether (MTBE)	TX	5000	10298121
Methylene chloride (Dichloromethane)	TX	4975	10298121
o-Xylene	TX	5250	10298121
Tetrachloroethylene (Perchloroethylene)	TX	5115	10298121
Toluene	TX	5140	10298121
trans-1,2-Dichloroethylene	TX	4700	10298121
trans-1,3-Dichloropropylene	TX	4685	10298121
Trichloroethene (Trichloroethylene)	TX	5170	10298121
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	TX	5175	10298121
Vinyl chloride	TX	5235	10298121
Xylene (total)	TX	5260	10298121

Method EPA 625.1

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10300024
1,2,4-Trichlorobenzene	TX	5155	10300024
1,2-Dichlorobenzene	TX	4610	10300024
1,2-Diphenylhydrazine	TX	6221	10300024
1,3-Dichlorobenzene	TX	4615	10300024
1,4-Dichlorobenzene	TX	4620	10300024
2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl)ether)	TX	4659	10300024
2,3,4,6-Tetrachlorophenol	TX	6735	10300024
2,4,5-Trichlorophenol	TX	6835	10300024
2,4,6-Trichlorophenol	TX	6840	10300024

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

2,4-Dichlorophenol	TX	6000	10300024
2,4-Dimethylphenol	TX	6130	10300024
2,4-Dinitrophenol	TX	6175	10300024
2,4-Dinitrotoluene (2,4-DNT)	TX	6185	10300024
2,6-Dinitrotoluene (2,6-DNT)	TX	6190	10300024
2-Chloronaphthalene	TX	5795	10300024
2-Chlorophenol	TX	5800	10300024
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	TX	6360	10300024
2-Methylphenol (o-Cresol)	TX	6400	10300024
2-Nitrophenol	TX	6490	10300024
3,3'-Dichlorobenzidine	TX	5945	10300024
4-Bromophenyl phenyl ether (BDE-3)	TX	5660	10300024
4-Chloro-3-methylphenol	TX	5700	10300024
4-Chlorophenyl phenylether	TX	5825	10300024
4-Methylphenol (p-Cresol)	TX	6410	10300024
4-Nitrophenol	TX	6500	10300024
Acenaphthene	TX	5500	10300024
Acenaphthylene	TX	5505	10300024
Anthracene	TX	5555	10300024
Benzidine	TX	5595	10300024
Benzo(a)anthracene	TX	5575	10300024
Benzo(a)pyrene	TX	5580	10300024
Benzo(b)fluoranthene	TX	5585	10300024
Benzo(g,h,i)perylene	TX	5590	10300024
Benzo(k)fluoranthene	TX	5600	10300024
bis(2-Chloroethoxy)methane	TX	5760	10300024
bis(2-Chloroethyl) ether	TX	5765	10300024
bis(2-Ethylhexyl) phthalate (Di(2-Ethylhexyl) phthalate, DEHP)	TX	6065	10300024
Butyl benzyl phthalate	TX	5670	10300024
Chrysene	TX	5855	10300024

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Dibenz(a,h) anthracene	TX	5895	10300024
Diethyl phthalate	TX	6070	10300024
Dimethyl phthalate	TX	6135	10300024
Di-n-butyl phthalate	TX	5925	10300024
Di-n-octyl phthalate	TX	6200	10300024
Fluoranthene	TX	6265	10300024
Fluorene	TX	6270	10300024
Hexachlorobenzene	TX	6275	10300024
Hexachlorobutadiene	TX	4835	10300024
Hexachlorocyclopentadiene	TX	6285	10300024
Hexachloroethane	TX	4840	10300024
Indeno(1,2,3-cd) pyrene	TX	6315	10300024
Isophorone	TX	6320	10300024
Naphthalene	TX	5005	10300024
Nitrobenzene	TX	5015	10300024
n-Nitrosodiethylamine	TX	6525	10300024
n-Nitrosodimethylamine	TX	6530	10300024
n-Nitrosodi-n-butylamine	TX	5025	10300024
n-Nitrosodi-n-propylamine	TX	6545	10300024
n-Nitrosodiphenylamine	TX	6535	10300024
Pentachlorobenzene	TX	6590	10300024
Pentachlorophenol	TX	6605	10300024
Phenanthrene	TX	6615	10300024
Phenol	TX	6625	10300024
Pyrene	TX	6665	10300024
Pyridine	TX	5095	10300024

Method EPA 632

Analyte	**AB**	**Analyte ID**	**Method ID**
Carbaryl (Sevin)	TX	7195	10108608

Method EPA 7196

Analyte	**AB**	**Analyte ID**	**Method ID**

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Chromium (VI)	TX	1045	10162206

Method EPA 7470

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10165603

Method EPA 8011

Analyte	AB	Analyte ID	Method ID
1,2,3-Trichloropropane	TX	5180	10173009
1,2-Dibromo-3-chloropropane (DBCP)	TX	4570	10173009
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10173009

Method EPA 8015

Analyte	AB	Analyte ID	Method ID
Allyl alcohol	TX	4350	10173203
Diesel range organics (DRO)	TX	9369	10173203
Ethanol	TX	4750	10173203
Ethylene glycol	TX	4785	10173203
Gasoline range organics (GRO)	TX	9408	10173203
Isobutyl alcohol (2-Methyl-1-propanol)	TX	4875	10173203
Isopropyl alcohol (2-Propanol, Isopropanol)	TX	4895	10173203
Methanol	TX	4930	10173203
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10173203
n-Propanol (1-Propanol)	TX	5055	10173203
Propylene Glycol	TX	6657	10173203

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10178800
4,4'-DDE	TX	7360	10178800
4,4'-DDT	TX	7365	10178800
Alachlor	TX	7005	10178800
Aldrin	TX	7025	10178800
alpha-BHC (alpha-Hexachlorocyclohexane)	TX	7110	10178800
alpha-Chlordane	TX	7240	10178800

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

beta-BHC (beta-Hexachlorocyclohexane)	TX	7115	10178800
Chlordane (tech.)	TX	7250	10178800
delta-BHC (delta-Hexachlorocyclohexane)	TX	7105	10178800
Dicofol (Kelthane)	TX	7460	10178800
Dieldrin	TX	7470	10178800
Endosulfan I	TX	7510	10178800
Endosulfan II	TX	7515	10178800
Endosulfan sulfate	TX	7520	10178800
Endrin	TX	7540	10178800
Endrin aldehyde	TX	7530	10178800
Endrin ketone	TX	7535	10178800
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	TX	7120	10178800
gamma-Chlordane	TX	7245	10178800
Heptachlor	TX	7685	10178800
Heptachlor epoxide	TX	7690	10178800
Methoxychlor	TX	7810	10178800
Mirex	TX	7870	10178800
Toxaphene (Chlorinated camphene)	TX	8250	10178800

Method EPA 8082

Analyte	AB	Analyte ID	Method ID
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	TX	9025	10179201
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	TX	9080	10179201
2,2',3',4,5-Pentachlorobiphenyl (BZ-97)	TX	9154	10179201
2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	TX	9035	10179201
2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	TX	8945	10179201
2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	TX	8980	10179201
2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	TX	8955	10179201
2,2',5-Trichlorobiphenyl (BZ-18)	TX	8930	10179201
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ-159)	TX	9196	10179201
2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	TX	8990	10179201

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	TX	8960	10179201
2,3-Dichlorobiphenyl (BZ-5)	TX	8920	10179201
2,4',5-Trichlorobiphenyl (BZ-31)	TX	8940	10179201
2-Chlorobiphenyl (BZ-1)	TX	8915	10179201
Aroclor-1016 (PCB-1016)	TX	8880	10179201
Aroclor-1221 (PCB-1221)	TX	8885	10179201
Aroclor-1232 (PCB-1232)	TX	8890	10179201
Aroclor-1242 (PCB-1242)	TX	8895	10179201
Aroclor-1248 (PCB-1248)	TX	8900	10179201
Aroclor-1254 (PCB-1254)	TX	8905	10179201
Aroclor-1260 (PCB-1260)	TX	8910	10179201
PCBs (total)	TX	8870	10179201

Method EPA 8151

Analyte	AB	Analyte ID	Method ID
2,4,5-T	TX	8655	10183003
2,4-D	TX	8545	10183003
2,4-DB	TX	8560	10183003
Dalapon	TX	8555	10183003
Dicamba	TX	8595	10183003
Dichloroprop (Dichlorprop, Weedone)	TX	8605	10183003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10183003
MCPA	TX	7775	10183003
MCPP	TX	7780	10183003
Pentachlorophenol	TX	6605	10183003
Picloram	TX	8645	10183003
Silvex (2,4,5-TP)	TX	8650	10183003

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	TX	5105	10184404
1,1,1-Trichloroethane	TX	5160	10184404
1,1,2,2-Tetrachloroethane	TX	5110	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	TX	5185	10184404
1,1,2-Trichloroethane	TX	5165	10184404
1,1-Dichloroethane	TX	4630	10184404
1,1-Dichloroethylene	TX	4640	10184404
1,1-Dichloropropene	TX	4670	10184404
1,2,3-Trichlorobenzene	TX	5150	10184404
1,2,3-Trichloropropane	TX	5180	10184404
1,2,4-Trichlorobenzene	TX	5155	10184404
1,2,4-Trimethylbenzene	TX	5210	10184404
1,2-Dibromo-3-chloropropane (DBCP)	TX	4570	10184404
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10184404
1,2-Dichlorobenzene	TX	4610	10184404
1,2-Dichloroethane (Ethylene dichloride)	TX	4635	10184404
1,2-Dichloropropane	TX	4655	10184404
1,3,5-Trimethylbenzene	TX	5215	10184404
1,3-Dichlorobenzene	TX	4615	10184404
1,3-Dichloropropane	TX	4660	10184404
1,4-Dichlorobenzene	TX	4620	10184404
1,4-Dioxane (1,4-Diethyleneoxide)	TX	4735	10184404
1-Chlorohexane	TX	4510	10184404
2,2-Dichloropropane	TX	4665	10184404
2-Butanone (Methyl ethyl ketone, MEK)	TX	4410	10184404
2-Chloroethyl vinyl ether	TX	4500	10184404
2-Chlorotoluene	TX	4535	10184404
2-Hexanone (MBK)	TX	4860	10184404
2-Nitropropane	TX	5020	10184404
4-Chlorotoluene	TX	4540	10184404
4-Isopropyltoluene (p-Cymene)	TX	4915	10184404
4-Methyl-2-pentanone (MIBK)	TX	4995	10184404
Acetone (2-Propanone)	TX	4315	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

Acetonitrile	TX	4320	10184404
Acrolein (Propenal)	TX	4325	10184404
Acrylonitrile	TX	4340	10184404
Allyl chloride (3-Chloropropene)	TX	4355	10184404
Benzene	TX	4375	10184404
Benzyl chloride	TX	5635	10184404
Bromobenzene	TX	4385	10184404
Bromochloromethane	TX	4390	10184404
Bromodichloromethane	TX	4395	10184404
Bromoform	TX	4400	10184404
Carbon disulfide	TX	4450	10184404
Carbon tetrachloride	TX	4455	10184404
Chlorobenzene	TX	4475	10184404
Chlorodibromomethane	TX	4575	10184404
Chloroethane (Ethyl chloride)	TX	4485	10184404
Chloroform	TX	4505	10184404
Chloroprene (2-Chloro-1,3-butadiene)	TX	4525	10184404
cis-1,2-Dichloroethylene	TX	4645	10184404
cis-1,3-Dichloropropene	TX	4680	10184404
cis-1,4-Dichloro-2-butene	TX	4600	10184404
Dibromofluoromethane	TX	4590	10184404
Dibromomethane (Methylene bromide)	TX	4595	10184404
Dichlorodifluoromethane (Freon-12)	TX	4625	10184404
Diethyl ether	TX	4725	10184404
Di-isopropylether (DIPE)	TX	9375	10184404
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	TX	4745	10184404
Ethyl acetate	TX	4755	10184404
Ethyl methacrylate	TX	4810	10184404
Ethylbenzene	TX	4765	10184404
Ethylene oxide	TX	4795	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	TX	4770	10184404
Hexachlorobutadiene	TX	4835	10184404
Iodomethane (Methyl iodide)	TX	4870	10184404
Isobutyl alcohol (2-Methyl-1-propanol)	TX	4875	10184404
Isopropyl alcohol (2-Propanol, Isopropanol)	TX	4895	10184404
Isopropylbenzene (Cumene)	TX	4900	10184404
m+p-xylene	TX	5240	10184404
Methacrylonitrile	TX	4925	10184404
Methyl acetate	TX	4940	10184802
Methyl bromide (Bromomethane)	TX	4950	10184404
Methyl chloride (Chloromethane)	TX	4960	10184404
Methyl methacrylate	TX	4990	10184404
Methyl tert-butyl ether (MTBE)	TX	5000	10184404
Methylcyclohexane	TX	4965	10184608
Methylene chloride (Dichloromethane)	TX	4975	10184404
Naphthalene	TX	5005	10184404
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10184404
n-Butylbenzene	TX	4435	10184404
n-Propylbenzene	TX	5090	10184404
o-Xylene	TX	5250	10184404
Propionitrile (Ethyl cyanide)	TX	5080	10184404
sec-Butylbenzene	TX	4440	10184404
Styrene	TX	5100	10184404
T-amylmethylether (TAME)	TX	4370	10184404
tert-Butyl alcohol	TX	4420	10184404
tert-Butylbenzene	TX	4445	10184404
Tetrachloroethylene (Perchloroethylene)	TX	5115	10184404
Toluene	TX	5140	10184404
Total trihalomethanes	TX	5205	10184404
trans-1,2-Dichloroethylene	TX	4700	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

trans-1,3-Dichloropropylene	TX	4685	10184404
trans-1,4-Dichloro-2-butene	TX	4605	10184404
Trichloroethene (Trichloroethylene)	TX	5170	10184404
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	TX	5175	10184404
Vinyl acetate	TX	5225	10184404
Vinyl chloride	TX	5235	10184404
Xylene (total)	TX	5260	10184404

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10185601
1,2,4-Trichlorobenzene	TX	5155	10185805
1,2-Dichlorobenzene	TX	4610	10185805
1,2-Diphenylhydrazine	TX	6220	10185805
1,3,5-Trinitrobenzene (1,3,5-TNB)	TX	6885	10185805
1,3-Dichlorobenzene	TX	4615	10185805
1,3-Dinitrobenzene (1,3-DNB)	TX	6160	10185805
1,4-Dichlorobenzene	TX	4620	10185805
1,4-Naphthoquinone	TX	6420	10185805
1,4-Phenylenediamine	TX	6630	10185805
1-Naphthylamine	TX	6425	10185805
2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl)ether)	TX	4659	10185805
2,3,4,6-Tetrachlorophenol	TX	6735	10185805
2,4,5-Trichlorophenol	TX	6835	10185805
2,4,6-Trichlorophenol	TX	6840	10185805
2,4-Dichlorophenol	TX	6000	10185805
2,4-Dimethylphenol	TX	6130	10185805
2,4-Dinitrophenol	TX	6175	10185805
2,4-Dinitrotoluene (2,4-DNT)	TX	6185	10185805
2,6-Dichlorophenol	TX	6005	10185805
2,6-Dinitrotoluene (2,6-DNT)	TX	6190	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

2-Acetylaminofluorene	TX	5515	10185805
2-Chloronaphthalene	TX	5795	10185805
2-Chlorophenol	TX	5800	10185805
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	TX	6360	10185805
2-Methylaniline (o-Toluidine)	TX	5145	10185805
2-Methylnaphthalene	TX	6385	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
2-Naphthylamine	TX	6430	10185805
2-Nitroaniline	TX	6460	10185805
2-Nitrophenol	TX	6490	10185805
2-Picoline (2-Methylpyridine)	TX	5050	10185805
3,3'-Dichlorobenzidine	TX	5945	10185805
3,3'-Dimethylbenzidine	TX	6120	10185805
3-Methylcholanthrene	TX	6355	10185805
3-Methylphenol (m-Cresol)	TX	6405	10185805
3-Nitroaniline	TX	6465	10185805
4-Aminobiphenyl	TX	5540	10185805
4-Bromophenyl phenyl ether (BDE-3)	TX	5660	10185805
4-Chloro-3-methylphenol	TX	5700	10185805
4-Chloroaniline	TX	5745	10185805
4-Chlorophenyl phenylether	TX	5825	10185805
4-Dimethyl aminoazobenzene	TX	6105	10185805
4-Methylphenol (p-Cresol)	TX	6410	10185805
4-Nitroaniline	TX	6470	10185805
4-Nitrophenol	TX	6500	10185805
5-Nitro-o-toluidine	TX	6570	10185805
7,12-Dimethylbenz(a) anthracene	TX	6115	10185805
Acenaphthene	TX	5500	10185805
Acenaphthylene	TX	5505	10185805
Acetophenone	TX	5510	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: *Non-Potable Water*

Aniline	TX	5545	10185805
Anthracene	TX	5555	10185805
Atrazine	TX	7065	10186002
Azobenzene	TX	5562	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805
Benzo(a)pyrene	TX	5580	10185805
Benzo(b)fluoranthene	TX	5585	10185805
Benzo(g,h,i)perylene	TX	5590	10185805
Benzo(k)fluoranthene	TX	5600	10185805
Benzoic acid	TX	5610	10185805
Benzyl alcohol	TX	5630	10185805
Biphenyl	TX	5640	10185601
bis(2-Chloroethoxy)methane	TX	5760	10185805
bis(2-Chloroethyl) ether	TX	5765	10185805
bis(2-Ethylhexyl) phthalate (Di(2-Ethylhexyl) phthalate, DEHP)	TX	6065	10185805
Butyl benzyl phthalate	TX	5670	10185805
Caprolactam	TX	7180	10185805
Carbaryl (Sevin)	TX	7195	10185805
Carbazole	TX	5680	10185805
Chlorobenzilate	TX	7260	10185805
Chrysene	TX	5855	10185805
Diallate	TX	7405	10185805
Dibenz(a,h) anthracene	TX	5895	10185805
Dibenzofuran	TX	5905	10185805
Diethyl phthalate	TX	6070	10185805
Dimethoate	TX	7475	10185805
Dimethyl phthalate	TX	6135	10185805
Di-n-butyl phthalate	TX	5925	10185805
Di-n-octyl phthalate	TX	6200	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Diphenylamine	TX	6205	10185805
Disulfoton	TX	8625	10185805
Ethyl methanesulfonate	TX	6260	10185805
Famphur	TX	7580	10185805
Fluoranthene	TX	6265	10185805
Fluorene	TX	6270	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10185805
Hexachloropropene	TX	6295	10185805
Indeno(1,2,3-cd) pyrene	TX	6315	10185805
Isodrin	TX	7725	10185805
Isophorone	TX	6320	10185805
Isosafrole	TX	6325	10185805
Kepone	TX	7740	10185805
Methapyrilene	TX	6345	10185805
Methyl methanesulfonate	TX	6375	10185805
Methyl parathion (Parathion, methyl)	TX	7825	10185805
Naphthalene	TX	5005	10185805
Nitrobenzene	TX	5015	10185805
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitrosodimethylamine	TX	6530	10185805
n-Nitrosodi-n-butylamine	TX	5025	10185805
n-Nitrosodi-n-propylamine	TX	6545	10185805
n-Nitrosodiphenylamine	TX	6535	10185805
n-Nitrosomethylethylamine	TX	6550	10185805
n-Nitrosomorpholine	TX	6555	10185805
n-Nitrosopiperidine	TX	6560	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

n-Nitrosopyrrolidine	TX	6565	10185805
o,o,o-Triethyl phosphorothioate	TX	8290	10185805
Parathion, ethyl	TX	7955	10185805
Pentachlorobenzene	TX	6590	10185805
Pentachloronitrobenzene (PCNB)	TX	6600	10185805
Pentachlorophenol	TX	6605	10185805
Phenacetin	TX	6610	10185805
Phenanthrene	TX	6615	10185805
Phenol	TX	6625	10185805
Phorate	TX	7985	10185805
Pronamide (Kerb)	TX	6650	10185805
Pyrene	TX	6665	10185805
Pyridine	TX	5095	10185805
Quinoline	TX	6670	10185805
Safrole	TX	6685	10185805
Thionazin (Zinophos)	TX	8235	10185805

Method EPA 9012

Analyte	**AB**	**Analyte ID**	**Method ID**
Amenable cyanide	TX	1510	10193405
Total cyanide	TX	1645	10193405

Method EPA 9040

Analyte	**AB**	**Analyte ID**	**Method ID**
pH	TX	1900	10196802

Method EPA 9050

Analyte	**AB**	**Analyte ID**	**Method ID**
Conductivity	TX	1610	10198604

Method EPA 9056

Analyte	**AB**	**Analyte ID**	**Method ID**
Bromide	TX	1540	10199209
Chloride	TX	1575	10199209
Fluoride	TX	1730	10199209

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Nitrate as N	TX	1810	10199209
Nitrate-nitrite	TX	1820	10199209
Nitrite as N	TX	1840	10199209
Sulfate	TX	2000	10199209

Method EPA 9060

Analyte	AB	Analyte ID	Method ID
Total Organic Carbon (TOC)	TX	2040	10200201

Method EPA 9066

Analyte	AB	Analyte ID	Method ID
Total phenolics	TX	1905	10200609

Method EPA RSK 175

Analyte	AB	Analyte ID	Method ID
Ethane	TX	4747	10212905
Ethene	TX	4752	10212905
Methane	TX	4926	10212905
n-Butane	TX	5007	10212905
n-Propane	TX	5029	10212905

Method HACH 8000

Analyte	AB	Analyte ID	Method ID
Chemical oxygen demand (COD)	TX	1565	60003001

Method IDNR OA-2; DRO

Analyte	AB	Analyte ID	Method ID
Extractable Petroleum Hydrocarbons (EPH)	TX	10331	90016607

Method Kelada-01

Analyte	AB	Analyte ID	Method ID
Total cyanide	TX	1635	60005303

Method SM 2120 B

Analyte	AB	Analyte ID	Method ID
Color	TX	1605	20223807

Method SM 2120 C

Analyte	AB	Analyte ID	Method ID

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Color	TX	1605	20002000

Method SM 2130 B

Analyte	AB	Analyte ID	Method ID
Turbidity	TX	2055	20042200

Method SM 2310 B (4a)

Analyte	AB	Analyte ID	Method ID
Acidity, as CaCO3	TX	1500	20002806

Method SM 2320 B

Analyte	AB	Analyte ID	Method ID
Alkalinity as CaCO3	TX	1505	20045005

Method SM 2340 B

Analyte	AB	Analyte ID	Method ID
Total hardness as CaCO3	TX	1755	20046008

Method SM 2510 B

Analyte	AB	Analyte ID	Method ID
Conductivity	TX	1610	20048004

Method SM 2540 B

Analyte	AB	Analyte ID	Method ID
Residue-total (total solids)	TX	1950	20004608

Method SM 2540 C

Analyte	AB	Analyte ID	Method ID
Residue-filterable (TDS)	TX	1955	20049803

Method SM 2540 D

Analyte	AB	Analyte ID	Method ID
Residue-nonfilterable (TSS)	TX	1960	20004802

Method SM 3500-Cr B

Analyte	AB	Analyte ID	Method ID
Chromium (VI)	TX	1045	20065809

Method SM 4500-Cl G

Analyte	AB	Analyte ID	Method ID
Total residual chlorine	TX	1940	20020604

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Non-Potable Water***

Method SM 4500-CN⁻ G

Analyte	AB	Analyte ID	Method ID
Amenable cyanide	TX	1510	20021607

Method SM 4500-H+ B

Analyte	AB	Analyte ID	Method ID
pH	TX	1900	20104603

Method SM 4500-S2⁻ D

Analyte	AB	Analyte ID	Method ID
Sulfide	TX	2005	20125400

Method SM 4500-S2⁻ F

Analyte	AB	Analyte ID	Method ID
Sulfide	TX	2005	20126209

Method SM 4500-SO3⁻ B

Analyte	AB	Analyte ID	Method ID
Sulfite	TX	2015	20026806

Method SM 5210 B

Analyte	AB	Analyte ID	Method ID
Biochemical oxygen demand (BOD)	TX	1530	20027401
Carbonaceous BOD, CBOD	TX	1555	20027401

Method SM 5310 C

Analyte	AB	Analyte ID	Method ID
Total Organic Carbon (TOC)	TX	2040	20138209

Method SM 5540 C

Analyte	AB	Analyte ID	Method ID
Surfactants - MBAS	TX	2025	20144405

Method TCEQ 1005

Analyte	AB	Analyte ID	Method ID
Total Petroleum Hydrocarbons (TPH)	TX	2050	90019208

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Method ASTM D2216

Analyte	AB	Analyte ID	Method ID
Moisture	TX	10337	ASTM D2216-05

Method EPA 1010

Analyte	AB	Analyte ID	Method ID
Ignitability	TX	1780	10116606

Method EPA 1030

Analyte	AB	Analyte ID	Method ID
Ignitability	TX	1780	10117201

Method EPA 1311

Analyte	AB	Analyte ID	Method ID
TCLP	TX	849	10118806

Method EPA 1312

Analyte	AB	Analyte ID	Method ID
SPLP	TX	850	10119003

Method EPA 300.0

Analyte	AB	Analyte ID	Method ID
Bromide	TX	1540	10053200
Chloride	TX	1575	10053200
Fluoride	TX	1730	10053200
Nitrate as N	TX	1810	10053200
Nitrate-nitrite	TX	1820	10053200
Nitrite as N	TX	1840	10053200
Orthophosphate as P	TX	1870	10053200
Sulfate	TX	2000	10053200

Method EPA 350.1

Analyte	AB	Analyte ID	Method ID
Ammonia as N	TX	1515	10063408

Method EPA 353.2

Analyte	AB	Analyte ID	Method ID
Nitrate-nitrite	TX	1820	10067604

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Nitrite as N	TX	1840	10067604

Method EPA 6010

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10155609
Antimony	TX	1005	10155609
Arsenic	TX	1010	10155609
Barium	TX	1015	10155609
Beryllium	TX	1020	10155609
Boron	TX	1025	10155609
Cadmium	TX	1030	10155609
Calcium	TX	1035	10155609
Chromium	TX	1040	10155609
Cobalt	TX	1050	10155609
Copper	TX	1055	10155609
Iron	TX	1070	10155609
Lead	TX	1075	10155609
Lithium	TX	1080	10155609
Magnesium	TX	1085	10155609
Manganese	TX	1090	10155609
Molybdenum	TX	1100	10155609
Nickel	TX	1105	10155609
Phosphorus	TX	1910	10155609
Potassium	TX	1125	10155609
Selenium	TX	1140	10155609
Silica as SiO2	TX	1990	10155609
Silver	TX	1150	10155609
Sodium	TX	1155	10155609
Strontium	TX	1160	10155609
Thallium	TX	1165	10155609
Tin	TX	1175	10155609

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Titanium	TX	1180	10155609
Vanadium	TX	1185	10155609
Zinc	TX	1190	10155609

Method EPA 6020

Analyte	AB	Analyte ID	Method ID
Aluminum	TX	1000	10156419
Antimony	TX	1005	10156419
Arsenic	TX	1010	10156419
Barium	TX	1015	10156419
Beryllium	TX	1020	10156419
Boron	TX	1025	10156419
Cadmium	TX	1030	10156419
Calcium	TX	1035	10156419
Chromium	TX	1040	10156419
Cobalt	TX	1050	10156419
Copper	TX	1055	10156419
Iron	TX	1070	10156419
Lead	TX	1075	10156419
Magnesium	TX	1085	10156419
Manganese	TX	1090	10156419
Molybdenum	TX	1100	10156419
Nickel	TX	1105	10156419
Potassium	TX	1125	10156419
Selenium	TX	1140	10156419
Silver	TX	1150	10156419
Sodium	TX	1155	10156419
Strontium	TX	1160	10156419
Thallium	TX	1165	10156419
Tin	TX	1175	10156419
Titanium	TX	1180	10156419

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Vanadium	TX	1185	10156419
Zinc	TX	1190	10156419

Method EPA 7196

Analyte	AB	Analyte ID	Method ID
Chromium (VI)	TX	1045	10162206

Method EPA 7470

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10165807

Method EPA 7471

Analyte	AB	Analyte ID	Method ID
Mercury	TX	1095	10166457

Method EPA 8015

Analyte	AB	Analyte ID	Method ID
Allyl alcohol	TX	4350	10173203
Diesel range organics (DRO)	TX	9369	10173203
Ethanol	TX	4750	10173203
Ethylene glycol	TX	4785	10173203
Gasoline range organics (GRO)	TX	9408	10173203
Isobutyl alcohol (2-Methyl-1-propanol)	TX	4875	10173203
Isopropyl alcohol (2-Propanol, Isopropanol)	TX	4895	10173203
Methanol	TX	4930	10173203
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10173203
n-Propanol (1-Propanol)	TX	5055	10173203
Propylene Glycol	TX	6657	10173203

Method EPA 8081

Analyte	AB	Analyte ID	Method ID
4,4'-DDD	TX	7355	10178800
4,4'-DDE	TX	7360	10178800
4,4'-DDT	TX	7365	10178800
Alachlor	TX	7005	10178800
Aldrin	TX	7025	10178800

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

alpha-BHC (alpha-Hexachlorocyclohexane)	TX	7110	10178800
alpha-Chlordane	TX	7240	10178800
beta-BHC (beta-Hexachlorocyclohexane)	TX	7115	10178800
Chlordane (tech.)	TX	7250	10178800
DDD,Total	TX	10314	10178800
DDE,Total	TX	10315	10178800
DDT,Total	TX	10316	10178800
delta-BHC (delta-Hexachlorocyclohexane)	TX	7105	10178800
Dieldrin	TX	7470	10178800
Endosulfan I	TX	7510	10178800
Endosulfan II	TX	7515	10178800
Endosulfan sulfate	TX	7520	10178800
Endrin	TX	7540	10178800
Endrin aldehyde	TX	7530	10178800
Endrin ketone	TX	7535	10178800
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	TX	7120	10178800
gamma-Chlordane	TX	7245	10178800
Heptachlor	TX	7685	10178800
Heptachlor epoxide	TX	7690	10178800
Methoxychlor	TX	7810	10178800
Toxaphene (Chlorinated camphene)	TX	8250	10178800

Method EPA 8082

Analyte	AB	Analyte ID	Method ID
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ-206)	TX	9095	10179007
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ-170)	TX	9065	10179007
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ-180)	TX	9134	10179007
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ-183)	TX	9075	10179007
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ-138)	TX	9025	10179007
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ-187)	TX	9080	10179007
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ-141)	TX	9030	10179007

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

2,2',3,4,5'-Pentachlorobiphenyl (BZ-87)	TX	8975	10179007
2,2',3,5,5',6-Hexachlorobiphenyl (BZ-151)	TX	9035	10179007
2,2',3,5'-Tetrachlorobiphenyl (BZ-44)	TX	8945	10179007
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ-153)	TX	9040	10179007
2,2',4,5,5'-Pentachlorobiphenyl (BZ-101)	TX	8980	10179007
2,2',5,5'-Tetrachlorobiphenyl (BZ-52)	TX	8955	10179007
2,2',5-Trichlorobiphenyl (BZ-18)	TX	8930	10179007
2,3,3',4',6-Pentachlorobiphenyl (BZ-110)	TX	8990	10179007
2,3',4,4'-Tetrachlorobiphenyl (BZ-66)	TX	8960	10179007
2,3-Dichlorobiphenyl (BZ-5)	TX	8920	10179007
2,4',5-Trichlorobiphenyl (BZ-31)	TX	8940	10179007
2-Chlorobiphenyl (BZ-1)	TX	8915	10179007
Aroclor-1016 (PCB-1016)	TX	8880	10179007
Aroclor-1221 (PCB-1221)	TX	8885	10179007
Aroclor-1232 (PCB-1232)	TX	8890	10179007
Aroclor-1242 (PCB-1242)	TX	8895	10179007
Aroclor-1248 (PCB-1248)	TX	8900	10179007
Aroclor-1254 (PCB-1254)	TX	8905	10179007
Aroclor-1260 (PCB-1260)	TX	8910	10179007
PCBs (total)	TX	8870	10179007

Method EPA 8151

Analyte	AB	Analyte ID	Method ID
2,4,5-T	TX	8655	10183003
2,4-D	TX	8545	10183003
2,4-DB	TX	8560	10183003
Dalapon	TX	8555	10183003
Dicamba	TX	8595	10183003
Dichloroprop (Dichlorprop, Weedone)	TX	8605	10183003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	TX	8620	10183003
MCPA	TX	7775	10183003

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

MCPP	TX	7780	10183003
Pentachlorophenol	TX	6605	10183003
Silvex (2,4,5-TP)	TX	8650	10183003

Method EPA 8260

Analyte	AB	Analyte ID	Method ID
1,1,1,2-Tetrachloroethane	TX	5105	10184404
1,1,1-Trichloroethane	TX	5160	10184404
1,1,2,2-Tetrachloroethane	TX	5110	10184404
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	TX	5185	10184802
1,1,2-Trichloroethane	TX	5165	10184404
1,1-Dichloroethane	TX	4630	10184404
1,1-Dichloroethylene	TX	4640	10184404
1,1-Dichloropropene	TX	4670	10184404
1,2,3-Trichlorobenzene	TX	5150	10184404
1,2,3-Trichloropropane	TX	5180	10184404
1,2,4-Trichlorobenzene	TX	5155	10184404
1,2,4-Trimethylbenzene	TX	5210	10184404
1,2-Dibromo-3-chloropropane (DBCP)	TX	4570	10184404
1,2-Dibromoethane (EDB, Ethylene dibromide)	TX	4585	10184404
1,2-Dichlorobenzene	TX	4610	10184404
1,2-Dichloroethane (Ethylene dichloride)	TX	4635	10184404
1,2-Dichloropropane	TX	4655	10184404
1,3,5-Trimethylbenzene	TX	5215	10184404
1,3-Dichlorobenzene	TX	4615	10184404
1,3-Dichloropropane	TX	4660	10184404
1,4-Dichlorobenzene	TX	4620	10184404
1,4-Dioxane (1,4-Diethyleneoxide)	TX	4735	10184404
1-Chlorohexane	TX	4510	10184404
2,2-Dichloropropane	TX	4665	10184404
2-Butanone (Methyl ethyl ketone, MEK)	TX	4410	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

2-Chloroethyl vinyl ether	TX	4500	10184404
2-Chlorotoluene	TX	4535	10184404
2-Hexanone (MBK)	TX	4860	10184404
4-Chlorotoluene	TX	4540	10184404
4-Isopropyltoluene (p-Cymene)	TX	4915	10184404
4-Methyl-2-pentanone (MIBK)	TX	4995	10184404
Acetone (2-Propanone)	TX	4315	10184404
Acetonitrile	TX	4320	10184404
Acrolein (Propenal)	TX	4325	10184404
Acrylonitrile	TX	4340	10184404
Allyl chloride (3-Chloropropene)	TX	4355	10184404
Benzene	TX	4375	10184404
Bromobenzene	TX	4385	10184404
Bromochloromethane	TX	4390	10184404
Bromodichloromethane	TX	4395	10184404
Bromoform	TX	4400	10184404
Carbon disulfide	TX	4450	10184404
Carbon tetrachloride	TX	4455	10184404
Chlorobenzene	TX	4475	10184404
Chlorodibromomethane	TX	4575	10184404
Chloroethane (Ethyl chloride)	TX	4485	10184404
Chloroform	TX	4505	10184404
Chloroprene (2-Chloro-1,3-butadiene)	TX	4525	10184404
cis-1,2-Dichloroethylene	TX	4645	10184404
cis-1,3-Dichloropropene	TX	4680	10184404
cis-1,4-Dichloro-2-butene	TX	4600	10184404
Dibromomethane (Methylene bromide)	TX	4595	10184404
Dichlorodifluoromethane (Freon-12)	TX	4625	10184404
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	TX	4745	10184404
Ethyl methacrylate	TX	4810	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Ethylbenzene	TX	4765	10184404
Hexachlorobutadiene	TX	4835	10184404
Iodomethane (Methyl iodide)	TX	4870	10184404
Isopropylbenzene (Cumene)	TX	4900	10184404
m+p-xylene	TX	5240	10184404
Methacrylonitrile	TX	4925	10184404
Methyl acetate	TX	4940	10184608
Methyl bromide (Bromomethane)	TX	4950	10184404
Methyl chloride (Chloromethane)	TX	4960	10184404
Methyl tert-butyl ether (MTBE)	TX	5000	10184404
Methylcyclohexane	TX	4965	10184608
Methylene chloride (Dichloromethane)	TX	4975	10184404
Naphthalene	TX	5005	10184404
n-Butyl alcohol (1-Butanol, n-Butanol)	TX	4425	10184404
n-Butylbenzene	TX	4435	10184404
n-Propylbenzene	TX	5090	10184404
o-Xylene	TX	5250	10184404
sec-Butylbenzene	TX	4440	10184404
Styrene	TX	5100	10184404
tert-Butyl alcohol	TX	4420	10184404
tert-Butylbenzene	TX	4445	10184404
Tetrachloroethylene (Perchloroethylene)	TX	5115	10184404
Toluene	TX	5140	10184404
trans-1,2-Dichloroethylene	TX	4700	10184404
trans-1,3-Dichloropropylene	TX	4685	10184404
trans-1,4-Dichloro-2-butene	TX	4605	10184404
Trichloroethene (Trichloroethylene)	TX	5170	10184404
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	TX	5175	10184404
Vinyl acetate	TX	5225	10184404
Vinyl chloride	TX	5235	10184404

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Xylene (total)	TX	5260	10184404

Method EPA 8270

Analyte	AB	Analyte ID	Method ID
1,2,4,5-Tetrachlorobenzene	TX	6715	10185407
1,2,4-Trichlorobenzene	TX	5155	10185805
1,2-Dichlorobenzene	TX	4610	10185805
1,2-Diphenylhydrazine	TX	6220	10185805
1,3-Dichlorobenzene	TX	4615	10185805
1,3-Dinitrobenzene (1,3-DNB)	TX	6160	10185805
1,4-Dichlorobenzene	TX	4620	10185805
2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl)ether)	TX	4659	10185805
2,3,4,6-Tetrachlorophenol	TX	6735	10185805
2,4,5-Trichlorophenol	TX	6835	10185805
2,4,6-Trichlorophenol	TX	6840	10185805
2,4-Dichlorophenol	TX	6000	10185805
2,4-Dimethylphenol	TX	6130	10185805
2,4-Dinitrophenol	TX	6175	10185805
2,4-Dinitrotoluene (2,4-DNT)	TX	6185	10185805
2,6-Dichlorophenol	TX	6005	10185805
2,6-Dinitrotoluene (2,6-DNT)	TX	6190	10185805
2-Acetylaminofluorene	TX	5515	10185805
2-Chloronaphthalene	TX	5795	10185805
2-Chlorophenol	TX	5800	10185805
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	TX	6360	10185805
2-Methylnaphthalene	TX	6385	10185805
2-Methylphenol (o-Cresol)	TX	6400	10185805
2-Nitroaniline	TX	6460	10185805
2-Nitrophenol	TX	6490	10185805
2-Picoline (2-Methylpyridine)	TX	5050	10185805
3,3'-Dichlorobenzidine	TX	5945	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

3-Methylphenol (m-Cresol)	TX	6405	10185805
3-Nitroaniline	TX	6465	10185805
4-Bromophenyl phenyl ether (BDE-3)	TX	5660	10185805
4-Chloro-3-methylphenol	TX	5700	10185805
4-Chloroaniline	TX	5745	10185805
4-Chlorophenyl phenylether	TX	5825	10185805
4-Methylphenol (p-Cresol)	TX	6410	10185805
4-Nitroaniline	TX	6470	10185805
4-Nitrophenol	TX	6500	10185805
7,12-Dimethylbenz(a) anthracene	TX	6115	10185805
Acenaphthene	TX	5500	10185805
Acenaphthylene	TX	5505	10185805
Acetophenone	TX	5510	10185805
Aniline	TX	5545	10185805
Anthracene	TX	5555	10185805
Atrazine	TX	7065	10186002
Azobenzene	TX	5562	10185805
Benzidine	TX	5595	10185805
Benzo(a)anthracene	TX	5575	10185805
Benzo(a)pyrene	TX	5580	10185805
Benzo(b)fluoranthene	TX	5585	10185805
Benzo(g,h,i)perylene	TX	5590	10185805
Benzo(k)fluoranthene	TX	5600	10185805
Benzoic acid	TX	5610	10185805
Benzyl alcohol	TX	5630	10185805
Biphenyl	TX	5640	10185601
bis(2-Chloroethoxy)methane	TX	5760	10185805
bis(2-Chloroethyl) ether	TX	5765	10185805
bis(2-Ethylhexyl) phthalate (Di(2-Ethylhexyl) phthalate, DEHP)	TX	6065	10185805
Butyl benzyl phthalate	TX	5670	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Caprolactam	TX	7180	10186002
Carbazole	TX	5680	10185805
Chrysene	TX	5855	10185805
Dibenz(a,h) anthracene	TX	5895	10185805
Dibenzofuran	TX	5905	10185805
Diethyl phthalate	TX	6070	10185601
Dimethoate	TX	7475	10185805
Dimethyl phthalate	TX	6135	10185805
Di-n-butyl phthalate	TX	5925	10185805
Di-n-octyl phthalate	TX	6200	10185805
Diphenylamine	TX	6205	10185805
Ethyl methanesulfonate	TX	6260	10185805
Fluoranthene	TX	6265	10185805
Fluorene	TX	6270	10185805
Hexachlorobenzene	TX	6275	10185805
Hexachlorobutadiene	TX	4835	10185805
Hexachlorocyclopentadiene	TX	6285	10185805
Hexachloroethane	TX	4840	10185805
Hexachlorophene	TX	6290	10185805
Hexachloropropene	TX	6295	10185805
Indeno(1,2,3-cd) pyrene	TX	6315	10185805
Isophorone	TX	6320	10185805
Methapyrilene	TX	6345	10185805
Methyl methanesulfonate	TX	6375	10185805
Naphthalene	TX	5005	10185805
Nitrobenzene	TX	5015	10185805
n-Nitrosodiethylamine	TX	6525	10185805
n-Nitrosodimethylamine	TX	6530	10185805
n-Nitrosodi-n-butylamine	TX	5025	10185805
n-Nitrosodi-n-propylamine	TX	6545	10185805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

n-Nitrosodiphenylamine	TX	6535	10185805
n-Nitrosomethylethylamine	TX	6550	10185805
n-Nitrosomorpholine	TX	6555	10185805
n-Nitrosopiperidine	TX	6560	10185805
n-Nitrosopyrrolidine	TX	6565	10185805
Pentachlorobenzene	TX	6590	10185805
Pentachloronitrobenzene (PCNB)	TX	6600	10185805
Pentachlorophenol	TX	6605	10185805
Phenacetin	TX	6610	10185805
Phenanthrene	TX	6615	10185805
Phenol	TX	6625	10185805
Pronamide (Kerb)	TX	6650	10185805
Pyrene	TX	6665	10185805
Pyridine	TX	5095	10185805
Quinoline	TX	6670	10185805

Method EPA 9012

Analyte	AB	Analyte ID	Method ID
Amenable cyanide	TX	1510	10193405
Total cyanide	TX	1645	10193405

Method EPA 9023

Analyte	AB	Analyte ID	Method ID
Extractable organics halides (EOX)	TX	1720	10195003

Method EPA 9034

Analyte	AB	Analyte ID	Method ID
Sulfide	TX	2005	10196006

Method EPA 9040

Analyte	AB	Analyte ID	Method ID
pH	TX	1900	10196802

Method EPA 9045

Analyte	AB	Analyte ID	Method ID
Corrosivity	TX	1615	10197805

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	T104704215-22-47
Expiration Date:	6/30/2023
Issue Date:	7/18/2022

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

pH	TX	1900	10197805

Method EPA 9056

Analyte	AB	Analyte ID	Method ID
Bromide	TX	1540	10199209
Chloride	TX	1575	10199209
Fluoride	TX	1730	10199209
Nitrate as N	TX	1810	10199209
Nitrate-nitrite	TX	1820	10199209
Nitrite as N	TX	1840	10199209
Orthophosphate as P	TX	1870	10199209
Sulfate	TX	2000	10199209

Method EPA 9066

Analyte	AB	Analyte ID	Method ID
Total phenolics	TX	1905	10200609

Method EPA 9071

Analyte	AB	Analyte ID	Method ID
n-Hexane Extractable Material (HEM) (O&G)	TX	1803	10201806
Silica Gel Treated n-Hexane Extractable Material (SGT-HEM)	TX	10220	10201806

Method EPA 9095

Analyte	AB	Analyte ID	Method ID
Paint Filter Liquids Test	TX	10312	10204009

Method IDNR OA-2; DRO

Analyte	AB	Analyte ID	Method ID
Extractable Petroleum Hydrocarbons (EPH)	TX	10331	90016607

Method SM 2320 B

Analyte	AB	Analyte ID	Method ID
Alkalinity as CaCO3	TX	1505	20045005

Method SM 2510 B

Analyte	AB	Analyte ID	Method ID
Conductivity	TX	1610	20048004

Texas Commission on Environmental Quality

NELAP - Recognized Laboratory Fields of Accreditation

Certificate:	**T104704215-22-47**
Expiration Date:	**6/30/2023**
Issue Date:	**7/18/2022**

Eurofins Houston

4141-4147 Greenbriar Dr.
Stafford, TX 77477

These fields of accreditation supercede all previous fields. The Texas Commission on Environmental Quality urges customers to verify the laboratory's current accreditation status for particular methods and analyses.

Matrix: ***Solid & Chemical Materials***

Method SM 2540 G

Analyte	AB	Analyte ID	Method ID
Residue-total (total solids)	TX	1950	20005203

Method SSA/ASA Part 3:34

Analyte	AB	Analyte ID	Method ID
Carbon, organic (Walkley-Black)	TX	10340	SSA/ASA Pt 3:34

Method TCEQ 1005

Analyte	AB	Analyte ID	Method ID
Total Petroleum Hydrocarbons (TPH)	TX	2050	90019208

APPENDIX C

ACCIDENT PREVENTION PLAN

(Provided separately by Renova-Sovereign Joint Venture.)

APPENDIX D

STANDARD OPERATING PROCEDURES

LABORATORY STANDARD OPERATING PROCEDURES

SOP Title: Standard Operating Procedure for Extractable Organic Halides in Solids

SOP ID: 07-TOX S **Revision #: 9** **Effective Date: 08/30/2022**

Approved By: Patrick G. Glaser Date: 8-16-22
Validator- Patrick Glaser

Approved By: Susan May Date: 8/16/2022
Quality Assurance Manager- Susan Magness

Approved By: Alan Lopez Date: 8/16/2022
Organics Manager - Alan Lopez

Annual Review:

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Reviewed By: _____ Date: _____

Document Control #:	**Archival Date:**

Uncontrolled

TABLE OF CONTENTS

1 Scope and Application 3
2 Summary of Method 3
3 Interferences 3
4 Safety 4
5 Apparatus and Materials 4
6 Reagents 5
7 Instrument Calibration 6
8 Quality Control 7
9 Sample Collection, Preservation and Handling 10
10 Procedure 10
11 Calculations 11
12 Reporting Results 12
13 Waste Disposal 12
14 Pollution Prevention 12
15 Definitions 12
16 Maintenance and Troubleshooting 13
APPENDIX A 14
APPENDIX B 15
Summary of Changes 16

Uncontrolled

1 Scope and Application

1.1 This method is adapted from SW-846, Method 9023, "Extractable Organic Halides (EOX) in Solids," Third Edition, Revision 0, December 1996.

1.2 This document states the laboratory's policies and procedures established to meet requirements of all certifications/accreditations currently held by the laboratory, including the most current standards in effect for the National Environmental Laboratory Accreditation Program (NELAP).

1.3 Extractable Organic Halides (EOX) is defined as the sum of those organic halides which are extracted and detected by pyrolysis/microcoulometry. Extractable organic halides containing chlorine, bromine, or iodine are detected; however, fluorine-containing species are not detected by this method. Applicable matrices include solid wastes, soils, and suspended solids isolated from industrial wastewater.

1.4 This method is restricted to use by, or under the supervision of trained analysts experienced in the operation of the pyrolysis microcoulometer and in the interpretation of the results.

1.5 Method Detection Limits (MDLs) are available on the ALS-MIDDLETOWN server and are maintained and updated by the QA Department. The detection limits for a specific sample may differ from those listed due to the nature of interferences in a particular sample matrix.

1.6 Individual project requirements may override criteria listed in this SOP.

2 Summary of Method

2.1 An approximate 2.0 to 2.2 g aliquot of a solid sample is extracted with ethyl acetate by sonication to isolate organic halides. A 20-µL aliquot of the extract is injected into a sample boat and pyrolyzed in a 900˚C furnace. The pyrolyzed product, being carried by a stream of Ar/O_2, is then determined by microcoulometric titration.

3 Interferences

3.1 Interferences may be caused by contaminants, reagents, and other sample processing hardware. Materials used in analysis must be routinely demonstrated to be free from interferences by running method blanks.

3.2 To eliminate glassware problems, all samples will be prepped using 20 mL pre-cleaned clear glass VOA vials, with polyvinyl caps and Teflon/silicone septums.

3.3 Only high purity reagents and gases are used to help minimize interference problems.

3.4 All operations shall be carried out in an area where halogenated solvents, such as Freon and methylene chloride are not being used.

Uncontrolled

3.5 Inorganic halide salts (e.g., mercuric chloride) will be extracted and therefore may interfere if the sample has large amounts of inorganic chlorides.

4 Safety

4.1 ALS-Middletown maintains Safety Data Sheets (SDSs) on all chemicals used in this procedure. ALS-Middletown recommends that all individuals performing this SOP familiarize themselves with the SDSs associated with the procedure prior to SOP performance. SDSs are available to all staff and are in hard copy in the QA reference library and electronically on the ALS-Middletown server in the Common>Health & Safety>SDS folder.

4.2 All possible steps shall be taken to limit analyst contact with reagents, standards, and samples. The minimum personal protective equipment (PPE) requirements are PVC gloves, safety glasses and a fully buttoned lab coat. Wearing this PPE shall greatly reduce the possibility of contact to a safe level, but the analyst shall not limit themselves to these PPE minimums. Refer to SOP 90-PPE for detailed PPE information.

4.3 Injuries from glass cuts are a serious concern in the laboratory. Several types of cut resistant gloves are available in all the laboratory work areas. Wells Lamont part # Y1700 or equivalent should be worn as an under glove to provide cut protection when nitrile, latex or vinyl gloves are worn for chemical protection. The use of cut resistant gloves is mandatory throughout the entire laboratory when handling glass sample containers and reusable labware constructed of glass. The handling of VOA and extract vials does not require cut-resistant gloves unless a cut hazard is evident. For example, loading capped vials unto an instrument does not require the use of cut resistant gloves, but capping extract vials does.

4.4 In addition to the PPE minimums required above, a face shield shall be worn at all times while dispensing, diluting or handling any quantity of concentrated acid.

4.5 Analysts should always exercise caution when handling samples since the chemical and biological composition of the samples is unknown.

4.6 The health hazards of each substance used in this method may not have been fully established. Each substance shall be regarded as a potential health hazard and exposure shall be as low as reasonably achievable.

5 Apparatus and Materials

5.1 Microsyringes - 25 and 1000 µL Hamilton gas-tight syringes for standard, sample, and spike preparation or equivalent.

5.2 Laboratory centrifuge capable of holding 40-mL VOA vials.

5.3 Sonicator with a power level of at least 200 watts.

5.4 Vials – 20-mL pre-cleaned with Teflon lined cap seals.

5.5 Metal spatulas.

Uncontrolled

5.6 Volumetric pipets for appropriate volumes, rinsed in ethyl acetate.

5.7 Laboratory Balance – Mettler PG2002-S or equivalent.

5.8 Mitsubishi TOX-100, consisting of a sample boat and injection port, automatic boat controller, pyrolysis furnace, flow controller, microcoulorimeter and titration cell or equivalent.

5.9 Computer- Dell Optiplex 780, or equivalent.

5.10 Computer software-

5.10.1 TOX-100 System Program Version 6.18, or equivalent.

5.10.2 Microsoft Excel, or equivalent.

5.10.3 Horizon LIMS version 11, or equivalent.

6 Reagents

NOTE: Unless otherwise noted in this section all chemicals are stored at room temperature and labeled with an expiration date of five years from receipt. Manufacturer's labeled expiration dates, when provided, take precedent over all other expiration dates.

6.1 Oxygen - 99.9% purity purchased from Airgas or equivalent.

6.2 Argon - 99.9% purity purchased from Airgas or equivalent.

6.3 Ethyl Acetate - 99.9% purity, VWR, catalog # EM EX0241-6 or equivalent.

6.4 Methanol, Purge and Trap grade - VWR, catalog # EM-MX0482-6 or equivalent

6.5 Sodium Acetate Trihydrate – VWR, catalog #JT3460-15 or equivalent.

6.5.1 Chlorine cell electrolyte. Dissolve 4.7 grams of sodium acetate in 50 mL of reagent grade water. Transfer to a 1-L volumetric flask along with another 50 mL of H_2O. Carefully add 1700 mL of concentrated glacial acetic acid. Dilute to 2 liters. Label with an expiration date of 90 days from preparation.

6.6 2,4,6-Trichlorophenol, purchased from Chem Service, catalog #F-21 or equivalent.

6.6.1 Trichlorophenol solution in Ethyl acetate (1 µL = 1 µg Cl^-): Prepare solution by weighing 0.1856 g of 2,4,6-Trichorophenol in 100 mL of ethyl acetate. This solution will be used for spiking solid sample extraction solutions. Label with an expiration date of 6 months from preparation.

6.6.2 Trichorophenol QC solution in Methanol (1 µL = 2 µg Cl^-): Prepare solution by weighing 0.3712 g of 2,4,6-trichorophenol (must be different lot number than the 2,4,6-trichlorophenol used in section 6.6.2) in 100 mL of methanol. This solution will be used for injecting standard into the system.

Uncontrolled

Label with an expiration date of 6 months from preparation.

6.7 Reagent water - A Filson Water Purification System is used which provides analyte-free, >16.0 megahm-cm deionized water on demand.

6.8 Glacial Acetic Acid – reagent grade, VWR, catalog # JT 9507-33 or equivalent.

6.9 Dehydration tube solution – 10 mL of concentrated sulfuric acid, "Baker Analyzed", purchased from VWR, catalog #JT 9681-33 or equivalent.

6.10 Potassium Chloride – purchased from VWR, catalog # JT3040-1 or equivalent.

6.10.1 Reference Electrode Inner Chamber Solution (1 M KCl). Dissolve 7.46 grams KCl in approximately 50 mL of reagent water in a 100-mL, Class A volumetric flask. Dilute to 100 mL with reagent water. This solution is used in the top chamber of the cell. Label with an expiration date of 90 days from preparation.

6.11 Potassium Nitrate – 98% purity, VWR, catalog # EM-PX1520-1 or equivalent.

6.11.1 Working Electrode and Reference Electrode Outer Chamber Solution. Dissolve 25.0 g of KNO_3 in approximately 50 mL of deionized water, in a 250-mL, Class A volumetric flask. Dilute to 250 mL with deionized water. This solution is used to fill the working electrode arm with the counter electrode placed in it, and the bottom chamber of the reference electrode. Label with an expiration date of 90 days from preparation.

6.12 Sand, washed and dried – Mallinckrodt catalog #7062-04 or equivalent.

6.13 1000 PPM TOX Std. - purchased from ERA, catalog no.976 or equivalent. Store at 0-6° C for up to five years or expiration date.

7 Instrument Calibration

7.1 Oxygen and argon regulators shall be set to deliver between 50 & 60 psi. Set the oxygen flow meter on the flow controller to 150 cc/min and the argon flow meter to 200 cc/min. The furnace for TOX-100 shall be set at 900°C. Allow the gas flows and temperatures to stabilize before calibration.

7.2 Boats must be prebaked for five minutes and then cooled to be prepped for analysis. Position below the injection port.

7.3 Inject 10 µL of the 1000 ppm trichlorophenol standard (6.13) into the injection port of the pyrolysis tube on to a prepared boat and push into the pyrolysis furnace slowly. Press "START" to begin the analysis. See 8.11 for criteria and corrective actions.

7.4 The titration proceeds automatically and a buzzer will sound when it is finished. The factor is calculated automatically and stored in memory.

7.5 Change the designation to 20 µg and inject 10 µL of the 2000 ppm trichlorophenol standard (6.6.3). See Section 8.11 for criteria and corrective

Uncontrolled

actions

7.6 Perform a blank ethyl acetate injection. When "READY" is displayed and baseline is below 0.2, inject 20 µL of ethyl acetate into the sample boat, click "START".

7.7 The titration will proceed automatically. When it has been completed the buzzer will sound. After boat has cooled, repeat 7.7 until desired number of blanks have been run. If the integrated response is greater than 0.1 µg Cl^-, then the system shall be checked for sources of contamination. Blank checks shall be run at the beginning of each batch and after every 10 determinations.

7.8 If the calibration blank concentration is greater than or equal to the reporting limit and is greater than 1/10 the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected samples reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.

7.9 For specific procedures regarding instrument calibration in the AOX-1 mode please refer to section 6 of Book 1 of the Instruction Manual for the Model TOX-100 (Control No. ZTX3MAE-10-A/ WetChem Manual QCID#113).

8 Quality Control

8.1 Initial Demonstration of Capability (IDOC)

8.1.1 Analyze four replicate blank spikes prepared as indicated in section 8.6. All four results shall be within ± 10% of the true value. Precision expressed as RSD must be ≤10%If the standards analyzed do not meet this requirement, the IDOC shall be repeated before independent analysis of samples begins.

8.1.2 Each analyst shall perform a successful Initial Demonstration of Capability (IDOC) before working independently to conduct this method. Each analyst shall perform an annual DOC for ongoing proficiency as specified in SOP 99-Train.

8.2 All policies and procedures in the most current revision of the ALS-MIDDLETOWN QA Manual shall be followed when performing this procedure.

8.3 Initial calibration check is performed with the 10 µg Cl standard and the 20 µg Cl standard. The 20 µg Cl standard is the 2nd source verification standard.

8.4 The 10 µg Cl standard is injected as a calibration verification standard after 10 determinations and at the end of the batch.

8.5 Ethyl acetate blanks must be analyzed after the initial calibration check and after every 10 determinations with mean values of less than 0.1 µg. To prepare transfer a 2-gram aliquot of dried sand to a 20-mL VOA vial. Add 1 mL of deionized water and 5 mL of ethyl acetate. Sonicate for 15 minutes then centrifuge for 5 minutes. Analyze as a normal sample by injecting a 20 µL aliquot into the sample boat. If the method blank concentration is greater than or equal to the reporting limit and is greater than 1/10 the sample concentration, the source of the contamination

Uncontrolled

must be investigated and measures taken to minimize or eliminate the problem and affected samples reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.

8.6 Spike analyses are run daily or with each different sample matrix whichever occurs in a daily run. A minimum of 10% of all samples to be analyzed must be spiked. To prepare spikes, weigh 2.0 gram of sample to which 1 mL of reagent water and 5 mL of ethyl acetate has been added, and spike with 1.0 mL of 1000 ppm solution of 2,4,6-Trichorophenol in an ethyl acetate solution. Shake sample vigorously for 30 seconds and then sonicate for 15 minutes. Allow sample to settle for 15 minutes and centrifuge. Transfer ethyl acetate layer to a clean 40-mL VOA vial and refrigerate until analyzed. In order to increase spike recoveries, variations on sample size, spike and solvent amounts may vary due to sample matrices and other interferants that may be present in the sample.

8.6.1 Spike recoveries must be within laboratory calculated control limits. In the absence of control limits, the spike recovery must be within 20% of the true value. If outside of this range and the standards are within acceptable limits, and the specific matrix interference is identified, report with a qualifying statement. If the specific matrix interference is unknown, reanalyze the sample and matrix spike to determine matrix effect or analytical error.

8.7 Analyze all samples and spikes in duplicate. The relative percent difference (RPD) between duplicates must be within calculated control limits. In the absence of calculated control limits, the RPD must be ≤20%.

8.8 Samples selected for duplicate and matrix spike analysis shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a duplicate or spike may indicate a problem with the sample composition and shall be reported to the client whose sample produced the poor recovery.

8.9 MDL studies must be performed at least annually or more frequently if required by the analytical method. Special projects may also require MDL studies to be performed at more frequent intervals. See SOP 99-MDL-LOD-LOQ.

8.10 A sample matrix LCS is run at the beginning of each batch following the initial calibration checks. To prepare transfer a 2 gram aliquot of dried sand to a 20-mL VOA vial. Add 1 mL of deionized water and 5 mL of ethyl acetate. Spike with 1 mL of the 1000 ppm TOXS spike. Sonicate for 15 minutes then centrifuge the LCS for 5 minutes. Analyze as a normal sample by injecting a 20 µL aliquot into the sample boat.

8.11 Quality Control Requirements

Quality Control Requirements
(Specific project requirements may override these requirements)

Parameter	Concentration	Frequency	Control Limits	Corrective Action

Uncontrolled

Solvent Blank	---	In duplicate with each newly prepared solvent standard.	<0.1 µg	Rerun until methanol contamination is confirmed. Prepare solvent standard from new methanol source. Re-prepare anything made from the bad methanol.
Sample Matrix Blank	---	In duplicate at the beginning of each new batch and after 10 determinations.	<0.1 µg **DoD sample:** <0.05 µg If blank contamination affects the sample results per the method or project of program requirement (ie: A "J" value in the blank will affect the results when "J" values are reported for a sample.	If the matrix blank concentration is greater than or equal to the reporting limit AND is greater than $^{1}/_{10}$ the sample concentration, the source of contamination must be investigated and measures taken to minimize or eliminate the problem and affected sample reanalyzed. If reanalysis is not possible, data shall be reported with a qualifying statement.
Sample Matrix LCS	500 mg/kg	Daily at the beginning of batch	± 10% of true value	Rerun or prepare fresh and run again. If fails again, recalibrate and rerun.
Calibration Verification Standard	10 µg (1000 ppm Trichlorophenol Standard)	Daily at the beginning of batch, every 10 determinations and at end of the run.	± 10% of true value	Rerun CVS or prepare fresh CVS without adjusting calibration. Run one additional time. If CVS fails again, resolve calibration problem and rerun all samples since last passing CVS. **DoD:** Recalibrate, and reanalyze all affected samples since the last acceptable CVS OR Immediately analyze two additional consecutive CVSs. If both pass, samples may be reported without re-analysis. If either fails, take corrective action and re-calibrate; then re-analyze all affected samples since the last acceptable CVS.
Check Standard	20 µg (2000 ppm Trichlorophenol standard	Daily at the beginning of the batch.	± 10% of true value	Rerun CVS or prepare fresh and run again. If fails again, recalibrate and rerun.
Matrix Spike	500 mg/kg based on a 2g sample amount	Daily and every 10 samples.	± 20% of true value. Laboratory control limits may be used when sufficient data	If LCS is acceptable and the specific matrix interference is identified, report with a qualifying statement. If the specific matrix interference is unknown, reanalyze the sample and

Uncontrolled

			are available (>30 points)	matrix spike to determine matrix effect or analytical error.
Duplicate	---	Every sample.	%RPD ≤ 20%	Rerun, if fails again, report with a comment.

8.12. The glass gastight syringes shall be calibrated as specified in SOP 19-AP, Standard Operating Procedure for Calibration Checks for Autopipetters/ Dispensers

9 Sample Collection, Preservation and Handling

9.1 Refer to SOP 20 – Field Services Plan for Sample Collection.

9.2 All samples must be iced or refrigerated from the time of collection until analysis. Samples shall be stored above the freezing point of water up to 6˚C and protected from light.

9.3 Grab samples must be collected in glass pre-cleaned 4oz sample bottles with PTFE lined caps. Other sizes are acceptable. Sample bottles shall be filled to nearly overflowing to minimize headspace until time of analysis.

9.4 All samples must be analyzed within 28 days of sample collection.

10 Procedure

10.1 Calibrate and check system performance daily as described in section 7.

10.2 Transfer a 2.0 to 2.2g aliquot of the solid sample to a 20-mL VOA vial. Add 1 mL of reagent water (if the sample is miscible in water), add 5 mL of ethyl acetate to the sample and cap tightly. Shake the sample vigorously for 30 seconds and then place the vial in a sonicator for 15 minutes. See SOP 99-Balances for balance calibration procedures

10.3 Allow the suspension to settle for 10 minutes and then centrifuge for 5 minutes. Decant the ethyl acetate layer to a clean 20-mL VOA vial and refrigerate above the freezing point of water up to 6˚C until analyzed.

10.4 For analysis withdraw 20 µL aliquot of the ethyl acetate into a 25-µL syringe and inject into the sample boat. Enter the sample amount and the solvent volume. When the "READY" is displayed and the baseline has dropped below 0.2, click START".

10.5 Sample will be integrated and results recorded automatically, subtracting out the blank value and calculating results in ppm. Repeat Section 10.4 for a second determination. Calculate the average of the two results and record under default blank. If the result exceeds the working range or if spike recovery values are poor due to interference, dilute the sample by extracting with a larger volume of ethyl acetate. Prepare spikes in the same manner. Reanalyze.

10.6 Sample extracts shall be diluted so that results fall within the calibration range.

Uncontrolled

10.7 For specific procedures for the analysis of solid samples in TSX-CL mode please refer to section 7 of Book 1 of the Instruction Manual for the Model TOX-100 (Control No. ZTX3MAE-10-A/WetChem Manual QCID#113).

10.8 All quality control samples, method blanks, LCS, etc., must undergo all preparation and analytical steps that are performed on client samples. For example, if client samples are filtered prior to analysis the QC samples must be filtered also."

11 Calculations

11.1 Determine the TOX concentration of the sample as follows (performed by instrument):

$$TOXS = mg/kg\ as\ Cl^- = \frac{Q_S \times V_S}{W_S \times V_i} \times 1000$$

Where: Q_s = Averaged quantity of TOXS as µg of Cl^- integrated by titration and recorded by the microcoulorimeter. Subtract µg of blank from average.
V_s = Total volume of extract in mL. Do not include volume of reagent water in total volume.
W_s = Weight of sample extracted in g.
V_i = Volume of aliquot injected in µL.

11.2 Report results in milligrams per kilogram.

11.3 Determine spike concentration as follows:

$$Spike\ Value = S_v - [TOXS\ (W_v/V_v)(.01)]$$

Where:
S_v = Averaged quantity of spike value as µg of Cl^- integrated and recorded by the microcoulorimeter.
TOXS = Result calculated in mg/kg of sample spiked as obtained above.
W_v = Weight of spike extracted in g.
V_v = Total volume of extract plus spike volume in mL.

11.4 Matrix Spike Recovery

$$\%Recovery = 100 \times \frac{Spike\ Value\ (11.3)}{Expected\ Concentration}$$

Where:
$$\text{Expected concentration} = \frac{1000\ \mu g/L}{sample\ amount\ (g)}$$

11.5 Precision (RPD): % Recovery= R_1-R_2/ (R_1+R_2)/2 x 100

Where: R_1= sample or spike result

R_2= duplicate or spike duplicate result

Uncontrolled

11.6 The default reporting limit based on a 2g sample amount and 0% moisture is 5 mg/kg. The final reporting limit is determined by the LIMS:

Reporting limit = $\frac{Default\ reporting\ limit\ (5\ mg/kg)}{Sample\ amt\ (g) x\ \%Dry\ Weight}$

Where % dry weight is in decimal form (ie: 60% dry weight = 0.6)

12 Reporting Results

12.1 All raw data used for reporting results must be dated and initialed by the qualified laboratory personnel performing first and second review per SOP 99-DATA.

12.2 When entering data into Horizon LIMS do not round off results: Horizon will automatically perform rounding appropriate to the method. Horizon LIMS results are reported to three significant figures but limited to the number of decimal places in the reporting limit for the individual compound or analyte.

Reporting limit = 5mg/kg; 5g sample size and 0% moisture. Actual reporting limit will vary with sample amount and moisture content.

12.3 Report the actual result, even if it is less than the reporting limit. Any sample with a result less than the reporting limit is reported as ND (non-detectable); LIMS will automatically report the appropriate detection limit. Results are reported in Horizon LIMS manually and are not auto-posted.

12.4 Report all sample results as an average of 2 replicates with an RPD of ≤20%.

12.5 Results shall be posted with an end time of the final bracketing CCV at the end of the batch run.

13 Waste Disposal

13.1 Refer to ALS-MIDDLETOWN SOP 19-Waste Disposal and 90-Waste-Mgmt.

14 Pollution Prevention

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operations. Management shall consider pollution prevention a high priority. Extended storage of unused chemicals increases the risk of accidents. The laboratory shall consider smaller quantity purchases which will result in fewer unused chemicals being stored and reduce the potential for exposure by employees. ALS-MIDDLETOWN tracks chemicals when received by recording their receipt in a traceable logbook. Each chemical is then labeled according to required procedures and stored in assigned locations for proper laboratory use.

15 Definitions

15.1 Refer to ALS-MIDDLETOWN QA Manual under Laboratory Quality Control Checks for general definitions.

Uncontrolled

16 Maintenance and Troubleshooting

16.1 Refer to maintenance logs and instrument manuals for guidance regarding general maintenance and troubleshooting specific problems related to the instrumentation used in this method.

Uncontrolled

APPENDIX A

Parameter Print

END.P	304.2 mV
GAIN-1	0.98
GAIN-2	2.79
GAIN-3	6.44
TITR-F	100%
SENS	0.5 mV
DELAY	90 sec
Ar TIME	150 sec
02 TIME	180 sec
BLANK	0.0594 µg
TEMP	900 ˚C
E1-TIME	180 sec
E2-TIME	600 sec

Uncontrolled

APPENDIX B

Analysis Coversheet
TOX

Analysis:	Matrix:

SOP ID:	Method:

Standards	
1000 ppm TOX:	
2000 ppm TOX:	
1000 ppm TOX (S):	
1000ppm Total Halogen Std:	

Instrument ID#:	
Batch #:	
Analysis Date:	

Initial and Date:	
Analyst:	
1st Review/Entry:	
2nd Review:	
Approval:	

Reagents	
10% KNO3:	
1M KCL:	
Cell Electrolyte:	
KNO3 Wash:	
GAC:	
Ethyl Acetate:	
Methanol:	
Sand Lot#:	

Balance ID#:	
Syringe ID#s:	

Samples for Re-analysis	
Sample ID	Reason for Re-analysis

Comments:

Rev. 02/12/2020

Uncontrolled

Summary of Changes

Revision 7

Section Number	Section	Description of Change
Spelling, grammar, and formatting changes may have been made throughout SOP for clarity, correctness, and conformity.		
4.1	Safety	Updated Safety standard verbiage
5.10	Apparatus and Materials	Updated LIMS version
5.11	Apparatus and Materials	Updated LIMS version
8.11	Quality Control	Added DoD requirements
	Concurrence Form	Updated
	Signature Page	Updated signatories
9.4	Sample Collection, Handling and Preservation	Updated analysis hold time
10.8	Procedure	Added standard verbiage
	Appendix B	Updated to most current revision
Revision 8		
	Cover Page	Updated
	Signature Page	Updated signatories
6.6	Reagents	Updated expiration date on standards
7.3 and 7.5	Instrument Calibration	Added name of the standard and section # where to find criteria and corrective action.
8.1.3	Quality Control	Added general statement.
8.9	Quality Control	Updated SOP ID
8.11	Quality Control	Updated quality control requirements table.
11.4	Calculations	Added calculation for matrix spike recovery
11.6	Calculations	Added calculation for reporting limit depending on sample volume.
12.2	Reporting Results	Added reporting limit value.
	Appendix B	Updated to most recent revision
Revision 9		
	Signature Page	Updated signatories
6.6.2	Reagents	Revised reagents used
8.1.1	Quality Control	Revision to acceptance criteria
8.11	Quality Control	Revised table
10.2	Procedure	Added reference to balance calibration
12.4 and 12.5	Reporting Results	Added instruction to reporting results

Uncontrolled

Uncontrolled Copy

QUALITY ASSURANCE MANUAL

ALS Environmental – Middletown
301 Fulling Mill Road
Middletown, PA 17057
(717) 944-5541

www.alsglobal.com

ALS-MDT QUALITY ASSURANCE MANUAL

Doc ID:	ALS-MDT QAM	Rev. Number:	32	Effective Date:	11/16/2020

Document Control #: **Archival Date:**

Approved By: _____ Date: 11-16-2020
Laboratory Director – Scott Brunk

Approved By: _____ Date: 11-17-2020
QA Manager – Susan Magness

Approved By: _____ Date: 11/16/2020
Operations Manager – Ray Martrano

Approved By: _____ Date: 11/16/2020
Technical Manager – Alan Lopez

Uncontrolled Copy

Table of Contents

1. Scope
2. Normative References
3. Terms and Definitions
4. General Requirements
   4.1 Impartiality
   4.2 Confidentiality
5. Structural Requirements
6. Resources Requirements
   6.1 General
   6.2 Personnel
   6.3 Facilities and Environmental Conditions
   6.4 Equipment
   6.5 Metrological traceability
   6.6 Externally provided products and services
7. Process Requirements
   7.1 Review of Requests Tenders and Contracts
   7.2 Selection, Verification, and Validation of Methods
   7.3 Sampling
   7.4 Handling of Test or Calibration Items
   7.5 Technical Records
   7.6 Evaluation of Measurement Uncertainty
   7.7 Ensuring the Validity of Results
   7.8 Reporting of Results
   7.9 Complaints
   7.10 Nonconforming Work
   7.11 Control of Data and Information Management
8. Management System Requirements
   8.1 Options
   8.2 Management System Documentation
   8.3 Control of Management System Documents
   8.4 Control of Records
   8.5 Actions to address Risks and Opportunities
   8.6 Improvement
   8.7 Corrective Actions
   8.8 Internal Audits

Uncontrolled Copy

8.9 Management Review

9. Appendices

10. SOP Change Form

Uncontrolled Copy

Cross Reference Table (ISO 17025:2017 to TNI Volume 1:2016)

QUALITY ASSURANCE MANUAL - CROSS REFERENCE TABLE

QAM, ISO/IEC 17025		TNI Volume 1, 2016
1	Scope	M2 1.2
2	Normative reference	M2 2.0
3	Terms and definitions	M2 3.0
4	General Requirements	M2 4.1
4.1	Impartiality	NA
4.2	Confidentiality	M2 4.2
5	Structural requirements	M2 4.1
6	Resource requirements	M2 4.0
6.1	General	M2 4.1.5
6.2	Personnel	M2 4.1.5, 5.2
6.3	Facilities and environmental conditions	M2 5.3
6.4	Equipment	M2 5.5
6.5	Metrological traceability	M2 5.6
6.6	Externally provided products and services	M2 5.10.6
7	Process requirements	M2 4.0
7.1	Review of requests, tenders and contracts	M2 4.4
7.2	Selection, verification and validation of methods	M2 5.4
7.3	Sampling	M2 5.4
7.4	Handling of test or calibration items	M2 5.5.6
7.5	Technical records	M2 4.13.2
7.6	Evaluation of measurement uncertainty	M2 5.4.6
7.7	Ensuring the validity of results	M2 5.9
7.8	Reporting of results	M2 5.10
7.9	Complaints	M2 4.8
7.10	Nonconforming work	M2 4.9
7.11	Control of data and information management	M2 5.4.7
8	Management system requirements	M2 4.0
8.1	Options	M2 4.0
8.2	Management system documentation (Option A)	M2 4.2
8.3	Control of management system documents (Option A)	M2 4.3
8.4	Control records (Option A)	M2 4.13
8.5	Actions to address risks and opportunities (Option A)	NA
8.6	Improvement (Option A)	M2 4.10
8.7	Corrective Actions (Option A)	M2 4.11
8.8	Internal Audits (Option A)	M2 4.14
8.9	Management Reviews (Option A)	M2 4.15

Uncontrolled Copy

1. Scope

This Quality Assurance Manual (QAM) describes the policies, procedures and accountabilities established by the Laboratory of ALS Environmental (ALS) to ensure that the test results reported from analysis of air, water, soil, waste, and other matrices are reliable and of known and documented quality. This document describes the quality assurance and quality control procedures followed to generate reliable analytical data.

This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

ALS maintains certifications pertaining to various commercial and government entities. Each certification requires that the laboratory continue to perform at levels specified by the programs issuing certification. Program requirements can be rigorous; they include performance evaluations as well as regular audits of the laboratory to verify compliance.

Quality Assurance Policy

ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of the Various States, United States Environmental Protection Agency (USEPA), TNI Volume 1 2009/2016, the most current Department of Defense Quality Systems Manual (QSM), and ISO/IEC 17025:2005/2017.

ALS corporate management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM and other client and project related requirements.

ALS management reviews its operations on an ongoing basis and seeks input from staff and clients to make improvements.

It is the policy of ALS that all employees be familiar with all quality documentation.

Quality System

This QAM and SOPs referenced in this document comprise the ALS management system. This management system includes all quality assurance policies and quality control procedures.

Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, procedures and email systems. All information essential for effective and consistent communication of analytical requirements and details affecting quality is available through these computerized systems.

Ethics and Data Integrity

It is the policy of ALS to perform work for clients in the most efficient manner possible, avoiding waste of resources. It is the role of both ALS management and employees to ensure that work for clients is performed most efficiently and effectively by properly utilizing ALS purchased materials, equipment, and the time and ability of personnel.

ALS policy on waste, fraud, and abuse is described in ALS SOP CE-GEN-001, “Laboratory Ethics and Data Integrity.” It is the policy of ALS to generate accurate and reliable data in accordance with contractual and regulatory requirements. As stated in the ALS policies manual, any undue pressure applied to employees in the performance of their

Uncontrolled Copy

duties must be reported as per procedures for reporting listed in ALS SOP CE-GEN-001. It is against ALS policy to improperly manipulate or falsify data or to engage in any other unethical conduct as defined in ALS Corporate SOP CE-GEN-001. ALS provides mandatory initial and annual refresher training for all employees on SOP CE-GEN-001, "Laboratory Ethics and Data Integrity."

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees as detailed in the Ethics and Data Integrity corporate SOP CE-GEN-001. Key topics covered are the organizational objective and its relationship to the critical need for honesty and full disclosure in all analytical reporting, record keeping, and reporting data integrity issues. Training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedures. Training topics also cover examples of improper actions, legal and liability implications (company and personal), causes, prevention, awareness, and reporting options. Computer security is also included, covering ALS computing security awareness, passwords and access, and related topics. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences including immediate termination, or civil/criminal prosecution. Evidence of training is maintained by the QA Department. See Appendix C for a copy of the ALS Ethics and Integrity Agreement.

In order to maintain compliance with the requirement to conduct and document ethics and data integrity training annually for all employees, data integrity training will occur no later than the first month of the last quarter in the calendar year. This allows for completion of the training and the proper documentation within the calendar year. Any employee that does not complete the required data integrity training by the start of the last month of the calendar year will be removed from normal laboratory operations until the requirement is met to complete the required annual training by the end of the calendar year.

The pertinent ALS Project Manager must approve deviations from contractual requirements. The Project Manager obtains approval for any such deviations, either in writing or by phone (documented in a phone log) from pertinent contract authorities. In addition, ALS requires that deviations from contractual requirements that might affect data quality be reported to clients. Any employee who knowingly manipulates and/or falsifies data or documents or engages in any unethical conduct is subject to immediate release from employment.

ALS employees who are aware of, or reasonably suspicious of, any case of data manipulation, falsification of data, waste of resources, or other unethical practice or misconduct shall notify any manager. Under the direction of the laboratory director, every allegation of unethical conduct will be fully investigated.

2. Normative References

ALS relies primarily upon the most current EPA approved revisions of the references listed below for methodologies used in the laboratory. Procedures contained in these references are acceptable for use only after the lab has demonstrated and documented adequate performance with the method such as method detection limit studies, precision and accuracy studies, proficiency sample analysis, and linear calibration range studies. These studies are then routinely verified as long as the methods are in use in the laboratory.

Uncontrolled Copy

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO/IEC 17025:2005 and 2017, "General requirements for the competence of testing and calibration laboratories"
- TNI 2009 and 2016, VOLUME 1, "MANAGEMENT AND TECHNICAL REQUIREMENTS FOR LABORATORIES PERFORMING ENVIRONMENTAL ANALYSIS"
- DoD/DOE QSM, "Department of Defense (DoD), Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories"
- ISO/IEC Guide 99, International vocabulary of metrology — Basic and general concepts and associated terms (VIM1)
- ISO/IEC 17000, Conformity assessment — Vocabulary and general principles
- "Methods for Chemical Analysis of Water and Wastes," U.S. Environmental Protection Agency, EPA/600/4-79/020, Revised 1983.
- "Standard Methods for the Examination of Water and Wastewater," American Public Health Association,18th edition, 20th Edition, 21st Edition, 22nd edition, on-line
- "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA SW-846, Third Edition, 1986, Updates I, II, IIA, IIB, III, IIIA, IIIB, IV, IVA, and IVB.
- 40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.
- 40 CFR Part 141, National Primary Drinking Water Regulations.
- "Methods for the Determination of Organic Compounds in Drinking Water", EPA 600/4-88/039, Rev. July 1991; Supplement I, EPA 600/4-90/020, July 1990; Supplement II, EPA 600/R-92/129, August 1992; Supplement III, EPA-600/R-95/131, August 1995.
- "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA 600/R-93/100, August 1993.
- "Methods for the Determination of Metals in Environmental Samples", Supplement EPA 600/4-88/039, Rev. July 1991; Supplement I, EPA 600/R-94/111, July 1990; Supplement II, EPA 600/R-92/129, August 1992.
- Methods for the Determination of Organic and Inorganic Compounds in Drinking Water, Volume 1, EPA815-R-00-014.
- NIOSH Manual of Analytical Methods, 4th Edition, DHHS (NIOSH) Publication 94-113 (August 1994), 1st Supplement Publication 96-135, 2nd Supplement Publication 98-119, 3rd Supplement Publication 2003-154.
- Annual Book of ASTM Standards.
- AIHA-LAP, LLC Current Policies

Uncontrolled Copy

3. Terms and Definitions

- Impartiality - presence of objectivity
- Complaint - expression of dissatisfaction by any person or organization to a laboratory (3.6), relating to the activities or results of that laboratory, where a response is expected
- Inter-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions
- Intra-laboratory comparison - organization, performance and evaluation of measurements or tests on the same or similar items within the same laboratory in accordance with predetermined conditions
- Proficiency testing - evaluation of participant performance against pre-established criteria by means of inter-laboratory comparisons
- Laboratory - body that performs one or more of the following activities:
  - — testing;
  - — calibration;
  - — sampling, associated with subsequent testing or calibration
- Decision rule - rule that describes how measurement uncertainty is accounted for when stating conformity with a specified requirement
- Verification - provision of objective evidence that a given item fulfils specified requirements
- Validation - verification , where the specified requirements are adequate for an intended use

4. General Requirements

4.1 Impartiality

All employees are required to enter into the following agreements:

- **Code of Conduct Agreement**
  Provides a framework for decisions and actions in relation to conduct in employment. The agreement covers a wide range of topics including personal and professional behavior, conflicts of interest, gifts, confidentiality, legal compliance, security of information, among others. The code of conduct agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Confidentiality Agreement**
  Describes policies for identifying and protecting information owned by ALS and its customers, and for keeping this information in confidence. The confidentiality agreement is administered by the USA Human Resources department. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed.

- **Ethics and Data Integrity Agreement**

Uncontrolled Copy

Provided to the employee as part of the hiring and induction process, and reviewed during periodic ethics refresher training. This is coordinated between the Human Resources and Quality Assurance (QA) departments. This agreement is provided to the employee during the hiring and induction process and the agreement is reviewed and signed. All employees are required to take annual ethics and data integrity refresher training.

In addition to the agreements, project managers act as a firewall to insulate the analysts from clients so that the lab personnel have no contact with clients. Lab IDs are assigned to samples and used throughout preparation and analysis to make the samples ambiguous to lab personnel. Together these agreements and procedures ensure freedom from undue internal and external commercial, financial, and other pressures or influences that could adversely affect the quality of work. They protect customers' confidential information and ALS' proprietary rights. They ensure avoidance of activities that could diminish confidence in the competence, impartiality, judgment or integrity of any ALS laboratory and staff.

It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This and the peer review of all data will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results, opinions and interpretation of data is outside the scope of the laboratory activities.

4.2 Confidentiality

All employees signed confidentiality statement upon employment. These are maintained by Human Resources (HR).

Documents provided to the laboratory are held in strict confidence by project management staff. Documents pertaining to quality assurance and analytical requirements are reviewed with appropriate managers and staff through the project specific meetings and LIMS. Project related information provided by clients is securely archived using procedures described in the ALS SOP LAB-013 "Retention of Records"

The transmittal of final results is specified by clients and follows those requirements unless specific changes are made by the ALS Project Manager assigned to the client/project. Client communication procedures and documentation requirements are listed in ALS SOP LAB-023 "Client Communication".

5. Structural Requirements

5.1 The laboratory, a legal entity, is part of ALS USA Corp and the Laboratory Director reports to the General Managers, Life Sciences, USA. There are other support functions such as human resources, accounting, safety oversight and computer systems that are provided to the laboratory by corporate entities but none of which is responsible for managing laboratory activities. The support functions of this laboratory involved with testing and services are under the direction of the laboratory director.

5.1.1 Limitation of Liability
Notwithstanding any other provision herein, ALS's liability and Client's exclusive remedy for any cause of action arising hereunder, whether based on contract, negligence, or any other cause of action, shall be limited to the compensation received by ALS from the Customer for the services rendered therewith. All

Uncontrolled Copy

claims, including negligence or any other cause whatsoever shall be deemed waived unless made in writing and received by ALS within ninety (90) days after ALS's completion of the services provided.

5.1.2 Transfer of Ownership
In the event of a transfer of ownership of the laboratory, the new owner will agree in writing, which shall be either stipulated in a purchase agreement or as a separate record retention document, that the current records shall be maintained for a period of not less than ten (10) years.

In the event of a laboratory closure, the current owner/management will notify in writing all Customers for whom the laboratory performed sample analysis within the last ten (10) years that the laboratory will be closing. This letter will instruct the Customers to contact the laboratory to provide instructions on how previous records are to be transferred to the Customer's care.

5.2 The responsibility for this laboratory under the direction of the laboratory director. Key employees in the management systems are identified in section 5.5.

5.3 This laboratory performs a full range of inorganic and organic analyses using EPA SW-846 methods, EPA drinking water methods per 40CFR141, EPA Clean Water Methods per 40CFR136, AWWA Standard Methods current approved methods, and Accreditation agency or State Approved Methodologies;. This QAM is designed to be an overview of ALS operations. Detailed methodologies and practices are written in ALS Standard Operating Procedures (SOPs). Where appropriate, ALS SOPs are referenced in this document to direct the reader to more complete information.

5.4 ALS is committed to producing legally defensible analytical data of known and documented quality acceptable for its intended use and in compliance with applicable regulatory programs. This QAM is designed to satisfy the applicable requirements of various states, United States Environmental Protection Agency (USEPA), Department of Defense Quality Systems Manual, TNI Volume 1 2009 and 2016 and ISO/IEC 17025:2005 and 2017.

5.5 Org Chart and Key personnel-see Appendix B.

5.5.1 ALS Laboratory Director, The Laboratory Director is responsible to ensure:

- ✓ Implementation of quality policy and applicable standards.
- ✓ Employees have sufficient experience and training to perform QAM-related duties and procedures.
- ✓ That the necessary facilities and equipment are available to meet the commitments of the laboratory.
- ✓ Sample handling, instrument calibration, sample analysis, and related activities are conducted and documented as described in this QAM, its related Standard Operating Procedures (SOPs), and its referenced methods.
- ✓ That routine QC samples are prepared, analyzed, and reviewed as required by this QAM.
- ✓ That at regular intervals audits are conducted and documented to assess compliance with this QAM.
- ✓ That corrective action is initiated and completed to remedy discrepancies or problems identified in any laboratory process.

Uncontrolled Copy

- ✓ Management review of all processes and procedures associated with the management system.
- ✓ In the absence of the Laboratory Director, the Operations is will assume the above responsibilities.

5.5.2 ALS Operations Manager, The Operations Manager reports directly to top management and is responsible to ensure:

- ✓ Implementation of quality policy and applicable standards.
- ✓ Employees have sufficient experience and training to perform QAM-related duties and procedures.
- ✓ That the necessary facilities and equipment are available to meet the commitments of the laboratory.
- ✓ Sample handling, instrument calibration, sample analysis, and related activities are conducted and documented as described in this QAM, its related Standard Operating Procedures (SOPs), and its referenced methods.
- ✓ That routine QC and production samples are prepared, analyzed, and reviewed as required by this QAM.
- ✓ That at regular intervals audits are conducted and documented to assess compliance with this QAM.
- ✓ That corrective action is initiated and completed to remedy discrepancies or problems identified in any laboratory process.
- ✓ Management review of all processes and procedures associated with the management system.
- ✓ In the absence of the Operations Manager, the Laboratory Director will assume the above responsibilities.

5.5.3 Quality Assurance Manager, The Quality Assurance Manager reports directly to top management and is responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Understand, monitor and evaluate the quality assurance (QA) and quality control (QC) activities described in this QAM and its references, reporting deficiencies and identifying resource requirements to the Laboratory Director.
- ✓ Conduct and document an annual internal audit of laboratory procedures to ensure compliance with this QAM and its references.
- ✓ Conduct an annual update of this QAM and review or update laboratory Standard Operating Procedures (SOPs).
- ✓ Arrange for the analysis of demonstration of competency (DOC) and performance evaluation (PE) samples.
- ✓ Maintain a record of ongoing personnel training for QAM-related activities, reporting training deficiencies to the Laboratory Director.
- ✓ Maintain the laboratory documentation of nonconformance, corrective action, preventive action, and improvement programs.
- ✓ In the absence of the QA Manager, the Technical Manager Assistant will assume the above responsibilities.

Uncontrolled Copy

5.5.4 Technical Manager, The Technical Manager reports directly to the Laboratory Director and is responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Read, understand and follow this QAM with its references.
- ✓ Ensure that method development projects meet the requirements specified in this QAM.
- ✓ Ensure that each set of reported results meets the requirements specified in this QAM and meets the client's requirements as defined in the applicable project requirements.
- ✓ Ensure that personnel are trained, authorized and utilized effectively.
- ✓ Ensure that facilities and equipment are maintained and utilized effectively.
- ✓ Ensure that supplies are available and utilized effectively.
- ✓ Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- ✓ In the absence of the Technical Manager, the Operations Manager will assume the above responsibilities.

5.5.5 Organic and Inorganic Technical Managers, The managers of these operations report directly to the Operations Manager and are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Read, understand and follow this QAM with its references.
- ✓ Ensure that each set of reported results meets the requirements specified in this QAM and meets the client's requirements as defined in the applicable project requirements.
- ✓ Ensure that personnel are trained, authorized and utilized effectively.
- ✓ Ensure that facilities and equipment are maintained and utilized effectively.
- ✓ Ensure that supplies are available and utilized effectively.
- ✓ Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- ✓ In the absence of the Organic or Inorganic manager, the technical Manager will assume the above responsibilities.

5.5.6 Project Managers, Project Managers report directly to the Client Services Manager. Project Managers are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Complete and distribute project related information for each project before the laboratory starts work on the project.
- ✓ Immediately communicate to the laboratory changes made to projects in progress and document these changes as appropriate.
- ✓ Respond to client requests for information and coordinate responses to client audits.
- ✓ Ensure Horizon work orders are reviewed and meet client project requirements before release to the laboratory.

Uncontrolled Copy

- ✓ Perform an initial review of results for large projects to verify that data reports submitted to the client meet all project requirements.
- ✓ Operate as approved signatories and have authority to sign laboratory Certificates of Analysis.

5.5.7 Support Management (Computers, Client Services, Health and Safety) are responsible to:

- ✓ Ensure implementation of quality policy and applicable standards.
- ✓ Read, understand and follow this QAM with its references.
- ✓ Ensure that procedures are followed and meets the client's requirements as defined in the applicable project requirements.
- ✓ Ensure that personnel are trained, authorized and utilized effectively.
- ✓ Ensure that facilities and equipment are maintained and utilized effectively.
- ✓ Ensure that supplies are available and utilized effectively.
- ✓ Immediately report technical and quality problems to the Laboratory Director or Quality Assurance Manager.
- ✓ Training staff to comply with all processes

5.6 It is the responsibility of all technical and support staff to comply with all procedures and be familiar with current quality systems and policies as established by management. At ALS, improvement of the quality systems and preventive action is effected through an ongoing systems review by management using input from all staff. ALS actively seeks employee and client input for improvements through surveys and questionnaires. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements. For clients, ALS surveys and gains feedback on services provided. This input to management is provided from the corporate level. To comply with these requirements all staff are responsible but not limited to the following:

- ✓ Follow project requirements as delineated by project managers to ensure analyses and commitments, including TAT, are performed as requested.
- ✓ Develop knowledge and understanding of the QAM requirements under which samples are handled and tested.
- ✓ Notify managers and Quality Assurance personnel when QA problems arise.
- ✓ Follow Quality Assurance requirements as outlined in the QAM and SOPs.
- ✓ Follow appropriate channels regarding modification of existing SOPs.
- ✓ Maintain accurate electronic and written records.
- ✓ Ensure that applicable data are included in each process in accordance with applicable SOPs.
- ✓ Record all nonconformance.
- ✓ Follow appropriate protocols when the handling and testing does not meet acceptance criteria.
- ✓ Apply integrity and professional judgment when dealing with analytical processes and laboratory operations.

Uncontrolled Copy

5.7 Although verbal communication with employees is essential, written and visual communication through email and computer systems is the cornerstone of effective communication at ALS. Computer workstations throughout the lab provide access to LIMS, ALS Portals, Instruments used for testing, Policies and Procedures, and Email. All information essential for effective and consistent communication of analytical requirements, client requirements and details affecting quality are available through these computerized systems.

ALS management is committed to improvements of the management systems through compliance with its own policies and procedures. ALS management ensures improvements are made to the management systems and also ensures data integrity is maintained.

6. Resources Requirements

6.1 General

6.1.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.2 Personnel

6.2.1 It is the responsibility of all staff to comply with all procedures, be familiar with current management systems and policies, and to record all data as established by management. This will ensure that all testing is objective and conflicts of interest do not exist. As a commercial laboratory, the decision making using test results is outside the scope of the laboratory activities. The ALS laboratory employs sufficient personnel to complete required chemical and support activities.

6.2.2 The ALS training program specified in the ALS SOP 99-Train, “Training Protocol” includes quality training, technical training, safety training, and other training as described in this QAM. ALS managers are responsible to ensure that all staff training is initiated, completed, verified, and documented.

The specific training and experience of laboratory personnel is documented in individual training files maintained in the ALS fileserver in accordance with ALS SOP 99-Train, “Training Protocol” and includes records of analytical proficiency through the analysis of QC and PT samples.

Job Descriptions include requirements for education, qualification, training, technical knowledge, skills and experience. Job descriptions are maintained by the corporate Human Resource Department.

6.2.3 All ALS staff assigned to perform tasks affecting or relating to testing receives training relative to pertinent areas of responsibility, both prior to performing work on client samples and on an ongoing basis. Such training comes from internal and external sources.

6.2.4 Laboratory personnel resources needed to carry out their duties. See 5.6

6.2.5 The laboratory procedure ALS SOP 99-Train, “Training Protocol” includes the following and records are retained for:

- ✓ determining the competence requirements;
- ✓ selection of personnel;
- ✓ training of personnel;
- ✓ supervision of personnel;

Uncontrolled Copy

- ✓ authorization of personnel;
- ✓ monitoring competence of personnel.

6.2.6 It is the responsibility of Technical and Support Management to authorize staff to perform specific laboratory activities. These tasks include testing methods, peer review and authorization to report results. Records are retained for the pertinent authorizations by the Quality Assurance department.

6.3 Facilities and Environmental Conditions

6.3.1 ALS management has committed its full support to provide the personnel, facilities, equipment, and procedures required by this QAM.

6.3.2 Records are maintained for the requirements and conditions necessary for method and regulatory compliance in the facility.

6.3.3 Records are retained with analytical data for monitoring and control of environmental conditions to relevant method and regulatory specifications.

6.3.4 See Appendix D for floor plan.

To maintain facility security and thus sample security, entrance to the ALS facility can be attained only through security access. At the main business entrance and sample receiving entrance access is open only during normal business hours and monitored by the receptionist at the business entrance and Sample Receipt Technicians at the sample receiving entrance. All non-employees are required to sign in with the receptionist at the main entrance.

Laboratory areas are segregated by HVAC systems to contain contamination and to eliminate potential contamination from specific laboratory areas that require low ambient chemical background levels for successful analysis. The volatile laboratory is separated from other laboratory areas to prevent solvent contamination.

Each area in the laboratory has adequate lighting, conditions and bench space for instrumentation and for the processes assigned to that area.

Laboratory reagent water is prepared and maintained using any combination of deionization, reverse osmosis, purging and UV radiation. See SOP 04-H2O Mon, “Reagent Water and Drinking Water Monitoring”.

Fume hoods have visual indicators to ensure flow is maintained during use and are performance tested semi-annually.

All safety inspection records are kept on file for a minimum of five years.

6.3.5 Laboratory activities outside the facility are limited to sample pick-up and sample collection, and are addressed in ALS SOP 90-FSSP, “Field Services Sampling Plan”. Field service activities are not included in our laboratory scopes of accreditation/certification.

6.3.5.1 Instructions for sample collection are available to clients and to internal field services personnel.

6.4 Equipment

6.4.1 A comprehensive list of instrumentation and support equipment utilized at ALS is included in Appendix E. Redundant instruments are maintained for particular analyses.

Uncontrolled Copy

6.4.2 Laboratory equipment items such as analytical balances, pipets, and thermometers are verified against reference standards rather than reference materials. Laboratory reference weights and thermometers are certified by ISO accredited vendors against ISO or National Metrology Institute (NMI) traceable standards. All support equipment is maintained in proper working order and verified daily or prior to use. Support equipment is calibrated or verified as described by the following SOPs: 99-Balances, "Calibration Verification and Operation of Laboratory Balances", ALS SOP 99-AP "Standard Operating Procedure for Calibration Checks for Autopipettors/Dispensers" and ALS SOP 99-TCAL, "Thermometer Verification".

6.4.2.1 In the event that equipment is sent outside of the laboratory, such as a NIST thermometer for calibration, the device shall be inspected by the laboratory prior to use. If found to be of the appropriate quality per the SOP and functioning properly, the Certificate or return documentation shall be marked as "approved" and maintained on file.

6.4.3 Routine maintenance is performed on laboratory instruments and equipment according to manufacturer recommendations. Maintenance is provided under warranty, through service contracts, and by ALS in-house personnel. The ALS approach to preventive maintenance is described in each analytical SOP. Records of routine maintenance and emergency maintenance are kept with the instruments or on the ALS server in hardcopy or electronic maintenance logbooks.

6.4.3.1 Maintenance logs contain general information about the instrument, such as the name of the manufacturer, instrument model, serial number, date of purchase, date placed into service, current instrument location, condition when received (e.g., new, used, reconditioned), and information concerning any service contracts maintained. They also contain information concerning any routine maintenance done by ALS personnel. Information concerning maintenance should include a brief description of the maintenance performed, the frequency required, the date performed, and the initials of personnel performing the maintenance and any comments concerning the procedure. Also to be entered in or to be stored with the log is information concerning repairs done by ALS personnel or instrument manufacturers. This information should include the date of servicing, the initials of personnel performing the service, record of why it was done and the results of the servicing relative to instrument performance. The individual logbooks are located on the server or in the laboratory with the instruments to which they pertain along with copies of manufacturer's instructions, where available. Records shall be retrievable for review and archived according to required procedures. See SOP 99-Records, "Records Management".

6.4.3.2 It is the responsibility of the technical managers to determine the effect, if any, of an instrument defect on previous results. If an effect has been determined to have impacted the validity of any sample results, the QA Manager is notified and the corrective action procedure is followed. See SOP 99-NCAR Procedures, "Non-Conformance / Corrective Action Procedures".

6.4.4 All instruments are calibrated or verified before use, using reference materials with traceability established. Specific calibration requirements, such as

Uncontrolled Copy

frequency required and materials needed, are detailed in the method or analytical SOPs and support equipment SOPs.

6.4.4.1 All initial calibrations are verified for accuracy by analysis of a second source standard. This is a check standard prepared from a reference material procured from a different source than that used for the calibration. When a different source is not available or cost prohibitive, a second lot of material from the same vendor is acceptable as long as the original source used to prepare the standards is not the same.

6.4.4.2 All initial calibrations are verified by analysis of continuing calibration standards and/or QC check samples. These are method or SOP specified calibration standards that are analyzed at specific frequencies as established by the method. The amount of analyte recovered is compared to the acceptance criteria of the method. Acceptable recoveries verify the stability of the calibration and lack of instrument drift throughout the analysis. Analysts perform trend analysis by monitoring instrument response and QC each day of analysis. If the acceptance criteria are not met, or sensitivity is determined to be changing, method specific corrective action must be taken. (See analytical SOPs)

6.4.5 The instrument manuals are provided in electronic format usually in the software programs, CDs, and available on network drives. Software is controlled through licensing and is the responsibility of computer support to maintain licenses required.

6.4.6 Testing instruments are calibrated as per method, regulatory and verification procedures listed in SOPs. Support equipment has verification and calibration frequencies specified in SOPs.

6.4.7 Calibration program. See 6.4.4

6.4.8 Calibration and verification periods are designated in support equipment and analytical method SOPs. This equipment is labeled with calibration dates and any correction factors, if needed.

6.4.9 Equipment that has been subjected to overloading or mishandling, gives questionable results, or has been shown to be defective or outside specified requirements, is taken out of service. It shall be recalibrated and not returned to service until it has been verified to perform correctly. The laboratory shall examine the effect of the defect or deviation from specified requirements and shall initiate the nonconformance process. See SOP 99-NCAR Procedure, “Non-Conformance / Corrective Action Procedures”.

6.4.10 Support equipment is verified on the day of use and calibration verification is required on analytical instruments as per method, program and SOP requirements.

6.4.11 All reference materials ordered by ALS have available documentation of purity, traceability and uncertainty. Support equipment which require correction factors shall be documented. See 99-TEMP, “Equipment Temperature Monitoring”.

6.4.12 Passing verification criteria ensures that unintended adjustment of equipment is identified.

6.4.13 Records of instruments are retained and include specifications, manufacturer, serial numbers, identification, software version, location, status and the date of

Uncontrolled Copy

purchase. The majority of firmware has no impact on laboratory activities. There are some instruments in which the firmware is the software and can affect the laboratory operations. These instruments are usually small like pH meters, conductivity meters and auto-titrators. If an instrument does not have typical software to load and firmware is used to generate results, then the firmware version must be entered in the instruments equipment record log and any updates to the firmware will be noted in the instrument maintenance log.

6.4.14 Records of calibration, maintenance, reference materials used, calibration checks or verifications are kept with analytical data and in maintenance logbooks

6.5 Metrological Traceability

6.5.1 All measurements made by the laboratory required an unbroken chain to NMI, Reference Standards or Reference Materials

6.5.2 Reference Standards and Reference Materials

a) Reference Standards

Reference standards used by the laboratory are calibrated at determined intervals by outside vendors for the following equipment. These reference standards are maintained under the control of QA personnel and are used for verifying intermediate materials used by the laboratory. Quality Assurance is responsible for maintaining records and schedules of calibration.

- Reference Thermometers - See SOP 99-TCAL, “Thermometer Verification”.
- Reference Weights – See SOP 99-Balances, “.

Intermediate checks are used in the laboratory to verify performance of support equipment and are verified to traceable reference standards. Records of such verifications are retained by Quality Assurance. See SOP 99-TCAL and SOP 99-Balances, “Calibration Verification and Operation of Laboratory Balances”,

b) Reference Materials

Reference materials used at ALS must be of the grade or quality specified by the pertinent analytical procedure (SOP) or methodology.

Purchased reference materials must be traceable to a National Metrology Institute (NMI) or equivalent national or international standards where possible.

6.5.3 Reference Standards are calibrated by vendors certified to ISO 17025:2005/2017.

Reference Materials are purchased, whenever possible. ALS uses reference materials from Guide 34 or ISO 17034 accredited vendors.

Second source reference materials are purchased and used in the testing process as an independent verification of primary reference materials prior to analysis of samples. The secondary reference material does not require accredited vendors.

6.5.3.1. The reference standards used are those specified in the reagent sections of the respective SOP.

Uncontrolled Copy

6.5.3.2. If reference materials from Guide 34 or ISO 17034 accredited vendors are not available, reference standards of the best purity and quality from a reputable supplier may be used. Determination is made by the laboratory with careful study and consideration of the chemically pure substances available.

6.5.3.3. All purchased reference standards are received and verified for accuracy against the invoice. They are entered into the inventory control system, and forwarded to the analytical section where the Certificate of Analysis shall be verified against the SOP required standards.

6.5.3.4 Certificates of Analysis are available electronically on the ALS network, or can be retrieved through the vendor.

6.5.3.5 Second source reference materials are purchased from a source from a reliable second source, they are prepared separately from a different lot than that of the primary, and a different original source material.

6.5.3.6 Any standard reference material which is past its expiration date is removed from use, and labeled as "experimental use only". Expired standard reference materials will not be used for analysis of samples.

6.5.4 Reagents

Reagent quality is of extreme importance to laboratory results. All chemicals and reagents used in the laboratory meet purity and traceability requirements specified in the laboratory method SOPs. Each laboratory area has standard operating procedures, which define the quality of reagents being used. The corporate requisition system allows requisition of reagents of required quality. All purchased reagents are delivered to the Inventory Control Area to be unpacked, verified for accuracy against the invoice, and labeled with a unique reference ID number. (See SOP 99- Chemical Labeling Protocol) The storage of chemicals is governed by the manufacturer's recommendations and by the analytical procedures for which the chemicals are used.
Verification that the chemical or reagent purchased is of the correct purity and traceability is performed by comparison of the acquired reagent to reagent listed in the associated SOP.

Each lot of chemical or reagent used is monitored and controlled for any unusual contaminants that interfere with analysis as evident in results of prescreens and/or method and reagent blanks. If a working reagent is found to be suspect, it is removed from use and traced back to the original lot number, which is then investigated. If the stock reagent is found to be the source of the problem, it is completely removed from use. Any samples contained in batches in which the suspect reagent was used for analysis will be reanalyzed if sufficient remaining sample and holding time allows, or clients will be contacted and results appropriately qualified with a sample or analyte level comment on the final report. See SOP 09-Lot Verification for procedure to verify targeted critical reagents.

6.6 Externally Provided Products and Services

6.6.1 Laboratories contracted to perform analytical services for ALS must maintain quality programs consistent with the quality requirements of ALS. Before a

Uncontrolled Copy

laboratory performs subcontracted work for ALS, the Quality Assurance Manager must verify the acceptability of the quality program. See SOP 99-Sub Lab App, "Procedure for Subcontractor Laboratory Approval".

ALS uses vendors which supply the level of quality required to perform testing activities. ALS maintains a relationship with multiple vendors and uses vendors with comparable certifications or accreditations.

6.6.1.1 A register of all approved subcontractors is retained in the QA Department. See SOP 99-SOP Lab App, "Procedure for Subcontractor Laboratory Approval".

6.6.1.2 ALS advises its customers in each proposal of its intention to subcontract any portion of the testing to a third party, or non-ALS laboratory. If it is necessary to subcontract work to a non-ALS laboratory as a result of unforeseen circumstances, customers will be contacted by their Project Coordinator to gain their permission. This approval is documented.

6.6.1.3 Any subcontracted analysis is noted as such on ALS's final laboratory analysis report with an identification of the appropriate subcontractor. The original subcontractor analysis report, or a true duplicate thereof, is also attached to the associated ALS Laboratory Analysis Report.

6.6.2 ALS SOP CE-GEN007, "Purchasing Services and Supplies" outlines the process, evaluation, criteria and records maintained from the evaluation and reevaluation of supplies and services. Corporate personnel are responsible for vendor approval and evaluation. Records are maintained by the corporate purchasing office.

6.6.3 Processes are designed to ensure that materials and services purchased meet the quality specifications of ALS. Procurement and receiving services are provided at ALS by administrative personnel. Procurement and receiving quality requirements established by ALS analytical SOPs are followed. All requisitions for purchase are approved by ALS operations management and specify 1) the level of service required or 2) the quality/specifications of material required. The receipt of materials not meeting specification in the purchase requisition require investigation.

7. Process Requirements

7.1 Review of Requests Tenders and Contracts

Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. They are also responsible for the archival or destruction of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required procedures and documentation are listed in the ALS SOP 99-Project, "Project Setup".

7.2 Selection, Verification, and Validation of Methods

7.2.1 Reference methods for environmental samples are drawn primarily from the current version of Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition. Reference methods for water analysis are taken from Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March, 1983 with its updates, and from 40 CFR, Part 136. Methods

Uncontrolled Copy

referenced in ALS SOPs also come from ASTM guides, and from Standard Methods for the Examination of Water and Waste Water.

SOPs are written for all environmental testing methods and any in-house developed methods. SOPs may be copies of reference methods that are not modified. All SOPs are reviewed using document control procedure. See SOP 99-SOPs, "Laboratory Policy on Writing, Issuing and Changing Standard Operating Procedures (SOPs)".

All analytical methods and preparatory method combinations are routinely tracked and ALS maintains statistical control limits and reporting limits. The laboratory can perform analyses using limits provided by clients or from referenced sources in the absence of historical data. The ALS SOP 99-QC Chart, "Control Chart Generation & Maintenance" describes how control limits are established and updated.

ALS policy is that all SOPs be compliant with the reference method. In the event that several methods are referenced in an SOP, all procedures must be compliant with all referenced methods. All SOPs include a section describing changes and clarifications from the reference method if applicable. In the event that an analytical reference method is modified, the SOP documentation must include a description of the modification, any justification of the method modification which includes, but is not limited to, method performance and recovery data, any other supporting data, and approval from the Technical Managers, Quality Assurance Manager, and Laboratory Director. In the event that an analytical reference method must be modified or is modified to perform on specific sample matrices, the modification and reason must be stated in the case narrative. All modified methods will be identified on the analytical report.

7.2.2 The policy of ALS is to apply analytical methods that have been approved, validated, and published by government agencies, professional societies and organizations, respected private entities, and other recognized authorities. These methods have been validated for their intended use and ALS uses the demonstration of competency procedures, calibration of instruments and LOD/LOQ procedures to verify laboratory capability.

7.2.2.1 For those analyses that do not have EPA-approved methods, the analytical methods used are taken from standard sources, where such methods exist (ASTM, API, etc.). The standard analytical methodologies performed by ALS can be found in the SOP 19-Preservation Protocol, "Procedure for Sample Preservation based on Analytical Method", along with the recommended container, preservation, storage and holding times for each methodology.

Published methods may be modified as a result of the request of the client or operational conditions prevailing in the laboratory. Operational conditions might relate to, for example, the availability of equipment or the performance of the method as determined by calibration processes, detection limits, or the results obtained for quality control samples.

7.2.2.2 ALS will not accept samples that require test methods that have not been published in national standards unless these methods have been agreed upon by the Client and have been documented and validated by the laboratory.

Validation procedures describe three different classifications of validations for method modification. New methods, permanent modifications to a published

Uncontrolled Copy

method which will be used in subsequent laboratory determinations, and temporary modifications applied only to immediate analytical projects. These methods are used with approval from the clients.

The essential quality control elements for modification and validation include:

Calibration - Number of levels and acceptance criteria must meet or exceed requirements of ALS analytical SOPs.

QC Samples - QC samples prepared in the specific matrix, are assessed. If possible the recoveries are compared to method or historical control limits used for the reference method.

Sensitivity - Method Detection and Reporting Limit, Method Detection Limit is the lowest analyte concentration that produces a response detectable above the noise level of the system and Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured. Method Detection Limits, if required, are generated. A reporting limit verification is accomplished using ALS SOP 99-MDL LOD LOQ "Establishing MDLs, LODs, and LOQs"

If validation reports are required to validate methods, these reports must address the following elements and follow established testing industry protocols:

Calibration – a demonstration of a concentration range where the analyte response is proportional to concentration.

Sensitivity – Method Detection Limit is the lowest analyte concentration that produces a response detectable above the noise level of the system and Reporting Limit is the lowest level at which the analyte can be accurately and precisely measured.

Selectivity - the ability of the method to accurately measure the analyte response in the presence of all potential sample components.

Precision and Bias - Precision – the type of variability that can be expected among test results. Bias - systematic error that contributes to the difference between the mean of a large number of test results and an accepted reference value.

Robustness – the ability of the procedure to remain unaffected by small changes in parameters or matrix.

7.3 Sampling

In order to produce meaningful analytical data, ALS must have samples that are representative of the system from which they were taken. If the representation and integrity of the samples received in the laboratory cannot be verified due to inadequate sampling procedures, the usefulness of the analytical data produced for these samples is limited. The laboratory cannot accept responsibility for improper sampling of Client-procured samples and will document the condition of the samples and analyze them as received. If an incorrect sampling procedure is suspected, the Client will be notified as soon as possible by the Project Manager. ALS will postpone testing, if the holding time will not be exceeded, pending client response. Sampling instructions and acceptance criteria are made available to Clients.

Sample collection services can be provided by ALS through personnel from the Field Services. Documented procedures for field sampling are outlined in the Field Services

Uncontrolled Copy

Sampling Plan (SOP 20-FSSP). Sampling personnel ensure that collected samples are representative of the original systems, fully labeled and identified, and properly preserved and transported to the laboratory.

Where sampling, as in obtaining sample aliquots from a submitted sample, is carried out as part of the test method, the laboratory uses documented procedures as outlined in SOP 09-Subsampling, "Subsampling Procedure for Nonvolatile Analysis or Preparation", to obtain a representative sub sample.

7.4 Handling of Test or Calibration Items

Procedures for receiving, processing, and storing samples and for ensuring continuity of the chain-of-custody are detailed in the following ALS SOP(s):19-Rec-Han, "Standard Operating Procedure for Receipt/Handling", 19-COC, "Standard Operating Procedure for Chain of Custody Entry", 19-LCOC, "Standard Operating Procedure for Legal Chain of Custody", 19-Tray, "Tray System for Sample Storage", and 19-Aliquot, "Sample Aliquot Protocol". Drinking water specific procedures are outlined in SOP, 19-DEP REP NOT, "Protocol for Reporting and Notification of DEP Drinking Water Samples".

The ALS Sample Receiving area is isolated from areas of the laboratory where analyses are performed. The area is equipped with ventilation hoods and adequate bench space to ensure that the sample receiving process is safe, efficient, and not a source of cross-contamination in the laboratory.

Sample Tracking

Sample handling in the laboratory is tracked using a computer-based Laboratory Information Management System. After samples are received by the laboratory, as described above, sample receiving personnel enter the sample information into the LIMS. See SOP 19-COC, "Standard Operating Procedure for Chain of Custody Entry".

When multiple analyses require splitting a sample, the custody documents are copied such that each split can be independently traced to its origin and appropriate entries can be entered into LIMS.

Sample Storage and Security

Following receipt, samples are stored in accordance with analytical method requirements for storage and preservation. See SOP(s) 19-Preservation Protocol, "Procedure for Sample Preservation based on Analytical Method" and 19-Tray, "Tray System for Sample Storage", for instructions for storage requirements of samples, and using the bar coding tray storage system. Samples for organic and inorganic analysis are normally stored in a walk in refrigerator or shelf in the sample receipt area. Storage locations are outlined in SOP 19-Rec-Han, "Standard Operating Procedure for Sample Receipt / Sample Handling". Samples to be analyzed for environmental volatile testing are stored separately from all other samples in a refrigerator or freezer. Samples are aliquoted for analysis using SOP 19-Aliquot Protocol, "Sample Aliquot Protocol" and then stored in a proper thermally controlled storage area until transferred to an analyst to initiate an analytical process. Samples are stored away from all standards, reagents, and all other potentially contaminating sources in such a manner as to prevent cross-contamination. High concentration samples or product samples shall be stored separately.

To maintain facility security and thus sample security, entrance to the ALS facility can be attained only through security card key access, except at the sample receiving entrance, which is open only during normal business hours and monitored by the Sample Receipt Technicians. All non-employees are required to sign in with the receptionist at the main entrance.

Uncontrolled Copy

Chain-of-Custody

In order to ensure that legally defensible data are produced at ALS, chain-of-custody procedures are established and are described in ALS SOPs 19-Rec-Han, "Standard Operating Procedure for Sample Receipt / Sample Handling", and 19-COC "Standard Operating Procedure for Chain of Custody Entry".

7.5 Technical Records

7.5.1 ALS maintains records electronically and as hardcopy in accordance with ALS 99-Records, "Records Management". ALS personnel are responsible for the generation, retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, analyst laboratory notebooks, instrument maintenance logs, and training records, as established by procedure. Records are traceable, retrievable and legible and include sufficient information such that any staff that did not perform the analysis and data generation can readily interpret them.

Data Packages - All documentation which pertains to the analysis of a sample or group of samples that are being reported together is kept on file, and can be compiled as a data package per client request. The following SOP(s) addresses the preparation and control of data packages: SOP 99-SDG CREATION, "Laboratory Policy on Creating and Assigning Sample Delivery Groups (SDGs)", SOP 99-CLP-Like ORG, "Protocol for Preparing CLP-like Forms, Organics Section", 99-LIMSQC, "Generation of LIMS QC Report", 99-Org Data Pack, "Procedure for Organics Section Data Package Submission to the Reporting Department", and 99-SDG Assembly, Laboratory Policy on Assembly of Data Packages".

Electronic records or scans of records that relate to the analysis of field samples are compiled into folders on network drives for storage. These data packages are generally stored electronically as per ALS 99-Records, "Records Management". Unless specified by contract, applicable statute, or program, data packages are retained for ten years.

Laboratory Notebooks and Logbooks - Laboratory notebooks and logbooks are retained by ALS for ten years and are not released to clients. Laboratory notebooks are assigned to specific analysts or areas. If corrections are made it requires a single-line cross-out, initials and date are entered. If the correction is due to other than a transcription error, the reason for the change should be documented.

Quality Assurance Records - Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically on networked drives.

The Quality Assurance Manager is responsible for maintaining and retrieving records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports. Copies of these records can be internally accessed by employees on network drives as needed.

Client-Related Information - Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS. They are also responsible for the destruction of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required documentation are listed in the ALS SOP 99-Project, "Project Setup".

Uncontrolled Copy

7.5.2 ALS ensures that amendments to technical records are tracked to previous versions or to original observations. Both the original and amended data and files are retained, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.

7.6 Evaluation of Measurement Uncertainty

Uncertainty is associated with most of the results obtained in the laboratory testing conducted by ALS. It is meaningful to estimate the extent of the uncertainty associated with each result generated by the laboratory. It is also useful to recognize that this measurement of uncertainty is likely to be much less than that associated with sample collection activities.

In practice, the uncertainty of a result may arise from many possible sources. ALS has considered the relative contribution of major sources of error. The approach to estimating uncertainty adopted by the laboratory resulted in the conclusion that many sources of error are insignificant compared to the processes of sample preparation, calibration, and instrumental measurement. The uncertainty associated with the processes can be estimated from quality control data. Accordingly, ALS estimates uncertainty from data derived from quality control samples carried through the entire analytical process. A description of the uncertainty calculation is presented in ALS SOP E-QA010 “Estimation of Uncertainty of Analytical Measurements”. The estimation of uncertainty applied by ALS relates only to measurements conducted in the laboratory. Uncertainty associated with processes conducted external to the laboratory (e.g., sampling activities) are not considered.

Calculation of uncertainty may use the precision measurement values for duplicate samples when LCS or QC samples are not used in testing.

The calculation of uncertainty is not required for qualitative tests. The process is assessed for contributors to uncertainty but the calculation of uncertainty has limited value when empirical values are not available.

7.7 Ensuring the Validity of Results

Before samples are analyzed, the analytical system must be in a controlled, reproducible state from which results of known and acceptable quality can be obtained. That state is verified through the use of Quality Control (QC) procedures intended to ensure accuracy, precision, selectivity, sensitivity, freedom from interference, and freedom from contamination. The QC procedures performed at ALS include: calibration and calibration verification; analysis and comparison of resultant data to predetermined control limits for method blanks, laboratory control samples, spiked matrix samples, duplicate matrix samples, and surrogates added to samples; analysis of performance evaluation samples; determination of Reporting Limits; and the tracking and evaluation of precision and accuracy. For specific analytical methods, other QC procedures are implemented as required by the method.

These QC procedures are performed and evaluated on a batch basis. A preparation batch must not exceed 20 field samples that are of a similar matrix type without additional method QC in the batch, unless specified differently in an SOP or reference method. The samples in a batch are processed together, through each step of the preparation and analysis, to ensure that all samples receive consistent and equal treatment. Consequently, results from the batch QC samples, not including field sample QC, are used to evaluate the results for all samples in the batch.

In general terms, instrument calibration, method quality control, and data evaluation is described in analytical SOPs.

Uncontrolled Copy

All QC parameters set by the applicable ALS SOP or method reference shall not be exceeded without initiation of the NCAR process. See SOP 99-NCAR Procedure, "Non-conformance / Corrective Action Procedures".

The hierarchy of quality control requirements begins with:

- ✓ Client Requirements (if specified and documented)
- ✓ Method and/or SOP requirements
- ✓ Guidance from QAM and other general SOPs

Calibration and Calibration Verification

Instrument calibration is a QC measure taken to verify selectivity and sensitivity. Calibration of instruments at ALS is accomplished through the use of reference materials of the highest quality obtainable. ISO or National Metrology Institute (NMI) traceable reference materials are procured and used if they are available. When ISO or National Metrology Institute (NMI) traceable reference materials are not available, certified reference materials from government agencies or reliable vendors are used. In all cases, written records are maintained that allow all analytical results to be traced unambiguously to the reference materials used for calibration.

In general, analytical instruments are initially calibrated with standard solutions made from the reference materials at levels appropriate for the analysis. This is called the initial calibration (IC). This calibration is verified with a standard solution independently prepared from a different lot of the reference material, preferably from a different vendor. This step is called initial calibration verification or ICV. At specified intervals throughout the analytical sequence, the calibration is re-verified again through the analysis of a calibration check solution, usually the mid-point standard solution. This process is called the continuing calibration verification or CCV. If the IC, the ICV, or any CCV fails criteria in the analytical method, the system is recalibrated or the results are narrated. It is ALS' intention to only report results generated under acceptable calibration conditions. Specific calibration procedures are found in the SOPs associated with each method of analysis.

Alternative calibration sequences or procedures will be discussed with clients.

Calibration parameters set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Method Blanks

The method blank (or preparation blank) contains no sample material; it is treated as a sample in every other way. It is analyzed to monitor any contamination to which the analytical batch might have been exposed during preparation and analysis. A method blank is analyzed with every analytical batch. Criteria set by the applicable ALS SOP or method reference shall not be exceeded without initiation of a NCAR.

Analysis of Laboratory Control Samples and QC Samples

A control sample (LCS or QC) contains the analyte(s) of interest in known concentration(s) in a laboratory matrix; it is used to monitor accuracy. It measures the success of the analysis in recovering the analyte(s) of interest from a QC matrix. Soil samples and other solid matrices are analyzed with an LCS made of clean sand or appropriate substrate spiked with the analyte(s) of interest. Water samples and other liquid matrices are analyzed with a method blank spiked with the analyte(s) of interest.

The results of the LCS are reported as percent recovery:

Uncontrolled Copy

$$\%\,Recovery = \frac{X}{K} \times 100$$

Where: X = Measured value and K = Expected value

LCS/QC criteria set by the applicable ALS SOP or method reference shall not be exceeded without initiation of the NCAR process.

Analysis of Spiked Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible, as with samples of limited matrix amount, a duplicate LCS or QC should be analyzed in the batch.

A known concentration of the analyte(s) of interest is added to a second representative portion of a field sample to prepare a matrix spike. The matrix spike is used to determine acceptability of the method chosen on a specific field matrix. It measures the success of the analysis in recovering the analyte(s) of interest from the type of field sample matrix in the batch. A matrix spike is analyzed with every analytical batch of environmental samples. The results are reported as percent recovery.

$$\%\,Recovery = \frac{(XS - Xu)}{K} \times 100$$

Where Xs = Measured value in the spiked sample, Xu = Measured value in the unspiked sample, and K= Expected value

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per the analytical SOP instructions, or as per client instructions for project specific requirements.

Analysis of Duplicate Matrix Samples

Matrix QC samples are generally used to determine acceptability of methods chosen on a field sample and are therefore not used to determine batch acceptability. If the analysis of matrix spike is not possible, as with samples of limited sample amount, a duplicate LCS or QC should be analyzed in the batch.

A duplicate matrix spike sample or duplicate matrix sample is used to monitor the precision (repeatability) of the method chosen on a field sample. If a sufficient amount of the analyte(s) of interest is present in the field sample, a matrix duplicate sample is analyzed directly. If the analyte(s) of interest are not present in a sufficient amount, two additional portions of field sample are spiked with the analyte(s) of interest to ensure that meaningful results are obtained. A pair of duplicate samples (matrix/matrix duplicate or matrix spike/matrix spike duplicate) is analyzed with every analytical batch of environmental samples. The results of the analysis of duplicate samples are reported as relative percent difference (RPD).

$$RPD = \frac{|X1 - X2|}{[(X1 + X2)/2]} \times 100$$

Where: $|X_1 - X_2|$ = The absolute value of the difference between the two sample values, $[(X_1 + X_2)/2]$= The average of the two sample values

Uncontrolled Copy

Laboratory criteria will be used in the absence of client-specified criteria. Failure to meet these criteria will be noted as per the analytical SOP instructions, or as per client instructions for project specific requirements.

Analysis of Surrogates Added to Samples

Surrogates are compounds similar to the analyte(s) of interest but that are known not to be present in the environment. Examples are fluorinated or deuterated homologues of the organic analyte(s) of interest. When appropriate compounds are available, their use is specified in the analytical method SOP. When surrogates are used, they are added to the calibration solutions and to each field and QC sample in the batch. Surrogate recovery is a measure of the accuracy and selectivity of the method in the sample matrix. Surrogate results are reported as percent recovery.

$$\%\,\text{Recovery} = \frac{X}{K} \times 100$$

Where: X = Measured value and K = Expected value

Surrogate criteria set by the applicable ALS SOP or method reference on method QC samples shall not be exceeded without initiation of the NCAR process.

The same criteria will be used for field samples although failure to meet these criteria will be noted in report, narrative comments, or as per client project specific requirements.

Reporting Limit Verification Sample(s) (RLVS)

An RLVS is a control sample that contains the analyte(s) of interest at or below the stated reporting limit(s) in an applicable QC matrix; it is used to monitor sensitivity and assess uncertainty at the reporting limit. These samples are not used for batch acceptance and should be recovered at ≥½ the stated reporting limit. The analyst shall raise the reporting limit if systematic failures are apparent.

- An RLVS is required for every sample batch for applicable environmental testing as prescribed by the analytical SOP.
- Reporting limits must be at or above the lowest calibration standard.

Analysis of Performance Evaluation Samples (PT)

Proficiency testing (PT) samples are prepared by an authorized independent organization outside the laboratory. They are received and analyzed at regular intervals to monitor laboratory accuracy. ALS Laboratories sends the PT sample results to the independent organization, where they are evaluated and then forwarded directly from that organization to accreditation bodies as needed. PT samples are introduced into the regular sample stream of the laboratory and analyzed as routine samples by analysts who regularly perform the method. Laboratory personnel follow all instructions provided by the PT provider.

The Laboratory Director, Technical Managers or the Quality Assurance Manager can institute the analysis of additional PT samples or modify the performance evaluation program as appropriate.

The following guidelines for PT samples are followed by ALS:

- Averaging results is prohibited.
- Only qualified ALS laboratory employees analyze PT samples.

Uncontrolled Copy

- Results are not discussed with outside entities or other ALS laboratories prior to the deadline for receipt of the results.
- ALS does not subcontract to other laboratories or receive from other laboratories any PT samples.

When a PT sample result is outside of acceptable PT ranges, and evaluated as "not acceptable", a NCAR is issued per SOP 99-NCAR Procedure, "Non Conformance / Corrective Action Procedures" to determine and correct any problem(s) leading to the unacceptable result. For multiple failures or loss of certification for an analytes in a given test/matrix, a corrective action is required.

Participation in Proficiency Testing programs provides the laboratory with evidence of correlation of results with other laboratories and national standards. A four year proficiency testing schedule is maintained by the QA Manager.

When no commercial Proficiency Testing (PT) sample is available for an analyte that is routinely reported by ALS to a client, the QA Department will use demonstration of capabilities (DOCs) to monitor and evaluate the precision and accuracy of the analytical procedure against defined acceptance criteria documented in the Standard Operating Procedure.

Tracking and Evaluation of Accuracy and Precision

When evaluating batch QC the analyst makes a sequence of decisions before reporting sample results regarding calibration, the method blank, LCS, surrogate recovery, matrix spike, and matrix spike duplicate recovery results.

Assessment of the accuracy of an analytical measurement is based upon the analysis of samples of known composition. ALS relies upon the analysis of LCS/QC samples to track accuracy. The percent recovery relative to the expected value is calculated and can be plotted.

Assessment of the precision (repeatability) of an analytical measurement is based upon repeated analysis of equivalent samples of known or unknown composition. ALS relies upon the analysis of pairs of LCS/QC samples, matrix samples (M/MD) or spiked matrix samples (MS/MSD) to assess precision. The range of the pair is expressed as a relative percent difference (RPD).

Control limits for the accuracy and precision of each method are included in the analytical SOPs, and are based on set limits as indicated by the client (project specific), in the reference method or program, or as calculated using in-house data, Control limits for accuracy and precision charts are calculated assuming a normal (Gaussian) distribution of results. Historical data points are used to calculate mean values, two-standard deviation warning limits, and three-standard deviation control limits. The establishment and updating of control limits is described in ALS SOP 99-QC Chart, "Control Chart Generation and Maintenance".

Trending

In addition to evaluating individual batch QC results against control limits, QC results from successive batches are also evaluated for possible trends. While a trend is not necessarily an out-of-control situation in itself, it can provide an early warning of a condition that can cause the system to go out of control. ALS SOP 99-Data, "Data Review and Approval Procedure" describes in detail the assessment of QC data in the laboratory. The following conditions are trends that may initiate action and/or monitoring.

- A series of successive points on the same side of the mean

Uncontrolled Copy

- A series of successive points going in the same direction
- Two successive points between warning limits and control limits

ALS relies on analytical staff to identify trends in analytical systems. Quality Assurance can produce control charts as needed to assess trends but this activity by QA is not preventive and is only used to verify trends exist. The occurrence of a trend does not invalidate data that are otherwise in control. However, trends do require attention to determine whether a cause can be assigned to the trend so that appropriate preventive action can be undertaken.

Long term trends in control limits are evaluated annually by quality assurance and technical operations. See ALS SOP, 99-QC Chart, "Control Chart Generation & Maintenance".

7.8 Reporting of Results

7.8.1 ALS relies upon a system of peer review to ensure the quality of analytical reports. Peer review procedures are specified in the ALS SOP 99-Data, "Data Review and Approval Procedure", 99-Analyte Level Comment Protocol, and 99-Lab Report Review, "Protocol for Review of Laboratory Analytical Reports". An analyst, familiar with the analytical method used to produce the results (peer reviewer), reviews each report. The peer reviewer verifies that the calibration standards, type of calibration, and sample set with associated QC samples were selected correctly. The peer reviewer also verifies any manual transcriptions and calculations. The applicable Technical Manager can perform additional technical review.

Project Managers perform an initial review of results for large projects to verify that data reports submitted to the client meet all project and client requirements.

7.8.2 When the peer review has been completed, a final report (Certificate of Analysis) is generated. In most situations the report is produced from LIMS. In some cases part or all of the report can be produced from the data system of the analytical instrument. The reports produced by ALS meet the following requirements:

- ✓ The report identifies the method used. If the method is modified, it is noted as "modified" in the report.
- ✓ Any abnormal sample conditions, deviation from hold time, irregularities in preservation or other situations that might affect the analytical results are noted in the report and associated with the analytical results.

The contents of the report include:

- ✓ The report title with the name, address, and telephone number of the laboratory
- ✓ The name of the client or project and the client identification number
- ✓ Sample description and laboratory identification number
- ✓ The dates of sample collection, sample receipt, sample preparation, and analysis
- ✓ The time of sample preparation and/or analysis if the required hold time for either activity is 48 hours or less
- ✓ A method identifier for each method, including methods for preparation steps

Uncontrolled Copy

- ✓ The MDL or minimum reporting limit for the analytical results per client request
- ✓ The analytical results with qualifiers as required
- ✓ A description of any quality control failures and deviations from the accepted method
- ✓ The name (electronic signature) and title of the individual(s) who accept responsibility for the content of the report
- ✓ The date the report is issued
- ✓ Clear identification of any results generated by a subcontract laboratory
- ✓ Page numbers and total number of pages
- ✓ Electronic Data Deliverables (EDDs) can be developed and generated per client or agency specific specifications, and may contain a subset of components included on the final report (Certificate of Analysis). See ALS SOP 99-EDD, "Electronic Data Deliverables" and 99-Land Form Gen, "Landfill Form Generation".

7.8.3 ALS does not evaluate or interpret results.

7.8.4 ALS does not perform calibration services.

7.8.5 Limited sampling activities are performed by ALS Field Services personnel.

7.8.6 The laboratory reports results based on the sample provided by the customer. If ALS reports to a specification it is only for the sample results and not involved with decision rules applied to the sampling site.

7.8.7 ALS does not make any statements concerning opinions and interpretation of results without identifying them clearly as such.

7.8.8 Amended reports of analytical results are issued to correct errors. Amended reports require the following items:

Amendments to analytical reports will only be made in supplemental documents and shall contain identification similar to "Amended" or "Revised".

Include the date amended or released to the client.

Amended reports shall meet all reporting and client requirements.

Amended Reports are stored with the original report, are uniquely identified, and make reference to original reports.

A peer review process is used to ensure amended results are accurate.

Any information changed in the report must have the reason for the change documented in the report.

7.9 Complaints

ALS has a documented process for how complaints are received and evaluated. Nonconformance or corrective actions are generated to ensure decisions and outcomes are monitored and communicated. These outcomes are reviewed by the Quality Assurance department. The ALS SOP on handling complaints is ALS SOP 99-Complaints "Standard Operating Procedure for External Complaints".

Uncontrolled Copy

7.10 Nonconforming Work

7.10.1 The ALS SOP for handling nonconformance is ALS SOP 99-NCAR Procedure "Nonconformance/Corrective Action Procedures".

This laboratory procedure shall be implemented when any aspect of its laboratory activities or results of this work do not conform to its own procedures or the agreed requirements of the customer. The procedure ensures that:

- ✓ the responsibilities and authorities for the management of nonconforming work are defined;
- ✓ actions (including halting or repeating of work and withholding of reports, as necessary) are based upon the risk levels established by the laboratory.
- ✓ Any employee may stop work when a task cannot be performed safely or the quality of data is determined to be or could be negatively affected. Metrics utilized for work stoppage may include but are not limited to exceeding instrument or sample control limits, QC trending, instrument problems, etc. The appropriate manager shall be consulted for any work stoppage;
- ✓ an evaluation is made of the significance of the nonconforming work, including an impact analysis on previous results;
- ✓ a decision is taken on the acceptability of the nonconforming work;
- ✓ where necessary, the customer is notified and work is recalled;
- ✓ the responsibility for authorizing the resumption of work is defined.

7.10.2 The laboratory retains records on all nonconformance.

7.10.3 Quality Assurance Manager or designee reviews all nonconformance for completeness and adds comments as necessary on the acceptance. If this evaluation determines the problem has or can reoccur or it is against the laboratories own policies or procedures the event requires a corrective action as described in section 8.7.

7.11 Control of Data and Information Management

7.11.1 The laboratory has access to all data and information through the internet, intranet, network locations and hard copy.

7.11.2 All of the software used for data reduction, verification, and reporting is documented and validated by the ALS computer support staff or by the vendor from whom it is purchased. ALS software is controlled and secured according to ALS SOPs 99-Software "Software Control/Validation/Audits", 99-MDT APP DEV Protocol, "Middletown Application Development – GIT Version Control". And 99-LIMS 11, "Horizon LIMS Version 11 Workstation Installation". A continuing effort is made at ALS to increase the use of automated data handling, improve efficiency, and minimize human error.

Software errors are treated as a nonconformance under section 7.10 or as a corrective action under 8.7.

7.11.3 Access to ALS networks are controlled through passwords and windows security. Network drives are backed up and disaster planning is evident. See ALS SOP 99-DATABU, "Data Back-up".

Uncontrolled Copy

7.11.4 ALS uses offsite locations from the laboratory but internal to ALS for data storage and is managed in accordance with these procedures.

7.11.5 Access to network locations is managed with windows security and roles throughout the system.

7.11.6 Calculations and data transfers are checked using the peer review process and through documentation of computer programs by the IT staff.

8. Management System Requirements

8.1 Options

8.1.1 The laboratory has implemented **Option A** from the ISO/IEC 17025:2017 standard as a management system. The following sections 8.2 through 8.9 address the required elements of Option A. This manual addresses management systems and demonstrates compliance with this document.

8.2 Management System Documentation

8.2.1 This manual describes the policies and objectives of the ALS management system. The laboratory procedures describe the details on how objectives are accomplished.

8.2.2 Policies and objectives of the management system address how competence is demonstrated and assessed, how testing is objectively reviewed and how consistent operations are accomplished. These are addressed in various procedures that define the processes used.

8.2.3 Evidence of commitment is the review of the manual annually and the records of reading by all employees. Additionally, employees are assigned pertinent procedures as needed to ensure objectivity and consistency.

8.2.4 The policies are supported in this management system with references to the procedures as appropriate.

8.2.5 All employees have access to the Quality Assurance Manual and the supporting procedures.

8.3 Control of Management System Documents

8.3.1 SOPs and the QAM are maintained under document control procedures described in ALS SOP 99-Document Control, “Document Control”. External documents, such as reference methods, accreditation policies and requirements, and reference manuals are maintained under document control policies through the use of hardcopy and network drives. Additionally, quality assurance program documents, project plan documents, and contractual Statement of Work documents generated by a client can be designated as controlled documents at the discretion of the ALS Project Manager, Quality Assurance Manager, or the Laboratory Director.

8.3.2 Revisions are made to uniquely identify internal documents in accordance with ALS SOP 99-Document Control, “Document Control” and ALS SOP 99-SOPs, “Laboratory Policy on Writing, Issuing, and Changing Standard Operating Procedures (SOPs)” and the following table. Assignments are made to the responsible SOP validator or their designee to review and update SOPs applicable to the area of responsibility. At times it is also necessary to obtain approval by specific clients before written SOPs can be modified. After revision, the appropriate Manager(s), must approve the updated SOP. Updated SOPs in PDF form are then electronically distributed on-line and to holders of controlled

Uncontrolled Copy

copies. All obsolete copies are removed from access and stored for historical purposes.

SOP Type	Review Cycle
DoD Environmental Testing SOPs	12 Months
Management Systems SOPs	12 Months
All other SOPs	24 Months

8.4 Control of Records

8.4.1 ALS maintains records electronically and in hard copy form in accordance with ALS SOP ALS 99-Document Control, "Document Control". ALS analytical departmental personnel are responsible for retention, retrieval, and disposition of final records of laboratory data and activities. This includes: data packages, laboratory notebooks, instrument maintenance logs, and training records.

Data Packages

All documentation which pertains to the analysis of a sample or batch of samples that are being reported together can be compiled as a data package.

Electronic records or scans of records that relate to the analysis of field samples are compiled into folders on network drives for storage. These data packages are stored electronically as per ALS SOP 99-Backup, "Data Back-up". Unless specified by contract, applicable statute, or program, data packages are retained for ten years.

Laboratory Notebooks and Logbooks

Laboratory notebooks and logbooks are retained by ALS for ten years and are not released to clients. Laboratory notebooks are assigned to specific analytical departments, who are responsible for their maintenance. If corrections are required, a single-line cross-out, initials and date are entered.

Quality Assurance Records

Quality control sample results data are retained in LIMS. Records of internal audits, nonconformance reports, and corrective action reports are retained and stored electronically for at least 10 years on networked drives.

The Quality Assurance Manager is responsible for maintaining and retrieving all records of audits, proficiency testing results, demonstration of competency, nonconformance and corrective action records and reports.

Client-Related Information

Project Managers are responsible for maintaining, archiving, and retrieving all contracts, project requirements and QAPPs provided to ALS by clients and related to projects completed by ALS in client project folders on the ALS fileserver. They are also responsible for the archiving of materials provided on unsuccessful proposals and bidding opportunities. Specific procedures for client communication and required documentation are listed in the ALS SOP LAB-023 "Client Communication". Communication."

Uncontrolled Copy

8.5 Actions to Address Risks and Opportunities

ALS views risk management as a key component of its corporate governance responsibilities and an essential process in achieving and mandating a viable organization. ALS is committed to enterprise wide risk management to ensure its corporate governance responsibilities are met and its strategic goals are realized.

Refer to ALS Limited Risk Management Policy CAR-GL-GRP-POL-007 and Risk Appetite and Tolerance Statement CAR-GL-POL-011 for details.

Risk is defined at ALS as the effect of uncertainty on objectives. Objectives for the organization have different attributes and aspects, such as financial, service, quality, health & safety, environmental stewardship, and are considered at different levels, such as enterprise-wide, operational, and project levels. ALS interprets risk as anything that could impact meeting its corporate strategic objectives, and believes risks can provide positive opportunities as well as having negative impacts.

Tools for evaluating and managing risk include routine procedures such as employee evaluations, control limits trending, sensitivity data evaluation, corrective action reports, nonconforming events, SOP review, internal and external audits, and PT results.

Risk reporting mechanisms vary from routine reporting mechanisms and immediate action for lower risk situations to immediate notification of the ALS CEO in extreme cases.

Refer to: ALS Code of Conduct, ALS Whistleblower Policy, ALS Integrity Hotline, and Integrity and Compliance Helpline.

Regardless of the mechanism used, the policies and tools provide a framework for categorizing, assessing, analyzing, and addressing risk, as well as monitoring and reviewing actions taken. Roles and responsibilities are defined in the relevant procedures.

Risk severity is evaluated during the decision making process. For each risk there is an opportunity.

Risks to our business and how ALS addresses them include:

Impartiality by Employees

Analytical testing is completed with undue pressure to modify results to meet client objectives.
ALS does not view this as a risk. There are many firewalls in the lab process to prevent occurrence.

- Project Managers are in contact with clients but there is no ability to influence testing results
- A data generated must be peer reviewed by a second party
- Lab operations only see samples, sample names and numbers. They do not have direct contact with clients.
- Annual Ethics and Data Integrity Training for all employees
- ALS Code of Conduct, ALS Whistleblower Policy, ALS Integrity Hotline, and Integrity and Compliance Helpline.

Chemical Exposure

Failure to practice procedures as trained, issues with the facility, and poor engineering controls can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

Uncontrolled Copy

ALS has policies, chemical exposure training, and readily available SDS sheets. Employees are expected to offer suggestions for improvement and formally report any conditions where concern for safety is recognized.

Explosion/Chemical Fire

Improper chemical storage and usage along with lack of equipment and facility upkeep can result in loss of life, loss of property, and laboratory down time.

ALS performs inspections and training, keep an inventory of chemicals, establish storage locations, and maintain minimal quantities of chemicals.

Supply Disruption

Natural disaster and vendors unable to provide needed supplies can disrupt the business, increase expenses, and result in lost production and lost clients.

ALS maintains multiple sources for supplies, develop relationships with our vendors, and emphasize communication between analysts, managers, purchasing and vendors.

Loss of Key Employees

Resignation, leave for personal reasons or for other employment can negatively impact the business.

Communication, cross-training, designated backups, and having a pool of potential replacements minimizes this risk. ALS provides a positive atmosphere for employees and provide small perks to reward dedication.

Computer and Instrument Issues

Computer, instrument, or other IT failures can result in loss of revenue, loss of service, and loss of data.

ALS provides necessary IT resources for instruments and computers including replacing older computers, keeping related systems in good repair, and replacing when necessary. ALS continue to build robust data systems and make provisions for stellar back-up storage for all data.

Reputation

Falsifying test results can result in loss of credibility, loss of clients, loss of revenue, and suspension.

All new employees must sign an ethics agreement and have initial ethics and data integrity training. Annually, all employees must take ethics and data integrity refresher training. All data undergoes a proper peer review. ALS maintain a strong quality system.

Legal Ramifications

Not following workplace and environmental laws and failure to practice procedures as trained can result in license revocation, fines, and disruption of the business.

Targeted and ongoing training, inspections, and having established procedures minimizes this risk. ALS continue to follow all laws and regulations.

Loss Time Injury

Failure to practice procedures as trained and not having proper safeguards in place can result in injury to employees, lost time, med/hospital situation, contamination, and can close the site.

Uncontrolled Copy

Policies, specific task related training, targeted and ongoing training, inspections, workplace safeguards, cross training, and designated backups, minimize this risk. ALS continues to grow the safety program and culture.

Loss of Revenue

Can be caused by various audit fines and contract penalties for late data resulting in loss of revenue and disruption in business.

Policies, specific quality training, targeted and ongoing training, inspections, workplace safeguards, and internal audits minimize this risk. ALS continues to perform lab operations at the highest level.

There is a new risk register in Laboratory Corrective Action SharePoint Site. Assigned risk is determined during the effectiveness review step (Follow-up).

8.6 Improvement

8.6.1 ALS management is committed to continually improving the effectiveness of the management and quality systems by implementing the requirements of this quality manual. ALS is also committed to improvements of the management systems through compliance with its own policies and procedures. ALS management is also committed to compliance with requirements related to current EPA CLP SOWs, DoD/DOE QSM, and other client and project related requirements. Internally ALS maintains a process improvement website for employees to provide suggestions for improvements.

8.6.1.1 ALS encourages all employees to contribute their ideas on issues relating to facility and system improvements, increased efficiency, waste elimination, ensuring a safe working environment and improving customer satisfaction while maintaining a high level of quality. For this purpose we have two Suggestion Boxes available on both upper and lower floors along with suggestion forms (See Figure 4). The Human Resources Manager retrieves these suggestions for review and then they are evaluated by Upper Management for implementation, when merited.

8.6.2 ALS surveys clients and gains feedback on services provided. This input to management is managed at a corporate level and is reviewed monthly and during the management review processes.

8.7 Corrective Actions

8.7.1 ALS Laboratory operations are governed by documented procedures, requirements, quality assurance plans, project plans, and contracts. When any operation, for any reason, does not conform to the requirements of the governing documents, the aberrant event, item, or situation must be properly documented and evaluated. In addition, appropriate corrective action must be initiated. Procedures for the documentation and resolution of corrective action are detailed in the ALS SOP 99-NCAR Procedure, “Nonconformance /Corrective Action Procedures”. It is the policy of ALS that any corrective action which impacts results of testing must include notification to clients.

8.8 Internal Audits

8.8.1 Internal audits are conducted in accordance with ALS SOP 99-Internal Audits “Internal Audits”. When internal and external audits or data assessments reveal a cause for concern with the quality of the data an investigation is initiated by quality assurance personnel to determine the extent of the problem. Internal

Uncontrolled Copy

audits include examination of laboratory practice, the use of data handling systems, documentation and document control, personnel qualification and training records, procurement activities, and other systems that support and augment the laboratory analytical function. All critical audit findings and any event that casts doubt on the validity of the testing results requires corrective action and client notification within two weeks.

8.9 Management Review

8.9.1 Review of the Management System is completed on an ongoing basis in accordance with ALS SOP 99-Mgmt Rev, "Management Review".

8.9.2 Inputs to management reviews may be kept in agenda notes and include but are not limited to:

a) Changes in internal and external issues that are relevant to the laboratory;

b) Fulfilment of objectives;

c) Suitability of policies and procedures;

d) Status of actions from previous management reviews;

e) Outcome of recent internal audits;

f) Corrective actions;

g) Assessments by external bodies;

h) Changes in the volume and type of the work or in the range of laboratory activities;

i) Customer and personnel feedback;

j) Complaints;

k) Effectiveness of any implemented improvements;

l) Adequacy of resources;

m) Results of risk and opportunity identification;

n) Outcome of the assurance of the validity of results; and

o) Other relevant factors, such as monitoring activities and training.

8.9.3 The outputs from the management review shall record all decisions and actions related to at least:

a) The effectiveness of the management system and its processes;

b) Improvement of the laboratory activities related to the fulfilment of the requirements of this document;

c) Provision of required resources;

d) Any need for change.

A summary of these outputs is generated annually.

9. Appendices

Appendices are available upon request. The documents listed in this section are dynamic; accordingly they can change without notice or revision to this QAM. Please contact the laboratory for the most current documents.

Uncontrolled Copy

APPENDIX A – Data Quality Objectives and Definitions

APPENDIX B – Key Personnel and Organization Charts

APPENDIX C – Ethics and Data Integrity Policy

APPENDIX D – Laboratory Floor Plan

APPENDIX E – Analytical & Support Equipment

APPENDIX F – Standard Operating Procedures

APPENDIX G – Master List of Controlled Documents

APPENDIX H – Laboratory Accreditations

APPENDIX I – Data Qualifiers

APPENDIX J – Report Deliverables Summary

10. SOP Change Form

10.1 Summary of Changes and Document History

Section #	Section	Reason for Change
All Sections	All Sections	New corporate format implemented to address New ISO/IEC 17025:2017 and QSM Revision 5.3.
Revision 31		
8.5	Risk and Impartiality	Revised verbiage for the entire section
	Appendix B	Updated
	Appendix E	Updated
	Appendix F	Updated
	Appendix H	Updated
Revision 32		
	Document	Revised information on the header of the document. Half of the document was displaying the effective date from last revision.

Uncontrolled Copy

Appendix A – Data Quality Objectives and Definitions

Data Quality Objectives

The data quality objectives discussed below ensure that data will be gathered and presented in accordance with procedures appropriate for its intended uses, and that the data will be of known and documented quality able to withstand scientific and legal scrutiny. The quality of the measurement data can be defined in terms of completeness, accuracy, precision and traceability.

Completeness- Completeness is defined as the percentage of measurements that are judged to be valid measurements. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, missed method prescribed holding times, lost sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or rejection of sample results due to failure to conform to QC criteria specifications.

Accuracy- Accuracy is the measure of agreement between an analytical result and its "true" or accepted value. Deviations from a standard value represent a change in the measurement system. Potential sources of deviations include (but are not limited to) the sampling process, sample preservation, sample handling, matrix effects, sample analysis and data reduction. Sampling accuracy is typically assessed by collecting and analyzing field and trip blanks for the parameters of interest. Analytical laboratory accuracy is determined by comparing results from the analysis of laboratory control samples or check standards to their known values. Accuracy results are generally expressed as percent recovery.

Precision- Precision is the determination of the reproducibility of measurements under a given set of conditions, or a quantitative measure of the variability of a group of measurements compared to their average value. Precision is typically measured by analyzing field duplicates and laboratory duplicates (sample duplicate, matrix spike duplicate, check standard duplicate and/or laboratory duplicate). Precision is most frequently expressed as standard deviation, percent relative standard deviation or relative percent difference.

Traceability- Traceability is the extent to which reported analytical results can be substantiated by supporting documentation. Traceability documentation exists in two essential forms: those which link the quantitation process to authoritative standards and those which explicitly describe the history of each sample from collection to analysis and disposal.

Laboratory Quality Control Definitions

Technical personnel are responsible for complying with all quality assurance/quality control requirements that pertain to their technical functions. ALS uses the following internal quality controls to verify that the data produced by the laboratory has the required degree of accuracy and precision and is free from contamination due to laboratory processes. All samples are normally processed in preparation and analytical batches of no more than 20 samples per batch. The following quality control checks defined below are appropriate for the various methods performed in the laboratory. Individual SOPs will further define the specific checks to be analyzed with each method. Additionally, a Customer's individual Quality Assurance Project Manual may require the laboratory to include additional checks for analysis depending on the *site* requirements.

Method Blank- A method blank is an analytical control consisting of all reagents, internal standards, and surrogate standards that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination contributed from the preparation or processing of the sample.

Uncontrolled Copy

Reagent Blank- A reagent blank is an analyte-free sample that contains all the reagents used in a particular method. It is prepared and analyzed to determine if contamination is present at detectable levels that can be attributed to the reagents used in the process.

Field Blank- A field blank consists of reagent water that is transported to the sampling site, transferred from one vessel to another at the site, and preserved with the appropriate reagents. This serves as a check on reagent and environmental contamination.

Trip Blank- A trip blank consists of reagent water that is transported to the sampling site and returned to the laboratory without being opened. This serves as a check on sample contamination originating from sample transport, shipping, and from the site conditions. The holding time for the trip blank begins when received by the laboratory, unless otherwise specified by the client, such as the time when field samples were collected.

Refrigerator / Storage Blank- Refrigerator/storage blanks are placed in VOA refrigerators on a weekly basis and analyzed by GC/MS for the full Volatile Organic Analytes/Target Compound List (VOA-TCL). These blanks are used to monitor the volatile storage refrigerators for the presence of sample cross-contamination. In order to maintain continuous measurement within each refrigerator these blanks are prepared and logged into the Laboratory Information Management System (LIMS) by the Sample Custodian for specific turnaround times. This ensures that at least one blank is present in each volatile refrigerator at all times. If contamination is found the analyst is required to take corrective action to prevent the problem from affecting other stored samples. All samples associated with a positive blank will then be qualified on the analytical report. The QC Department reviews these results and maintains these files for review by regulatory agencies for a period of 10 years.

Quality Control Reference Sample or Calibration Verification Standard (Second Source Standard)- A QC reference sample is a sample prepared from a source other than that used for calibration at a concentration within the calibration range. It is used to verify that the calibration standards were prepared accurately. It is analyzed after every initial calibration performed in the laboratory.

Laboratory Control Sample (LCS/LFB)- A Laboratory Control Sample (aka Laboratory Fortified Blank) is a laboratory blank fortified at a known concentration. Aqueous and solid LCSs are analyzed using the same sample preparation, reagents, and analytical methods employed for the samples. An LCS is analyzed with each preparative or analytical batch as required by the method. It provides a measure of the accuracy of the analytical system in the absence of matrix effects.

Surrogate Standards- Surrogates are organic compounds which are similar to analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, calibration and check standards, samples (including duplicates and QC reference samples), and spiked samples prior to an organic analysis. Percent recoveries are calculated for each surrogate to detect problems in the sample preparation process and monitor the efficiency of the process.

Duplicate- A duplicate is a second aliquot of a sample that is prepared and analyzed in the same manner as the original sample in order to determine the precision of the method. Samples selected for duplicate analysis are rotated among Customer samples so that various matrix problems may be noted and/or addressed. Poor precision in a sample duplicate may indicate a problem with the sample composition and shall be reported to the Customer whose sample was used for the duplicate analysis.

Matrix Spike/Matrix Spike Duplicate- A matrix spike/matrix spike duplicate is the addition of a known amount of a target analyte to a sample that is subjected to the entire analytical procedure.

Uncontrolled Copy

Samples selected for matrix spiking are rotated among Customer samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the Customer whose sample was used for the spike.

Method Detection Limit (MDL)- The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Reportable Detection Limit (RDL)- The reportable detection limit on the laboratory report is a concentration at which the laboratory routinely reports results. The RDL may also be the method detection limit and is based on whether the Customer requires the result reported down to the MDL. It is laboratory policy to indicate on the laboratory report when the method detection limit is used as the RDL.

Common Laboratory Contaminants- Some common laboratory contaminants include: methylene chloride, acetone, 2-Butanone, hexane, phthalates, aluminum, and zinc. These analytes are sometimes seen in laboratory blanks due to their use in the processing of samples. When blank contamination occurs it is required that samples associated with these blanks be reprocessed. However, if reprocessing cannot occur due to lack of sample, holding time issues, or Customer turnaround time a comment will be placed on the analytical report defining the problem.

Internal Standard (IS)- A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method (NELAP).

Minimum Reporting Level (MRL)- Minimum Reporting Levels represent an estimate of the lowest concentration of a compound that can be quantitatively measured by a group of experienced drinking water laboratories.

Detection Limit (DL) for DoD- The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

Limit of Detection (LOD) for DoD- The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limit of Quantitation (LOQ) for DoD- The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

Holding Times - Samples are prepared and analyzed within method prescribed holding times per SOP 19-Sample Preservation Protocol and the appropriate method SOP. Holding time is the time from sampling until the start of analysis unless otherwise specified by a project QAPP. The date and time of sampling documented on the chain of custody establishes the time zero. If the holding time is specified to be measured in hours, then each hour is measured from the minute the sample was collected in 60-minute intervals. When the maximum allowable holding time is expressed in days, the holding time is based on calendar day measured from time zero, the date the sample was collected. The first day of holding time is not passed until midnight of the day after the sample was collected. Holding times for analysis include any necessary re-analysis due to instrument failure or analyst error that does not yield useful data. If sample re-analysis is necessary due to sample matrix, such as a dilution or matrix spike failure due to matrix interference, the holding time still applies. A comment is added to the final report stating that

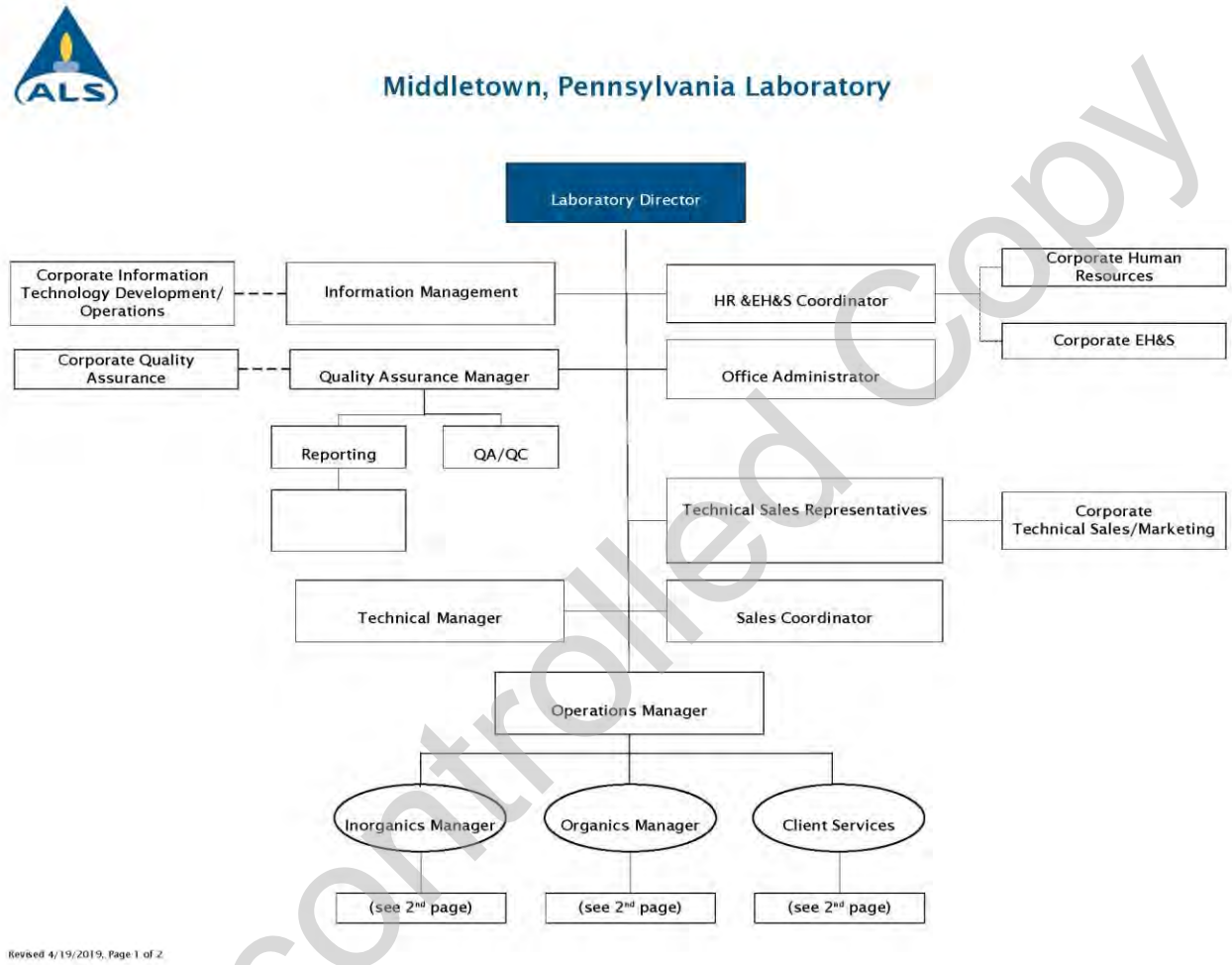
Uncontrolled Copy

further analysis was required past hold time. The sampling time must be documented on the chain of custody form by the Customer.

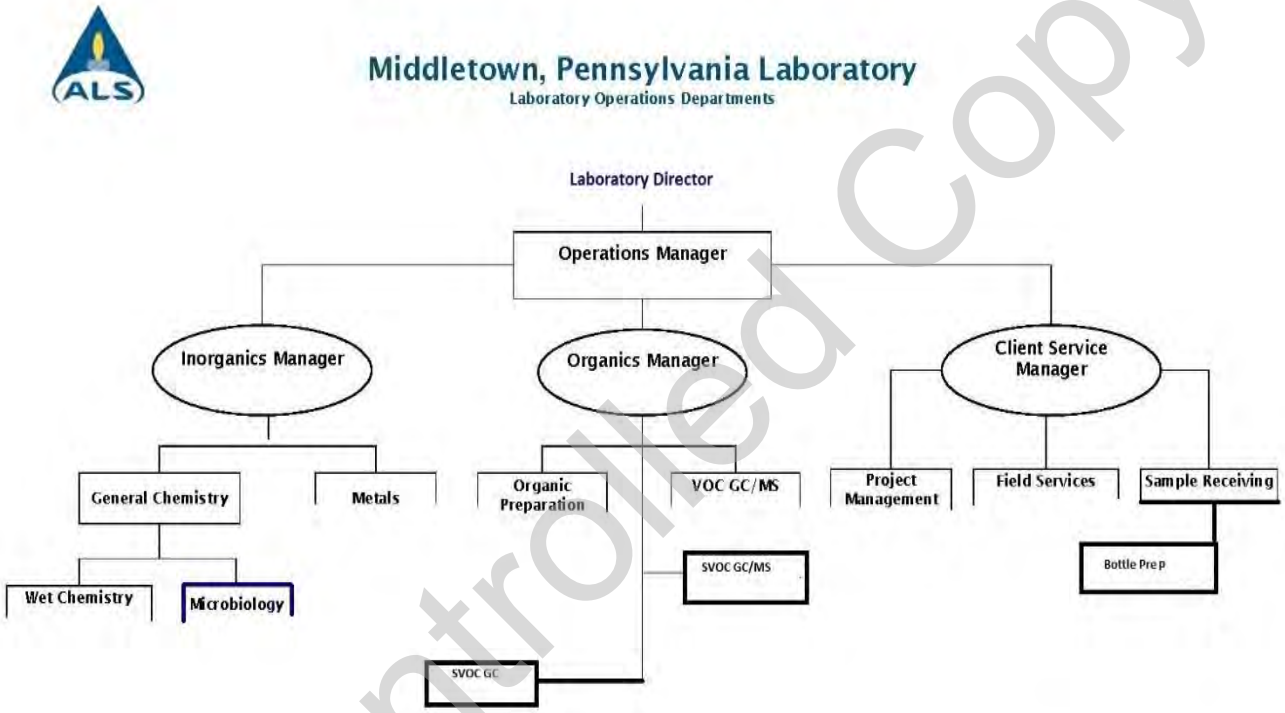
Turn Around Time - Turnaround time is the time from receipt of samples to the transmittal of analytical data by mail, electronically or facsimile. The day the chain-of-custody is signed by the sample custodian is day zero in the turnaround time. Samples results will be due by the close of business on the last day of the turnaround time unless alternate arrangements have been made with the laboratory. The turnaround time is based on working business days, excluding weekends and holidays.

Uncontrolled Copy

Appendix B – Key Personnel and Organizational Charts



Uncontrolled Copy



Revised 7/6/2020 Page 2 of 2

Uncontrolled Copy

Appendix C – Ethics and Data Integrity Policy

I state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at ALS.

I agree that in the performance of my duties at ALS:

1. I shall not intentionally report data values that are not the actual values obtained;

2. I shall not intentionally report the dates, times and method citations of data analyses that are not the actual dates, times and method citations of analyses;

3. I shall not intentionally represent another individual's work as my own;

4. I shall not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operating Procedures, or as defined by company policy.

5. I agree to inform ALS of any accidental or intentional reporting of non-authentic data by other employees.

6. I have read this ethics and data integrity agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination.

7. I agree to adhere to the following protocols and principals of ethical conduct in my work at ALS. All work assigned to me will be performed using ALS approved methods and procedures and in compliance with the quality assurance protocols defined in the ALS Quality System.

8. I will not intentionally falsify nor improperly manipulate any sample or QC data in any manner. Furthermore, I will not modify data values unless the modification can be technically justified through a measurable analytical process or method acceptable to ALS. All such modifications and their justification will be clearly and thoroughly documented in the raw data and appropriate laboratory record, and will include my initials or signature and the date.

9. I will not make false statements to, or seek to otherwise deceive ALS staff, managers or clients. I will not knowingly, through acts of commission, omission, erasure or destruction, improperly report any test results or conclusions, be they for client samples, QC samples, or standards.

10. I will not condone any accidental or intentional reporting of unauthentic data by other ALS staff and will immediately report such occurrences to my Supervisor, Lab Director, Quality Assurance Manager, or Human Resources. I understand that failure to report such occurrences may subject me to immediate discipline, including termination.

11. If a supervisor, manager, director or other member of the ALS leadership group requests me to engage in or perform an activity that I feel is compromising data validity or defensibility, I have the right to not comply with the request. I also have the right to appeal this action through an ALS local Quality Staff, Corporate Quality Assurance or Human Resources.

12. I understand that if my job includes supervisory responsibilities, I will not instruct, request or direct any subordinate to perform any unethical or non-defensible laboratory practice. Nor will I discourage, intimidate or inhibit a staff member who may choose to appropriately appeal my

Uncontrolled Copy

supervisory instruction, request or directive that may be perceived to be improper, nor retaliate against those who do so.

13. I understand that employees who report violations of this policy will be kept free from intimidation and recrimination arising from such reporting.

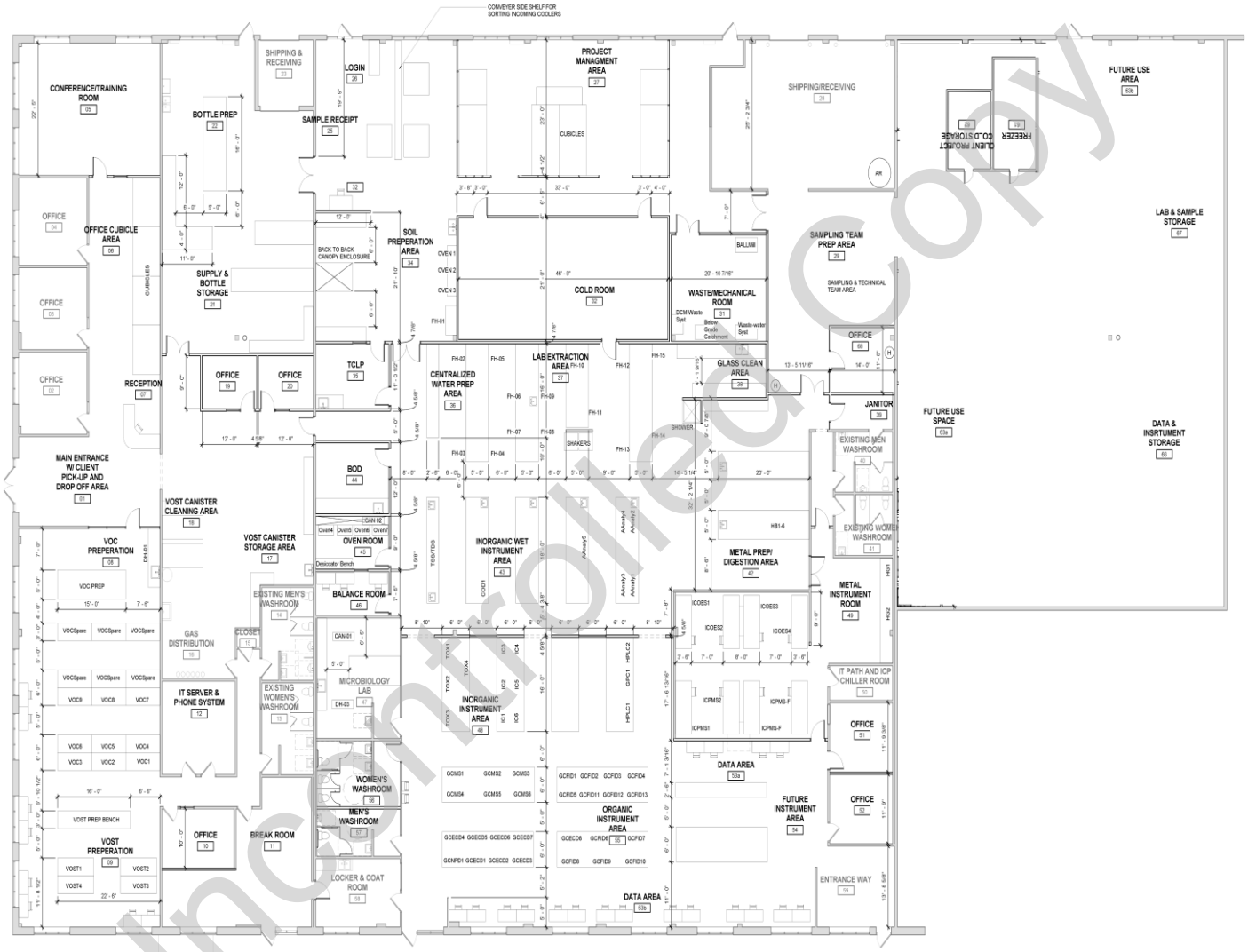
I have read, and understand the above policy and realize that failure to adhere to it may result in disciplinary action, up to and including termination. Compliance with this policy will be strictly enforced with all personnel employed by the company.

Employee Name _____ Signature _____

ALS Location_____ Date _____

Uncontrolled Copy

Appendix D – Laboratory Floor Plan



Uncontrolled Copy

Appendix E – Analytical and Support Equipment

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
			Organic Prep			
BAL-02	Analytical Balance	Ohaus	PA224C	B443176129	Oil & Grease	2015: new
BAL-03	Analytical Balance	Mettler Toledo	PB5001-S/FACT	1129070472	Organic extraction prep	prior to 2010
BAL-09	Analytical Balance	Uline	H-1650	910363027	8330 prep	pre 2010
BAL-29	Balance	Mettler Toledo	XS205 Dual Range	B750155064	Oil & Grease	3/20/2018
NA	AccuPrep GPC Cleanup System	J2 Scientific	Series I Pump	A12598	organics GPC cleanup	2005: new
NA		J2 Scientific	Auto-Injector	04L-1137-3.2	organics GPC cleanup	2005: new
NA		J2 Scientific	Auto-Sampler	4451 A2960	organics GPC cleanup	2005: new
NA		J2 Scientific	UV Detector	DT0002X	organics GPC cleanup	2010: new
GW Oven 1	Oven	Linberg		9902378	Organic Prep Glassware Drying	2014: uesed
GW Oven 2	Oven	Quincy			Organic Prep Glassware Drying	
WC Oven 10	Oven	Sheldon Manufacturing	SG02E	11017316	OG	1/3/2017
Flor Oven 1	Oven	Shelolab	SG02E	5008916	Organic prep Florisil Drying	5/16/2017:New
Flor Oven 2	Oven	Thermo Scientific	F6018	1126222101-181-108	Sodium Sulfate Drying	11/21/18: New
DES-05	Dessicator	Labconco	55300-00	030706649V	Oil & Grease	Prior to 11/2019
DRY-01	Dry Keeper	SANPLATEC Corp.	SANPLA	NA	Oil & Grease	Prior to 11/2019
NEVAP-1	N-EVAP	Organomations Assoc	112	54640	organic extraction	prior to 2013
NEVAP-2	N-EVAP	Organomations Assoc	112	52731	organic extraction	6/2008: new
NEVAP-3	N-EVAP	Organomations Assoc	8125	59802	Organic Extraction	Prior to 2018
NEVAP-4	N-EVAP	Organomations Assoc	112	N-24-31163	Various Organic Extractions	5/2/18 : NEW
NEVAP-5	N-EVAP (Water Bath Portion Only)	Organomations Assoc	9125	62959	Various Organic Extractions	7/15/19: New
NEVAP-6	N-EVAP (Waterbath Portion Only)	Organomation	9125	63038	various organic prep	9/23/19: New
WB-9	Water Bath	Bockel	1494	183617358	Organic Extraction Concentration	11/14/18: New
WB-10	Water Bath	Bockel	1494	1836177351	Organic Extraction Concentration	11/14/18: New
WB-11	N-Evap Water Bath	Organomations Assoc	5085	15987	HPLC Extraction	prior to 1995
WB-13	Water Bath	Bockel	1494	193926178	Organic Extraction Concentration	10/28/19: New
MWV-3	Microwave Digestion System	CEM Corporation	MARS 230/60	MD2299	various 3546 organics extraction	2009: new
MWV-4	Microwave Digestion System	CEM Corporation	Mars 6	MJ6073	various 3546 organics extraction	2015: new
SOX-01	Soxhlet Extractor	Organomations Assoc	9125	62605	1664B/9071B	11.2018
SKR-1	Floor Shaker	Glas Col	099A-VS650-04	481700	Separatory Funnel Extractions	2012
SKR-3	Table Shaker	New Brunswick Scientific	Innova 2100	400869373	Separatory Funnel Extractions	9/2013:used
SKR-4	Environ Shaker	Lab Line	3527-6	06018415	organic extraction	2008: new
SKR-5	Glass Col Floor Shaker	Glas Col	099AVS6504T	11705049	Separatory Funnel Extractions	2017: new
SKR-6	Floor Shaker	Edmund Buhler - GMBH	VKS-75B Control	6312BF01009	Organic Prep	3/20/2018
ROTA-7	Rotator	Analytical Testing Corp.	DC-208/DC-CD2	5046WFBG0033	Organic Extractions	10/9/2019: New
ROTA-8	Rotator	Analytical Testing Corp.	DC-208/DC-250	5046XDCC0005	250mL Seperatory Funnel Extractions	New: 07/01/2020
SPE-1	SPE Manifold	CPI	6 position manifold	NA	1664	pre2015:used
NA	Dual Horn Sonicator	Sonics & Materials Corp	VC-750	49252N	organics extraction	2005: new
NA	Dual Horn Sonicator	Sonics & Materials Corp	VC-750	39145H	organics extraction	2004: new
MILL-1	Ring Puck Mill	Labtech Essa	100154	215740-012	8330 prep	Prior 2017
"	Air Compressor	Craftsman	919.167301	2102069608	8330 prep	Prior 2017
PUCK-1	Puck	Labtech Essa	1058-000170	NA	8330 prep	Prior 2017
PUCK-2	Puck	Labtech Essa	1658-000170	NA	8330 prep	Prior 2017
S-5	Sieve	VWR	57334-480	200SS8F471887	3546/3050	Prior 2017
S-6	Sieve	VWR	10811-638	5SS12H811078	3546/3050	Prior 2017
S-7	Sieve	VWR	10811-644	7SS12H714465	3546/3050	Prior 2017
S-8	Sieve	VWR	10811-646	8SS12H811097	3546/3050	Prior 2017
S-9	Sieve	VWR	10811-650	12SS12H811004	3546/3050	Prior 2017
S-10	Sieve	VWR	10811-640	14SS12H811006	3546/3050	Prior 2017
S-11	Sieve	VWR	10811-652	16SS12H811008	3546/3050	Prior 2017
S-12	Sieve	VWR	10811-654	18SS12H811019	3546/3050	Prior 2017
S-13	Sieve	VWR	47730-306	20SS12H811035	3546/3050	Prior 2017

1 MDT Equipment List.xls

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
S-14	Sieve	VWR	10811-650	25SS12H811039	3546/3050	Prior 2017
S-15	Sieve	VWR	47730-310	30SS12H811059	3546/3050	Prior 2017
S-16	Sieve	VWR	10811-658	35SS12H819924	3546/3050	Prior 2017
S-17	Sieve	VWR	10811-658	35SS12H819926	3546/3050	Prior 2017
S-18	Sieve	VWR	10811-658	35SS12H811060	3546/3050	Prior 2017
S-19	Sieve	VWR	10811-658	35SS12H819925	3546/3050	Prior 2017
Semi Vol Gas Chromatography						
Fridge #52	Refrigerator	IGLOO	FR1151	A1705206620000365	VOMS Sample Storage	2017:New
SKR-7	Wrist Action Shaker	Burrell Corporation	75	NA-5247	3511/8081	10/11/19: Used
GC-3	Gas Chromatograph (with FID)	Hewlett Packard	5890	2607A0721B	RSK-175	2007: used
GC-7	Gas Chromatograph (with FID)	Hewlett Packard	5890 II	3126A36696	FID 8015	1997: new
GC-13	Gas Chromatograph (NPD/NPD)	Hewlett Packard	6890	US00001429	NPD 8141	2003: used
GC-15	Gas Chromatographs (with FID)	Hewlett Packard	6890	US00020831	GC-TPH/DRO EPH	2008: used
GC-16	Gas Chromatograph (with ECD/ECD)	Hewlett Packard	6890	US00021496	504/552	2010: used
GC-17	Gas Chromatograph (with dual ECD)	Hewlett Packard	6890	US00010631	GC-Pesticides/PCBs	2008: used
GC-19	Gas Chromatograph (with dual ECD)	Hewlett Packard	G1530A	US00036128	515	2011: used
NA	Gas Chromatograph Data System	PE Nelson	Turbochrom 4.1	3231271082 VER 6.1.2.0.1:D19	GC	1995: new
GC-20	Gas Chromatograph	Hewlett Packard	6890N	US10533043	8015 FID	2012: used
GC-22	Gas Chromatograph	Agilent	6890 FID	US000040991	DRO 6C	11/2013:used
GC-23	GC with dual ECD	Agilent	7890B	CN14153048	8081/8082	04/2014: new
GC-24	GC with dual ECD	Hewlett Packard	6890-G1530A	US00052944	552/504/515	11/2014:used
GC-25	GC with dual ECD	Agilent	7890-G3440G	CN17213154	8081/8082	8/18/17: New
GC-26	Gas Chromatograph	Agilent	7890B (G3440B)	US18333047	8015 DRO	11/10/18: New
GC-27	Gas Chromatography - GC Dual ECD	Agilent	7890B	US19013002	504	New: 2/19/19
GC-28	Gas Chromatography - GC Dual ECD	Agilent	7890B (G3440B)	US19123019	515, 505	New: 5/9/19
GC-29	Gas Chromatograph-FID	Agilent	8890 (G3540A)	Dissolved Gases	US1919A03	New: 8/15/2019
	Headspace Sampler	EST	LGX-50	Dissolved Gases	LGX-118050819	New: 8/15/19
Semi Vol Gas Chromatography/Mass Spectrometry						
Fridge #29	Refrigerator	Frigidaire	FRU17B2JW25	WA42602385	VOL Samples	2014
Fridge #32	Refrigerator				GC/MS Samples	
Fridge #32 Freezer	Freezer				GC/MS Samples	
Fridge #46	Refrigerator	Magic Chef	HMBR350WE1	YOW1510HMBR350WE10113	Standards storage	2016: new
MS-04	Gas Chromatograph/Mass Selective Detector with Autosampler and Injector	Agilent	GC:7890A MS:5975C AS:7693AS INJ:7693AS	GC:CN13061057 MS:US13073A16 AS: CN13050166 INJ: CN12510076	625, 8270	3/25/13: new
MS-06	Gas Chromatograph/Mass Selective Detector with Autoinjector	Agilent	GC:7890E MS:5977A AS:7693AS INJ:7693AAAS	GC:CN14293112 MS:US1428L308 AS:CN14240055 INJ:14240149	GC/MS-BNA	8/11/14: new
MS-09	Gas Chromatograph/Mass Selective Detector	Agilent	GC:6890 MS:5973 AS:G2614A INJ:G2613A	GC:US00027847 MS:US92522731 AS:CN74446053 INJ:US80400174	GC/MS-BNA (DW)	2000: new
MS-10	Gas Chromatograph/Mass Selective Detector	Agilent	GC:7890A MS:5975C AS:7693AS INJ:7693AS	GC:CN11431068 MS:US12113A09 AS:CN12030067 INJ:CN12050221	SVMS	2013: used
MS-12	Gas Chromatograph/Mass Selective Detector with Autosampler and Injector	Agilent	GC:7890A MS:5975C AS:7683 INJ:7683B	GC:US10747008 MS:US73337770 AS:US94206245 INJ:N74444553	GC/MS-BNA (DW)	2007: new
MS-14	Gas Chromatograph/Mass Selective Detector with Autosampler and Injector	Agilent	GC:7890A MS:5975C AS:7693AS INJ:7693AS	GC: CN10934018 MS:US91732697 AS:CN91300208 INJ:US9100249	GC/MS-BNA	2009: new
MS-16	Gas Chromatograph/Mass Selective Detector with Autosampler and Injector	Agilent	7890B/5977B		Semi-Volatiles, 525, 625, 548, 8270	5/18/17: New
High Performance Liquid Chromatography (HPLC)						
HPLC-1	Quat Pump	Dionex	LPG3400A	1730713	HPLC	2006: New
HPLC-1	Autosampler	Dionex	WPS3000SL	1710710	HPLC	2006: New

2 MDT Equipment List.xls

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
HPLC-1	ColumnCompartment	Dionex	TCL3000	3880607	HPLC	2006: New
HPLC-1	UV Detector	Dionex	VWD3400	2110718	HPLC	2006: New
HPLC-2	Degasser	Agilent	G1322A	JP3018586	HPLC	2009: Used
HPLC-2	Quat Pump	Agilent	G1311A	US53601035	HPLC	2009: Used
HPLC-2	Autosampler	Agilent	G1313A	US82404196	HPLC	2009: Used
HPLC-2	Column Compartment	Agilent	G1316A	DE82206233	HPLC	2009: Used
HPLC-2	Fluorescence Detector	Agilent	G1321B	DE14904125	HPLC	2009: Used
HPLC-2	Hand Held Controller	Agilent	G1323B	CN23605769	HPLC	2009: Used
HPLC-2	Post Column Reactor	ASI	310	310-0501	HPLC	2004: new
HPLC-2	Series II Pump 1	Lab Alliance	Series II	A12537	HPLC	2004: new
HPLC-2	Series II Pump2	Lab Alliance	Series II	A12538	HPLC	2004: new
PCR-1	Post Column Reactor	Pickering	PCX	718300	531 and 547	8/23/18: New
HPLC-3	HPLC	ThermoScientific	Ultimate 3000	NA	8330/549/531/547	New: 1/23/2019
"	Pump	ThermoScientific	DGP-3600SD	8151463	8330/549/531/547	New: 1/23/2019
"	Autosampler	ThermoScientific	WPS-3000TSL	8151324	8330/549/531/547	New: 1/23/2019
"	Solvent Rack	ThermoScientific	SRD-3600	7262709	8330/549/531/547	New: 1/23/2019
"	Photometer	ThermoScientific	VWD-3400RS	8151475	8330/549/531/547	New: 1/23/2019
"	Fluorescence Detector	ThermoScientific	FLD-3100	8151035	8330/549/531/547	New: 1/23/2019
"	Column Compartment	ThermoScientific	TCC-3000SD	6020645	8330/549/531/547	New: 1/23/2019
HEAT-01	VWR Advanced 6 Block Heater 120V	VWR	N075838-306	190425002	552.2/552.3	6/20/2019
Sonicator 1	Sonicator	Branson	2510R-MT	RLA080842886E	organic extraction	2008
S-1	Sieve	VWR	57334-552	10SS8F415193	8330B	Prior 2017
S-2	Sieve	VWR	57334-552	10SS8F415188	8330B	Prior 2017
S-3	Sieve	ADVANTECH	10SS12F	10SS12F608969	8330B	Prior 2017
S-4	Sieve	ADVANTECH	10SSF12	10SS12F614529	8330B	Prior 2017
Volatile Gas Chromatography/Mass Spectrometry						
BAL-17	Balance	Ohaus	AV212	8033071257	Volatiles	pre 2012
F-05	2 door freezer	True Food Service Equipment	GDM-46F-LD	8439855	sample storage	2015:new
F-09	freezer	Blue Air-Commercial Refrigeration	BKGF23	KGF23-T07-0063	Storage	11/6/18: New
Fridge #47	3 door refrigerator	True Refrigeration	GDM-72-LD	8521480	sample storage	2015: new
GC-08	Gas Chromatograph	Hewlett Packard	5890 Series II	3203A40203	GRO	1995:used
NA	Purge and Trap Concentrator with Autosampler and Sample Heater	Tekmar/OI	LSC2000/4552	90135019/-	GRO	2003:used
MS-01	Gas Chromatograph/Mass Selective Detector (with EI, packed or capillary columns, and autoinjector)	Hewlett Packard	7890A/5975C	CN11141117/ US11243913	GC/MS-VOA	2011:new
NA	Purge and Trap Concentrator with Autosampler and Sample Heater	EST	Enchon Evolution/Centurion	EV36105191/ CENTS232060111	GC/MS-VOA	2011:new
MS-03	Gas Chromatograph/Mass Selective Detector	Agilent	7890B/5977A	8260/624	CN13483184/US1348L218	2014:new
NA	Purge & Trap Concentrator	EST	EnchonEvolution	8260/624	EV540112213	2014:new
NA	Autosampler	EST	Centurion	8260/624	CENTS3391122313	2014:new
MS-05	Gas Chromatograph/Mass Selective Detector	Agilent	7890B/5977A	8260/624/524	CN14383089/US1436L410	2014:new
NA	Purge & Trap Concentrator	EST	EnchonEvolution	8260/624/524	EV590062414	2014:new
NA	Autosampler	EST	Centurion ws	8260/624/524	CENTS244100411	2014:new
MS-07	GC/MS	Agilent Technologies	5977A MSD	CN15253039/ US1521L408	GC/MS-VOA	2015: new
NA	Concentrator	EST Analytical	NEDNEV	EV683060815	GC/MS-VOA	2015: new
NA	P&T Autosampler	EST Analytical	Centurion W/S	CENTS414060815	GC/MS-VOA	2015: new

3 MDT Equipment List.xls

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
	GC/FID with P&T and concentrator	Agilent Technologies	7890B	CN13143030 /CENTS307062413/ EV494072213	VOA	used
MS-11	Gas Chromatograph/Mass Selective Detector	Finnigan	Trace CC/Trace DSQ	20033754/100084	GC/MS-VOA	2003: new
NA	Purge and Trap Concentrator with Autosampler and Sample Heater	Tekmar/Tekmar	Velocity XPT/ Aquatek 70	US03150011/ US06023010	GC/MS-VOA	2003: new
MS-15	Gas Chromatograph/Mass Selective Detector	Agilent Technology	7890A/5975C	CN13061011/ US13073A23	8260, 624, 524	3/18/13:new
NA	Purge and Trap Concentrator with Autosampler and Sample Heater	Tekmar	Atomx	US13010003	8260, 624, 524	3/25/13: new
MS-17	Gas Chromatograph/Mass Selective Detector with Purge and Trap Concentrator/Autosampler	Agilent Technology	GC:7890A MS: 5975C	GC:CN10833010 MS:0583130149	GC/MS-VOA	2008: new
NA	Purge & Trap Concentrator	EST	EnchonEvolution	8260/624/524	EV78101001	2012:new
NA	Autosampler	EST	Centurion ws	8260/624/524	CENTS243091911	2012:new
MS-19	Gas Chromatograph/Mass Selective Detector with Purge and Trap Concentrator/Autosampler	Agilent Technology with Tekmar and Environmental Sample Technologies (EST)	GC:5890 Series II MS: 5971 PT:LSC2000 AS:Archon	GC:2950A26771 MS:3118A02554 PT:90169022 AS:11897-396A	GC/MS-VOA	2008: used
NA	Water Purification System	Millipore	Synergy R System	F2SA71766D	Removal of organic compounds	2013: new
MS-21	Gas Chromatograph/Inert XL Mass Selective Detector	Agilent	7890A/5795C	CN 11261104/ US 11293908	GC/MS-VOA IN AIR	2012: new
NA	Autosampler	Entech	7016CA	1336	GC/MS-VOA IN AIR	2012: new
NA	Preconcentrator	Entech	7200	1005	TO15	1/5/12: new
NA	Precision Diluter	Entech	4700	0136	GC/MS-VOA IN AIR	2017: new
			Metals			
ICP-1	Inductively Coupled Plasma w/autosampler	Thermo	ICAP-6000 SERIES	ICP 20073007	ICP Metals	2007: new
ICP-2	Inductively Coupled Plasma w/autosampler	Thermo	ICAP-6000 SERIES	ICP20083713	ICP Metals	2008: new
ICP-3	Inductively Coupled Plasma w/autosampler	Agilent	ICP-OES 5100	MY15270003	ICP Metals	8/5/16: refurbished demo
ICPMS-1	Inductively Coupled Plasma-Mass Spectroscopy	Agilent	7700X	JP11040846	ICP-MS Metals	2011:new
ICPMS-2	Inductively Coupled Plasma-Mass Spectroscopy	Agilent	7700X	JP13082308	ICP-MS Metals	2013: new
ICPMS-3	Inductively Coupled Plasma-Mass Spectroscopy	Agilent	7800	SG19193750	TRMD 200.8 and SW846-6020	6/4/2019
NA	Inductively Coupled Plasma-Mass Spectroscopy-Autosampler	Teledyne/CETAC	ASX560	051937A560	TRMD 200.8 and SW846-6020	6/4/2019
CETAC-3	Mercury Analyzer	CETAC	M-7600	US18283009	EPA 245.1, 7471, 7470	2018: New
*	Autosampler	CETAC	ASX-560	081801A560	EPA 245.1, 7471, 7470	2018: New
HYDRA-2	Low Level Hg Analyzer	Teledyne CETAC	M-8000	US17282015	Low Level Mercury	11/30/2017
MWV-1	Microwave Digestion System	CEM Corporation	MARS	MD9111	Metals Digestion	2007: new
MWV-2	Microwave Digestion System	CEM Corporation	MARS 6	MJ4137	Metals Digestion 3015/6010/6020 3051/6010/6020	8/27/14:new
HBLK-01	Hotblock	Environmental Express	SC154	8140CECW3429	Metals Digestion	2012: New
HOT-3	Hotblock w/ Controller	ALS Global	Digestion Hot Block Rev. 3/Hot Contol Box	ALS 16220/ALS 16071	Metals Digestion	3/1/2017: New
HOT-5	Hotblock Digester	SCP Science	DigiPrep MS	MSX1017331770	TRMD and 3050 Digestions	12/4/17: New
SCP-3	Hotblock & Controller	SCP Science	Dig PREP	MSX0512391056	200.8 & 200.7 TRMD Digestions	10/23/12: new
WB-8	Water Bath	Thermo Fisher	Precision GP-28	300117233	Hg Water Prep	2017: New
BAL-30	Balance	VWR	VWR-363AC	577022	Metals Prep / 3051A	2018: New

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
			Microbiology			
Fridge #44	Refrigerator	Kenmore			Media Fridge	2013:new
Fridge #57	Refrigerator	True Manufacturing Co., Inc.	GDM-23-HC-TSL01	9504993	Storage	11/6/18: New
BAL-01	Balance	Mettler Toledo	PM4800	1113242887	Metals Prep	prior to 2010
AC-2	Autoclave	Market Forge	STME	060216MB086S	Micro, Hg, Phos	6/2016: new
BL-1	Black light Device	Spectro Line	EA160	1498439	Microbiology	2003: new
CC-1	Colony Counter	Darkfield Quebec	3325	Not Available	Microbiology	1986: new
FS-01	FoodSaver (Vacuum Sealer)	FoodSaver	FM2000-000	174178	Fecal Coliform	3/24/17: New
MINC-3	Incubator (AIR)	VWR	1535	0101000	Microbiology	prior to 2010
MINC-5	Incubator (AIR)	VWR	1536	11044010	Microbiology	pre2013:new
MINC-6	Incubator (AIR)	VWR	1535	4042307	Microbiology	pre2013:new
MINC-7	Incubator (AIR)	VWR	F Air 2.3 CF	41846912	Enterococcus	11/2015: new
WB-3	Incubator (Water Bath)	Precision Scientific	251	604081209	Microbiology	2005: new
WB-4	Incubator (Water Bath)	VWR	89032-218	WL0832002	Microbiology	pre2010:used
MSCOP-1	Microscope	Fisher Scientific	Micromaster	Not Available	Microbiology	1988: new
MSCOP-2	Microscope	Fisher Scientific	Micromaster CK	Not Available	Microbiology	1988: new
MSCOP-3	Stereoscopic Microscope	Fisher	Stereomaster	H0807-0704-003	Microbiology	1988: new
pH-10	pH Meter	VWR	SympHony B10P	18003S0006	Microbiology	3/15/18: NEW
P-37	pH Meter Probe	VWR	Symphony	18110V0001	Microbiology	NEW
QS-4	Quanti-Tray Sealer	IDEXX	Quanti-Tay Sealer Plus	QTP13154100096	Microbiology	10/28/17: New
QS-5	Quanti-Tray Sealer	IDEXX	Quanti-Tay Sealer Plus	QTP13171802460	Total Coliform/E. Coli SM9223B	6/13/19 : New
SHOOD-1	Sterile Hood	Baker	SG-250	50350	Microbiology	2015: used
INCIN-2	Microincinerator	VWR	VWR Incinerator	V3644	Fecal Coliform	12/20/18: New
UV-1	UV Sterilizer Box	Millipore	XX83700 00	NA	Fecal Coliform	9/26/16: new
			Wet Chemistry			
BRANLU	AA3 Autoanalyzer (Colorimeter)	Bran-Luebbe	AA3	54449525/9528237	OOH/Cyanide/P/NO3,353.2/LLNH3/TKN	2002: new
BRANLU	AA3 Autoanalyzer (Pump)	Bran Luebbe	Pump 4	9525859/54504070	OOH/Cyanide/P/NO3,353.2/LLNH3/TKN	2002: new
BRANLU	AA3 Autoanalyzer (Autosampler)	Wescto Sci. Inst.	Bran Luebbe Compact Autosampler	96227	OOH/Cyanide/P/NO3,353.2/LLNH3/TKN	2002: new
AUTOT	Autotitrator (Buret Module)	ManTech	PC1104-00	MS-0C6-695	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (Buret Module)	ManTech	PC1104-00	MS-0E6-695	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (TitraSip Module)	ManTech	PC-1300-475	MS-OE6-686	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (Interface Module)	ManTech	PC-100102/4	MS-0D6-420	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (Titra Rinse Module)	ManTech	PC-1000-408	MS-0D6-282	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (Titra Rinse Module)	ManTech	PC-1000-408	MS-OE6-712	pH/Alk/SpCond	2006:new
AUTOT	Autotitrator (Conductivity Meter)	Jenway	4510	02013	pH/Alk/SpCond	2006:new
P-1	Autotitrator Meter Probe	ManTech		PCE-96-CT-1003	pH/Alkalinity	2006:new
P-17	Autotitrator Conductivity Probe	Jenway	PCE-86-EX1001	PCE-80-PH1013 (Lot#4169)	Conductivity	2006:New
AUTOT2	Autotitrator (Autosampler)	Gilson	123XL	N207633	N/A	4/3/2019: New
AUTOT3	Autotitrator	Skalar Robotics	SP2000 Robotic Analyzer	19514	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
AUTOT3	Buret2 Acidity	Metrohm	848 Titrino Plus	30038863	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
AUTOT3	Buret1 Alkalinity	Metrohm	848 Titrino Plus	30038871	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
AUTOT3	pH Meter	HACH	TU5200	1751643	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
AUTOT3	Colorimeter	MACHEREY-NAGEL	NANOCORLOR VIS II	NVIS21421	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
AUTOT3	Electrochemical Analyser	Consort	C6010	113405	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
AUTOT3	Computer	DELL	OptiPlex 3060	8730550478/40DXZV2	pH/Conductivity/Turbidity/Color/Alkalinity/Acidity	8/15/2019: New
BAL-05	Balance	Mettler	AG245	1113372791	Various	prior 2016: New
BAL-07	Balance	Mettler	PB602	1117170658	OG/Org Prep	pre2010:new
BAL-11	Balance	Mettler	PB303-S	1119330260	Dry Weights	prior 2016: New
BAL-13	Balance	Mettler	PG2002-S	1122131298	various WC/TCLP/Org Prep	2002:new
BAL-18	Balance	Ohaus	AV212	8033121261	various	pre2012: Unknown
BAL-25	Balance	Ohaus	AV212	B416518647	various	5/2014: new
BAL-26	Balance	Ohaus	DV215CD	1124023376	various	5/2014: new
BAL-27	Balance	Mettler Toledo	XS205DU	B525069083	various	11/2015:new
BAL-28	Balance	VWR	3002	12252015014	various	10/18/2016: new
BAL-33	Balance	VWR	VWR-2002P2	627785	General Use	10/17/19: New
BAL-34	Balance	VWR	VWR-2002P3	627790	General Use	10/17/19: New
BAL-35	Balance	VWR	VWR-2002P4	627794	General Use	10/17/19: New
BOD-1	BOD System	Skalar	SP1000	Not Available	BOD	2008:new
DO-1	Dissolved Oxygen Meter	YSI	ProODO	13M100531	DO/BOD	2014: new
P-12	DO Probe	YSI	ProODO	16L100633	DO/BOD	2016: new
DO-4	Dissolved Oxygen Meter	YSI	ProODO	13J100718	DO/BOD	2014: new
P-8	DO Probe	YSI	ProODO	16E100055	DO/BOD	2014: new
BOD-2	BOD System	Skalar	SP1000	Not Available	BOD	2014: new
DO-2	Dissolved Oxygen Meter	YSI	ProODO	13H101358	DO/BOD	2014: new
P-10	DO Probe	YSI	ProODO	16K100063	DO/BOD	2014: new
DO-3	Dissolved Oxygen Meter	YSI	ProODO	13H101357	DO/BOD	2014: new
P-11	DO Probe	YSI	ProODO	16F104833	DO/BOD	2014: new
DO-6	Dissolved Oxygen Meter	YSI	ProODO	16K103011	DO/BOD	2016: new
P-29	DO Probe	YSI	ProODO	18C100703	DO/BOD	2018: New
DO-7	Dissolved Oxygen Meter	YSI	ProODO	18H108307	DO/BOD	11/2/18: New
P-30	DO Probe	YSI	ProODO	18C100702	DO/BOD	2018: New
METBO-01	Digital Meter for Wireless Sensors	YSI-MultiLabs IDS	YSI 4010-1W	20050684	BOD/CBOD	2020:New
DO-8	DO Probe	YSI MultiLabs IDS	4100 BOD IDS Probe	20A104961	DO/BOD	2/15/2020: New
CENT-1	Centrifuge	Garver	336HS	17648	Wet Chem	2006:new
COD-7	COD Instument	Skalar	SP2003	17295	COD	New: 5/17/18
COND-2	Conductivity Meter	YSI	3100	14H103844	TDS screen	2014: new
P-14	Conductivity Probe	YSI	3252	14H100517	TDS screen	2014:new
DIG-2	Digester	Buchi	K-438	NA	TKN	pre2012
DIG-3	Digester	Skalar	Controller: 25600900/Block: 25600912	Controller: 16495/Block: 16108	TKN Analysis	2016:new
DIS-4	Distillation Unit	Buchi	K-355	1000198137	TKN and Ammonia	2015: new
DIS-5	Distillation Unit	Labconco	Cat#: 6520000-Rapid Still II	181268324 Rev. F	Phenol Distillation	4/1/19: New
HBLK-04	Hotblock	Environmental Express	SC154	2017CECW4671	Cyanide, Acid Soluble Distillation	2017: New
PENSKY	Flash Point Apparatus, Closed Cup	Koehler	K16200	R61091664	Wet Chem	1991: new
FP-01	Flash Point Apparatus, Closed Cup	Koehler Inc., Co.	K16200	N/A	Flashpoint (EPA 1010A)	2019: New
SAN-01	Flow Analyzer	Skalar	San++SA5000	131393	TKN, Cyanide	2014:new
* N/A	Autosampler	Skalar	1100	13862	TKN, Cyanide	2014:new
SAN-02	Segmented Flow Analyzer	Skalar	5000-01	162193	Cyanide, Phenols	Prior to 2018
* N/A	Autosampler	Skalar	1100	161148	Cyanide, Phenols	Prior to 2018

6 MDT Equipment List.xls

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
" N/A	Power Box	Skalar	5565	16117	Cyanide, Phenols	Prior to 2018
SAN-03	Segmented Flow Analyzer	Skalar	SA 3000/5000	182719	Total PO4 and UV Digestion	New: 7/18/18
" N/A	Autosampler	Skalar	1100	181529	Total PO4 and UV Digestion	New: 7/18/18
" N/A	Switch Box	Skalar	6482	172392-05H	Total PO4 and UV Digestion	New: 7/18/18
" N/A	Power Box	Skalar	2500952-01	16935	Total PO4 and UV Digestion	New: 7/18/18
SAN-04	Segmented Flow Analyzer	Skalar	San++SA5000	192896	Ammonia/TKN	New: 2/18/19
" N/A	Autosampler	Skalar	21074600-01	19916	Ammonia/TKN	New: 2/18/19
BODIN10	Incubator (AIR)	Thermo Scientific	3733A	300072507	BOD, CBOD	2016:new
BODIN12	Incubator (AIR)	VWR	3733A	300187510	BOD, CBOD	3/19/18: New
IC-4	Ion Chromatographer	Dionex	ICS-2100	11060838	300.0/300.1/314.1	2011:new
IC-5	Ion Chromatographer	Dionex	ICS-2000	08640079	300.0/300.1/314.1	2008:new
IC-6	Ion Chromatography System	Dionex/Thermo	ICS-2100/AS-DV	12031443/12031331	Ammonia D6919-03	4/9/12: new
IC-7	Ion Chromatographer	Dionex/Thermo	ICS2100	12120157	300.0	1/3/13: new
IC-8	Ion Chromatograph with Autosampler	Thermo Scientific	IC:ICS2100 AS: AS-DV	IC:13060542 AS:13060690	Ammonia D6919-03	7/2013: new
"	Ion Chromatographer Autosampler	Dionex/Thermo	AS-DV	12120136	300.0	1/3/13: new
"	Ion Chromatographer DX-500 Conductivity Detector	Dionex	CD20	99120554	D6919-03/Cr6	2004: new
"	Ion Chromatographer DX-500 Gradient Pump	Dionex	GP50	99100132	D6919-03/Cr6	2004: new
"	Ion Chromatographer Autosampler	Dionex	AS40	08040644	D6919-03	2008:new
IC-9	High Pressure Ion Chromatography System	Thermo Scientific	Integrion	17090627	Ammonia - ASTM D6919-09	10/11/17: New
IC-10	High Pressure Ion Chromatography System	Thermo Electron	Integrion	17090626	Ammonia	3/27/18: New
MET-3	pH/ISE Meter	Thermo Scientific	ORION Dual Star	E-10371	NH3, TKN	Prior to 2018
P-13	Expandable Ion Analyzer Probe	Orion	9512hpbnwp	VV1-12192	NH3	2015:used
P-16	Ion Analyzer Temperature Probe	Orion	N/A	LT1-14683	NH3	2015:used
OIFlow	OI Flow Inject Autoanalyzer (FS3100)	OI Analytical	322689	616831029	Phenol/Cyanide/Phosphate/Nitrate by 353.2/ LL ammonia and TKN	2007: new
OIFlow	OI Flow Inject Autoanalyzer (Pump)	Ismates	ISM938C	16236-0001	Phenol/Cyanide/Phosphate/Nitrate by 353.2/ LL ammonia and TKN	2007: new
OIFlow	OI Flow Inject Autoanalyzer (Autosampler)	Cetac	ASX-130	060611A130	Phenol/Cyanide/Phosphate/Nitrate by 353.2/ LL ammonia and TKN	2007: new
OSMO-1	Osmometer	Advanced Instruments	3W2	38948	Wet Chem	1990: new
WC Oven 2	Oven	Quincy	40GC	9604361	Inorganic Prep	2007: used
WC Oven 4	Oven	Fisher Scientific	OV02F	2153100436982	Wet Chem	2010: new
WC Oven 5	Oven	Fisher Scientific	13247750F	611081-339	Wet Chem	2012:new
WC Oven 6	Oven	VWR	Symphony E191047	4113061226010	solids	2012: new
WC Oven 7	Oven	VWR	Symphony	4113061327007	Wet Chem	7/2013: new
WC Oven 8	Oven	Binder	FED 720	14-13405	various	7/2015:new
WC Oven 9	Oven	Neytech	3-1750	NA	Wet Chem	1988:new
pH-4	pH Meter	Mettler	Seven Comp	B421630203	Wet Chem	2014: new
P-2	pH Meter Probe	Mettler	Seven Comp	RV1-12461	Wet Chem	2014:new
P-15	pH Meter Temperature Probe	N/A	N/A	N/A	Wet Chem	2014:new
pH-5	pH Meter	VWR	SB80PI	D04529	BOD	pre2015
P-3	pH Meter Probe	VWR	SB80PI	TW1-10518	BOD	pre 2015
P-4	pH Meter Probe	accumet	136-620-181	7052024P	BOD	pre 2015
pH-6	pH Meter	VWR	Symphony	16187S0004	TCLP	9/21/2016
P-5	pH Meter Probe	VWR	Symphony	17226V0002	TCLP	9/21/2016
pH-7	pH Meter	VWR	Symphony	16187S0004	TCLP	9/21/2016
P-6	pH Meter Probe	VWR	Symphony	17226V0001	TCLP	9/21/2016
ROTA-1	Rotator	ATC	42R5BFCI-E3	0685KYIMI0011	Various	Prior to 2012
ROTA-2	Rotator	ATC	42R5BFCI-E3	0685PYLH0003	Various	Prior to 2012

7 MDT Equipment List.xls

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
ROTA-3	Rotator	ATC	42R5BFCI-E3	0685KYIN0007	Various	Prior to 2012
ROTA-4	Rotator	ATC	42R5BFCI-E3	0685PYLH0004	Various	Prior to 2012
ROTA-5	Rotator	ATC	42R5BFCI-E3	0685RU2716	Various	Prior to 2012
ROTA-6	Rotator	ATC	42R5BFCI-E3	0685EWGN0007	Various	Prior to 2012
SPEC-3	Spectrophotometer	HACH	DR5000	1401324	Various	Prior to 2013
TOC-3	TOC Analyzer	Elementar	Vario TOC Cube	38123029	TOC	2012: new
TOC-4	TOC Analyzer	Elementar	Vario TOC Cube	38133026	TOC	2013: new
TOX-1	Total Organic Halogen Analyzer	Mitsubishi	TOX-100	A7M 42636	TOX	2010:new
*	Total Organic Halogen Automatic Boat Controller	Mitsubishi	ABC-100	A7B 33056	TOX	2010:new
*	Total Organic Halogen Sample Preparater	Mitsubishi	TXA-03	A7A 30849	TOX	2010:new
TOX-2	Total Organic Halogen Analyzer	Mitsubishi	TOX-100	A7M43790	TOX	2011: new
*	Total Organic Halogen Automatic Boat Controller	Mitsubishi	ABC-100	A7A31081	TOX	2011: new
*	Total Organic Halogen Sample Preparater	Mitsubishi	TXA-03	A7B36790	TOX	2011: new
NA	Tunable Abs Detector	Waters	M486	486 PRD 499	Cr6	1998: used
TURB-3	Turbidimeter	HACH	2100N	16040C034271	Turbidity	7/2016:new
TURB-4	Turbidimeter	HACH	2100P	400024890	Turbidity	Prior to 11/2019
DES-01	Desicator	Labconco	55300-00	121066425	TDS/TSS	Prior to 11/2019
DES-02	Desicator	Labconco	55300-00	190256	TDS/TSS	Prior to 11/2019
DES-03	Desicator	Labconco	55300-00	101826	TDS/TSS	Prior to 11/2019
DES-04	Desicator	Labconco	55300-00	232461	TDS/TSS	Prior to 11/2019
DES-06	Desicator	Labconco	55300-00	242086	TDS/TSS/OTHERS	Prior to 11/2019
DES-07	Desicator	Labconco	55300-00	242369	TDS/TSS/OTHERS	Prior to 11/2019
DES-08	Bell Jar Desicator	NA	NA	NA	TDS/TSS/OTHERS	Prior to 11/2019
DRY-02	Dry Keeper	NA	NA	NA	TSS	Prior to 11/2019
PG-3	Pressure Gauge on ZHE	Ashcroft	0217	T0916	TCLP Prep	Prior to 12/17
PG-4	Pressure Gauge on ZHE	Ashcroft	0217	T0916	TCLP Prep	Prior to 12/17
PG-5	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-6	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-7	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-8	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-9	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-10	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-11	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-12	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
PG-13	Pressure Gauge on ZHE	Ashcroft	0217	T0196	TCLP Prep	Prior to 12/17
UC-1	Ultrasonic Cleaner	Branson	5210	5210R-DTH	Wet Chem	1994: new
UC-2	Ultrasonic Cleaner	Branson	2800	BGE011425300	Wet Chem	2014: new
NA	Universal Chrom. Int.	Dionex	UCI-50	8011100	Cr6	2008: new
			GENERAL FACILITY			
AV-2	Anemometer	VWR	33500-090	150636066	Ignitability	11/2015: new
WalkIn D	Cold Sample Storage Unit	Polar King	H820	A3073704	General unpreserved sample storage, PTs	2011
Walk-in E	Cold Sample Storage Unit	US Cooler	FCL3476GLI	40363	General unpreserved sample storage, PTs	2018: New
F-06	Freezer Storage Unit	US Cooler	FFL3476GLI	34356	General unpreserved sample storage, PTs	2015: new
F-10	Freezer	Blue Air-Commercial Refrigeration	BKGF23	KGF23-T07-0062	Storage	11/6/18: New

Uncontrolled Copy

ALS-Middletown Equipment List

Instr ID #	Instrument	Manufacturer	Model	Serial No.	Analysis	Acquisition Date: Condition
F-11	Freezer	Blue Air-Commercial Refrigeration	BKGF23	KGF23-T07-0058	Storage	11/6/18: New
F-12	Freezer	Blue Air-Commercial Refrigeration	BKGF23	KGF23-T07-0069	Storage	11/8/18: New
Fridge #51	Refrigerator	Frigidaire	FFPA33L2SM	8A73001543	Micro Sample Storage	2017:New
Fridge #53	Refrigerator	Magic Chef	HMBR265WE1.BE1.SE1	1709000614	sample storage	3/30/18: New
Fridge #54	Refrigerator	Blue Air	BKGM23	KGM23W-T01-0011	Prep Lab B - Sample Storage	New: 6/12/18
Fridge #55	Refrigerator	True Manufacturing Co., Inc.	GDM-23-HC-TSL01	9441954	Storage	11/6/18: New
Fridge #56	Refrigerator	True Manufacturing Co., Inc.	GDM-23-HC-TSL01	9516462	Storage	11/6/18: New
Fridge #58	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9505751	Storage	11/9/18: New
Fridge #59	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9509493	Storage	11/9/18: New
Fridge #60	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9531959	Storage	11/9/18: New
Fridge #61	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9509518	Storage	11/9/18: New
Fridge #62	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9509496	Storage	11/9/18: New
Fridge #63	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9505755	Storage	11/9/18: New
Fridge #64	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9509499	Storage	11/9/18: New
Fridge #65	Refrigerator	True Manufacturing Co., Inc.	GDM-49-HC-TSL01	9509498	Storage	11/9/18: New
NORM #1	Galleghar Counter	Johnson	DSM-500N	D500N2007	Radioactivity Measurement in Sample Receiving Area	New: 03/26/2019
*P-52	NORM Meter Probe	Johnson	GSP-1	31552		New: 03/26/2019
NORM #2	Galleghar Counter	Johnson	DSM-500N	D500N2006	Radioactivity Measurement in Sample Receiving Area	New: 03/26/2019
*P-53	NORM Meter Probe	Johnson	GSP-1	31551		New: 03/26/2019

Uncontrolled Copy

APPENDIX F – Standard Operating Procedures

SOP Master List-Modified.xls

SOP ID	Document Title	References
01 SVOC		
01-515.3	Determination of Chlorinated Acids in Water by Gas Chromatography with an Electron Capture Detector	EPA 515.3 r1.0 1996
01-8015 Alc-Nonhal	Alcohol and Nonhalogenated Organics by GC/FID using a Direct Aqueous Injection	8015D rev 4 2003 8000D rev 3 2018
01-8015 Glycol	Glycol Analysis by GC/FID Using a Direct Aqueous Injection	SW 8015D r4 2003/SW 8000C 2003
01-D8028-17	ASTM D8028-17, Dissolved Gases by Static Headspace Sampling and Flame Ionization Detection (GC/FID)	ASTM D8028-17, July 31, 2018
01-Chemstation Protocol	Chemstation Protocol	In-house
01-RSK175	Analysis of Dissolved Gases in Ground Water by a Standard Gas Chromatography Technique	EPA RSKSOP-175 rev 2 2004
1A-504	1,2-Dibromoethane (EDB), 1,2,3-Trichloropropane and 1,2-Dribromo-3-Chloropropane (DBCP) in Water by Microextraction and gas Chromatography	EPA504.1 r1.1 1995 SW8011 r0 1992
1A-505	Analysis of Organohalide Pesticides & PCBs in Water by Microextraction and Gas Chromatography	EPA 505 Rev 2.1 1995 508 Rev 3.1 1995
1A-552.2	Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Extraction, Derivatization and Gas Chromatography with Electron Capture Detection	EPA 552.2 Rev1.0 1995

7/6/2020 SOP Master List 1

SOP Master List-Modified.xls

SOP ID	Document Title	References
1A-608.3	Organochlorine Pesticides and PCBs by GC: Capillary Column Technique, EPA Method 608.3	EPA 608.3 40CFR 136.1 2016
1A-622	The Determination of Organophosphorous Pesticides in Municipal and Industrial Waste	EPA 622 August 1993 8000C Rev 3 2003
1A-8015 DRO	Method for Determination of Diesel Range Organics By EPA Method 8015D (ALS Modified)	SW 8015D r4 2003/API 4711 r5 1992/Wis DNR 1995/8000C r3 2003
1A-8081	Organochlorine Pesticides by GC: Capillary Column Technique	SW8081B r2 2007/8000C r3 2003
1A-8082	Polychlorinated Biphenyls (PCBs) by Gas Chromatography: Aroclors	SW8082A r1 2007/8000C r3 2003
1A-8151	Chlorinated Herbicides	SW8151A r1 1996/8000C r3 2003
1A-D3695	ASTM Method for the Determination of Volatile Alcohols in Water by Direct Aqueous Injection by GC	ASTM D3695-95
1A-EPH	Method for Determination of Extractable Petroleum Hydrocarbons (EPH) by GC/FID	NJDEP EPH r3 2010/NJ OQA-QAM-025-02/08 r7 2008/EPA 8000C r3 2003
1A-FID-Organic Acid	Organic Acids by GC/FID	In-House

7/6/2020 SOP Master List 3

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
1A-NJTPH	Method for Determination of Total Petroleum Hydrocarbons (TPH) in the Normal Alkane Range of nC8 - nC40 By EPA Method 8015D (ALS Modified)	SW 8015D r4 2003/API r 5 1992/Wis DNR 1995/SW 8000C 2003/OQA-QAM-025 r7 2008
1B-3C Gas	Determination of Carbon Dioxide, Carbon Monoxide, Methane, Nitrogen, and Oxygen from Stationary Sources	EPA 3C
09-515.3	Microextraction of Chlorinated Acids (Herbicides) in Drinking Water for GC Analysis by EPA Method 515.3	EPA 515.3 r1.0 1996
09-552 EXT	Micro Extraction for the Determination of Haloacetic Acids by EPA Method 552	EPA 552.2 r1.0 1995
09-608.3EXT	Microextraction of Waters for the Analysis of Organochlorine Pesticides and PCBs by Gas Chromatography Method EPA 608.3	SW846 3511 Rev. 1 2014, EPA 608.3 Section 8.1.2, 40 CFR 136.6, ATP Protocol for Regulated Organic and Inorganic Analytes in Wastewater Section 1.3.2, USEPA Flexibility to Modify CWA Methods Memo (200.7)
HPLC		
01-547	Determination of Glyphosate in Drinkng Water by Direct-Aqueous-Injection HPLC, Post-Column Derivatization, and Fluoresence Detection	EPA 547 1990
1B-549.2	Determination of Diquat and Paraquat in Drinking Water Sources and Finished Drinking Water	EPA 549.2 r1.0 1997

7/6/2020 SOP Master List 3

SOP Master List-Modified.xls

SOP ID	Document Title	References
1B-8330	Nitroaromatics and Nitroamines by HPLC with Ultraviolet Detection	SW8330B r2 2006
1B-CARB	Carbamate Pesticides, Measurement of n-Methylcarbamoyloximes and n-Methylcarbamates in Water by Aqueous Injection HPLC with Post Column derivatization	EPA531.1 r3.1 1995
09-549.2	Solid Phase Extraction for the Determination of Diquat and Paraquat in Drinking Water by HPLC by EPA Method 549.2	EPA 549.2 r1.0 1997
09-8330 Grinding	Drying and Particle Size Reduction of Solids/Soils	SW 8330B r2 2006
09-8330 S	Extraction of Solids for the Analysis of Explosives by EPA Method 8330B (HPLC)	SW8330B r2 2006 ERDC/CRREL TR-06-6 2006 ERDC/CRREL TR-07-15 2007
09-8330 W	Solid Phase Extraction of Water for the Analysis of Explosives by EPA Method 8330B (HPLC)	SW8330B r2 2006/SW3535A r1 2007
02 SVMS HPLC		
02-522	Determination of 1,4Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography/Mass Spectrometry (GC/MS) With Selected Ion Monitoring (SIM)	EPA 522 r1 2008

7/6/2020 SOP Master List 4

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
02-525.2	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) by Method 525.2	EPA 525.2 r2.0
02-525.3UCMR4	Determination of Semivolaties Organic chemicals in Drinking Water by Solid Phase Extraction and GC/MS in SIM Mode	EPA 525.3 r1 2012
02-546 UCMR4	Determination of Tot Microcystins and Nodularins in DW and Ambient Water by ADDA Enzy-Linked Immunosorbent Assay	EPA 546
02-548.1	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) by Method 548.1	EPA 548.1 r1.0 1992
02-625.1	Semi-Volatile Organic Compounds by GC/MS	EPA 625.1, 40 CFR Part 136, Appendix A/SW846-8000C Rev.3, 2003/8270D Rev. 4, 2007
02-680	Determination of PCBs in Water and Soil/Sediment by GC/MS-SIM	EPA 680 1985 8000C 0 2003 8270D 2007
02-8270	Semi-volatile Organic Compounds by GC/MS	SW8270D r4 2007/SW8000C r3 2003/SW8270E r6 2018
02-8270SIM	Quantitative Determination of Polynuclear Aromatic Hydrocarbons by Gas Chromatography/Mass Spectrometry (GC/MS) - Selected Ion Monitoring (SIM) Mode	SW8000C r3 2003 SW8270D r4 2007 8270SIM Guidance 2009

7/6/2020 SOP Master List 5

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-3535	Solid Phase Extraction for the Determination of Select Semi-Volatile Organic Analytes	EPA 3535A Rev. 1 2007
09-548.1	Solid Phase Ion-Exchange Extraction for the Determination of Endothall in Drinking Water for Analysis by EPA Method 548.1	EPA 548.1 r1.0 1992
09-525 EXT	Solid Phase Extraction for the Determination of Organic Compounds by EPA Method 525.2	EPA 525.2 r2.0 1995
09-SOC DW COMP	Protocol for In-Lab Compositing of SOC Drinking Water Samples	40 CFR 141
02-VOL GCMS		
01-8015 GRO	Gasoline Range Organics	SW 8015D r4 2003
02-5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples	SW 5035A-1 r1 2002
02-524.2	Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry	EPA 524.2 r4.1 1995
02-624.1	Volatile Organic Compounds by EPA Method 624.1	EPA 624.1, 40 CFR 136 Appendix A
02-8260	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique by Method 8260B	SW 8260B r2 1996

7/6/2020 SOP Master List 6

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
02-8260C	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Capillary Column Technique by Method 8260C	SW 8260C r3 2006 SW 5035A r1 2002 SW 5030C r3 2003
02-8260D	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) Capillary Column Technique by Method 8260D	SW 8260D R4 2018 SW 5035A R1 2002 SW 5030C R3 2003 8000D R4 2014
03-METALS		
03-200.7	Analysis of Total Metals by Inductively Coupled Plasma by EPA Method 200.7	EPA 200.7 r 4.4 1994 (r 5.0 2001 available but not CFR approved)
03-200.8	Method 200.8 – Determination of Trace Elements in Water and Waste by inductively Coupled Plasma – Mass Spectrometry	EPA 200.8 Rev 5.4 1994
03-6010C	Analysis of Total Metals by Inductively Coupled Plasma by Method 6010C	SW6010C r3 2007
03-6010D	Analysis of Total Metals by Inductively Coupled Plasma by Method 6010D	SW6010D r4 2014
03-6020	Method 6020 – Determination of Trace Elements in Water and Waste by Inductively Coupled Plasma – Mass Spectrometry	SW6020A r1 2007

7/6/2020 SOP Master List 7

SOP Master List-Modified.xls

SOP ID	Document Title	References
03-Hg	Mercury by Cold-Vapor Atomic Absorption Using an Automated Continuous-Flow Vapor Generator	EPA 245.1 r3.0 1994 SW7470A r1 1994 SW7471B r2 1998 SW846 7000A r1 1992
03-Hg CVAFS	Mercury in water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry	EPA1631 rE 2002
03-TB	Standard Operating Procedure for Turbidity Screen Prior to Metals Digestion	EPA 180.1 r2.0 1993
09-3015	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts for Total Metals Analysis by ICP or ICP-MS Spectroscopy	SW3015A r1 2007
09-3050	Hot Plate Acid Digestion of Sediments, Sludges, Solids and Oils	SW 3050B r2 1996
09-3051	Microwave Assisted Acid Digestion of Sediments, Sludges, Soils and Oils	SW 3051A r 1 2007
09-DW Hg	Sample Preparation for the Determination of Mercury in Drinking Water Samples	EPA 245.1 r 3.0 1994
09-Hotblock	Hot Block Acid Digestion of Waters for Total Recoverable Metals for Analysis by ICP and ICP/MS	EPA 200.7 r 4.4 1994 EPA 200.8 r5.4 1994

7/6/2020 SOP Master List 8

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-SOLID WW Hg	Sample Preparation for the Determination of Mercury in Aqueous and Soil Samples	SW7470A r1 1994 SW7471B r2 2007
04-WET CHEM		
04-1010	Flashpoint SW-846 Method 1010 (Pensky-Martens Closed-Cup Method for Determining Ingitability)	SW 1010A r1 2004 ASTM D93-15
04-218.6	Determination of Hexavalent Chromium in Drinking Water by Ion Chromatography with Post-Column Derivatization and UV-Visible Spectroscopic Detection	EPA 218.6 r 3.3 1994
04-218.7	Low-Level Determination of Hex Chromium in DW by Ion Chromatography with Post-Column Derivatization and UV-Visible Spectroscopic Detention	EPA 218.7 r 1.0 2011
04-300.1	Determination of Bromide, Bromate Chlorite, and Chlorate in Drinking Water by Ion Chromatography – Method 300.1	EPA 300.1 r1.0 1999
04-ACETATE	Acetate by Ion Chromatography	SW 9056A r 1 2000 EPA 300.0 r 2.1 1993
04-ACIDITY	Acidity by Titration	SM2310B 22nd Ed.

7/6/2020 SOP Master List 9

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-ALK2	2-Point Alkalinity	SM 2320B 2011
04-ANION2	Determination of Inorganic Anions by Ion Chromatography	EPA 300.0 r2.1 1993 SW 9056A r1 2007
04-BOD	Biochemical Oxygen Demand/Carbonaceous Oxygen Demand (Total and Soluble)	SM5210B 2011
04-Ca Hd	Calcium Hardness	SM 2340 B 2011 SM 3500 CaB 2011
04-CALC	Wet Chemistry Calculations	various
04-Chlorophyll	Determination of Chlorophyll a in the Presence of Pheophytin a	SM 10200 H 2011
04-CLD	Chlorine Demand	SM 2350B 2011
04-CN	Determination of Cyanide by Semi-Automated Colorimetry	EPA335.4 r1.0 1993/SW9012B r2 2004/Bran-Luebbe Method US-696L-82W

7/6/2020 SOP Master List 10

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-COD	Chemical Oxygen Demand	EPA 410.4 r2.0 1993
04-Color	Color	SM2120B 2011
04-CN-FLOW	Total Cyanide by Segmented Flow Colorimetry	EPA 335.4 rev. 1.0 1993, 9021B Rev. 2 Nov. 2004
04-Cr+6 S	Hexavalent Chromium by SW-846 Methods 7196A and 3060A	SW3060A r1 1996 SW7196A r1 1992
04-Cr+6 W	Hexavalent Chromium in Water	SM3500 Cr B 2011
04-DO	Dissolved Oxygen	SM 4500-O G 2011
04-Ferrous	Ferrous Iron	SM3500 Fe B 2011
04-H150M NALCO	H-150M NALCO—Colorimetric	NALCO AP-97
04-H2O Mon	Reagent Water and Drinking Water Monitoring	In-house
04-Hd	Total Hardness and Temporary Hardness	SM2340C 2011
04-Hydrazine	Determination of Hydrazine in Water	ASTM D1385-01

7/6/2020 SOP Master List 11

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-IG	Ignitability	SW1030 r0 1996
04-LI SI	Langelier's Index & Saturation Index by Calculation	SM 2330B 22nd Ed. 1998
04-MAINT	Wet Chemistry Instrument Maintenance Protocol	In-house
04-MBAS	Methylene Blue Active Substances (MBAS) - Colorimetric	SM5540C 2011
04-NEUT POT	Neutralization Potential (Calcium Carbonate Equivalence, CCE)	AOAC955.01 FM-871 2002
04-NH3 AA3	Determination of Ammonia-Nitrogen and Total Kjeldahl Nitrogen by Semi-Automated Colorimetry	SM 4500-NH3 G 2011 EPA 350.1 rev 2.0 1993 EPA 351.2 rev 2.0 1993 4500 NH3G
04-NH3 AIR	Determinatino of Ogawa-Passive Ammonia by Ion Chromatography	ASTM D6919-09 Ogawa Sampler User Guide 2010
04-NH3-FLOW	Determination of NH3-FLOW	Determination of Ammonia-Nitrogen by Gas Diffusion and Segmented Flow Colorimetry

7/6/2020 SOP Master List 12

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-NH3 IC	Determination of Ammonia-Nitrogen by Ion Chromatography	ASTM D6919-09 2009
04-NH3D SM	Ammonia-Nitrogen with Distillation (Potentiometric Ion Selective Electrode)	SM4500NH3-B 1997 SM4500NH3-D 1997
04-NO2	Nitrite, Spectrophotometric	SM4500-NO2 B 2011
04-NO3	Nitrate-Nitrite Nitrogen by Automated Colorimetry	EPA 353.2 r2.0 1993
04-Odor	Odor	SM2150B 1997
04-O-OH	Determination of Total Phenolics by Semi-Automated Colorimetry	EPA 420.4 r1.0 1993 SW9066 1986
04-O-OH-FLOW	Determination of Total Phenolics by Segmented Flow Colorimetry	EPA 420.4 rev 1.0 Aug 1993; 9066 1986
04-OP	Orthophosphate	SM 4500 PE 1999
04-Osm	Osmotic Pressure	PADEP 391-2000-008 2003 Osm Pressure

7/6/2020 SOP Master List 13

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-OX SCREEN	Oxidizer Screen	ASTM D4981-12
04-OX SOLIDS	Oxidizing Solids	SW846 1040 r0 2007
04-P	Determination of Phosphorus by Digestion and Semi-Automated Colorimetry	EPA 365.1 Rev2 1993
04-PERCH-IOD	Determination of Perchlorate & Iodide by Ion Chromatography	EPA 314.0 Rev1 1999
04-pH S	pH in Soil and Waste	SW9045D r4 2004 SW9041A r1 1992
04-pH W	pH (Electrometric) in Water	EPA 150.1 1982 SM4500-H+B 2011 SW9040C r3 2004
04-Res Cl	Chlorine, Total and Free Residual	SM4500-Cl G 2000
04-S	The Determination of Total and Reactive Sulfide	SM4500-S^2 F 2011 SW846 Ch 7.3.4 r3 1996
04-S 5560	The Determination of Total Volatile Acids in Water, Sludges and Wastewater	SM 5560C 2011

7/6/2020 SOP Master List 14

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-S 9030B-9034	Determination of Acid Soluble Sulfides by Distillation and Iodimetric Titration	SW9030B r2 1996 SW9034 r0 1996
04-SALINITY	Salinity	SM2520B 2011
04-SetSol	The Volumetric Determination of Settleable Matter in Water and Wastewater using the Imhoff Cone	SM2540F 1997
04-SiO2	Silica, Dissolved	SM 4500 SiO2 C 2011
04-SO3	Sulfite Iodometric Method (Titrimetric, iodide-iodate titrant)	SM 4500S03 B 22nd Ed.
04-SOCR	Specific Oxygen Consumption Rate Test (SOCR)	SM 2710B 2011
04-SPC	Specific Conductance, µmhos at 25 °C	SW9050A rev 1 1996 SM2510B 1997
04-TANNIN	Tannin	SM5550B 21st Ed.
04-TB	Turbidity	SM 2130B 2011

7/6/2020 SOP Master List 15

SOP Master List-Modified.xls

SOP ID	Document Title	References
04-TDS	Total Dissolved Solids	SM2540C 2011
04-TKN-FLOW	Total Kjeldahl Nitrogen by Segmented Flow Colorimetry	SM4500NorgC 2011
04-TS Sol	Total Solids on Solids	SM2540G 2011
04-TS W	Total Solids on Waters	SM2540B 2011
04-TSS	Total Suspended Solids	SM2540D 2011
04-UV254	Ultraviolet Absorption by Organic Constituents	SM5910B 2011
04-VS	Volatile (or Fixed) Solids	SM2540E 2011 SM2540G 2011
09-CN Amen PreTrt	Pretreatment of Samples for Cyanides Amenable to Chlorination	SM4500-CN G 2011 EPA 9012B r2 2004
09-CN DIS	Distillation of Total Cyanide and Weak Dissociable Cyanide	EPA 335.4 r1.0 1993 SW 9010C r3 2004 SM4500-CN I 2011
09-Composite	Protocol for In-lab Compositing of Non-Potable Water and Solid Samples	In-house

7/6/2020 SOP Master List 16

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-O-OH DIST	Phenolic Distillation by Rapid Still	SW 9066 r0 1986 EPA 420.4 r1.0 1993
09-R	Reactivities Prep	SW846 Chap. 7.3.3 and 7.3.4 Rev 3 1996/SW846 Chap. 7.3 Rev 4 2004
09-TKN-DIG DIS	Total Kjeldahl Nitrogen Digestion and Distillation	SM4500NorgB+C 2011 SM4500NH3G
09-TCLP EXTRACTION		
09-ASTM	ASTM Leaching Procedure (Shake Extraction of Solid Waste with Water)	ASTM D-3987-06
09-PFT	Paint Filter Test	SW9095B r2 2004
09-SPLP	Synthetic Precipitation Leaching Procedure (SPLP) for Non-Volatile Organics, Metals and Wet Chemistry Analysis	SW846 1312 Rev0 1994
09-TCLP	Toxicity Characteristic Leaching Procedure (TCLP) for Non-Volatile Organics, Metals and Wet Chemistry Analysis	SW846 1311 r0 1992

7/6/2020 SOP Master List 17

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-TCLP/SPLP-ZHE	Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP) for Volatile Organics	SW1311 r0 1992 SW1312 R0 1994
05-MICROBIOLOGY		
05-Micro QA Plan	Microbiological Quality Control Procedures	In-house
05-Enterolert	Enterolert	SM 9230D 2007
05-FC	Fecal Coliform - Membrane Filtration	SM 9222D 1997 (2006 available but not promulgated) EPA/625/R-92/013 App F 2003
05-FC-SLG-1680	Fecal Coliforms in Sludge by Multiple-Tube Fermentation Using Lauryl Tryptose Broth (LTB) and EC Medium	EPA 1680 Apr 2010
05-HPC	Heterotrophic Plate Count	SM9215B 22nd Ed.
05-IRB-BART	Iron-related Bacteria	Droycon Bioconcepts, Inc. IRB-BARTtm1
05-SRB-BART PROTOCOL	Sulfate-reducing Bacteria	Droycon Bioconcepts, Inc. SRB-BARTtm1

7/6/2020 SOP Master List 18

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
05-TC	Total Coliform in Drinking, Pool, and Wastewaters by Chromogenic Substrate	SM 9223B 22nd Ed. PADEP Min Med ONPG-MUG Test
07-TOC/TOX		
07-TOC	Determination of Total & Dissolved Organic Carbon and Total Carbon in Water	SM5310B 2011 SW9060A r1 2004
07-TOC S	The Determination of Total Organic Carbon and Total Inorganic Carbon in Soils	SW9060A r1 2004
07-TOX	Determination of Total Organic Halogens in Water	SW846 9020B Rev2 1994
07-TOX S	Standard Operating Procedure for Extractable Organic Halides in Soil	SW846 9023 Rev0 1996
07-TX	SOP for total Chlorine in New and Used Petroleum Products	SW846 9076 Rev0 1994
09-ORGANIC PREP		

7/6/2020 SOP Master List 19

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-1664	Oil and Grease and Total Petroleum Hydrocarbons by EPA Method 1664	EPA 1664 rB 2010 EPA-821-R-10-001 2010
09-1664-47	Oil and Grease and Total Petroleum Hydrocarbons by EPA Method 1664	EPA 1664 rB 2010 EPA-821-R-10-001 2010
09-3510-EPH	Separatory Funnel Extraction of Waters for the Determination of Extractable Petroleum Hydrocarbons (EPH)	SW3510C r3 1996 NJDEP EPH 10/08 r3 2010
09-3511	Microextraction Extraction of Water for the Analysis of Organochlorine Pesticides by Gas Chromatography	U.S. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846) 8081B Rev. 2 Feb 2007 3511 Rev. 1 July 2014
09-3546 DRO	Microwave Extraction of Solids for the Analysis of Diesel Range, Oil Range, and Total Petroleum hydrocarbon Organics by Gas Chromatography	SW 3546 r0 2007 SW 8015D r4 2003 OQA-QAM-025
09-3580 WD	Waste Dilution for the Analysis of Semivolatile Organic Compounds by Gas Chromatography and Gas Chromatography/Mass Spectronometry	SW 3580A r1 1992 SW 8270D r4 2007 SW 8081B r2 2007 SW 8151A r1 1996
09-8081 8082 ME	Microwave Extraction of Solids for the Analysis of Organochlorine Pesticides and PCB's by Gas Chromatography	SW8081B r2 2007 SW8082A r1 2007 SW3546 r0 2007 SW3660B r2 1996 SW3665A r1 1996

7/6/2020 SOP Master List 20

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-622	Separatory Funnel Extraction of Organophosphorous Compounds for Analysis by EPA Method 622	SW3510C r3 1996 EPA 622 1993
09-680 W	Separatory Funnel Extraction of Waters for the Analysis of PCB's by Gas Chromatography/Mass Spectrometry	EPA 680 Nov. 1985
09-680 ME	Microwave Extraction of Solids for the Analysis of PCB's by Gas Chromatography/Mass Spectrometry	EPA 680 Nov. 1985
09-8151 W	Separatroy Funnel Extraction of Chlorinated Herbicides Using Methylathion for GC Analysis by EPA Method 8151	SW 3510C r3 1996 SW 8151A r1 1996
09-8151 Z	Shaker Extraction of Chlorinated Herbicides Using Methylation for GC Analysis by EPA Method 8151	SW8151A r1 1996
09-8270 ME	Microwave Extraction of Solids for the Analysis of Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry	SW3546 r0 2007 SW8270D r4 2007
09-9071B	Oil and Grease on Solid Samples	SW9071B r2 1998 EPA 821-R-98-002 1999 EPA 1664B 2010
09-Diazometh	Diazomethane Preparation	SW8151A r1 1996
09-EPH-ME	Microwave Extraction and Silica Gel Fractionation of Solids for the Analysis of Extractable Petroleum Hydrocarbons	SW3546 r0 2007 NJDEP EPH r3 2010 EPA 3630C r3 1996

7/6/2020 SOP Master List 21

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-GLWH	Washing and Handling of Glassware	In-house
09-GPC-Cleanup	Gel Permeation Chromatography Clean up of Semivolatile Organic Compounds and Organochlorine Pesticides and PCBs	SW846 3600C Rev3 1996 SW846 3640A Rev1 1994
09-Lot Verification	System for verifying new lots of chemicals and reagents before use in the laboratory	In-house
09-MC1	Separatory Funnel Extraction of Waters for the Determination of Diesel Range Organics	SW3510C r3 1996 SW8015D r4 2003
09-Microfl	Microcolumn Florisil Cleanups for Extracts Requiring Pesticide Analysis by EPA Methods 608 or 8081	SW3600C r3 1996 SW3620B r2 1996 SW8081B r2 2007 40CFR EPA608 2001
09-PE1	Separatory Funnel and Continuous Liquid-Liquid Extraction of Waters For the Analysis of Organochlorine Pesticides and PCBs as Aroclors by Gas Chromatography	SW8081B r2 2007 SW8082A r1 2007 SW3510C r3 1996 SW3520C r3 1996 Pt136 EPA608 2001
09-SIL GEL CLEANUP	Silica Gel Cleanup of Extracts for Analysis by Method 8081	SW8081B r2 2007 SW3630C r3 1996
09-Subsampling	Subsampling Procedure for Nonvolatile Analysis or Preparation	In-house

7/6/2020 SOP Master List 22

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
09-SV1BNA	Separatory FunnelExtraction of Waters for the Analysis of Semivolatile Organic Compounds by GC/MS for EPA Methods 625 and 8270	SW3510C r3 1996 SW3520C r3 1996 EPA 625 SW8270D r4 2007
19-SAMPLE RECEIVING		
19-Aliquot	Sample Aliquot Protocol	In-house
19-BOTTLE	Bottle Preservation and Preparartion Procedure	In-house
19-COC	Standard Operating Procedure for Chain of Custody Entry	In-house
19-LCOC	Standard Operating Procedure For Legal Chain-Of-Custody	In-house
19-Preservation	Procedure for Sample Preservation based on Analytical Method	In-house
19-Rec/Han	Standard Operating Procedure for Sample Receipt- Sample Handling	In-house

7/6/2020 SOP Master List 23

SOP Master List-Modified.xls

SOP ID	Document Title	References
19-Subcontracting	Standard Operating Procedure for Subcontracting Analyses	In-house
19-TNFBLANK	Trip and Field Blank Preparation	In-house
19-Tray	Tray System for Sample Storage	In-house
19-Tray System Movement Protocol	Tray System Sample Subsample Movement Protocol	In-house
19-RAD	Standard Operating Procedure for Screening Incoming Samples for Radiation	In-house
19-WEB APP-Rapid Login Protocol	RAPID LOGIN OF SAMPLES IN LIMS VIA WEB-BASED APPLICATION	In-house
19-Waste Disposal	Waste Disposal	In-house
20-FIELD SERVICES		
20-Cl	Free and Total Chlorine (Field Determination)	SM4500-Cl G 2011
20-DO	Dissolved Oxygen (Field Determination)	SM 5400-O G 2001

7/6/2020 SOP Master List 24

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
20-FSSP	Field Services Sampling Plan	In-house
20-pH	pH for Field Sampling	SM4500 H+B 2011
20-Redox	Reduction-Oxidation Potential Measurement (Redox)	SM2580 2011
20-SPC	Conductivity in the Field	SM2510B 22nd ed.
20-TB	Turbidity in Field	SM 2130B 22nd ed.
20-Temp	Procedure for Temperature in Field	SM 2550B 2010 EPA 170.1 1974
99-CUSTOMER SERVICE		
99-Cabot Oil and Gas Protocol	Protocol for Sample Receipt, Handling and Reporting of amples for Cabot Oil & Gas	In-house
99-Complaints	Standard Operation Procedure for External Complaints	In-house
99-COPYING PROFILES PROTOCOL	Protocol for Copying Client Profiles	In-house

7/6/2020 SOP Master List 25

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-DEP REP NOT	Protocol for Reporting and Notification of DEP Drinking Water Samples	In-house
99-DoD Client Notification	DoD Client Notification	In-house
99-Lab Report Review Protocol	Protocol for the Review of Laboratory Analytical Reports	In-house
99-NJ DEP E2	Procedure for Set Up of Clients Requiring Nj DEP E2 Reporting	In-house
99-Project	Project Setup	In-house
99-IT		
99-DATABU	ALS - Middletown Computer Backup Standard Operating Procedure	In-house
99-IT SECURITY	Computer Security Policies and Procedures	In-house

7/6/2020 SOP Master List 26

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-LIMS 11	Horizon LIMS 11 Workstation Installation	In-house
99-MDT APP DEV Protocol	Middletown Application Development - GIT Verson Control	In-house
99-Software	Software Control/Validation/Audits	EPA 2185 1995
99-Sample Disposal App	ALS - Middletown Sample Disposal Application - Operating Manual Protocol	In-house
99-QAQC		
ALS-MDT QAM	Quality Assurance Manual- Middletown	In-house
99-Analyte Level Comment Protocol	Analyte Level comments used in the Prep Area	In-house

7/6/2020 SOP Master List 27

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-AP	Standard Operating Procedure for Calibration Checks for Autopipetters/Dispensers	TNI Section 5.5.2.1 and DoD QSM 5.3-QSM Section 5.5.2.1 and grey box 31
99-ARCADIS	Arcadis US Metals Refining Company, Certeret, NJ Project Sample Prepration Protocol	In-house
99-ARCADIS SOIL PROJECT	Protocol for Processing of Soils for Arcadis Shooting Range Project	In-house
99-AUTOCLAVE PROTOCOL	Digestion of Phosphorus by Method 365.1and Mercury by 7471B and the sterlization of various Micro methods	In-house
99-Balances	Calibration Verification and Operation of Laboratory Balances	In-house
99-Chemical Labeling Protocol	Standard and Reagent Labeling Protocol	In-house
99-DATA	Data Review and Approval Procedure	USACE SOP Q-024-MRL-DR Version 1.0

7/6/2020 SOP Master List 28

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-Document Control	Document Control	Current TNI Std. 2009/2016/2017/Current DoD QSM 5.3
99-HSCA	DNREC HSCA Project Protocol	DNREC HSCA SOPCAP
99-IC UPLOAD DATA	Protocol for Uploading Data for IC Instrument	In-house
99-Imp Soil	Imported Soil Handling & Disposal	USDA Permit to Receive Soil exp 12/28/14
99-INTEGRATION PROTOCOL	Manual Integrations on Chromatographic Data Using the Target Software	ALS Corp CE-QA002 r 2.1
99-Internal Audits	Internal Audits	SOP CE-QA001 Rev. 2
99-Location Change	Location Change - Movement Plan Protocol	In-house

7/6/2020 SOP Master List 29

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-Mgmt Rev	Management Review	In-house
99-MDL-LOD-LOQ	Establishing MDLs, LODs, LOQs	40 CFR Part 136 Appendix B
99-Method Development	Method Development	SOP CE-GEN008 Rev. 0
99-Missing Sample	Missing Sample Protocol	In-house
99-NCAR Procedure	Non-Conformance/Corrective Action Procedures	In-house
99-PT	Proficiency Testing	SOP CE-QA006 Rev. 1
99-QA TASK	Quality Assurance Task Completion Procedure	In-house
99-QC CHART	Control Chart Generation & Maintenance	SW8000B r2 1996/USACE Q-009-MRL-QC V 1.0/QAQC Utility User Documentation 2011

7/6/2020 SOP Master List 30

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-Records	Records Management	In-house Process based on TNI NELAP 2009/2016/2017 and DoD QSM 5.3
99-Sample Flow	Sample Flow Process	In-house
99-SOPs	Laboratory Policy on Writing, Issuing and Changing Standard Operating Procedures (SOPs)	In-house
99-Sub Lab App	Procedure for Subcontractor Laboratory Approval	In-house
99-TCAL	Thermometer Verification	TNI QSM 2009/2016/2017/DoD QSM 5.3 Rev 5.3 2019
99-TEMP	Equipment Temperature Monitoring	TNI Std EL-VIMA-2009 DoD QSM 5.0QSM 5.0QSM ver 4.2
99-Train	Training Protocol	TNI Std 2009 DOD QSM 5.0
ALS Corporate-General	NOTE REMOVE UNCONTROLLED STAMP ON VIEW AND CONCUR COPIES	
CE-GEN001	Laboratory Ethics and Data Integrity	Corporate

7/6/2020 SOP Master List 31

SOP Master List-Modified.xls

SOP ID	Document Title	References
CE-GEN002	BP Laboratory Management Program SOP	Corporate
CE-GEN004	Preventative Action	Corporate
CE-GEN006	Data Recall	Corporate
CE-GEN007	Procurement and Control of Laboratory Services and Supplies	Corporate
CE-GEN012	Policy for the Use of Accreditation Organization Names, Symbols and Logos	Corporate
CE-GEN013	Enterprise Products Laboratory Program SOP	Corporate
CE-GEN014	Spectra Energy Contract Laboratory Program	Corporate
CE-GEN015	Management of Change Procedure	Corporate

7/6/2020 SOP Master List 32

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
CE-GEN016	Continuous Quality Improvement	Corporate
ALS Corporate-Quality Assurance	NOTE REMOVE UNCONTROLLED STAMP ON VIEW AND CONCUR COPIES	
ALS USA Quality Management System	Quality Management System Summary	Corporate
CE-QA007	Making Entries Onto Analytical Records	Corporate
CE-QA010	Estimation of Uncertainty	Corporate
CE-QA012	Quality of Reagents and Standards	Corporate
CE-QA013	New Instrument Suitability and Validation	Corporate
CE-QA014	ALS Limeted Risk Appetite and Tolerance Policy	Corporate

7/6/2020 SOP Master List 33

SOP Master List-Modified.xls

SOP ID	Document Title	References
CE-QA015	ALS Limited Risk Management Policy and Framework	Corporate
99-REPORTING		
99-CLP-Like ORG	Protocol for Preparing CLP-Like Forms, Organics Section	In-house
99-EDD	Generation of Electronic Data Deliverables	In-house
99-LAND FORM GEN	Landfill Form Generation	In-house
99-Org Data Pack	Procedure for Organics Section Data Package Submission to the Reporting Department	In-house
99-PKG-CD	Transfer of Client Data Packages to Compact Disk (CD)	In-house
99-SDG Assembly	Laboratory Policy on Assembly of Data Packages	In-house
99-SDG CREATION	Laboratory Policy on Creating and Assigning Sample Deliverable Groups (SDG)	In-house

7/6/2020 SOP Master List 34

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
99-SDG Val	Laboratory Policy of Validation of Data Packages	EPA QA/G-8 EPA/240/R-02/004 Nov 2002
90-HSE SAFETY		
90-BBP-MDT	Middletown BBP Control Plan	Corporate
90-CHP-CB	Chemical Hygiene Plan - Columbia Facility	Corporate
90-CHP-MDT	Chemical Hygiene Plan - Middletown 301 Facility	Corporate
90-CHP-SPC	Chemical Hygiene Plan - Spring City Facility	Corporate
90-EAP-CB	Emergency Action Plan- Columbia Facility	Corporate
90-EAP-MDT	Emergency Action Plan - Middletown 301 Facility	Corporate
90-EAP-SPC	Emergency Action Plan- Spring City Facility	Corporate
90-EAP-YRK	Emergency Action Plan- York Facility	Corporate
90-Fall Protection	Fall Protection Plan	Corporate
90-FA	First Aid Protocol	Corporate
90-GSP	General Safety Program Protocol	Corporate
90-LV	Laboratory Ventilation Protocol	Corporate
90-Waste.Mgmt	Waste Management - Middletown	Corporate
90-PPE	Personal Protective Equipment Protocol	Corporate
90-RPP-MDT	Middletown respiratory	Corporate
HSE-DMP-CB	Disaster Management Plan - Columbia	Corporate
HSE-DMP-MDT	Disaster Management Plan - Middletown301	Corporate

7/6/2020 SOP Master List 35

SOP Master List-Modified.xls

SOP ID	Document Title	References
HSE-DMP-PIT	Disaster Management Plan - Pittsburgh	Corporate
HSE-DMP-SPC	Disaster Management Plan - Spring City	Corporate
HSE-DMP-YRK	Disaster Management Plan - York	Corporate
ALS-HSE-NA-GD-001-EN	First Aid Treatment -NA	Corporate
ALS-HSE-NA-PY-005-EN	First Aid Attendants - NA	Corporate
ALS-HSE-NA-PY-009-EN	Injury Management - NA	Corporate
ALS-HSE-NA-EX-001-EN	Blood Borne Pathogens	Corporate
ALS-HSE-NA-PY-003-EN	Employee Handbook	Corporate
ALS-HSE-NA-PY-015-EN	Respiratory Protection - NA	Corporate
ALS-HSE-NA-PY-021-EN	Vehicle Use	Corporate
ALS-HSE-NA-PY-022-EN	Driver Safety	Corporate
ALS-HSE-NA-PY-032-EN	Non-Owned Vehicle Use	Corporate
ALS-HSE-NA-PY-036-EN	Driver Authorization	Corporate
SPRING CITY FACILITY		
ALS-SPC QAM	Quality Assurance Manual-Middletown	In-house
Micro QA Plan SPC	Microbiological Quality Control Procedures- Spring City Facility	In-house
05-TC-EC-SPC	Procedure for the Analysis of Total Coliform and Escherichia coli in Waste Water, Drinking Water, and Clean Water Sources Using Chromogenic Substrate Analysis (MMO-MUG-ColiLert – Presence/Absence & QuantiTray Method)- Spring City Facility	SM9223B 2004

7/6/2020 SOP Master List 36

Uncontrolled Copy

SOP Master List-Modified.xls

SOP ID	Document Title	References
05-FC-9222-SPC	Fecal Coliform - Membrane Filtration	PADEP Critical El for Cert Labs NJAC 7:18 SM9222D 22nd Ed.
19-REC HAN-SPC	Procedure for Sample Receipt/Sample Handling for Spring City Division	In-house
COLUMBIA FACILITY		
Micro QA Plan COL	Microbiological Quality Control Procedures for Columbia Facility	In-house
05-Enterolert-COL	Enterolert	SM 9230D 2007
05-TC/EC-COL	Procedure for the Analysis of Total Coliform and Escherichia coli in Waste Water, Drinking Water, and Clean Water Sources Using Chromogenic Substrate Analysis (MMO-MUG-ColiLert - Presence/Absence & QuantiTray Method)	SM 9223B 2004 PADEP Min Med ONPG-MUG Test NJAC 7:18
SPARROWS POINT PROJECT SOPS		
01-8015 GRO-SP	Gasoline Range Organics	SW 8015D r4 2003
1A-8015 DRO-SP	Method for Determination of Diesel Range Organics By EPA Method 8015D (ALS Modified)	SW 8015D r4 2003 API 4711 r5 1992 Wis DNR 1995 SW 8000C r3 2003

SOP Master List-Modified.xls

SOP ID	Document Title	References
1A-8082-SP	Polychlorinated Biphenyls (PCBs) by Gas Chromatography: Aroclors	SW8082A r1 2007 8000C r3 2003
02-8260-SP	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique	SW 8260B r2 1996
02-8270-SP	Semi-volatile Organic Compounds by GC/MS	SW8270D r4 2007 SW8000C r3 2003
02-8270SIM-SP	Quantitative Determination of Polynuclear Aromatic Hydrocarbons by Gas Chromatography/Mass Spectrometry (GC/MS) - Selected Ion Monitoring (SIM) Mode	SW8000C r3 2003 SW8270D r4 2007 8270SIM Guidance 2009
03-6010-SP	Analysis of Total Metals by Inductively Coupled Plasma by Method 6010C	SW6010C r3 2007
03-6020-SP	Method 6020 - Determination of Trace Elements in Water and Waste by Inductively Coupled Plasma - Mass Spectrometry	SW6020A r1 2007

Uncontrolled Copy

Appendix G – Master List of Controlled Documents

Internal Documents
Quality Assurance Manual
Standard Operating Procedures (SOPs)
Protocols
Logbooks
Logbook Pages
Analytical Coverpages
Calculating Worksheets
External Documents
ALS-Middletown's complete list of normative documents that are used in conjunction with the quality system is maintained by the QA Department in a network file in the folder ALSICommon>QA New>Controlled Reference Materials. This list includes:
Regulations
Test Methods
Guidelines
Instrument Manuals
Textbooks
Journals

Appendix H – Laboratory Accreditations

Accreditation	Accreditation Number
Arkansas	88-1604
Delaware Office of Drinking Water	NA
Delaware HSCA	NA
DoD	74618
Maryland DEP Water Supply Program	128
Florida	E871113
New Jersey DEP	PA010
New York DOH	11759
Pennsylvania DEP/ NELAP	22-00293
USEPA UCMR4	PA00102
USDA Soil Import Permit	USDA P330-11-00430
Virginia	460157
Washington Department of Ecology	C999
West Virginia DEP	343
West Virginia DHHR Drinking Water	9961C

Current Scopes of Accreditation are available online or by request.

Uncontrolled Copy

Appendix I – Data Qualifiers

Acronym/Flag	Definition
J	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte
U	Indicates that the analyte was Not Detected (ND)
E	Estimated value above the calibrated range of the instrument
N	Indicates presumptive evidence of the presence of a compound
I	Indicates an estimated value between the Method Detection Limit (MDL) and the Practical Quantitation Limit (PQL) for the analyte (FL reports)

Uncontrolled Copy

Appendix J – Report Deliverables Summary

ALS - Middletown Data Deliverables	Level 1	Level 2	Level 2+	Level 3	Level 4
	Certificate of Analysis	Level 1 with QC	Level 2 with Narrative	Level 1 with CLP forms	Level 3 with Raw Data
	STANDARD	LIMSQCPKG	USACE_DEF	NJREDUCED	**CLPLIKE
General Lab Records					
Cover/Signature Page	√	√	√	√	√
Table of Contents (containing Hyperlinks)				√	√
Sample Cross Reference Table	√	√	√	√	√
Standard Acronym/Flag Definitions	√	√	√	√	√
Report Narrative (sample and analyte level)	√	√	√	√	√
Method Specific Case Narrative			√		√
Method Non-Conformance Form				√	
Laboratory Deliverable Checklist				√	
Methodology Descriptions				√	
Sample Management Records					
Client Chain of Custody	√	√	√	√	√
Sample Receipt Checklist	√	√	√	√	√
Internal CoC (as required by project or SOW - request on client COC)				√	√
Sample Summary Results					
Certificate of Analysis	√	√	√	√	√
Tentatively Identified Compounds (TICs) as required	√	√	√	√	√
Sample CLP-like Summary Form 1				√	√
QC Summary Results					
QC Association Summary		√	√		
Laboratory Chronicle/ Preservation Narrative					√
Surrogate Recovery Report	√	√	√	√	√
QC Report Summary (MB, LCS/LCSD, MS/MSD, DUP)		√	√		
QC Sample CLP-like Summary Form(s) (MB, LCS/LCSD/MS/MSD, DUP, Tune)				√	√
Calibration CLP-like Summary Form(s) (ICAL, CCAL/CCV, ICV)				√	√
Expanded/Raw Results					
Organics					
Sample					
Sample Raw Data Quant Rpt with Spectra				√	√
Sample Library Search with Spectra (as required)				√	√
Screening Data/Confirmation Data					√
Calibration					
Instrument Tune Raw Data					√
ICAL Raw Data Quant Rpt					√
CCAL/ICV/CCV Raw Data Quant Rpt					√
QC					
Blank Raw Data Quant Rpt				√	√
Laboratory Fortified Blank/LCS Quant Rpt					√
MS/MSD Quant Rpt					√
Sample Duplicate Quant Rpt					√
Logs - Preparation and Analysis					√
Inorganics					
Raw Data (Calibration, QC, and Samples)					√
Logs - Preparation and Analysis					√

**Level 4 Data Deliverable formats are also available for programs including, but not limited to DOD, NJFULL, NY-ASPB, and TO-15.

Packages are saved as bookmarked .pdf files, and delivered on CD. FTP site access is available upon request.
Paper copies provided upon request or per SOW. Additional charges may apply.
Custom Packages are available upon request or per SOW.

Rev. 12/20/2016
Revision 1/14

Uncontrolled Copy

eurofins	Always check on-line for validity. **Nonvolatiles-Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312**	Level: **Work Instruction**
Document number: **T-TL-WI7151**		
Old Reference: **1-P-QM-WI -9015086**		
Version: **17**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **26-AUG-2022**	Document users: **5_EUUSLA_Leachate Preparation_All**	Responsible: **5_EUUSLA_Leachate Preparation_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Glassware Cleaning
Determining the Amount of Extract to Prepare
Preliminary Solids Determination
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision	17	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure C.2	Update to reflect current practice		Added requirements for non-aqueous layers in samples

Revision	16	**Effective Date:**	Jan.24.2022
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Preliminary Solids Determination 5.	EPA Method 1311 7.2.8		Refrigeration of filtrate required until tumbling has completed.

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 1311, July 1992.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 1312, September 1994.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-TL-WI7143	Glassware Cleaning for Leachate Extractions
T-TL-WI7144	Leachate Blank Evaluations
T-TL-WI7145	Subsampling and Preservation of Leachates
T-TL-FRM7229	Containers, Preservation, and Departments by Analytical Method
T-TL-FRM36652	Entering Leachate Blanks in LIMS

Scope

TCLP is designed to determine the mobility of organic and inorganic nonvolatile contaminants in potentially hazardous waste. SPLP is designed to determine the mobility of waste samples under conditions that simulate rainwater percolating through a sample.

Basic Principles

For liquid wastes (containing <0.5% solids), the extract is defined as the filtrate resulting from filtration of the waste through a 0.6- to 0.8-µm glass fiber filter.
For wastes containing greater than or equal to 0.5% solids that have some liquid phase, the waste is filtered through a glass fiber filter and the filtrate is stored for later use.

The extraction fluid used with the solid portion of waste is determined by the type of extraction. TCLP (1311_T, 1311T_M, 1311T_Hg) are determined using a portion of the solid sample and testing the alkalinity of the waste. SPLP (1312_E, 1312_E_Hg, 1312_E_M, 1312_W, 1312_W_Hg, 1312_W_M) are determined either by the origin of the sample, the type of sample, or the type of analysis performed on the sample. The extractions are performed by tumbling over an 18 hour period.

Following the extraction, the leachate is filtered through a glass fiber filter and the final and initial filtrates are combined.

Interferences

Any potential interferences are discussed in the individual analytical methods.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.
See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.
Follow routine safety steps. Special care must be taken when mixing the acid solution. Wear gloves, lab coat, and safety glasses when preparing the solution and handling samples. Read all lab notes and follow instructions carefully. Avoid skin contact or breathing the vapors from any of the reagents or samples. Use the appropriate ventilation system (bench top or hood) when instructed, if the sample looks suspicious (plating waste contains cyanide), or is particularly odoriferous.
If the sample fumes or reacts in any way when the acid is added during the extraction procedure, vent the sample periodically until the reaction is no longer evident.
Discard or send for repair any glassware that is chipped, flawed, or broken.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and a documented Demonstration of Capability (DOC).

The technician using this method must be trained by qualified personnel and perform these procedures at least twice in that person's presence before they are considered qualified.

Sample Collection, Preservation, and Handling

Samples must not be preserved and are stored at 0°C to 6°C, not frozen. Samples that require percent solids determination must have a minimum of 100g, plus any additional sample received to get sufficient extract for all analyses.

Samples for organic analysis must be collected in glass containers with PTFE-lined lids.

The holding time is from time of collection to time the leachate extraction starts. The holding time is:

14 days for semivolatile or pesticide/herbicide analysis.

28 days for mercury analysis.

180 days for metals analysis, other than mercury.

Evaluate the solid waste for particle size. The material must be able to pass through a 9.5-mm sieve or have a diameter of <1 cm with visual inspection. If the particle size does not meet this criteria, have the sample subcontracted for pulverization (if it is a stone-like material) or cut the material into smaller pieces if possible.

Apparatus and Equipment

1. Agitation apparatus (tumbler) – This must be an EPA-approved device which is capable of rotating the extraction vessels at 30 ±2 rpm in an end-over-end manner.

2. Extraction vessel – The extraction vessel must be a jar large enough to contain the volume of extraction fluid required (within the limitation of tumbler space). The vessel must be made of Borosilicate glass, Teflon, or polyethylene.

3. Filtration device – The Millipore Hazardous Waste Filtration system is suitable (also known as pressure filters).

4. Vacuum filtration system – Consisting of a vacuum flask, filter holder, and hose.

5. Acid Washed Glass fiber filters (0.6- to 0.8-µm pore size) – Assorted sizes

6. Beakers – Assorted sizes

7. Stirring hot plates

8. Thermometer – Capable of reading temperatures up to 70°C

9. pH meter – Orion Model 210 or equivalent – Capable of 0.01 pH unit display

10. Watch glasses

11. Graduated cylinders – Class A, assorted sizes

12. Glass jar for combining extracts

13. Glass bottles – Assorted sizes

14. Jug for preparing extraction fluid

15. Gooch crucible

16. Pipettes – Class A, assorted sizes

17. Balance – Capable of weighing to 0.01 g

18. Dispensette® Bottle-top Dispenser

19. 9.5 mm sieve

20. Centrifuge

Reagents and Standards

NOTE: Reagents used are ACS grade or equivalent. Recipes of standards may be adjusted as long as equivalent ratios are maintained.

1. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Concentrated hydrochloric acid (HCl) - stored at room temperature per manufacturer's expiration date

3. Glacial acetic acid (CH2COOH) – abbreviated as Hac in prep logbook, stored at room temperature per manufacturer's expiration date

4. 10 N sodium hydroxide (NaOH) – purchased, stored at room temperature per manufacturer's expiration date

5. Concentrated nitric acid (HNO3) - stored at room temperature per manufacturer's expiration date

6. Concentrated sulfuric acid (H2SO4) - stored at room temperature per manufacture's expiration date

7. Metals Spike A – VHG Labs ZLANLABCM#1 or equivalent. This is stored at room temperature for up to one year.

8. Metals Spike B – VHG Labs ZLANLABCM#2 or equivalent. This is stored at room temperature for up to one year.

9. 1 N hydrochloric acid (HCl) : This can be purchased otherwise prepare as directed below

   a. Use a graduated cylinder to slowly add 83 mL of concentrated HCl to approximately 500 mL reagent water in a 1000-mL volumetric flask.

b. Dilute the solution to volume with reagent water. Remake every 6 months.

c. Store in a glass bottle at room temperature.

10. 1 N nitric acid (HNO_3): This can be purchased otherwise prepare as directed below

a. Use a graduated cylinder to slowly add 64mL of concentrated HNO_3 to approximately 500mL reagent water in a 1000mL volumetric flask.

b. Dilute the solution to volume with reagent water.

c. Remake every 6 months.

d. Store in a glass bottle at room temperature.

11. Acid washed filters - Used if the leachate is to be analyzed for metals Prewashed filters are purchased. Alternatively, prepare the filter as follows:

a. Assemble the filtration apparatus with the filter in place.

b. Cover the filter with 1N nitric acid by pouring the acid from the bottle.

c. Apply vacuum or pressure (whichever is appropriate) until the filter is dry.

d. Using a graduated cylinder, pour a minimum of 100mL reagent water into the apparatus.

e. Apply vacuum or pressure until the filter is dry.

f. If a vacuum apparatus was prepared, discard the waste acid/water mixture and rinse the flask several times with reagent water. If a pressure filter was prepared, discard the waste acid/water mixture.

12. TCLP Extraction Fluid #1

a. Use a graduated cylinder to add 57 mL of glacial acetic acid to approximately 5000 mL reagent water in a 10 L jug.

b. Use a graduated cylinder to add 64.3 mL of 10 N NaOH.

c. Dilute with the solution to volume with reagent water.

d. The pH of this fluid must be 4.93 ±0.05.

e. Record the preparation and the pH of the extraction fluid in the appropriate logbook.

f. This solution must be prepared daily.

g. It is acceptable to prepare this solution in other volumes as long as the ratio of acetic acid and NaOH to final volume is maintained.

13. TCLP Extraction Fluid #2

a. Use a graduated cylinder to add 57 mL of glacial acetic acid to approximately 5000 mL reagent water in a 10 L jug.

b. Dilute the solution to volume with reagent water.

c. The pH of this fluid must be 2.88 ±0.05.

d. Record the preparation and the pH of the extraction fluid in the appropriate logbook.

e. This solution must be prepared daily.

f. It is acceptable to prepare this solution in other volumes as long as the ratio of acetic acid to final volume is maintained.

14. SPLP stock solution (60%H_2SO_4/40%HNO_3)

a. Fill a 100mL volumetric flask with approximately 50 mL of reagent water.

b. Add 6 mL of H_2SO_4

c. Add 4 mL of HNO_3.

d. Bring to volume with reagent water and mix thoroughly.

e. Store at room temperature in a glass bottle for up to 6 months.

15. SPLP Intermediate
a. Fill a 1 L volumetric flask with approximately 500 mL of reagent water.
b. Add 10mL of the SPLP stock solution.
c. Bring to volume with reagent water and mix thoroughly.
d. Store at room temperature in a glass bottle for up to 6 months.

16. SPLP Extraction Fluid #1 - Soil Samples East of Mississippi
a. Prepare enough for each day of use and discard extra.
b. Determine volume needed, and prepare 2 mL of SPLP Intermediate to 1 L total volume with reagent water. Alternate volumes are acceptable, the ratio must remain the same.

SPLP Intermediate (mL)	Final Volume (L)
1	0.5
2	1
4	2
10	5

c. Mix thoroughly

d. Determine the pH of the fluid. The pH must be 4.2 +/- 0.05. Record the preparation and pH in the appropriate logbook.

17. SPLP Extraction Fluid #2 - Soil Samples West of Mississippi
a. Prepare enough for each day of use and discard extra.
b. Determine volume needed, and prepare 3mL of SPLP Intermediate to 10L total volume with reagent water. Alternative volumes are acceptable, the ratio must remain the same.

SPLP Intermediate (mL)	Final Volume (L)
1.5	5
3	10

c. Mix thoroughly

d. Determine the pH of the fluid. The pH must be 5.00 +/- 0.05. Record the preparation and pH in the appropriate logbook.

18. SPLP Extraction Fluid #3

a. Reagent water is used as extraction fluid for SPLP extractions of wastes or soils that are extracted for cyanide analysis (Method 7196A).

Glassware Cleaning

See *T-TL-WI7143*.

Determining the Amount of Extract to Prepare

1. Look up the leachate sample in LIMS, under the sample data program.

2. Note the analyses requested. Information about sample requirements is found in *T-TL-WI7145*.

3. Add up the sample volume required and divide by 20 to determine how much sample must be extracted.

4. Perform an additional extraction if the volume from a single TCLP extraction is not anticipated to be sufficient to perform all the required analyses. The leachates from multiple extractions are combined and then divided for analysis.

Preliminary Solids Determination

The *Federal Register* TCLP method defines percent solids as that fraction of a waste sample from which no liquid is forced out by an applied pressure.

The following is documented in the Preliminary Determination of %Solids section of the Prefilter Template spreadsheet (Figure 1):

1. If the sample is obviously 100% solids, proceed to Procedure B.

2. Record the date, technician, sample number and bottle codes used for the %solids determination.

3. Preweigh the container that will contain the filtrate ('Weight of filtrate container')

4. Weigh out the subsample of the waste. A minimum of 100g is required. If 100g is not available contact the CSR and place comment on sample if no more volume is obtained.

   a. Record the weight of the sample in grams plus the beaker ('Weight of beaker + sample')

   b. Assemble the vacuum filtration unit with filters and pour the sample into the unit.

   c. Before applying the vaccum, ensure that the valve to the filtration unit is CLOSED. Bring the psi to 1-10 before opening the valve.

   d. If air does not flow through the filter after 2 minutes, increase the pressure by 10 psi. Repeat this step until air flows through the filter or a maximum of 50 psi is reached.

   c. Reweigh the beaker and record the weight ('Weight of beaker + sample residue'). The spreadsheet calculates the weight of sample filtered.

5. The solid phase is the material in the filter holder ('sludge cake and filter') of the waste and the filtrate is the liquid phase. The liquid phase must be stored at 0 - 6 degrees Celsius until it can be combined with the leachate portion of the waste.

6. Weigh the container with the filtrate and record the weight on the spreadsheet ('Weight of the liquid phase + filtrate container')

7. The spreadsheet determines the percent solids using Calculation A

8. If there are <0.5% solids, then go to Procedure A.

9. If there are =0.5% solids with no liquid phase entrapped in the filter, then determine if sufficient extract will be generated to support all analyses. If an additional extract must be prepared, repeat steps 2-6 of this procedure and record these weights in the Filtration of Additional Waste section of the spreadsheet. Process all solid portions to be extracted following Procedure B.

10. If there are =0.5% solids and there is liquid phase entrapped in the filter, the percent dry solids is determined.

a) Dry the solid at 80-120c until two successive weights agree to within 1% and then calculated using Calculation B.

b) A fresh portion of waste is prepared following the Preliminary Solids Determination Steps 2-6. Record these weights in the Filtration of Additional Waste section of the spreadsheet.

c) See Procedure B with the new portion of solid to be extracted. If the liquid is organic and cannot be combined with the extraction fluid then see Procedure C.

Calibration

Not applicable to this procedure

Procedure

A. If the sample contains <0.5% solids

1. Filter the waste through glass fiber filter (0.6 to 0.8 µm). The filter must be acid washed if the leachate is to be analyzed for metals. The filtrate is defined as the TCLP extract.

2. Determine and record the pH of this extract in the logbook.

3. The filtrate is considered the leachate. Enter any appropriate comments and preserve the subsamples as per *T-TL-WI7145*.

B. If the sample contains >/= 0.5% solids

1. Determine if particle reduction is required.

Reduce the solid portion to a particle size of </= 1cm in diameter, if necessary, using a sieve. When a sieve is used for reducing particle size, a sieve blank test must be performed. To perform the test, pour the extraction fluid to be used for the batch blank through the sieve and into the blank vessel to check for cleanliness. Document that the sieve test was performed on the batch sheet.

2. Weigh out a minimum of 100g of sample.

3. Determine the extraction fluid required for the solid portion of the waste.
TCLP (1311_T, 1311T_M, 1311T_Hg)

a. Weigh out 5.0 to 5.1g of the solid portion into a 150 or 250 mL beaker using a 1mm sieve if sample particle reduction is necessary.

b. Add 96.5 mL reagent water and stir for 5 minutes. Measure and record the pH. If the pH is <5.0, go to step 3 of this section and use TCLP Extraction Fluid 1.

c. If the pH is >/= 5.0, use a pipette or bottle-top dispenser to add 3.5 mL 1 N HCL to beaker, cover with a watch glass, and heat on a hot plate to 45-54 degC. The temperature must then be maintained at 45-54 degC for 10 minutes. Record the thermometer ID in the logbook.

d. Cool the slurry to room temperature. Measure the pH and record. If the pH is <5.0, use Extraction Fluid #1. If the pH is still >/= 5.0, use TCLP Extraction Fluid 2.

SPLP (1312)

e. SPLP Extraction Fluid #1 is for all solid samples east of the Mississippi River (1312_E, 1312_E_Hg, 1312_E_M), and waste and wastewater samples (i.e. non-soils)

f. SPLP Extraction Fluid #2 is for all solid samples west of the Mississippi River (1312_W, 1312_W_Hg, 1312_W_M)

g. SPLP Extraction Fluid #3 is reagent water, for samples receiving Cyanide analysis. (analysis 7196A)

4. Use a graduated cylinder to slowly add the appropriate extraction fluid at a volume 20x the weight of the solid

5. Close the extraction bottle tightly, and place in a tumbler (rotating 30 +/- 2rpm) for 18 +/- 2hours. Record the ID of the tumbler and the start time in the leachate extraction logbook. Ambient temperature must be maintained at 23 degC +/- 2 degC (69.8 degF-77.0 degF) during the extraction period.

6. Following the 18 +/- 2 hours extraction, filter the solution through a pressure filter assembled with two stacked glass fiber filters of the same pour size (one 125 mm-and one 150 mm), again taking care to increase the pressure by 10-psi increments and to not exceed 50psi if using the pressure filter. Change the filter if necessary. The filter(s) must be acid washed if the extract is to be analyzed for metals.

7. If the phases can be mixed, combine the extract with any initial filtrate from the waste (see Procedure C if the phases cannot be combined) If multiple jars of the sample were leached, combined the extracts.

8. Measure and record the pH of the extract in the logbook.

9. Use pipettes to add the appropriate matrix spikes to metals samples. In order to give the correct spike levels, 8 mL of each spike (A and B) are added to 400 mL of leachate. Adjust spike amount appropriately to maintain equivalent concentration of spike levels if leachate is different from 400 mL.

10. Subsample and preserve the leachate for the appropriate analyses in accordance with *T-TL-WI7145*

C. If the liquid and extraction fluid are not miscible (cannot be combined):

1. If the layer of liquid in the solid is organic and does not mix with water, a large quantity of sample must be filtered. This is because each layer of the final leachate, must be analyzed separately and enough solids must be collected to generate enough extraction fluid for the assigned analyses.

2. If the initial filtrate does not mix (is not miscible) with the extraction fluid, do not mix the two together. Contact Department Management and technical services. Each phase must be analyzed separately; therefore each phase must be entered as a sample.

a. Contact the Project Manager to enter an additional samples for the non-aqueous layer

b. Add the non-aqueous layer to the batch in LIMS

c. Measure the volume of both layers using a Class A Volumetric cylinder

d. Record the volume of the aqueous and non-aqueous layers in the " Volume of Leachate (Multiphastic Only) " field in the analytical batch

NOTE: All Volumes of initial filtrate and extracted filtrate must be measured and recorded, for any phase that cannot be combined

D. After tumbling a centrifuge maybe used to help separate solids from liquid. Follow directions below to operate centrifuge.

1. Turn centrifuge on

2. Fill a minimum of two centrifuge bottles with equal amount of fluid to maintain balance.

3. Label bottles with sample number
4. Shut lid and press start. Centrifuge is programmed to run for 15 minutes and will automatically stop.

5. Press open to unlatch the lid and pull out samples for filtration

Calculations

A. Percent solids:

$$\% \, Solids = \frac{(Weight \ of \ solid \ phase)}{(Total \ Weight \ to \ be \ Filtered)} x \ 100$$

B. Percent dry solids:

$$\% \, Solids = \frac{(Weight \ of \ dried \ solid \ recovered)}{(Weight \ of \ sample \ filtered)} x \ 100$$

Statistical Information/Method Performance

See specific analysis method.

Quality Assurance/Quality Control

1. A new matrix batch must be prepared each day samples are leached. Batches must not be continued. Therefore, each matrix is a new batch each day.

2. An extraction fluid tumble blank (leachate blank, LB) must be prepared for each extraction fluid used per day. A blank must be started for each 20 samples with the same fluid type. A sieve test must be performed on a blank if any of the samples on a batch are sieved. When filtering the blank after tumbling, if any samples associated with that blank are pressure filtered, the blank must be pressure filtered also to check for cleanliness of the apparatus. Log in a sample in LIMS to represent the LB following instructions in *T-TL-FRM36652*.

3. A blank must be performed after every 20 times an individual extraction vessel is used. A logbook of vessel usage is kept. Each time a vessel is used, record the date and the sample number. After 20 uses, prepare a blank in that vessel and record the blank number in the logbook. Every blank must be evaluated for contamination using the guidelines in *T-TL-WI7144*. Log in a sample in LIMS to represent the LB following instruction in *T-TL-FRM36652*.

4. Record all the sample numbers in the batch logbook. One sample in the batch must be designated as the waste type spike. Choose the first sample in the batch that has sufficient volume. Each subsample type in the batch must have a spike. Record the lot number of the spike solution used on the batch sheet. Enter the appropriate leachate information in LIMS.

5. Extraction of the solid phase must be initiated as soon as possible after initial filtration.

6. All instruments used in this procedure (i.e., pH meter and balance) must be calibrated according to an approved laboratory plan.

7. All quality control measures described in the appropriate analytical methods must be followed.

Attachment:
Figure 1 (.xls)

36652 Entering Leachate Blanks in LIMS
7143 Glassware Cleaning for Leachate Extractions
7144 Leachate Blank Evaluations
7145 Subsampling and Preservation of Leachates - ASTM D3987-12/85, EPA 1311, and EPA 1312
7229 Leachates - Containers, Preservation, and Departments by Analytical Method

---

End of document

Version history

Version	Approval	Revision information	
15	13.OCT.2020		
16	24.JAN.2022		
17	12.AUG.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-TL-WI7258**	**Volatiles by Zero Headspace Extractor (ZHE) - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015085**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-MAR-2022**	Document users: **5_EUUSLA_Leachate Preparation_All**	Responsible: **5_EUUSLA_Leachate Preparation_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precaution and Waste Handling
Personnel Training and Qualification
Sample Collection Preservation and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Preliminary Solids Determination
Procedure
Calculations
Statistical Information Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 14	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Method Reference	Changed to current LIMS Methods
Procedure	Reflects current Practice	Changed Verbiage to reference the LIMS

Revision: 13	**Effective Date:**	July 11,2019

Revision: 13	**Effective Date:**	**Changes**

Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Consolidated Departmental SOPs	Combined T-TL-WI7561 with this SOP
Cross Reference	Added Reference	Added Nonvolatile SOP
Regent and Standards	Method requirement	Updates 10N NaOH to 64.3mL for Extraction Fluid #1
Preliminary Solid Determination	Clarification	Reorganized section. Add reference to nonvolatile SOP determination
Procedure C	Enhancement	Removed repeated verbiage and added reference to Procedure B
Figure 1	Enhancement	Added new template document

Reference

1. Method 1311, *Test Methods for Evaluating Solid Waste*, SW-846, USEPA, July 1992.

2. Test Methods for Evaluating Solid Waste, SW-846 Method 1312, September 1994.

3. *Chemical Hygiene Plan,* Lancaster Laboratories, current version.

Cross Reference

Document	Document Title
T-TL-WI7143	Glassware Cleaning for Leachate Extractions
T-TL-WI7144	Leachate Blank Evaluations
T-TL-WI7151	Nonvolatiles - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312

Scope

TCLP is designed to determine the mobility of organic and inorganic contaminants in potentially hazardous waste. SPLP is designed to determine the mobility of waste samples under conditions that simulate rainwater percolating through a sample.

Basic Principles

For liquid wastes (containing <0.5% solids), the extract is defined as the filtrate resulting from filtration of the waste through a 0.6-0.8µm glass fiber filter.

For waste containing greater than or equal to 0.5% solids that have some liquid phase, the waste is filtered through a glass fiber filter and the filtrate is stored for later use with zero headspace. The extractions are performed with zero headspace over an 18 hour period.

Following the extraction, the leachate is filtered through a glass fiber filter and the final and initial filtrates are combined.

Interferences

Any interferences encountered during analysis are discussed in the individual analytical methods.

Safety Precaution and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Lab coats, gloves, and safety glasses must be worn all times when working with samples or reagents. Avoid skin contact or breathing the vapors from any reagents or samples. If samples are odorous or contain hazardous material, use a ventilation hood.

Discard or send for repair any glassware that is chipped or broken.

When working on the ZHE, use the ratchet wrench or cordless drill to prevent any wrist strain or injury. In case of injury notify your supervisor.

Personnel Training and Qualification

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Technicians using this method must have documentation of training by a qualified person and perform these procedures at least twice in that person's presence before they are considered qualified.

Sample Collection Preservation and Handling

Samples must be collected in glass with **NO** headspace, unpreserved and stored at 0°-6°C and extracted within 14 days from the date of collection.

Samples that require percent solids determination must have a minimum of 100g, plus any additional sample received to get sufficient extract for all analyses.

Certain state or QAPP specific requirements require samples to be collected in Encore sampling devices. If this is the case, samples must be frozen within 48 hours of collection, and extracted within 14 days from the date of collection.

For Method 1311_Z_48H and 1312_Z_48H (NJ), Sample hold time is 48 hours from collection.

Apparatus and Equipment

1. Tumbler – Capable of rotating the extraction vessel at 30 ± 2 RPM in an end-over-end manner

2. Zero headspace extractor (ZHE)
3. Glass fiber filter (0.6- to 0.8-µm pore size; 90 mm in diameter)
4. Tedlar® bag – 0.5 or 1.2-L or equivalent
5. Vacuum filtration system (vacuum flask, filter holder [gooch], hose.
6. 48-lb. torque wrench (± 4 lbs.)
7. Poly extraction fluid transfer bag
8. Graduated cylinders – Class A, assorted sizes
9. Gooch crucibles
10. Drill
11. Ratchet wrench
12. Balance – Capable of weighing to 0.01 g
13. pH Meter – Orion Model 210A or equivalent – Capable of 0.01 pH unit display
14. Carboy for preparing extraction fluid
15. Volumetric flasks – Class A, assorted sizes
16. Aluminum weighing pans
17. Ruler
18. 40-mL vials
19. Septa for 40-mL vials – modified to allow a Teflon®- outlet tube to pass through

Reagents and Standards

NOTE: All reagents used are ACS grade or equivalent. The recipes for the standards may be made at alternate volumes of equivalent ratios.

1. 10 N Sodium Hydroxide (NaOH)

2. Glacial acetic acid (HAC)

3. TCLP Extraction Fluid #1

Acetic acid	57 mL
10 N NaOH	64.3 mL

a. Use graduated cylinders to add 57 mL acetic acid and 64.3 mL 10 N NaOH to approximately 5 L of reagent water in a 20-L jug.

b. Dilute to 10 L with reagent water and swirl until the solution is thoroughly mixed.

c. This solution can be made in larger or smaller volumes as long as the ratio of acetic acid and NaOH to final volume is maintained.

d. The pH of this solution must be 4.93 ± 0.05.

e. Record the preparation and the pH of the extraction fluid in the LIMS.

f. This solution must be prepared daily.

4. Reagent water (SPLP Extraction Fluid #3)

a. Water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

Calibration

Not applicable to this procedure

Preliminary Solids Determination

If the waste appears to be liquid and seems to contain a very low percentage of solids, perform the solids determination. The *Federal Register* TCLP method defines percent solids as that fraction of waste from which no liquid may be forced out by an applied pressure.

1. If the total solids determination was performed on the sample for the nonvolatile leachate, those values are used. See T-TL-WI7151. If a total solids determination is required, perform the following:

a. Weigh out a minimum amount of 25 g to 26 g of the sample into a crucible and record the sample number and weight including the graduated cylinder on the spreadsheet.

b. Pour the sample into the vacuum filter apparatus and slowly apply vacuum until no liquid flows through the filter.

c. Reweigh the crucible and record the weight and residue adhered to the cylinder. The spreadsheet calculates the weight of sample filtered.

d. Weigh a Tedlar® bag. Attach Tedlar® bag, filter liquid, reweigh bag with filtrate.

e. The material in the filter holder is defined as the solid phase (sludge cake and filter) of the waste and the liquid phase is the filtrate.

f. The spreadsheet determines the percent solids using the calculation included in the attachment.

2. If the percent solids is <0.5% solids then go to Procedure A
If the percent solids is greater than or equal to 0.5% solids then go to Procedure B.
If the sample is 100% solids with no liquid phase then go to Procedure C.

Procedure

A. If the sample contains <0.5% solids

1. Assemble the ZHE and add enough sample to fill three 40-mL vials after filtration (1311_Z).

2. Filter the sample through glass fiber filters (0.6- to 0.8-µm) and collect the sample in the vials with **NO** headspace unless the sample is from California (1311_Z CA Samples only). In that case, collect the final filtrate into a single labeled Tedlar® bag and deliver to the appropriate department. This filtrate is defined as the TCLP volatile extract.

NOTE: If any sample is from California, the blank must be collected in a Tedlar® bag.

B. If the sample contains >0.5% solids and has a standing liquid phase

1. Assemble the ZHE extractor.

2. Preweigh an empty Tedlar® bag and record the weight in the volatile prefilter spreadsheet (see Figure 1).

3. Use the Percent Solids to determine amount to weigh into crucible and record the weight in the spreadsheet.

$$Amount\ (g) = \frac{25}{\%\ solids} x100$$

4. Perform particle size reduction **WITHOUT** sieving as necessary.

5. Pour the sample into the ZHE extractor.

a. Re-weigh the aluminum pan used to weigh out the initial sample and record the weight of the residue and cup.

b. The spreadsheet calculates the weight of the sample.

6. Attach the Tedlar® bag to the ZHE extractor and filter the sample through the ZHE into the Tedlar® bag until the liquid stops flowing.

a. Reweigh the Tedlar® bag with the liquid and record the weight.

b. The spreadsheet calculates the weight of the liquid in the bag and the weight of the solid in the extractor.

NOTE: If the filter in the ZHE gets clogged **DO NOT** change it. Any sample left in the ZHE extractor is considered to be the solid. If the liquid is not water-soluble a larger amount of sample must be filtered; both layers must be analyzed separately. Verify that you have enough solids to complete the TCLP analysis on the sample.

7. Record the weight of the solids in the LIMS Batch.

8. The necessary volume of extraction fluid (20× the weight of the sample to be extracted) must be measured into the carboy using a graduated cylinder.

   a. Connect the carboy to the ZHE and open the valves on both the transfer line and the ZHE.

   b. Slowly add Extraction Fluid 1 by turning the ZHE piston downward with a drill.

9. Once the entire volume of extraction fluid has been transferred from the carboy to the ZHE, close the valve on the ZHE and hand crank the piston with the 48-lb. torque wrench until it clicks.

   a. Slowly open the valve to release any air that was trapped in the extractor.

   b. Close the valve when the liquid appears.

10. Again crank the piston with the 48-lb. torque wrench until it clicks.

11. Place the extractor on the tumbler and rotate at 30 ± 2 rpm for 18 ± 2 hours.

12. Record the tumbler ID in the LIMS Batch.

13. Ambient temperature must be maintained at 23° ± 2°C (69.8° to 77°F) during the extraction.

14. When the extraction is complete, connect the Tedlar® bag containing the initial filtrate to the ZHE unit and slowly open the valve on the bag. Quickly open and close the valve of the extractor while listening for an escape of gas. If no gas escapes, the extractor had a leak during the extraction and the sample must be repeated.

   a. In addition, the extractor must be checked for leaks by pressurizing it to 50 psi and submerging it in water.

   b. Check for air bubbles coming from any of the fittings. If air bubbles are present, check all fittings and inspect O-rings and replace them if necessary.

   c. Reassemble and pressurize the extractor and repeat the submersion leak check. If the extractor continues to leak, remove it from service and contact the manufacturer.

15. Filter the entire sample extract through the filter already in the ZHE and into the Tedlar® bag unless the filtrate is not water-soluble.

   a. If the initial filtrate is not water-soluble, **DO NOT** try to mix them together. They must be analyzed separately. Notify your supervisor to contact the appropriate person(s).

   b. If the sample is scheduled for 1311_Z or 1311_Z_48H, collect the final filtrate into three 40-mL glass vials with no headspace.

   c. If the sample is from California 1311_Z(CA samples only) collect the final filtrate into a single labeled Tedlar® bag and deliver to the appropriate department.

   NOTE: If any sample is from California, the blank must be collected in a Tedlar® bag.

C. If the sample is 100% solid and contains no liquid

1. Weigh out 25 g to 26 g of sample into an aluminum weighing pan and record the weight in the LIMS Batch.

2. Pour the sample into the ZHE extractor.

3. Add 500mL of Extraction Fluid #1 to the extractor, release any trapped air and pressurize the ZHE following Procedure B 8-9

4. Verify that 500 mL of extraction fluid was added to the extractor by measuring the length of the rod protruding from the bottom of the extractor using a ruler.

   a. At least 4 3/8" of the rod must be visible or the extractor does not contain 500 mL of fluid.

   b. If the required length is not visible, add additional fluid following Procedure Steps B.8-9. until the extractor contains 500 mL of extraction fluid.

   NOTE: This step is only performed if 25 g to 26 g of sample was weighed in step C.1.

5. Tumble the samples and deliver samples to departments.

Calculations

1. Calculation for % solids

$$\%\ Solids = \frac{Weight\ of\ sample\ recovered}{Weight\ of\ sample\ filtered} \times 100$$

2. Calculation for % dry solids

$$\%\ Dry\ Solids = \frac{Weight\ of\ dried\ solid\ recovered}{Weight\ of\ sample\ filtered} \times 100$$

Statistical Information Method Performance

Not applicable to this method.

Quality Assurance/Quality Control

1. A minimum of one blank must be performed for every 20 samples extracted in a day. This blank is not the same as the vessel blank.

2. A vessel blank must be performed after every 20 times an individual ZHE is used. A logbook of vessel usage is kept. Each time a vessel is used, record the date and sample number. After 20 uses, prepare a blank in that vessel and record the blank number in the logbook. Every blank must be evaluated for contamination using the guidelines in T-TL-WI7144.

3. Record all sample numbers and the batch blank number in the batch logbook.

4. All instruments used in this procedure must be calibrated according to an approved laboratory plan.

5. All quality control measures described in the appropriate analytical methods must be followed.

Attachment:
Figure 1 (.xls)

7143 Glassware Cleaning for Leachate Extractions
7144 Leachate Blank Evaluations

End of document

Version history

Version	Approval	Revision information	
12	15.OCT.2018		
13	11.JUL.2019		
14	17.MAR.2022		

Volatile Pre-Filtration Data

Date:	
Technician:	
Non-Volatile Sample# (%Solids Determination Data):	
Volatile Sample #	

Preliminary Determination of %Solids			**EPA 1311 / EPA 1312**
Percent Solids from Non-Volatile worksheet		DO NOT ENTER IF VOLATILE ONLY	
Weight required for 25g solid phase		g	
Percent Solids (Volatile only)			
Pre-filtration			
Weight of filtrate container		g	7.3.1
Weight of cruicible + sample		g	7.3.4
Weight of crucible + sample residue		g	7.3.8
Total weight of sample to be filtered (**25 g minimum**)	0.0	g	
Post-filtration			
Weight of liquid phase + filtrate container		g	7.3.9
Weight of liquid phase	0.0	g	
Weight of solid phase	0.0	g	

Comments

Section
Percent Solids (Volatile only)
Total weight of sample to be filtered (**25 g minimum**)
Weight of liquid phase
Weight of solid phase

Calculation

(Weight of solid phase) / (Weight of sample to be filtered)

(Weight of crucible + sample) - (Weight of crucible + sample residue after loading sample onto filter)

(Weight of liquid phase + filtrate container) - (Weight of filtrate container)

(Weight of sample to be filtered) - (Weight of liquid phase)

Validated
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19
KNB 6/17/19

eurofins	Always check on-line for validity. **Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA**	Level: **Work Instruction**
Document number: **T-MET-WI7965**		
Old Reference: **1-P-QM-WI-9015067**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **27-APR-2022**	Document users: **6_EUUSLA_Metals_Hg Analysis, 6_EUUSLA_Metals_Hg Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Sample Analysis
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Data Review
Instrument Maintenance and Repair

Revision Log

Revision	20	**Effective Date**: This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Header	Clarification	Update to reflect current company name
Procedure B.2.c.	Clarification	Updated to reflect current process
Sample Analysis 3. 4. and 6.	Current Process	Updated to reflect current process

Revision	19	**Effective Date**: Nov 24,2020
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Current Practice	Updated QC IDs
LIMS ID	New procedure	Added new LIMs method IDs
Cross Reference	Update	Added Do Not Use Form and verification SOP
Basic Principals	Current Process	Updated to reflect current process
Sample Collection, Preservation, and Handling	Method Required	Added information regarding preservation hold time
Apparatus and Equipment	Addition	Added products used for analysis
Reagents and Standards	Clarification	Added note about deviation from method
Calibration	Update	Criteria has been moved to new SOP and removed wording of old LIMs
Procedure	Update/Enhancement	Added direction for new LIMs and feature in Envoy
Sample Analysis	Update	Updated to current practice
Calculations	Enhancement	Add units to water sample
Quality Assurance/Quality	Update	change to reference Verification SOP

Control 2		
Data Review	Update	Updated to reflect current practice
Instrument Repair and Maintenance	Enhancement	Added Q-E*QA-FRM6871*

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, February 2007.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A, September 1994

4. Method 245.1 (rev. 3), Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectroscopy, USEPA 600/R-94/111 May 1994.

5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11948	Preparation of Solids by EPA 7471A or B for Mercury Analysis
T-MET-WI11924	Digestion of Aqueous Samples by SW-846 Method 7470A
T-MET-WI26740	Digestion of Aqueous Samples for Mercury by EPA 245.1
T-MET-WI9084	Preparation of Mercury Solutions and Standards
QA-SOP11178	Demonstrations of Capability
QA-SOP11901	Instrument Maintenance and Calibration
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11886	Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples
QA-FRM6871	Do Not Use - Environmental
T-MET-WI35797	Metals Data Verification Process

Scope

This method is used for determination of mercury in aqueous and solid samples. The optimum concentration range for this method is 0.2 to 5.0 ppb.

Matrices - EPA 7470A and EPA 245.1 are applicable to water analysis. EPA 7471A and EPA 7471B are applicable to soil and tissue analysis. EPA 245.1 is applicable to drinking water analysis.

Method Detection Limits (MDLs) are based on annual statistical evaluation of laboratory data and are subject to change. The current MDLs and RLs are maintained in the LIMS, and are subject to change without notification.

Basic Principles

The Leeman Labs Mercury Analyzer utilizes continuous flow technology with drying of the sample vapor for the analysis of mercury by automated vapor generation. The reaction for the mercury analysis is a simple reduction reaction. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride. An inert gas is used to sweep the volatile mercury into the absorption cell in the optical path of the atomic absorption spectrophotometer. The dry vapor enters one path of the optical cell, which has been optimized for fast response (small diameter), and sensitivity (long length).

Mercury is measured using a solid state detector with a wide dynamic range and a mercury source that delivers a stable source of emission at 254 nm. The signal is referenced to the simultaneous absorbance of air through direct view of the lamp. The system adds Stannous chloride to the samples via a "Y" connection in the pump tubing. The peristaltic pump then carries the sample/stannous mix to the liquid gas separator. Argon gas is bubbled through the liquid and used to transport the volatile mercury into the detector. The mercury is reduced with stannous chloride to liberate mercury metal and Tin (IV) chloride.

Definitions

1. CRA - Low Level Check Standard

2. MSA – Method of Standard Additions

3. SPLP - Synthetic Precipitation Leaching Procedure

4. TCLP – Toxicity Characteristic Leaching Procedure

5. QC Type Designators:

    a. BKG – unspiked background sample

    b. DUP – Sample Duplicate

c. MS – sample spike

d. MSD – Sample spike duplicate

e. MB –Preparation Blank (Water/ Solid). Equivalent to a Method Blank (MB)

f. LCS/LCSD - Laboratory Control Sample/Laboratory Control Sample Duplicate

Interferences

Potassium permanganate is added to samples to eliminate possible interference from sulfide. Concentrations as high as 20 mg/L of sulfide as sodium sulfide do not interfere with the recovery of added inorganic mercury from reagent water.

Samples high in chlorides require additional permanganate (as much as 25 mL) because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253.7 nm. Take care to ensure that free chlorine is absent before the mercury is reduced and swept into the cell by using an excess of hydroxylamine sulfate (or chloride) reagent.

Copper has been reported to interfere; however, copper concentrations as high as 10 mg/kg had no effect on recovery of mercury from spiked samples.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Sulfuric acid (H2SO4) – This acid is a strong oxidizing agent and can cause severe burns. Sulfuric acid spills are extremely slippery, adding to the danger. Always use in a fume hood. Never mix with concentrated HCl or concentrated KMNO4 to avoid a violent reaction (explosive splattering and extreme heat).

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds. Samples that contain dust may be hazardous. Open in a fume hood.

Samples that may contain cyanide require special precautions to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the system to set up sequences, perform the calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to *QA-SOP11178* for more guidance on these options.

Sample Collection, Preservation, and Handling

Aqueous samples are collected in plastic or glass containers, preserved to a pH of <2 with nitric acid. Samples must be analyzed within 28 days of collection.
NOTE: Regulatory Drinking Water samples (EW) are collected in 1-L plastic or glass containers and must be analyzed by EPA 245.1. Drinking water samples are not analyzed for dissolved mercury.

Solid samples are collected in glass containers and stored at 0° to 6°C not frozen. Samples must be analyzed within 28 days of collection.

Dissolved Mercury: Samples to be analyzed for soluble mercury requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and are collected in plastic containers and preserved to a pH of <2 with HNO3.

Samples must be held for 16 hours following preservation and checked again prior to processing.

Store sample digestates in plastic bottles at room temperature. Store standards and digestates separately.

Apparatus and Equipment

1. Hydra II Mercury Analyzer
2. Leeman Labs Envoy software – a windows based program to help navigate the software.
3. 15-mL graduated polypropylene screw cap tubes (certified ± 1%)
4. 10-mL sterile disposable syringes
5. 25-mm syringe filters, PTFE, 0.45-µm
6. 40-mL clear glass VOA vials and lids
7. 50-mL polypropylene containers and covers (digestion vessels for block digestion) - certified clean and Class A equivalent

Reagents and Standards

A. Store all standards and reagents in polyethylene or glass containers at room temperature. Label the container with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

NOTE: Standard/ spiking concentration and reagent vendors are subject to change without notification.

B. Reagents use the following or equivalent:

1. Nitric acid, 70.0% to 71.0% HNO3, Fisher Trace Metal Grade reagent, 1.428 g/mL; Store in glass container at room temperature. Follow manufacturer's expiration date.
2. Sodium chloride, NaCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
3. Hydroxylamine hydrochloride, NH2OH·HCl, J.T. Baker, Certified ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
4. Reagent Water
5. Stannous chloride solution, 10% SnCl, Baker Analyzed reagent, ACS. Store in plastic container at room temperature. Follow manufacturer's expiration date.
6. Hydrochloric acid, HCl, 36.5% to 38.0%, Fisher Trace Metal Grade reagent, 1.194 g/mL or equivalent. Store in glass container at room temperature. Follow manufacturer's expiration date.

C. For the preparation of calibration blanks, ICBs, CCBs, calibration standards, ICVs, CCVs, CRAs, Method Blanks, LCSs and Matrix Spikes solutions, see Form *T-MET-WI9084*.

D. General solutions - See Form *T-MET-WI9084*.

NOTE: Method states to use Sulfuric acid when making Stannous Chloride, however, manufacture requires HCl. The lab practices this deviation in order to maintain instrument performance.

Calibration

Leeman Labs Hydra II Mercury Analyzer

1. The software program has been developed to check the correlation coefficient of the curve, run appropriate ICV and CCVs at proper intervals, and check the percent recoveries of the ICV and CCVs.
2. Due to the instrument software limitations, the calibration blank is included in the correlation coefficient calculation.
3. A recalibration and reread of any associated samples is required for any checks that fall outside the windows.
4. For the frequency, acceptance criteria and corrective action see SOP *T-MET-WI35797*
5. For the preparation of calibration standards, see *T-MET-WI9084*.
6. The calibration is part of each run shown in the LIMs system

Procedure

A. Sample Digestion

1. Aqueous samples are digested by EPA 7471A/B according to SOP *T-MET-WI11924*.
2. Aqueous samples are digested by EPA 245.1 according to SOP *T-MET-WI26740*.
3. Solid samples are digested according to SOP *T-MET-WI11948*.

B. Leeman Labs Hydra II Mercury Analyzer Operation

1. Instrument Setup

a. Turn ON the power to the instrument (switch in the back) and computer.

b. Ensure that Argon supply is set to 15 psi.

c. Double click the Envoy icon on the desktop to initialize the instrument software.

d. Put on the peristaltic pump cassettes. Do not over tighten. At the end of shift, remove them from the pump.

e. Place levers in the 1 o-clock position to avoid stalling the pump. Do not fully tighten at this point.

f. Check that the rinse bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. Refill the rinse tank with a 2.0% Hydrochloric Acid (HCl) solution. For preparation of 2.0% HCl solution, see *T-MET-WI9084*.

g. Check that the 10% stannous chloride bottle is full and Luer connections are tight. Only a 'light' finger tightening is required. For preparation of 10% stannous chloride, see *T-MET-WI9084*.

h. Click the start icon on the Tool Bar to turn on the peristaltic pump and press the green play button.

i. Check to see that the lamp, pump and gas turn on. If necessary, open the Method/Instrument Control Panel and turn them on and set appropriate parameters.

j. When the pump is turning, tighten the cassettes by lowering the levers to a horizontal position. Allow 20 minutes for lamp and pump equilibration.

a) There is an option to use Chart Recorder which displays when the instrument is optimized. To utilize this feature follow these steps
   i. Observe Instrument
   ii. Stabilization Tools
   iii. Chart Recorder : resize window to ~1200 seconds or 10mins.

k. Inspect all system connections for leaks.

l. The system is now ready to be optimized for automated analysis.

2. Autosampler and Run Setup

a. Clear previous analyses
   i. Analysis Tab
   ii. Tools
   iii. Database Manger
   iv. Create Archive

b. Scan the samples from their label that is on the sample itself into the Envoy program under the Sequence Tab
   i. Select Sequence
   ii. New
   iii. Select correct rack size
   iv. Scan samples in order

c. Check QC
   i. Method Tab
   ii. QC control checks tab
   iii. Modify QC as needed to set pass/fail flags

d. Press Run Sequence (Test tube rack icon): The calibration and sequence will run automatically with CCV and CCB every 10 analyses.

e. The results of the calibration and samples can be observed in the Analysis Tab.

Sample Analysis

1. Filtering Samples

a. Samples that are cloudy or have particulate suspended in solution must be filtered prior to analysis.

b. Difficult matrix samples or samples with limited volume may be filtered using a 10-mL sterile disposable syringe fitted with a 0.45 um PTFE syringe filter.

c. If any samples are filtered, the MB and the LCS on the batch must be filtered.

d. Document all filtrations on the run cover sheet.

2. Dilutions

a. Dilute samples with appropriate matrix matching solution when necessary to yield a response that falls within the calibration range.

b. Stop run if sample is above 4.5ppb. Rinse system and dilute sample immediately. Reanalyze. If the subsequent sample analyzed after an over range sample has a detection, reanalyze the subsequent sample as well.

c. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

3. Data Export: follow the below step by step instructions
   On the instrument
   a. Analysis Tab
   b. Report Tab
   c. Select Statisics
   d. Select Load
   e. Select TALS Export
   f. Select OK
   g. Check all data on this run
   h. Select Report
   i. Select CSV File
      1.Name CSV file (2034301MO7)
   j. Select Save
   k. Open IDAT sequence shortcut on desktop
   l. Highlight and copy run file
   m. Open TALS import file on desktop and paste run

4. Attach raw data to run: follow the step by step instructions
   On the instrument
   a. Analysis Tab
   b. Report Tab
   c. Select Detailed
   e. Select Load
   f. Select Detailed TALS
   g. Select OK
   h. Check all data on this run
   i. Select report
   j. Select CSV file
      1.Name CSV file (2034301MO7)
   k. Select Save

NOTE: Do not paste this report into the TALS import file.

5. See Data Review section for when data is in LIMs system. See SOP *T-MET-WI35797* for final data review.

6. Shutdown

   a. Place Stannous Chloride and rinse tubing into 2% HCl for minimum of 5 minutes.

   b. Place tubing into reagent water for a minimum of 5 minutes

   c. Remove tubing from reagent water to allow the aspirating of air for a minimum of 5 minutes.

   Never leave bottle of Stannous Chloride and rinse connected to the instrument if the pump clamps are released because siphoning can occur and cause damage to the instrument.

NOTE: Do not turn off power switch to instrument on a daily basis.

Calculations

1. Final Result

   a. Water sample (ug/L)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

   b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\% \, Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\% \, Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)

Take 4 identical aliquots of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution. Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2/n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum\{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$$

The correlation coefficient (r) for the least squares fit must be ³0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

Statistical Information/Method Performance
Generate MDLs and LOQs according to *QA-SOP11892*. The department supervisor maintains annual study data.

QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data. The limits are maintained in the LIMS for the relevant analysis numbers.

The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

Quality Assurance/Quality Control
Batch Quality Control

1. For the preparation and concentrations of Batch Quality Control see *T-MET-WI9084*.

2. For the frequency, acceptance criteria and corrective action see *T-MET-WI35797*.

3. For EPA 7470A, 7471A, and 7471B, a digestion batch is up to 20 samples. Each batch must contain a MB, LCS, BKG, DUP, MS and MSD (an LCSD is used if there is insufficient sample for an MSD).

4. For EPA 245.1 Rev 3, a digestion batch is up to 10 samples. Each batch must contain a MB, LCS, BKG, DUP, and MS (an LCSD is used if there is insufficient sample for an MSD).

Data Review

1. To view imported analytical batch in the LIMS, follow these steps:
    a. Go to Analyst
    b. Choose Analyst Desktop II
    c. Select the instrument where the data is pulled from on the left hand side by expanding the Instrument option
    d. Data will be listed with a designated analytical batch number given by the LIMs system under the instrument where it was analyzed.
    e. Record this designated analytical batch number on prep batch paperwork.

2. How to complete 1st level review of analytical batch
    a. Once analytical batch is located from following steps in #1 double click to open the batch
    b. Choose Edit button
    c. When asked if data should be processed choose No
    d. Edit Standards/Batch QC
        i. Scan calibration standards from prep batch sheet
    e. If PDS is on analytical run enter PDS data
        i. Go to the Reagents tab at the bottom
        ii. Scan lot number of spike used in PDS
        iii. Enter volume of spike used for PDS. Normally this would be 0.1mL to a final volume of 10mL
        iv. Go to Worksheet Tab and enter a final volume for the PDS. Normally, this would be 10mL
    f. Calculate Results
        i. Go to Samples Results Tab

ii. Highlight all samples by using Ctrl + L
iii. Right click and choose Identify
iv. Once samples are and calibration and all identified it is always a good practice to recalculate by hitting F6

g. Evaluate the Results
i. Go to the Sample List tab
ii. Either look at each line individually to ensure calibration and data are valid or filter by job number and evaluate data
iii. Look for recoveries in the spiked calibration as well as the batch QC
iv. Look for contamination in blanks
v. Look for E flags for samples that need to be diluted. If they were diluted check that the dilution makes sense.

h. Enter Batch Information
i. Prior to saving batch right click and chose View Batch Information or press Ctrl + 1
a. If you try to save batch without going to this screen the program will prompt you
ii. Enter analyst
iii. Enter Stannous Chloride ID lot #
iv. Enter tube lot #s if dilutions were made, filtering of samples occurred, or PDS was used
v. Enter lot number of filters used
vi. Hit Ok to save

i. Attach Raw Data
i. Go to IDAT Sequence folder \\lldata\Env\IDAT-Sequences
ii. Find the analytical run by searching the unique run number given to it by the analyst.
iii. Double Click on file once located
iv. Once file is open, Save As pdf file and name the file the analytical run number give to the data by the LIMs system.
v. Open Sharefile in Google Chrome
vi. Go into the Personal Folder and choose Browse Files
vii. Find File and select Upload
viii. Once uploaded into Sharefiles go into the analytical batch in the LIMs system and choose Docs button at top
ix. Right click and select Add New Document
x. Select the document in the Personal Folder in Sharefiles and hit Select
xi. Hit OK and now the raw data file is attached into the analytical batch

j. 1st level data
i. Once data has been confirmed by analyst to be valid and the raw data is attached go to Sample List tab
ii. Highlight calibration and samples that are valid (if all samples Ctrl +L to highlight)
iii. Either do Ctrl + Shift + 1 to turn status to 1st Level or right click, Review Sample, Choose 1st Level Review

Instrument Maintenance and Repair

A. Routine Maintenance

1. Replace the pump tubing as needed under normal daily usage.
   a. Inspect tygon supply lines for discoloration and cloudiness
   b. Check peri-pump lines for flattening

2. As needed for foamy samples, replace liquid/gas separator
   a. Remove and rinse the clear front panel
   b. For severe foam replace entire gas box module

3. If liquid has entered the optical cell, check the optical cell and windows, and if needed, clean the optical cell.

   a. Wipe the optical cell with a soapy solution (one drop of liquid Ivory soap to 500 mL reagent water) and warm tap water.

   b. Rinse with reagent water and dry. To speed the drying of the optical cell, connect the heater plug to the optical cell with the windows off for several minutes.

   c. Clean the quartz windows with methanol and a piece of lens paper.

4. Document any maintenance in the Mercury maintenance logbook located next to the instrument.

NOTE: Detailed instructions for the maintenance and troubleshooting of the Leeman Labs Mercury Analyzer can be found in the Leeman Labs Hydra II Mercury Analyzer Manual.

B. Taking an instrument/analysis out of service/returning an instrument/analysis to service.

NOTE: In the event of an equipment failure, perform the steps in SOP *QA-SOP11901*:

1. Document the nature of the failure in the maintenance logbook.

2. Document how and when the defect was discovered.

3. Notify a supervisor or experienced analyst to determine a person who can decide on appropriate action to take.

4. The instrument must be clearly tagged as Out of Service. The tag must be printed from Q-E*QA-FRM6871* contain the following information:

   a. Date taken out of service.

   b. Employee who took the instrument out of service.

c. Reason for tagout.

5. The date taken out of service and the date returned to service must be documented in the logbook.

6. Document any corrective action that was taken and the result of that corrective action (i.e., system calibration within specifications, etc.) to bring the equipment back into service.

7. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument.

8. After a repair, document whether the function has been fixed. Calibration or verification activities are to be performed before the instrumentation is put back into service.

11178 Demonstrations of Capability
11886 Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits
11901 Instrument Maintenance and Calibration
11924 Digestion of Aqueous Samples by SW-846 Method 7470A
11948 Preparation of Solids by EPA 7471A or B for Mercury Analysis
26740 Digestion of Aqueous Samples for Mercury by EPA 245.1
35797 Metals Data Verification Process
6871 Do Not Use - Environmental
9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
18	29.JUL.2019		
19	24.NOV.2020		
20	27.APR.2022		

eurofins	Always check on-line for validity. **VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D**	Level: **Work Instruction**
Document number: **T-VOA-WI8194**		
Old Reference: **1-P-QM-WI- 9013078**		
Version: **11**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **11-MAY-2022**	Document users: **6_EUUSLA_GC/MS Volatiles_GC/MS Auditors/Verifiers, 6_EUUSLA_GC/MS Volatiles_Level II Peer Review, 6_EUUSLA_GC/MS Volatiles_Management, 6_EUUSLA_GC/MS Volatiles_SW846 8260B/C Water**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/method Performance
Quality Assurance/Quality Control
Table 1
Table 2
Table 3

Revision Log

	Revision: 11	**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Header	Update	Added UST LIMs IDs

	Revision: 10	**Effective Date:** 08.APR.2021
Section	**Justification**	**Changes**

	Revision: 10	**Effective Date:** 08.APR.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Cross Reference	Update	Added reference to QA SOP for information regarding LLOQ
Reagents and Standards 2.d	Correction	Updated TSC Figure references
Calibration D	Enhancement	Added reference to Figure 3 for preparation
Quality Assurance/ Quality Control	Enhancement	Added reference to QA SOP for LLOQ procedure
Table 2	Clarification	Added note concerning alternative ion selection for quantitation
Figure 1-7	Update	Added Figure # and updated method to include 8260D, removed 8260A

Reference

1. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.

1. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW-846 Method 8260D, June 2018.

2. Determinative Chromatographic Separations, SW-846 Method 8000D, Revision 4, July 2014.

3. Purge and Trap for Aqueous Samples, SW-846 Method 5030B, December 1996.

4. Purge and Trap for Aqueous Samples, SW-846 Method 5030C, Rev 3, May 2003.

5. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.

6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-VOA-WI7691	Glassware Washing
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629	GC/MS Volatile Standards Traceability
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373	GC/MS Volatiles Audit Process
T-VOA-WI8400	Level II Review of GS/MS Volatiles
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is suitable for the determination of the target compounds listed and maintained in the LIMS (Laboratory Information Management System) for aqueous matrices. Associated MDLs/LOQs are also listed in the LIMS under the analysis number and/or Project Information lists. Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration. Compounds other than those listed in the LIMS for this group of master scans are analyzed using USEPA SW-846 Method 8260C. Theoretical Standard Calibration (TSC) Sheets are included in the Appendix (Figures 1-7). These TSC sheets are to serve as examples only and may not reflect most current version in use. Due to poor purging efficiency or poor gas chromatographic performance, some analytes require calibration at higher levels and higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles

A 5-mL or 25-mL sample or a dilution of a sample is placed in a specially designed purge vessel. The sample is purged with an inert gas and the effluent gas passed through a sorbent tube where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed on to the head of a gas chromatographic (GC) capillary column. The GC column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

When a compound reaches the Mass Spectrometer, it is bombarded by high-energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first standard analyzed in the ICAL. The C5 range retention time is 0.1 minutes before the peak apex of pentane. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

Interferences

Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated waters can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, safety glasses, lab coats, and gloves. Neat compound sources and stock solutions must be collected into a lab pack upon expiration. The lab pack is delivered to Safety personnel for appropriate disposal. Expired secondary standard solutions in methanol must be disposed of as solvent waste. Pour expired secondary standard solutions into the appropriate solvent waste collection container. Aqueous calibration standard mixes are disposed of as nonhazardous aqueous waste due to the low concentration. Samples with a pH ≤2 are taken to storage until disposal in an acid waste container.

Personnel Training and Qualifications

Education Requirement: A 4-year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or one to three years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in his/her training record. Specifically, each new chemist trains with an experienced chemist for the first 12 weeks depending on the individual and his/her previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time is less if the new chemist has prior relevant experience in GC/MS and/or analytical chemistry background.

During the training period, the new chemist learns daily maintenance, calibration techniques, data and library search review, and forms generation. He/she is also required to read all relevant SOPs and EPA methods. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP. Each analyst must perform an Initial Demonstration of Capability to measure proficiency. Thereafter, an annual Demonstration of Capability is performed and maintained in the analyst's training records.

NOTE: A separate Demonstration of Capability for GRO is required.

Sample Collection, Preservation, and Handling

The samples to be analyzed with this method must be stored in a refrigerator at 0°C to 6°C, not frozen. Samples are collected in 40-mL vials with no headspace. Preserve samples to a pH of <2 in order to prevent degradation of aromatic compounds that are present in the sample. 1:1 HCL is the recommended preservative. Preserved samples must be analyzed within 14 days of collection; those that are not preserved must be analyzed within 7 days of collection. Samples to be tested for Acrolein and Acrylonitrile must be collected without headspace in vials that are preserved to a pH range of 4.0 to 5.0 and must be analyzed within 7 days of collection. Samples may also be submitted in unpreserved vials for Acrolein and Acrylonitrile, but must be analyzed within 3 days of collection. Unpreserved samples from South Carolina for Acrolein and Acrylonitrile do not meet RCRA requirements and must be qualified. Samples submitted outside of the pH range or analyzed outside of the specified holding time windows will be reported with a comment on the final analytical report.

Apparatus and Equipment

1. Gastight micro-syringes – 1 to 1000 µL (various sizes)
2. 5-mL gastight syringes
3. Analytical balance, capable of accurately weighing ±0.0001 g
4. Glassware
   a. Class-A Volumetric flasks with ground-glass stopper
   b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon™/silicone septa
   c. Mininert vials, 1 mL, 2 mL, and 5 mL

5. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.

6. Autosampler – OI Analytical 4551, OI Analytical 4552, Archon, or equivalent meets the requirements of this method.

7. Spiker unit – OI analytical Model 4551/4552 SAM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551/4552 autosampler to automatically introduce 1 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.

8. GC/MS system – The Agilent 5890GC/5972 MSD, Agilent 6890GC/5973MSD, Agilent 6890GC/5975MSD and Shimadzu GC/MS QP5000 meet the requirements for this method.

9. Data System/Computer/Software – this is interfaced to the GC/MS system that continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.

10. GC Columns

a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

c. Column 3 – 20M × 0.18 mm ID DB-VRX capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

NOTE: Refer to *T-VOA-WI7619* for instrumentation maintenance and troubleshooting.

Reagents and Standards

A. Reagents

1. Reagent water is defined as water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Methanol, Purge and Trap Grade or equivalent.

B. Standards

See *T-VOA-WI7629* for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as ≥96%. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at ≤-10°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

a. For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.

b. 8260A Surrogate standard spiking solution (8260SS) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier.

c. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d10) is prepared

in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d10) is used sometimes as an auxiliary ISTD.

d. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.

e. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

To prepare stock standards from neat compounds:

(1) Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.

(2) Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

(3) The stock standard solutions are stored in Teflon™-sealed screw-capped vials at ≤-10°C. The compound name, concentration, date prepared, expiration date, preparer name and storage method must appear on the bottle.

(4) Replace in-house prepared stock standard solutions every 6 months.

2. Secondary dilution standards - Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required to produce a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these are diluted down individually or combined together with other mixes. The working standard is tested according to *T-VOA-WI7629*. The verified working standard is poured into Teflon-lined screw-capped GC vials or mininert vials and stored at ≤-10°C. A designator indicating the standard name, month, and day of preparation and expiration date must be on the standard vials. The designator and all data pertaining to the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies depending on the actual stock concentration.

b. IS/SS spiking solution – Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.(50& µg/L for 5-mL purge, 10 µg/L for 25-mL purge).

c. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 1, 4, 10, 20, 50, 100, and 300 ppb for 5-mL purge analysis. Suggested calibration levels are 0.2, 0.5, 1, 2, 5, 10, and 25 ppb for 25-mL purge analysis. A Theoretical Standard Concentration (TSC) sheet is filled out for all initial calibrations (see Figures 1, 2, and 5). Replace calibration spiking solution every 2-4 weeks (1 week for standards containing gases).

d. Matrix spiking solution – Prepare second source solutions in methanol that contain the compounds of interest at known concentrations. A TSC sheet is filled out for all quality control samples (see Figures 3, 4 and 6). These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates. Therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace matrix spiking solution every 2-4 weeks (1 week for standards containing gases).

Store all standard solutions at ≤-10°C and protected from light.

Preparation of Glassware

All glassware is cleaned according to *T-VOA-WI7691*.

Calibration

A. Instrument conditions

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.

2. An example of purge and trap conditions are listed below:

Purge Gas	Helium
Purge Flow	35 - 45 mL/min
Purge Temperature	40°C for 8260C waters
Purge Time	11 minutes
Desorb Temperature	190°- 220°C
Desorb Time	0.5 to 4 minutes **
Bake Temperature	180°-220°C
Bake Time	5 – 16 min

**Range as suggested by the purge and trap instrument manufacturer

NOTE: Purge and trap conditions are changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument is found in the appropriate instrument maintenance log.

3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	Column 1	**Column 2**	**Column 3**
Column liquid phase	DB-624	DB-624	DB-VRX
Carrier gas	Helium	Helium	Helium
Carrier gas flow	0.8 mL/min	0.6 mL/min	0.6 mL/min
Make-up gas flow	None	None	None
Initial temperature	45°C	45°C	45°C
Initial hold time	4.5 min	2.5 min	4 min
Temperature ramp	12°/min until 100°C then 25°/min until 240°C	12°/min until 100°C then 25°/min until 235°C	25°/min until 60°C then 36°/min until 240°C
Final temperature	240°C	235°C	240°C
Final hold time	None	.02 min	1 min

4. The recommended mass spectrometer operating conditions are listed below:

Mass range:	35 – 300 amu
Scan time:	One scan cycle per second or less and resulting in at least five scans per chromatographic peak

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions that give the performance required by the method are acceptable.

B. Tuning

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp is increased and the initial temperature and flow rate is different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

NOTE: All standards, samples, and associated quality control samples must be analyzed with the same MS parameters as those used to obtain a successful tune.

C. Initial calibration

1. The initial internal standard calibration consists of analyzing seven distinct levels of analyte concentrations and producing response factors for each compound (six levels are required if second order regression fits are used). Calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration. Refer to Figure 1, 2 or 5 for the preparation of the calibration standards and Figure 7 for preparation of GRO standards. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte concentration. Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

NOTE: 5 levels of standard are required by the method.

a. When using an OI 4552 or OI 4551 autosampler, the standards (including target and surrogate compounds) are prepared and poured into 40-mL vials with Teflon™-lined septa. A 5-mL or 25-mL aliquot is withdrawn from the vial by the autosampler. The aliquot is transferred through the spiker unit to add the IS/SS spiking solution and then transferred to the sparge vessel.

b. Purge and desorb according to instrument conditions listed in Calibration A.

c. Collect GC/MS data until the end of the GC run.

d. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

e. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The calibration is valid for 12 hours from the injection of the BFB tune standard, at which time a new tune check and a continuing calibration check standard are evaluated prior to the analysis of additional samples. The following table describes the guidelines for an acceptable initial calibration:

Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	1. % RSD of≤20% is required for all analytes. 10% of the analytes may fail this criteria. 2. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 3. Minimum response factors must be met for select compounds. See Table 3.	1. Any target analyte with a %RSD of ≤20% must use the average RRF for quantitation. For any analyte in which the %RSD >20%, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥0.995). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is >0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is <0.995 for linear or <0.99 for quadratic, recalibrate. Supervisory approval is required for exceptions to these guidelines. If >10% target analytes fail, recalibration is required. If a linear or quadratic curve fit is used for a target analyte, the calibration data must be refit back into the calibration model for all calibration levels. Percent error between the calculated and expected amounts of an analyte should be ≤30% for all standards. For some data uses, ≤50% may be acceptable for the lowest calibration point. NOTE: Quadratic regression cannot be used for South Carolina compliance samples. 2.-3. Perform system maintenance and recalibrate.

**Consult USEPA method 8000D for non-linear curve fitting techniques/guidelines

f. Each level is analyzed as described above. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative

response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for fluorobenzene. Although four internal standard compounds are spiked for the 8260C analysis, only one, fluorobenzene, is used for the quantitation of the GRO result.

Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be ≤20%. If the calibration meets this requirement then the average RRF is used to calculate sample concentrations. If the %RSD is >20% then re-analysis of one or more levels can be necessary before the calibration is valid.

D. Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130% and is prepared according to the TSC sheet in Figure 3. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken. For the GRO analysis, the ICV is prepared according to the TSC sheet in Figure 7 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

E. Continuing calibration verification (CCV) – The CCV is performed by analyzing a CCV standard in subsequent tune periods after an initial calibration. The CCV (prepared daily due to aqueous nature) is analyzed at 50 ppb for 5-mL purge waters and 10 ppb for 25-mL purge waters. The CCV is considered valid when the criteria listed below are met:

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	1. % Drift of ≤20% is required for all analytes. No more than 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of −50 % to +100 % from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3.	1.-4. In the event that the continuing calibration verification (CCV) standard fails any of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

A 1100-ppb standard (prepared daily due to aqueous nature) is analyzed for the GRO analysis. The calibration is considered valid if the percent drift is ≤20%. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be −50% to +100% of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

F. MDL Sensitivity Check- A MDL Sensitivity Check must be analyzed in cases where compounds fail to meet the % drift criteria in the CCV and have decreased sensitivity (-20% drift or greater). Affected compounds can be reported as non-detects if it is demonstrated that there is adequate sensitivity to detect the compound at the MDL. If the failed compound is detected, the concentration must be reported as an estimated value.

Procedure

A. Method Blank

Analyze the method blank as described above for the initial calibration standards using reagent water. Refer to table in QA/QC section for specific requirements. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than

the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met. The method blank must be analyzed before processing any samples.

B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

C. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of this suspected compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

2. The compound relative retention time must compare within ±0.06 RRT units of the RRT of the standard.

3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the criteria listed above and the analyst's discretion is used to determine compound identification.

6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed.

The primary and secondary ions for the target compounds can be found in Table 2.

7. For GRO, the Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.

D. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated area from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions is listed in Table 2.

The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

E. Sample Analysis

A 5-mL or 25-mL aliquot of the sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution is performed if:

1. Prescreening indicates a high volatile organic content in the sample

2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (See *T-VOA-WI7692* for information on when cleaning blanks must be run). See Section 11.5.6 in method SW-846 8260C for recommended dilution procedures.

Calculations

A. Calibration calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Characteristic ion area for the compound being measured

A(is) = Characteristic ion area for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression Equations:

1st Order (linear) regression: Y = MX + B

2nd order (quadratic) regression: Y = CX2 + MX + B

Where:
x = Area(Std) /Area(Istd)
Y = Conc.(Std)/Conc.(Istd)
M = 1st degree slope
C = 2nd degree slope
B = Y-intercept

3. Percent relative standard deviation (%RSD):

$$\% \ RSD = \frac{Standard\ Deviation}{Mean} \times 100$$

4. Calculation of the percent drift:

$$\% \ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:
C(i) = Calibration check compound standard concentration
C(c) = Measured concentration using selected quantification method

B. QA Calculations

1. Calculation of percent recovery

$$\% \ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

2. Relative percent difference (RPD):

$$RPD = \frac{MSR - MSDR}{(1/2)\ (MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

3. Analyte Concentration

$$Concentration\ (\mu g/L) = \frac{(Ax)\ (Is)}{(Ais)\ (RRF)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured

Ais = Area of the quantitation ion peak for the appropriate internal standard

Is = Concentration of internal standard added in µg/L

RRF = Relative response factor from the initial calibration

Statistical Information/method Performance

The LCS must contain 80% to100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated on an annual basis in accordance with 40 CFR Part 136. The MDLs are maintained in the LIMS. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

Each analysis batch (consisting of no more that 20 samples) must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), a

laboratory control sample/laboratory control sample duplicate (LCS/LCSD) or a duplicate (DUP). The LCS serves as a 2nd source standard verification of the initial calibration (ICAL). Additional QC samples are required to meet project or state certification requirements. Every sample or QC analysis must contain internal standards and surrogate compounds at a concentration of 50 µg/L for a 5-mL purge or 10 µg/L for a 25-mL purge. For South Carolina samples, an LCS duplicate (LCSD) is only necessary per client request, or when adequate sample volume is not provided to prepare a matrix spike and matrix spike duplicate (MS/MSD). It is not appropriate to prepare and analyze an LCSD with each batch of samples if adequate sample volume has been provided for a MS/DUP or MS/MSD.
The laboratory will establish the Lower Limit of Quantitation (LLOQ) at concentrations where both quantitative and qualitative requirements can consistently be met for 8000D. The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≤ the lowest point in the calibration curve. The LLOQ/LLOQVs (Limit of Quantitation Verifications) are analyzed once per instrument per quarter. See SOP *QA-SOP11892*.

The GC/MS system must be tuned to meet the criteria in Table 1 following BFB injection. The chromatographic conditions must be the same as those under which the samples are analyzed except that the rate of temperature ramping may be increased and the initial temperature and column flow may be different. The BFB tune must be verified every 12 hours.

Quality Control Item	Acceptance Criteria	Corrective Action
1. Internal Standards Added to every sample, standard, method blank and QC sample	1. Peak areas within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injecting meets the criteria, report this analysis. 3. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
2 Surrogates Added to every sample, standard, method blank and QC sample	All % recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis.	If non-compliant, check for calculation or preparation errors. If no errors are found, check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected, then a reanalysis or comment is not required.
3 Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. Quantitative results for all target compounds must be less than the reporting limit for the associated samples.	1.-2.Inspect system for possible problems and reanalyze. 3. If the MB contains target analytes and the associated samples do not, then no corrective action is required. If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) LCS analyzed with each batch of ≤ 20 samples LCSD analyzed if MS/MSD unavailable See Figure	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All % recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis.	1.-2. If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with a LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be reported. Otherwise, the sample must be analyzed with a compliant LCS.

Quality Control Item	Acceptance Criteria	Corrective Action
Matrix Spike/Matrix Spike Duplicate (MS/MSD) MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) See Figures 4 and 5 for preparation info.	1. % Recoveries must fall within statistically derived QC limits, which are evaluated on a semi-annual basis 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with *T-VOA-WI8373* or *T-VOA-WI8400* (dual purge and trap).

Table 1

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Table 2

Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132

Compound Name	Primary Ion	Secondary Ion
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

NOTE: Alternative ions may be used for quantitation due to response factor, ion interference or other analytical needs.

Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100
Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400

1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

Table 3 - Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

Attachment:
Figure 1 (.doc)
Figure 2 (.doc)
Figure 3 (.doc)
Figure 4 (.doc)
Figure 5 (.doc)
Figure 6 (.doc)
Figure 7 (.xls)

11892 Determining Method Detection Limits and Limits of Quantitation
7619 GC and GC/MS Instrumentation Maintenance
7629 GC/MS Volatile Standards Traceability
7691 Glassware Washing
7692 Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
8373 GC/MS Volatiles Audit Process
8400 Level II Review of GC/MS Volatiles

End of document

Version history

Version	Approval	Revision information	
9	25.MAR.2020		
10	08.APR.2021		
11	27.APR.2022		

eurofins	Always check on-line for validity. **VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D**	Level: **Work Instruction**
Document number: **T-VOA-WI8236**		
Old Reference: **1-P-QM-WI-9013077**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **11-MAY-2022**	Document users: **6_EUUSLA_GC/MS Volatiles_GC/MS Auditors/Verifiers, 6_EUUSLA_GC/MS Volatiles_Management, 6_EUUSLA_GC/MS Volatiles_SW846 8260B/C Soil**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Calibration Calculations
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table 1
Table 2
Table 3

Revision Log

	Revision: 10	**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version
Procedure NOTE	Current process	Addition of client specific compositing performed by the analyst upon request.
Attachment 7	Current process	Addition of client specific compositing performed by the analyst upon request.

	Revision: 9	**Effective Date:** 23-APR-2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per G-DC-SOP16244	Removed revision logs up to the previous version

	Revision: 9	**Effective Date:** 23-APR-2021
Section	**Justification**	**Changes**
Cross Reference	Update	Added reference to QA SOP for information regarding LLOQ
Reagents and Standards B.7.e	Enhancement	Added reference to Figure 1 for preparation
Quality Assurance/ Quality Control	Enhancement	Added reference to QA SOP for LLOQ procedure
Table 2	Clarification	Added note concerning alternative ion selection for quantitation
Figure 1-6	Update	Added Figure # to header

Reference

1. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.

2. Volatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS), SW-846 Method 8260D, June 2018.

3. Determinative Chromatographic Separations, SW-846 Method 8000D, March 2018.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 5030B, December 1996.

5. Test Methods for Evaluating Solid Wastes, SW-846 Method 5030C, May 2003.

6. Test Methods for Evaluating Solid Wastes, SW-846 Method 5035, Revision 0, December 1996.

7. Test Methods for Evaluating Solid Waste, SW-846, Method 5035A, July 2002.

8. *Total Petroleum Hydrocarbons Analysis-Gasoline Method*, California Department of Health Services, LUFT Task Force.

9. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10682	GC/MS - Bulk Solid Matrix Sample Preparation
S-SS-WI11170	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629	GC/MS Volatile Standards Traceability
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
T-VOA-WI8373	GC/MS Volatiles Audit Process
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is suitable for the determination of target compounds listed and maintained in the Laboratory Information Management System (LIMS) for soil and solid matrices. Samples consist of soils/solids collected or submitted in bulk in glass containers with Teflon-lined screw-caps or in field core sampling/storage containers (i.e., EnCore or equivalent). Associated MDLs/LOQs are listed in the LIMS under the analysis numbers and/or Project Information lists.

Theoretical Standard Calibration (TSC) Sheets are included in the Appendix (Figures 1-6). These TSC sheets are to serve as examples only and may not reflect most current version in use. Non-target volatile compounds in the sample can be tentatively identified (TIC) using a mass spectral reference library comparison. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by purge and trap GC/MS methodologies and skilled in mass spectral interpretation. Using this method, the TICs are quantitated with an estimated concentration.

Compounds other than those listed in the LIMS for this group of master scans may be analyzed using USEPA SW-846 Method 8260C. Selected Ion Monitoring (SIM) parameters can be used to detect, identify and quantitate volatile organic compounds in methanol extracts of soils/solids, if lower quantitation limits are required (project- or client-specified) and/or matrix interferences are anticipated. Attachment I describes the proper analysis procedure for Gasoline Range Organics in soils and solids. Due to poor purging efficiency or poor chromatography, some analytes require calibration at higher levels and/or higher practical quantitation limits (PQLs). Any additional compounds must be added to the theoretical standard concentrations (TSC) sheet. Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Basic Principles

The soil sample is prepared according to analysis *S-SS-WI10682* and *S-SS-WI11170* for 8260C. The sample is purged with an inert gas and the effluent gas passed through a sorbent trap where the volatile organics are trapped. After purging, the sorbent trap is rapidly heated and backflushed onto the head of a gas chromatographic column held at the appropriate initial temperature for the column in use. The gas chromatographic column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

When a compound reaches the MS, it is bombarded by high energy electrons (70 eV). This causes the compound to fragment and form ions. The positive ions are focused into a quadrupole mass analyzer, where the ions are separated according to their mass/charge ratios during rapid repetitive scans. These ions are then amplified and detected with an electron multiplier.

The resulting time/intensity/mass spectra data are stored and processed by a computer. Target compounds are identified on the basis of relative retention times and mass spectral matches to standards, which are injected every 12 hours on the same system. The internal standard method is used for quantitation.

The GRO analysis is typically performed in conjunction with the analysis of other volatile target compounds by SW-846 Method 8260C. The GRO quantitation range is 0.1 minutes before the peak apex of C6 (hexane) to 0.2 minutes after the peak apex of C12 (dodecane); however, other ranges can be established. By establishing a (C12) GRO window to 0.2 minutes following the elution of dodecane, the areas from a trio of unresolved peaks eluting near to the upper limit of the range must consistently be included in the total GRO area. In addition, the range remains tight enough to ensure that no C13 or greater compounds can be included in the total GRO area. The C4 range retention time is determined by selecting the first peak after the air and/or artifact peak minus 0.1 minutes in the first level of standard analyzed with the ICAL. The C5 range retention time is 0.1 minutes before the peak apex of pentane.This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. The area of the total ion chromatogram for the GRO range is determined. The area of the internal standards and surrogate standards are found and subtracted from the total area of the chromatogram within the desired time range. The resulting area is then quantitated versus the internal standard, fluorobenzene.

Interferences

Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analyzing a batch of samples. Matrix effects from heavily contaminated soils and solids can interfere with the internal standard responses, target analytes and surrogate recoveries, thereby hindering accurate quantitation. See Section 4.0 of SW-846 Method 8260C for further discussion.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity of each reagent used has not been precisely determined. However, each reagent must be treated as a potential health hazard. Safety measures would include the use of fume hoods, safety glasses, lab coats, and gloves when working directly with reagents. Refer to the *Chemical Hygiene Plan* for specific details.

Personnel Training and Qualifications

Education Requirement: A 4–year Baccalaureate Degree from an accredited College or University in one of the physical sciences and/or 1 – 3 years of relevant gas chromatography experience.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). All training and education relating to volatile organic sample preparation and analysis must be documented by each analyst in their training record. Specifically, each new chemist must train with an experienced chemist for the first 12 weeks depending on the individual and their previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time may be less if the new chemist has prior relevant experience in GC/MS and analytical chemistry background.

During the training period, the new chemist must learn daily maintenance, calibration techniques, data and library search review, and forms generation. They are also required to read all relevant SOPs and EPA methods. All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP. Each analyst must perform an Initial Demonstration of Capability to measure proficiency. Thereafter, an annual Demonstration of Capability is performed and maintained in the analyst's training records.

NOTE: A separate Demonstration of Capability for GRO is required.

Sample Collection, Preservation, and Handling

Soils are either collected/submitted in bulk in glass containers with Teflon-lined screw-caps, in field core sampling/storage containers (i.e., EnCore or equivalent), or preserved in the field before submittal to the laboratory. Samples for low level volatiles analysis are frozen with reagent water at ≤ 10 °C, and may be preserved with sodium bisulfate. Samples for high level volatiles analysis are preserved in methanol. Refer to the volatiles preservation SOPs *S-SS-WI10682* and *S-SS-WI11170* for further information. All samples must be analyzed within 14 days of collection.

Apparatus and Equipment

1. Gastight micro syringes – 10-µL and larger
2. 5-mL gastight syringes
3. Analytical balance, capable of accurately weighing ±0.0001 g
4. Top-loading balance capable of weighing ±0.01 g
5. Glassware
   a. Class A Volumetric flasks with ground-glass stopper
   b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon/silicone septa
   c. Mininert vials, 1-mL, 2-mL, and 5-mL

6. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, OI Analytical 4660, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the headspace between the sample and the trap to <15 mL.

7. Autosampler – OI Analytical 4551, Archon, or equivalent meets the requirements of this method. The Archon has the capability to purge solid samples directly in the 40-mL vial (needed for samples prepared by analysis 8389).

8. Spiker units (optional) – OI Analytical Model 4551 SIM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551 autosampler to automatically introduce 10 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a groove that can deliver 1 µL of appropriate standards.

9. GC/MS system – The HP 5890GC/5972 MSD, HP 6890GC/5973MSD, HP 6890GC/5975MSD, and Shimadzu GC/MS QP5000 meet the requirements for this method.

10. Data System/Computer/Software– this is interfaced to the GC/MS system, which continuously acquires and stores data during the analysis, and can process/reduce data to generate the appropriate forms and supporting data. The software used for acquisition is HP Chemstation®, and data reduction is accomplished using Target® software.

11. GC Columns

a. Column 1 – 30M × 0.25 mm ID DB624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

b. Column 2 – 20M × 0.18 mm ID DB624 capillary column with a 1.0-µm film thickness from Agilent, or equivalent (to be used with the Shimadzu QP5000 or the Agilent 5972, 5973 and 5975 MSDs)

Different sampling/analysis combinations are used based on how the sample was collected, expected level of VOCs in the sample, possible matrix interferences, list of target compounds, whether TICs were requested, the required quantitation limits and the type of equipment/instrumentation available.

NOTE: Refer to *T-VOA-WI7619* for instrumentation maintenance and troubleshooting.

Reagents and Standards

A. Reagents

1. Reagent water is defined as water in which an interferant is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory must meet these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Purge and Trap grade Methanol or equivalent

3. Sodium bisulfate – ACS grade

4. Sand- Ottawa Standard

B. Standards

See *T-VOA-WI7629* for standards traceability.

1. Stock standard solutions – Stock solutions must be prepared in methanol. Standards are prepared from ampulated and neat compounds obtained from suppliers that indicate the purity of the compound. No correction for purity is made if the purity is listed as ≥96%. Pre-made solutions can be used if the supplier documents the concentrations of the solutions. All ampulated standards are stored at ≤-10°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

NOTE: For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). The internal and surrogate standards are purchased from a vendor, as well as the target compounds that are gases at room temperature. These gaseous standards have a 1-week expiration date, starting from the date they are opened.

2. Surrogate stock standard solution (for high level soils) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier

3. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and 12500 µg/mL deuterated tertiary butyl alcohol (tBA-d10) is prepared in methanol by a commercial supplier. Deuterated tertiary butyl alcohol (tBA-d10) is used sometimes as an auxiliary ISTD. If an autosampler is used, dilute the stock to 250 µg/mL (1250 µg/mL for tBA-d10) in methanol. This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained (50 µg/kg).

4. GRO calibration standard – a 5500-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier.

5. GRO QC standard – a 20,000-µg/mL stock unleaded gasoline composite prepared in methanol by a commercial supplier

6. To prepare stock standards from neat compounds:

a. Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.

b. Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

c. The stock standard solutions are stored in Teflon-sealed screw-capped vials at ≤-10°C. The compound name, concentration, date prepared, expiration date, preparer name and storage conditions must appear on the bottle.

d. Replace in house prepared stock standard solutions every 6 months.

7. Secondary dilution standards – Using the stock standard solutions, prepare secondary stock solutions in methanol containing the desired compounds. These standards are prepared by calculating the volume of each stock standard required producing a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these may be diluted down individually, or combined together with other mixes. The working standard is tested according to *T-VOA-WI7629*. The verified working standard is poured into Teflon-lined screw-capped GC vials or mininert vials and stored at ≤-10°C. A designator indicating the standard, month, and preparation date must be on the standard vials. The designator and all data pertaining to the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50-µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies, depending on the actual stock concentration.

b. Surrogate standard spiking solution (high level only) – Prepare the surrogate standard spiking solution from the stock standard solutions at a concentration of 25 or 250 µg/mL in methanol. The requested soil preparation method dictates what concentration of surrogates are required for analysis.

c. Internal standard (IS) solution (high level only) – fluorobenzene, chlorobenzene-d5, 1,4-dichlorobenzene-d4, and tert-Butyl Alcohol-d10. One mL of 8260IS is diluted with methanol to a total volume of 10 mL to give a final concentration of 250 µg/mL (1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained (50 µg/kg).

d. IS/SS spiking solution (low level only)– Dilute 1 mL of 8260IS and 1 mL of 8260SS with methanol to 10-mL final volume (resulting in a concentration of 250 µg/mL, 1250 µg/mL for tBA-d10). This is assuming a 1-µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained 50 µg/kg).

e. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. Suggested calibration levels are 4, 10, 20, 50, 100, and 300 (µg/kg). Replace the calibration spiking solution every 2-4 weeks (1 week for standards containing gases). See Figure 1 for preparation information.

f. Matrix spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates; therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace the matrix spiking solution every 2-4 weeks (1 week for standards containing gases). See Figures 2-5 for preparation information.

g. Store all standard solutions at ≤-10°C and protected from light.

Calibration

A. Instrument Conditions:

1. The purge and trap device must have the trap conditioned for at least 10 minutes at 180° to 220°C at a flow rate of 20 to 60 mL/min prior to initial use.

2. An example of purge and trap conditions are listed below:

Purge gas	Helium
Purge flow	35 – 40 mL/min
Purge temperature	40°C for low level soils and ambient temp. for medium/high level soils
Purge time	11 min
Desorb temperature	190°-220°C
Desorb time	0.5 to 4 minutes **
Bake temperature	180°-220°C
Bake time	8 min (±3 min)

** - Range as suggested by the purge and trap instrument manufacturer

NOTE: Purge and trap conditions may be changed to optimize instrument operations. A record of actual purge and trap conditions for each instrument may be found in the appropriate instrument maintenance log.

3. The suggested gas chromatographic operating conditions are listed in the table below, depending on the column used:

	Column 1	**Column 2**
Column liquid phase	DB-624	DB-624
Carrier gas	Helium	Helium
Carrier gas flow	0.8 mL/min	0.6 mL/min
Make-up gas flow	None	None
Initial temperature	45°C	45°C
Initial hold time	4.5 min	2.5 min
Temperature ramp	12°/min to 100°C then 25°/min to 240°C	12°/min to 100°C then 25°/min to 235°C
Final temperature	240°C	235°C
Final hold time	None	.02 min

4. Recommended mass spectrometer (MS) operating conditions:

Ions	Positive
Electron energy	70 volts
Mass range	35 – 300 amu

H-P systems Scan time:

Number A/D Samples	22 (4)
Integration Time/Sample	50 microsec
Total Scan Time	0.6 sec

B. Tuning:

Tune the GC/MS system to meet the criteria in Table 1 following a 50-ng injection of BFB. The chromatographic conditions must be the same as those under which the samples are analyzed except that the temperature ramp may be increased and the initial temperature and flow rate may be different. The BFB tune must be verified every 12 hours.

The tune must be evaluated by taking the average of the three scans across the BFB peak apex with a background subtraction of a scan within 20 scans prior to the start of the BFB peak.

NOTE: All standards, samples, and associated quality control samples must be analyzed with the same mass spectrometer parameters as those used to obtain a successful tune.

C. Initial Calibration:

1. Perform the initial calibration by analyzing at least six distinct levels of analyte concentration. For high level soils, the surrogates are also analyzed at each distinct level. Response factors for each analyte are determined from these levels. Six levels are required if second order regression fits are used. Calibration for GRO consists of analyzing six distinct levels of GRO area in order to produce a response factor for the GRO quantitation range of interest using the internal standard, fluorobenzene. The relative standard deviation of the response factor determines the suitability of the average relative response factor for calculation of the GRO concentration. Refer to Figure 1 for the preparation of calibration standards and Figure 6 for preparation of GRO standards. The relative standard deviation of the response factors determines the suitability of the average relative response factor for calculation of the analyte or GRO concentration. Prior to the analysis of any calibration level, retention time markers must be run for the GRO range of interest. The retention time markers are hexane (C6) and Dodecane (C12). Other markers can be used if different ranges are required by a project.

NOTE: 5 levels are required by the method.

2. A method detection limit (MDL) standard must be analyzed with each initial calibration. This standard is prepared at or near the departmental MDL and is not to be included in the calibration curve. All compounds must be detected at or below MDL standard.

3. For medium/high level soils, methanol is added to all calibration standards. For low-level soils prepared according to EPA Method 5035, 1 scoop (approximately .50 -.75 grams) of sodium bisulfate is added to all calibration standards.

4. When using an autosampler, blanks and standards are prepared and poured into 40-mL vials with Teflon-lined septa. For the high-level method, 5 mL is withdrawn from the vial and transferred to the sparge vessel along with the appropriate amount of the internal standard spiking solution. For the low-level method, the autosampler transfers 5 mL of reagent water along with the appropriate amount of IS/SS spiking solution to the 40-mL vial.

5. Purge and desorb according to conditions listed in Calibration A.2.

6. Collect GC/MS data until the end of the GC run.

7. Empty and rinse the purging chamber at least twice with reagent water prior to loading another sample into the vessel, to minimize the possibility of carryover contamination.

8. Each level is analyzed as described above. Next, tabulate the area response of the characteristic ions (Table 2) against concentration for each analyte, surrogate standard, and internal standard and calculate relative response factors (RRF) for each compound (see Calculation section). The following table describes the guidelines for an acceptable initial calibration:

Frequency	Acceptance Criteria	Corrective Action

Frequency	Acceptance Criteria	Corrective Action
Initially and then when analytes in the daily calibration standard fail criteria.	1. % RSD of ≤20% is required for all analytes. 10% of the analytes may fail this criteria. 2. All compounds of interest must be detected in the MDL standard. 3. The relative retention times of the target compounds must agree within 0.06 relative retention time (RRT) units. The exception would be in the case of system maintenance. 4. Minimum response factors must be met for select compounds. See Table 3.	1. Any target analyte with a %RSD of ≤20% must use the average RRF for quantitation. For any analyte in which the %RSD >20%, a first-degree linear regression can be used (providing that the correlation coefficient [CC] is ≥0.995). A quadratic fit ** (using 6 stds) can also be used (provided the coefficient of determination [CD] is >0.99). If the linear fit and quadratic fit pass the criteria for any given analyte, then use the line/curve with the smallest positive y-intercept. If the y-intercept quantifies to be greater than the LOQ, consult your supervisor immediately or recalibrate. If CC or CD is <0.995 for linear or <0.99 for quadratic, recalibrate. Supervisory approval is required for exceptions to these guidelines. If >10% target analytes fail, recalibration is required. If a linear or quadratic curve fit is used for a target analyte, the calibration data must be refit back into the calibration model for all calibration levels. Percent error between the calculated and expected amounts of an analyte should be ≤ 30% for all standards. For some data uses, ≤ 50% may be acceptable for the lowest calibration point. NOTE: Quadratic regression cannot be used for South Carolina compliance samples. 2. If a compound is not detected in the MDL standard, then report to the level of the lowest standard detected. 3,4. Perform system maintenance and recalibrate.

**Consult USEPA method 8000D for non-linear curve fitting techniques/guidelines

9. Each GRO level is analyzed as described above. Next, tabulate the area response for the GRO quantitation range minus the peak areas for the internal and surrogate standards that elute within the GRO range. Calculate the relative response factor (RRF) for GRO (see Calculation section) using the internal standard peak area for Fluorobenzene. Although four internal standard compounds are spiked for the 8260C analysis, only Fluorobenzene, is used for the quantitation of the GRO result.

10. Calculate the average relative response factors for the GRO quantitation range of interest. The calibration levels are evaluated on the basis of the relative standard deviation of the RRF values (%RSD). The %RSD for the GRO range of interest must be ≤20%. If the calibration meets this requirement, then the average RRF is used to calculate sample concentrations. If the %RSD is >20% then re-analysis of one or more levels can be necessary before the calibration is valid.

D. Initial Calibration Verification:

Following the calibration, an Initial Calibration Verification (ICV) standard must be run. The ICV is prepared according to the TSC sheet in Figure 5. The ICV acts as a second source standard to check against the initial calibration. All analytes must meet ICV acceptance windows of 70%-130%. If the ICV does not meet the aforementioned criteria, a second ICV is analyzed before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

For the GRO analysis, the ICV is prepared according to the TSC sheet in Figure 6 (QC prep). The ICV acts as a second source standard to check against the initial calibration. Results must quantitate within the 70-130% window. If the ICV does not meet the aforementioned criteria, a second ICV can be run before invalidating the initial calibration. Upon failure of the second ICV, the system must be recalibrated after proper corrective action is taken.

E. Continuing Calibration:

Continuing Calibration Verification (CCV) – The CCV is performed by analyzing a 50-ppb calibration standard (prepared daily due to aqueous nature) in subsequent tune periods after an initial calibration. The CCV is considered valid when the criteria listed below are met:

Frequency	Acceptance Criteria	Corrective Action

Frequency	Acceptance Criteria	Corrective Action
Every 12 hours.	1. % Drift of ≤20% is required for all analytes. No more than 20% of analytes may fail this criteria if not detected in proceeding samples. 2. The relative retention times (RRT) of the target compounds must agree within 0.06 RRT units. The exception would be in the case of system maintenance. 3. The extracted ion current profile (EICP) area for each internal standard must fall within the window of −50 % to +100 % from the mid-level standard area produced during the last initial calibration. 4. Minimum response factors must be met for select compounds. See Table 3.	1. - 4. In the event that the continuing calibration verification (CCV) standard fails any of these criteria, sample analysis must be suspended and the CCV must be re-analyzed. If the re-analysis fails any of the criteria then adjustments are to be made to the analytical system to return it to its original condition, followed by the analyses of 2 consecutive CCVs at the same level that failed. If both CCVs pass the criteria, then sample analysis can continue. Otherwise, the system must be recalibrated and the samples reanalyzed, or the data can be qualified.

A 1100-ppb standard is analyzed for the GRO analysis. The calibration is considered valid if the percent drift is ≤20%. Also, the internal standard peak area of fluorobenzene for the CCV is monitored against the mid-point standard of the initial calibration and must be −50% to +100% of the area counts. If any criteria listed above fails, the CCV is considered invalid. In the case where two consecutive CCVs fail, corrective action must be taken which can include re-analysis of the calibration check, instrument maintenance, and/or recalibration. If the criteria are met, the selected quantitation method from the initial calibration is used for blank and sample calculations until the end of the 12-hour period.

F. MDL Sensitivity Check- A MDL Sensitivity Check must be analyzed in cases where compounds fail to meet the % drift criteria in the CCV and have decreased sensitivity (-20% drift or greater). Affected compounds can be reported as non-detects if it is demonstrated that there is adequate sensitivity to detect the compound at the MDL. If the failed compound is detected, the concentration must be reported as an estimated value.

Calibration Calculations

1. Calculation of the relative response factor (RRF):

$$RRF = \frac{[A(x) \times C(is)]}{[A(is) \times C(x)]}$$

Where:

A(x) = Characteristic ion area for the compound being measured

A(is) = Characteristic ion area for the specific internal standard

C(x) = Concentration of the compound being measured

C(is) = Concentration of specific internal standard

2. Regression equations:

1st Order (linear) regression: $Y = Mx + B$

2nd order (quadratic) regression: $Y = Cx2 + Mx + B$

Where:

x = Area(Std) /Area(Istd)

Y = Conc.(Std)/Conc.(Istd)

M = 1st degree slope

C = 2nd degree slope

B = Y-intercept

3. Percent relative standard deviation (%RSD):

$$\% \quad RSD = \frac{Standard\ Deviation}{Mean} \times 100$$

4. Calculation of the percent drift:

$$\% \ Drift = \frac{C(i) - C(c)}{C(i)} \times 100$$

Where:
C(i) = Calibration check compound standard concentration
CI = Measured concentration using selected quantification method

Procedure

A. Method Blank:

Analyze the method blank as described above for the initial calibration standards using reagent water. Refer to table in QA/QC section for specific requirements. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met. The method blank must be analyzed before processing any samples.

B. Laboratory Control Sample/ Duplicate and Matrix Spike/Duplicate: Refer to table in QA/QC section for specific requirements.

NOTE: Per client request, the analyst may perform a compositing procedure prior to analysis. See Attachment 7, or the specific procedure provided by the client for this process.

C. Qualitative Analysis:

Sample analysis for soil, solids, and nonaqueous matrices proceeds as described in the Calibration section. The aqueous matrix is replaced by the soil sample, which is prepared according to *S-SS-WI10682* and *S-SS-WI11170*. A compound is identified by comparison of the following parameters with those of a standard of this target compound (standard reference spectra). In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other.

2. The compound relative retention time must compare within ±0.06 RRT units of the RRT of the standard.

3. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

4. The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. Analyst discretion is used to determine compound identification. (Example: for an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

5. The above criteria apply to hits greater than or equal to the LOQ. For hits between the MDL and the LOQ, both the above criteria and analyst discretion are used to determine compound identification.

6. The analyst must account for peaks that are greater than 10% relative intensity in the sample mass spectrum, but not present in the standard mass spectrum. Also, if a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed. The primary and secondary ions can be found in Table 2.

7. For the GRO analysis, the Total Ion Chromatogram (TIC) is reviewed to insure proper integration around the 8260 surrogates and internal standards. Also the TIC is checked to make sure all major peaks are integrated.

D. Quantitative Analysis:

Once a compound has been identified, quantitation of identified priority pollutant compounds is performed using the equations listed in the Calculations section of this SOP. The primary ions listed in Table 2 are used for quantitation. A secondary ion may be used if there is interference with the primary ion. All calculations must report concentrations in values of µg/kg. Any analyte with a calculated concentration above the highest standard must be reanalyzed at a dilution that brings the concentration in the solution within the calibration curve. It is desirable to have the dilution fall within the top half of the calibration curve, but it is not required.

The quantitation of the GRO range is performed using the equations listed in the Calculations section of this procedure. All calculations must report concentrations in values of µg/L. In the case where the total GRO concentration exceeds the calibration range, the sample is re-analyzed at a dilution that brings the GRO concentration within the calibration range of the GC/MS system.

Calculations

A. Analyte Concentration

1. Low level

$$\text{Concentration } (\mu g/kg) \frac{(Ax)(Is)}{(Ais)(RRF)(Ws)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured
Ais = Area of the quantitation ion peak for the appropriate internal standard
Is = Amount of internal standard added in nanograms
Ws = Weight of sample purged
RRF = Relative response factor from the initial calibration

2. Medium/high level

$$\text{Concentration } (\mu g/kg) \frac{(Ax)(Is)(Vt)}{(Ais)(RRF)(Ws)(Vi)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured
Ais = Area of the quantitation ion peak for the appropriate internal standard
Is = Amount of internal standard added in nanograms
Vt = Volume of the total extract in microliters
Vi = Volume of the extract used for purging in microliters
Ws = Weight of sample extracted
RRF = Relative response factor from the initial calibration

B. QC Calculations:

$$\% \text{ Recovery} = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

C. Relative percent difference (RPD)

$$RPD = \frac{MSR - MSDR}{(1/2)\ (MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

Statistical Information/Method Performance

The LCS must contain 80% to100% of the compounds in the calibration mix. LCS, MS, and surrogate recoveries and RPD are compared to the limits stored on the LIMS. These limits are statistically derived but must fall within 70% to 130% recovery for South Carolina compliance samples. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated on an annual basis in accordance with 40 CFR Part 136. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

Each analysis batch must contain a method blank, a laboratory control sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD), or a laboratory control sample/laboratory control sample duplicate (LCS/LCSD). Additional QC samples may be required to meet project or state certification requirements. For South Carolina, an LCS duplicate (LCSD) is only necessary per client request, or

when adequate sample volume is not provided to prepare a matrix spike and matrix spike duplicate (MS/MSD). It is not appropriate to prepare and analyze an LCSD with each batch of samples if adequate sample volume has been provided for a MS/DUP or MS/MSD. Every sample or QC analysis must contain internal standards and surrogate compounds.

The laboratory will establish the Lower Limit of Quantitation (LLOQ) at concentrations where both quantitative and qualitative requirements can consistently be met for 8000D. The LLOQ is the lowest concentration at which the laboratory has demonstrated target analytes can be reliably measured and reported with a certain degree of confidence, which must be ≥ the lowest point in the calibration curve. The LLOQ/LLOQVs (Limit of Quantitation Verifications) are analyzed once per instrument per quarter. See SOP *QA-SOP11892*.

The GC/MS system must be tuned to meet the criteria in Table 1 following BFB injection. The chromatographic conditions must be the same as those under which the samples are analyzed except that the rate of temperature ramping may be increased and the initial temperature and column flow may be different. The BFB tune must be verified every 12 hours.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards • Added to every sample, standard, method blank or QC sample	1. Peak areas within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then reanalyze samples. 2. If re-injecting meets the criteria, report this analysis. 3. If this reanalysis still shows the same problem, report results from first analysis and qualify data with a comment.
Surrogates • Added to every sample, standard, method blank or QC sample	All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis.	If non-compliant, check for calculation or preparation errors. If no errors are found, check system for problems and reanalyze. If this reanalysis still shows the same problem, report first analysis and qualify data with a comment. If recoveries are outside of specification high and no target compounds are detected then a reanalysis or comment is not required.
Method Blank (MB) Performed during each tune period after the initial calibration or CCV (minimum of 1 MB per 20 samples) • 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. • Approximately 5 grams of sand is required for low level analysis.	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. Quantitative results for all target compounds must be less than the reporting limit for the associated samples.	1,2. Inspect system for possible problems and reanalyze. 3. If the MB contains target analytes and the associated samples do not, then no corrective action is required. If the target compounds in the MB are also in the associated samples, then they must be reanalyzed after a clean MB is obtained (certain projects may allow some exceptions for common laboratory contaminants like methylene chloride and acetone up to 5X the LOQ)

Quality Control Item	Acceptance Criteria	Corrective Action
Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) • LCS analyzed with each batch of ≤ 20 samples • LCSD analyzed if MS/MSD unavailable • Approximately 5 grams of sand is required for low level analysis. • 1 scoop of Sodium Bisulfate is added if the preservative was added to the initial calibration. • See Figures 2, 3 and 4 for preparation info.	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All % recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis.	1,2. If non-compliant, check for calculation or preparation errors. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD re-analysis still fails, perform appropriate system maintenance and restart the tune period. Only with an LCS % recovery failing high (for the requested target compounds) with targets non-detected in the sample, can the results be reported. Otherwise, the sample must be analyzed with a compliant LCS.
Matrix Spike/Matrix Spike Duplicate (MS/MSD) • MS/MSD analyzed with each batch of ≤ 20 samples (if sufficient sample volume available) • See Figures 2 and 3 for preparation info.	1. % Recoveries must fall within statistically derived QC limits, which are reviewed and updated on a semi-annual basis 2. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries and/or RPDs outside of QC limits, consult the supervisor.

The method blank must meet all the above criteria for internal standard recoveries and surrogate recoveries. In addition, the method blank may not contain any target compound above the reporting limit for the associated samples. All method blanks must meet these criteria; otherwise, the system is considered out of control and corrective action must be taken.

If sufficient sample volume is not available to perform MS/MSD, LCS/LCSD are prepared and analyzed and must meet the above-mentioned criteria.

NOTE: Prior to release from the analytical laboratory, all data is reviewed in accordance with *T-VOA-WI8373*.

The sample is analyzed using the same instrumental conditions as the standard (whether ICAL or CCV), tune and method blank. If the QA criteria are satisfied and no target compounds are detected at concentrations above the calibration range, the results can be reported. To avoid possible matrix effects, sample carryover and re-analyses, an initial dilution may be performed if:

1. Prescreening indicates a high volatile organic content in the sample

2. Historical data (or lack thereof) and/or sample appearance indicate a need for dilution

If target compounds are detected in the sample at concentrations above the calibration range, a dilution must be performed (see *T-VOA-WI7692* for information on when cleaning blanks must be run). See method SW-846 8260C for the recommended dilution procedures.

Table 1

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15% to 40% of mass 95
75	30% to 60% of mass 95
95	base peak, 100% relative abundance
96	5% to 9% of mass 95
173	less than 2% of mass 174

174	greater than 50% of mass 95
175	5% to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5% to 9% of mass 176

Table 2

Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzen-d4	152	115

Continued
Primary and Secondary Ions

Compound Name	Primary Ion	Secondary Ion

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61, 63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49, 86
1,1-Dichloroethane	63	65, 83
trans-1,2-Dichloroethene	96	61, 63
cis-1,2-Dichloroethene	96	61, 63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61, 99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130, 132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77, 110
trans-1,3-Dichloropropene	75	77, 110
1,1,2-Trichloroethane	97	83, 85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131, 164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85, 131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenzene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzene-d4	152	115

NOTE: Alternative ions may be used for quantitation due to response factor, ion interference or analytical needs.

Table 3
Minimum Relative Response Factors For ICAL and CCV

Volatile Compounds	Minimum Response Factor
Dichlorodifluoromethane	0.100
Chloromethane	0.100
Vinyl Chloride	0.100
Bromomethane	0.100
Chloroethane	0.100
Trichlorofluoromethane	0.100
1,1-Dichloroethene	0.100
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100
Acetone	0.100
Carbon Disulfide	0.100
Methyl Acetate	0.100
Methylene Chloride	0.100
trans-1,2-Dichloroethene	0.100
cis-1,2-Dichloroethene	0.100

Methyl tert-Butyl Ether	0.100
1,1-Dichloroethane	0.200
2-Butanone	0.100
Chloroform	0.200
1,1,1-Trichloroethane	0.100
Cyclohexane	0.100
Carbon Tetrachloride	0.100
Benzene	0.500
1,2-Dichloroethane	0.100
Trichloroethene	0.200
Methylcyclohexane	0.100
1,2-Dichloropropane	0.100
Bromodichloromethane	0.200
cis-1,3-Dichloropropene	0.200
trans-1,3-Dichloropropene	0.100
4-Methyl-2-pentanone	0.100
Toluene	0.400
1,1,2-Trichloroethane	0.100
Tetrachloroethene	0.200
2-Hexanone	0.100
Dibromochloromethane	0.100
1,2-Dibromoethane	0.100
Chlorobenzene	0.500
Ethylbenzene	0.100

Table 3 Continued

Volatile Compounds	Minimum Response Factor
m&p-Xylene	0.100
o-Xylene	0.300
Styrene	0.300
Bromoform	0.100
Isopropylbenzene	0.100
1,1,2,2-Tetrachloroethane	0.300
1,3-Dichlorobenzene	0.600
1,4-Dichlorobenzene	0.500
1,2-Dichlorobenzene	0.400
1,2-Dibromo-3-chloropropane	0.050
1,2,4-Trichlorobenzene	0.200

Attachment:
Attachment 7 (.doc)
Figure 1 (.doc)
Figure 2 (.doc)
Figure 3 (.doc)
Figure 4 (.doc)
Figure 5 (.doc)
Figure 6 (.doc)

10682 GC/MS - Bulk Solids Matrix Sample Preparation
11170 Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 and Method 5035A
11892 Determining Method Detection Limits and Limits of Quantitation
7619 GC and GC/MS Instrumentation Maintenance
7629 GC/MS Volatile Standards Traceability
7692 Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles
8373 GC/MS Volatiles Audit Process

End of document

Version history

Version	Approval	Revision information	
8	26.MAR.2020		
9	09.APR.2021		
10	11.MAY.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-VOA-WI8544**	**Toxicity Characteristic Leachate Procedure (TCLP) and Synthetic Precipitate Leaching Procedure (SPLP); VOCs by GCMS in Zero Headspace Extraction (ZHE) by 8260B/C/D**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015142**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **02-NOV-2020**	Document users: **6_EUUSLA_GC/MS Volatiles_GC/MS Auditors/Verifiers, 6_EUUSLA_GC/MS Volatiles_Management, 6_EUUSLA_GC/MS Volatiles_SW846 8260B/C Water**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Additional Analyses
Table 1
Table 2

Revision Log

Revision: 14		**Effective Date:** This version
Section	**Justification**	**Changes**
Title	Update	Updated to include SPLP
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Current practice	Added Method 1312
Cross Reference	Referenced in SOP	Added 8260 analyses and updated title and document name for 1311/1312
Scope	Current practice	Removed reference to scan number and PI lists and replaced with referencing method
Sample Collection, Preservation, and Handling	Current practice	Added Method 1312. Updated reference with link. Added Note regarding preps/matrices in LIMS.
Apparatus and Equipment	Update	Updated data reduction software to Chrom
Reagents and Standards	Current requirements	Updated standard expiration dates
Calibration	Redundancy	Removed all specific calibration information and added statement with links to refer to referenced 8260 method

Revision: 14		**Effective Date:** This version
Procedure	Current practice	Added SPLP information throughout section
Quality Assurance/ Quality Control	Current practice	Added statement concerning LLOQ, referring back to 8260 method
Table I	Update	Removed Analysis 3636 from header

Revision: 13		**Effective Date:** 02.MAR.2018
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Cross Reference	Referenced in SOP	Added Analysis DOD - #0946, 2573, 0075; Removed Level 2 SOPs
Sample Collection, Preservation, and Handling	Clarification	Added reference to ZHE by 1311 SOP and information concerning sample hold time after extraction.
Personnel Training and Qualifications	Clarification	Added additional information concerning IDOC. Removed unclear information about analyst calibration requirement.
Reagents and Standards B.	Current requirement	Updated storage temperature throughout section.
Entire Document	Redundancy	Removed all Level 2 SOP references

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8260B, December 1996.

2. Volatile Organic Compounds by Gas Chromotography/ Mass Spectrometry (GC/MS), SW-846 Method 8260C, August 2006.

3. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), SW-846 Method 8260D, June 2018.

4. Determinative Chromatographic Separations, SW-846 Method 8000D, Revision 4, July 2014.

5. Method 1311, SW-846, U.S. EPA, July 1992.

6. Method 1312, SW-846, U.S. EPA. September 1994.

7. *Federal Register*, Vol. 55, No. 126, Friday June 29, 1990, (TCLP).

8. *Federal Register, Vol. 57, No. 227, November 24, 1992, (TCLP).*

9. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-TL-WI7258	Volatiles by Zero Headspace Extractor (ZHE)- Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by 1312
T-VOA-WI7691	Glassware Washing
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance
T-VOA-WI7629	GC/MS Volatile Standards Traceability
T-VOA-WI8194	VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D
T-VOA-WI8197	VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260B
T-VOA-WI8225	VOCs and GRO by GC/MS in Soils and Solids by EPA 8260B
T-VOA-WI8236	VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D
T-VOA-WI8373	GC/MS Volatiles Audit Process

Scope

This method is suitable for the determination of compounds listed in Table 1 for ash, aqueous, organic solids, sludge, soils, solid waste, oil and grease, and solvent matrices. If requested by a client, additional volatile compounds than those listed in Table 1 are analyzed by this method provided they meet the quality control requirements of the analytical method. The method also is appropriate for acquiring data files required to perform a search for tentatively identified compounds (TIC) in volatile organics GC/MS analyses. Theoretical Standard Calibration (TSC) Sheets are included in the Appendix (Figures 2-4). These TSC sheets are to serve as examples only and may not reflect most current version in use. This analysis must be performed by or under the direct supervision of an operator experienced in the analysis of volatile organics by GC/MS purge and trap methodologies. Associated MDLs/LOQs are listed in the Laboratory Information Management System (LIMS) under the referencing analytical method.

Basic Principles

A 5-mL sample or a dilution of a sample is analyzed in a specifically designed purge vessel. The sample is purged with an inert gas and the effluent gas is passed through a sorbent trap where the volatile organic compounds are trapped. After purging, the sorbent trap is rapidly heated and backflushed onto the head of a gas chromatographic column held at the appropriate initial temperature for the column in use. The gas chromatographic column is temperature programmed to separate the volatile compounds, which are subsequently detected and identified using mass spectrometric techniques.

Interferences

Contaminant sources are volatile compounds in the laboratory environment, impurities in the inert purging gas, carryover from samples containing high concentrations of volatile organic compounds and dirty glassware. The analyst must demonstrate that the system is free from interferences (by producing acceptable method blank data) before analysis of samples. Matrix effects from heavily contaminated samples may interfere with the internal standard responses, target analytes, and surrogate standard recoveries, hindering accurate quantitation. See Section 3.0 of SW-846 Method 8260B for further discussion.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, lab coats, safety glasses, and gloves.

Neat compound sources and stock solutions must be collected into a lab pack upon expiration. The lab pack is delivered to safety personnel for appropriate disposal. Expired secondary standard solutions in methanol must be disposed of as solvent waste. Pour expired secondary standard solutions into the appropriate solvent waste collection container. Aqueous calibration standard mixes are be disposed of as nonhazardous aqueous waste due to the low concentration of volatile organics. After analysis, all water samples are returned to the main storage system and are discarded by the sample storage personnel. Sample extracts are placed in the hazardous vials drum for disposal.

Personnel Training and Qualifications

Education Requirements: A four-year Baccalaureate degree from an accredited college or university in one of the physical sciences and/or one to three years of relevant gas chromatography experience.

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Analysts must be trained in the proper method of volatile organic sample preparation and analysis as determined by the supervisor(s). Each analyst in his/her training records must document all relevant training and education to volatile organic sample preparation and analysis.

Specifically, each new chemist will train with an experienced chemist for the first 12 weeks depending on the individual's previous experience. The first 12 weeks are spent working one-on-one with the trainer. This time is less if the new chemist has prior relevant experience in the GC/MS and analytical chemistry field.

During the training period, the new chemist will learn daily maintenance, column and source changing procedures, calibration techniques, data and library search review, and forms generation. He/she is also required to read all relevant SOPs and EPA methods.

To measure the proficiency of each chemist, an Initial Demonstration of Capability is required prior to the analysis of samples. Each analyst must perform an annual Demonstration of Capability. Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

The samples must be stored in a refrigerator between 0° to 6°C, not frozen. In addition, all samples must be prepared using Method 1311 or Method 1312 within 14 days of collection. It must be noted that the preparation of TCLP/SPLP samples is performed in another department within the laboratory. Refer to *T-TL-WI7258*. After extraction, all samples are stored in 40-mL vials, except for California ELAP samples, which are stored in Tedlar® bags. Holding time for samples is 14 days from the completion of the extraction analysis.

NOTE: The prep method codes in LIMS of 5030B_Leach and 5030C_Leach denote sample that have been extracted via the TCLP/SPLP methods. The Container Matrix is Purge Gas - Leached. The sample matrix will still be Solid/Water depending on the matrix submitted by the client.

Apparatus and Equipment

1. Gastight micro syringes – 10 µL and larger

2. 5-mL,10-mL ,25-mL gastight syringe

3. Analytical balance – Mettler AE100, range 0 to 109 g ± 0.001 grams

4. Glassware

a. Volumetric flasks, Class A with ground-glass stopper

b. Vials, 1.5-mL, 15-mL, and 40-mL screw cap, with Teflon™/silicone septa

c. Mini-nert, 1 mL, 2 mL, and 5 mL

5. Disposable Pasteur pipettes and pipette bulb

6. Purge and trap device – Consisting of the sample purger, the trap, and desorber; the OI Analytical 4560, or equivalent meets the requirements of this method. The purging chamber must have the purge gas passing through the sample as finely divided bubbles and minimize the gaseous headspace between the sample and the trap to <15 mL.

7. Autosampler – OI Analytical 4551, 4552, or equivalent meets the requirements of this method.

8. Spiker units – OI Analytical Model 4551 SAM/Spiker or equivalent. One or two automated syringe spikers can be added to the OI Analytical Model 4551 autosampler to automatically introduce 1 µL of internal standard (ISTD), surrogate standard, and/or matrix spiking solutions to the sample as it is being transferred to the sparge vessel. The Archon has a rotary valve with a groove that can deliver 1 µL of appropriate standards to the sample stream.

9. GC/MS system – Agilent 5890GC/5971 MSD, Agilent 5890GC/5972 MSD, Agilent 6890GC/5973MSD, and Shimadzu GC/MS QP5000 meet the requirements for this method. Equivalent instrumentation that meets the requirements of the method are also acceptable.

10. Data system – Interfaced to the GC/MS system, continuously acquires and stores data during the analyses, and processes/reduces data to generate the appropriate forms and supporting data.

a. Acquisition software – ChemStation or equivalent

b. Data reduction software – Chrom or equivalent.

11. Columns

Column 1 – 30M × 0.25 mm ID DB-624 capillary column with a 1.4-µm film thickness from Agilent, or equivalent

NOTE: Refer to *T-VOA-WI7619* for instrumentation maintenance and troubleshooting.

Reagents and Standards

A. Reagents

1. Reagent water is defined as water in which an interferant is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in

the laboratory will meet these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

2. Methanol– For purge and trap analysis or equivalent.

B. Standards

1. Stock standard solutions – Stock solutions must be prepared in methanol or an equivalent solvent. Standards are prepared from ampulated and neat compounds obtained from suppliers which indicate the purity of the compound. No correction for purity is made if the purity is listed as >96%. Premade solutions can be used if the concentrations of the solutions are documented by the supplier. All ampulated standards are stored at ≤ -10°C until the expiration date indicated by the vendor or for 1 year if no expiration date is provided.

a. For most of the target compounds, the stock standard solutions are purchased from a vendor as custom mixes (V for calibration and Q for separate source quality control). Also, the internal standards, surrogate standards, and target compounds that are gases at room temperature are currently being purchased from a vendor. In some applications the stock standard is used as is.

b. 8260A Surrogate standard spiking solution (8260SS) – a 2500 µg/mL stock standard solution of dibromofluoromethane, toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4 is prepared in methanol by a commercial supplier.

c. 8260A Internal standard spiking solution (8260IS) – a 2500 µg/mL stock standard solution of fluorobenzene, chlorobenzene-d5, and 1,4-dichlorobenzene-d4 is prepared in methanol by a commercial supplier.

d. To prepare stock standards from neat compounds

(1) Place about 9.8 mL methanol or an equivalent solvent into a tared 10.0-mL glass-stoppered volumetric flask. Weigh the flask to the nearest 0.1 mg.

(2) Add the liquids using a syringe or pipette by adding 2 or more drops of the assayed material to the flask, being careful that no drop hits the side of the flask. Reweigh the flask, record/note the amount, dilute to volume, stopper, and mix by inverting the flask at least 3 times. Calculate the concentration of the standard.

(3) The stock standard solutions are stored in Teflon™-sealed screw-capped vials at ≤ -10°C. The compound name, concentration, date prepared, preparer's name, storage conditions and expiration date must appear on the bottle.

(4) Replace in house prepared stock standard solutions every 6 months.

2. Secondary dilution standards – Using the stock standard solutions, prepare secondary stock solutions in methanol or an equivalent solvent containing the desired compounds. See Table I for example. These standards are prepared by calculating the volume of each stock standard

required to produce a given volume of a mixed working standard with a known concentration of each analyte. When custom mixes are used, these are diluted down individually or combined together with other mixes. The working standard is tested according to *T-VOA-WI7629*. The verified working standard is poured into Teflon™-lined screw-capped GC vials or mininert vials and stored at ≤-10°C. A designator indicating the standard, month, and day of preparation must be on the standard vials. The designator and the calculations for the working standard preparation are to be recorded in the standards logbook. Replace secondary dilution standards every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated. Since the working standards are prepared the day of the analysis and not reused, no expiration date is required.

a. 1,4-Bromofluorobenzene (BFB) standard – Prepare a 50 µg/mL solution of BFB in methanol by diluting the stock standard (prepared from neat material) with methanol to a final volume of 100 mL. The volume of stock standard used varies depending on the actual stock concentration.

b IS/SS spiking solution – One mL of 8260IS and 1 mL of 8260SS are diluted with methanol to a total volume of 10 mL to give a final concentration of 250 µg/mL. This is assuming a 1 µL groove in the autosampler. If the groove is determined to be other than 1 µL, the standard preparation must be adjusted so that appropriate final concentration is obtained.

c. Calibration spiking solution – Prepare solutions in methanol that contain the compounds of interest at known concentrations. See Figure 2. The 50-ppb level on the TSC sheet also serves as the calibration verification standard. Replace calibration spiking solution every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

d. Matrix spiking solution – Prepare second source solutions in methanol that contain the compounds of interest at known concentrations. To help prevent confusion, a TSC sheet is filled out for all quality control samples (See Figure 3). These solutions serve as both the matrix spiking solution and the laboratory control sample solutions. Matrix spikes also serve as duplicates. Therefore, two aliquots of the same sample need to be spiked for analysis with these solutions. Replace matrix spiking solutions every 2-4 weeks (1 week for standards containing gases) unless otherwise indicated.

3. Store all standard solutions at ≤ -10°C.

Preparation of Glassware

All glassware is prepared in accordance with *T-VOA-WI7691*.

Calibration

Refer to *T-VOA-WI8194*, *T-VOA-WI8197*, *T-VOA-WI8225* and *T-VOA-WI8236* for calibration preparation and method requirements.

Procedure

A. A method blank is prepared and analyzed as indicated below. The method blank is examined for interfering peaks. Any target compound peaks are calculated as described under the Calculations section of this procedure. All compounds must be less than the reporting limit for the associated samples. If the blank values exceed these values, corrective action must be taken and the method blank reanalyzed until the criteria are met. Also, all surrogate compound recoveries must meet the criteria. The method blank is prepared by filling a pre-preserved 40-mL vial with reagent water. A 5-mL aliquot is withdrawn from the vial by the autosampler. The aliquot is transferred through the spiker unit to add the IS/SS spiking solution and then transferred to the sparge vessel.

B. The Extraction Blank is analyzed at a dilution factor of 20 for TCLPs and a dilution factor of 1 for SPLPs following the Method Blank and prior to the samples in the extraction batch.

C. The matrix spike (MS) and matrix spike duplicate (MSD) pair are analyzed for each set of 20 field samples. Analysis of an additional method spike is required for each new matrix. The matrix type is documented on the extraction log. There are 8 general classifications of matrices: Ash, Aqueous, Organic Solids, Sludge, Soils, Solid Waste, Oil and Grease, and Solvent. The recoveries and the percent differences of the recoveries for each spiked compound are calculated and compared to statistically generated windows with a set percent difference of recoveries. If required by a client, additional MS/MSD pairs are analyzed.

D. A laboratory control sample is required with each batch of up to 20 samples. The laboratory control sample is a method blank spiked with each of the matrix spiking solutions. The laboratory control sample must yield recoveries for all analytes within the statistically derived windows. The current statistical windows for MS/MSD and LCS/LCSD are located in the Laboratory Information Management System (LIMS). If the laboratory control sample fails to meet the criteria for target compounds, corrective action must be taken. This includes reanalysis of the laboratory control sample, instrument maintenance and/or recalibration, reanalysis of samples, or data qualification and is determined on a case-by-case basis. If sufficient sample is not available to perform MS/MSD, LCS/LCSD are analyzed and must meet the above mentioned criteria.

E. Sample analysis – All samples must meet the surrogate recoveries. If a sample surrogate recovery falls outside the criteria, the sample must be reanalyzed. If the reanalysis shows the same surrogate results, the sample matrix is assumed to be interfering and the initial results are reported. If the reanalysis meets the recovery criteria, the first analysis is assumed to have been outside of limits due to a laboratory error and the second analysis is reported.

1. For TCLP samples and extraction blanks, a 20-times dilution of the sample is poured into a 40-mL vial is placed in the autosampler carousel/tray. SPLP samples and extraction blanks are analyzed undiluted. A 5-mL aliquot is withdrawn from the vial by the autosampler. The aliquot is transferred through the spiker unit to add the IS/SS spiking solution and then transferred to the sparge vessel. TCLP samples may require dilutions greater than 20 times;

however, if possible the dilution must not exceed 40 fold so that the limits of quantitation do not exceed the Hazardous Limits as noted in Table 1.

2. If samples are a two-phase leachate, the non-aqueous phase is placed in a Tedlar® bag. The non-aqueous phase must be tested for solubility in either methanol or water. If this phase is soluble in water, it must be analyzed at an appropriate dilution in water. If it is not water soluble then the Project Manager is contacted. The sample must be re-entered as a high level soil/oil for analysis.

E. Data analysis

1. Sample chromatograms are analyzed both qualitatively and quantitatively. First, a determination of the identity of a sample peak as a target compound (Table I) is made through the use of computerized analysis. Guidelines for the qualitative determination are as follows:

a. The relative retention time (RRT) of the sample peak is within 0.06 of the RRT of the most recent check standard.

b. Each ion with a relative intensity of greater than 10% of the base ion of the mass spectra of the sample must be present in the sample spectrum produced on the same mass spectrometer, except near the detection limit for each compound.

c. The relative intensities of the ions in the sample mass spectrum must be within 20% of the intensities of the standard mass spectrum, except near the detection limit for each compound.

d. Peaks greater than 10% relative intensity in the sample mass spectrum but not present in the standard mass spectrum from the same mass spectrometer must be accounted for by the analyst.

e. If a compound fails any of the criteria listed above but in the judgment of the mass spectral interpretation specialist is a correct identification, the identification is used and the quantitation of the peak is performed.

2. Quantitation of identified target compounds is performed using the equations listed in the Calculations section of this procedure. The primary ions listed in Table III are used for quantitation. A secondary ion can be used if there is interference with the primary ion. All calculations must report concentrations in values of µg/L. Any analyte with a calculated concentration above the highest standard must be reanalyzed at a dilution that will bring the concentration in solution within the calibration curve. It is desirable to have the analyte concentration within the upper half of the calibration curve, but is not required.

Calculations

1. Relative Response Factor (RRF)

$$(RRF) = \frac{Ax}{Ais} \times \frac{Cis}{Cx}$$

Where:

Ax = Area for the characteristic ion for the analyte

Ais = Area of the characteristic ion of the appropriate internal standard
Cis = Concentration of the internal standard
Cx = Concentration of the analyte to be measured

2. Percent relative standard deviation (%RSD)

$$\%\ RSD = \frac{Standard\ Deviation}{Mean} \times 100$$

3. Regression Equations

$$1^{st}\ Order\ Regression:\ Y = M(X) + B$$

$$2^{nd}\ Order\ Regression:\ Y = B + M(X) + C X^2$$

Where:

$$Y = \frac{Conc\ Std}{Conc\ Istd}$$

$$X = \frac{Area\ Std}{Area\ Istd}$$

$M = 1^{st}$ Degree Slope

$C = 2^{nd}$ Degree Slope

$B = Y$ Intercept

4. Percent Drift

$$\%\ Drift = \frac{C_c - C_1}{C_1} x\ 100$$

Where:

C_1 = Standard concentration of analyte

Cc = Measured concentration of analyte using selected quantitation method

5. Water

$$Concentration\,(\mu g/L) = \frac{(Ax)\,(Is)}{(Ais)\,(RRF)\,(Vo)}$$

Where:

Ax = Area of the quantitation ion peak for the compound to be measured

Ais = Area of the quantitation ion peak for the appropriate internal standard

Is = Amount of internal standard added in nanograms

Vo = Volume of sample purged

RRF = Relative response factor from the initial calibration

6. Percent recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added

7. Relative percent difference (RPD)

$$RPD = \frac{MSR - MSDR}{(1/2)\ (MSR + MSDR)} \times 100$$

Where:

MSR = Matrix spike measured concentration

MSDR = Matrix spike duplicate measured concentration

Statistical Information/Method Performance

Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated semi-annually. Updates to the LIMS are made as needed by the QA Department and only as directed by the supervisor. The department database is updated via a download from the LIMS. Matrix spike, matrix spike duplicate (MS/MSD) sample and laboratory control sample (LCS/LCSD) recoveries are

compared to statistically determined percent recovery windows. The relative percent difference (RPD) between duplicate analyses must be within 30%.

Quality Assurance/Quality Control

For each set of 20 field samples, one sample must be analyzed in triplicate, spiking the duplicate and triplicate with each of the matrix spiking solutions. Analysis of an additional method spike is required for each new matrix. The matrix type is documented on the extraction log. There are 8 general classifications of matrices: Ash, Aqueous, Organic Solids, Sludge, Soils, Solid Waste, Oil and Grease, and Solvent. See Figure 3 for preparation information and spike concentrations. Results of the matrix spike/matrix spike duplicate (MS/MSD) samples are compared to the QC windows (% recovery) that are statistically derived. The current statistically derived windows for MS/MSD and LCS/LCSD are located in the LIMS. The relative percent difference (RPD) between duplicate analyses must be within 30%. A laboratory control sample (LCS) is required for each batch of up to 20 samples. If the laboratory control sample fails to meet the criteria for target compounds, corrective action must be taken. This includes reanalysis of the laboratory control sample, instrument maintenance and/or recalibration, reanalysis of samples, or data qualification and is determined on a case-by-case basis. If sufficient sample is not available to perform MS/MSD, LCS/LCSD are analyzed and must meet the above mentioned recovery and RPD criteria. See the referencing 8260 method for Lower Limit of Quantitation (LLOQ) information.

1. The following criteria concerning internal standards and surrogates must be met in order to produce valid data:

a. Abundances for the internal standards must be within -50% and +100% of the abundances of the internal standards of the current calibration check standard. The retention time for each internal standard must be within 30 seconds of the value for the last calibration check. Values outside these limits indicate a change in system performance or a matrix effect. Samples with internal standard abundances outside of limits are to be reanalyzed. If the reanalysis is within limits, the data from the reanalysis is reported. If the reanalysis confirms the first analysis, the sample matrix is interfering and the data from the first analysis must be reported.

b. Surrogate recoveries are calculated for each sample and blank analyzed. Surrogate recovery limits are generated statistically. The surrogate recovery windows are maintained in the LIMS. If any surrogate is outside of limits, the sample is to be reanalyzed. If surrogates in the reanalysis are within limits, the reanalysis data are reported. If surrogate recoveries are again outside of limits on the reanalysis, the first analysis is reported.

2. The method blank and extraction blanks must meet all the above criteria for internal standard recoveries and surrogate recoveries. In addition, the method blank or extraction blanks must not contain any target compound above the reporting limit of the associated samples. All

method blanks and extraction blanks must meet these criteria; otherwise, the system is considered out of specification and corrective action must be taken.

3. Prior to release from the analytical laboratory, all data is reviewed in accordance with *T-VOA-WI8373*.

Additional Analyses

Compounds other than those listed in Table I are able to be analyzed. Due to poor purging efficiency or poor chromatography, some analytes require calibration at higher levels and/or higher practical quantitation limits (PQLs). Standards containing additional analytes must be prepared as described in the Standards section of this document. Both secondary stock solutions and matrix spike solutions must be prepared for use in analyzing additional compounds.

Table 1

Practical Quantitation Limits (PQL) for Volatile Organics*

Volatile Compound	Practical Quantitation Limits ppm	LOQ Ppm	Hazard Action Limits ppm
Benzene	0.1	0.02	0.5
Carbon Tetrachloride	0.1	0.02	0.5
Chlorobenzene	0.1	0.02	100.
Chloroform	0.1	0.02	6.0
1,2-Dichloroethane	0.1	0.02	0.5
1,1-Dichloroethene	0.1	0.02	0.7
2-Butanone (MEK)	0.2	0.06	200.
Tetrachloroethene	0.1	0.02	0.7

Trichlorethene	0.1	0.02	0.5
Vinyl Chloride	0.1	0.02	0.2

*Sample PQLs are highly matrix dependent. The PQLs listed herein are provided for guidance and are not always achievable.

Table 2

BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15 to 40% of mass 95
75	30 to 60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	less than 2% of mass 174
174	greater than 50% of mass 95
175	5 to 9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5 to 9% of mass 176

Attachment:
Figure 1 (.doc)
Figure 2 (.doc)
Figure 3 (.doc)
Figure 4 (.doc)
Table 3 (.doc)

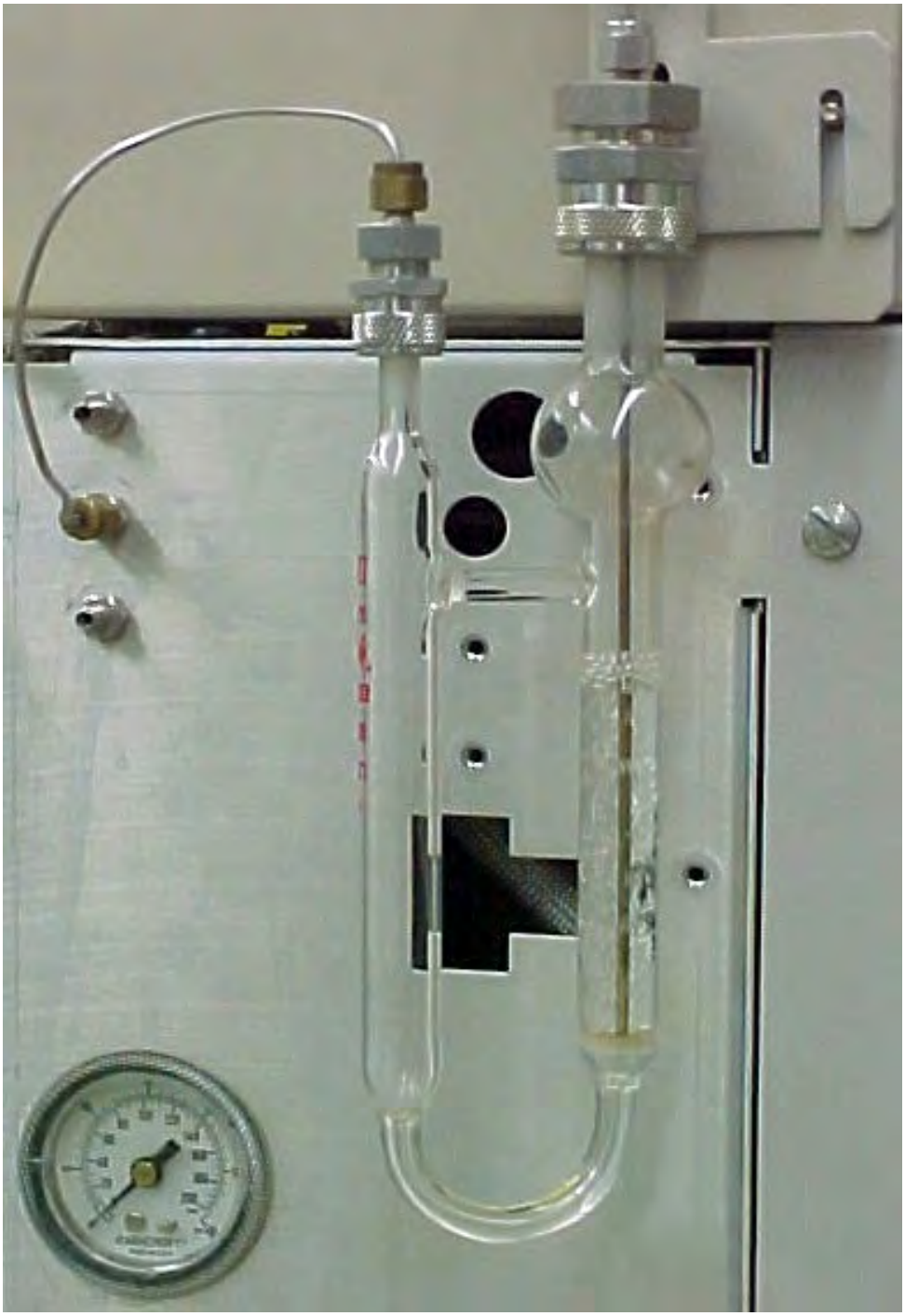
11178 Demonstrations of Capability
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits
7258 Volatiles by Zero Headspace Extractor (ZHE) - Toxicity Characteristic Leaching Procedure

(TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312
7629 GC/MS Volatile Standards Traceability
7691 Glassware Washing
8194 VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D
8197 VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260B
8225 VOCs and GRO by GC/MS in Soils and Solids by EPA 8260B
8236 VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D
8373 GC/MS Volatiles Audit Process

End of document

Version history

Version	Approval	Revision information	
12	03.JUN.2016		
13	02.MAR.2018		
14	02.NOV.2020		



Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Date:_____
Instrument:_____

VOA1= 1:5 dilution of VCS#1B, VCS#2B, and VCS#4C
VOA2= 1:5 dilution of VCS#2B
VOA6= 1:5 dilution of VCS#6
VOA3= 1:5 dilution of VCS#3B and Vacrolein
2CEVE= 1:5 dilution of VCS#1B-2CEVE
VOA8= 1:5 dilution of Hexachloroethane and 2,2'-oxybis(1-Chloropropane)

Stock mix name	VOA1 _____ 2CEVE _____ 1,3-BUT _____	VOA3 _____	VOA2 _____	VOA6 _____ EE _____ Custom V LG Freons _____	n-PEN _____ VOA8 _____ 1-CLHEX _____	CYC _____	EOH _____	Restek Gases (2000 ppm) Lt#_____		Flask mL	
300 ppb std	15 µL	6 µL		15µL	15 µL	30 µL	30 µL	7.5 µL		50	
100 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		50	
50 ppb std	5 µL	2 µL		5 µL	5 µL	10 µL	10 µL	2.5 µL		100	
20 ppb std	4 µL	1.6 µL	4 µL	4 µL	4 µL	16 µL	16 µL	2.0 µL		200	
10 ppb std	2 µL	0.8 µL	2 µL	2 µL	2 µL	8 µL	8 µL	1.0 µL		200	
4 ppb std	4 µL	1.6 µL	12 µL	4 µL	4 µL	32 µL	20 µL	2.0 µL		1000 *	
1 ppb std	* Aliquot 12.5 mL of 1000 mL flask into 50 mL flask										
0.5 ppb MDL std	+ Aliquot 12.5 mL of 1000 mL flask into 100 mL flask										

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Benzene	CS#1B	5000	300	100	50	20	10	4	1	0.5
Bromobenzene		5000	300	100	50	20	10	4	1	0.5
Bromodichloromethane		5000	300	100	50	20	10	4	1	0.5
Bromoform		5000	300	100	50	20	10	4	1	0.5
n-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
sec-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
tert-Butylbenzene		5000	300	100	50	20	10	4	1	0.5
Carbon Tetrachloride		5000	300	100	50	20	10	4	1	0.5
Chlorobenzene		5000	300	100	50	20	10	4	1	0.5
Chloroform		5000	300	100	50	20	10	4	1	0.5
2-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
4-Chlorotoluene		5000	300	100	50	20	10	4	1	0.5
Dibromochloromethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromo-3-chloropropane		5000	300	100	50	20	10	4	1	0.5
1,2-Dibromoethane (EDB)		5000	300	100	50	20	10	4	1	0.5
Dibromomethane		5000	300	100	50	20	10	4	1	0.5
1,2-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Dichlorobenzene		5000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
1,1-Dichloroethane	CS#1B	5000	300	100	50	20	10	4	1	0.5
1,2-Dichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
cis-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
trans-1,2-Dichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,3-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
2,2-Dichloropropane		5000	300	100	50	20	10	4	1	0.5
1,1-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
cis-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
trans-1,3-Dichloropropene		5000	300	100	50	20	10	4	1	0.5
Ethylbenzene		5000	300	100	50	20	10	4	1	0.5
Hexachlorobutadiene		5000	300	100	50	20	10	4	1	0.5
Isopropylbenzene		5000	300	100	50	20	10	4	1	0.5
p-Isopropyltoluene		5000	300	100	50	20	10	4	1	0.5
Methylene Chloride		5000	300	100	50	20	10	4	1	0.5
Naphthalene		5000	300	100	50	20	10	4	1	0.5
n-Propylbenzene		5000	300	100	50	20	10	4	1	0.5
Styrene		5000	300	100	50	20	10	4	1	0.5
1,1,1,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2,2-Tetrachloroethane		5000	300	100	50	20	10	4	1	0.5
Tetrachloroethene		5000	300	100	50	20	10	4	1	0.5
Toluene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trichlorobenzene		5000	300	100	50	20	10	4	1	0.5
1,1,1-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
1,1,2-Trichloroethane		5000	300	100	50	20	10	4	1	0.5
Trichloroethene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trichloropropane		5000	300	100	50	20	10	4	1	0.5
1,2,4-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3,5-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
m-Xylene		5000	300	100	50	20	10	4	1	0.5
o-Xylene		5000	300	100	50	20	10	4	1	0.5
p-Xylene		5000	300	100	50	20	10	4	1	0.5
Pentachloroethane	CS#6	5000	300	100	50	20	10	4	1	0.5
Allyl Chloride		5000	300	100	50	20	10	4	1	0.5
Bromochloromethane		5000	300	100	50	20	10	4	1	0.5
Methyl Acetate		5000	300	100	50	20	10	4	1	0.5
Methylcyclohexane		5000	300	100	50	20	10	4	1	0.5
2-Methylnaphthalene		5000	300	100	50	20	10	4	1	0.5
1,2,3-Trimethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,2-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,3-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5
1,4-Diethylbenzene		5000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	Std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Methacrylonitrile	CS#2B	12500	750	250	125	100	50	40	10	5
Propionitrile		25000	1500	500	250	200	100	80	20	10
trans-1,4-Dichloro-2-Butene		12500	750	250	125	100	50	40	10	5
t-Butyl Alcohol		25000	1500	500	250	200	100	80	20	10
2-Propanol		25000	1500	500	250	200	100	80	20	10
Isobutyl Alcohol		62500	3750	1250	625	500	250	200	50	25
n-Butanol		125000	7500	2500	1250	1000	500	400	100	50
1,4-Dioxane		62500	3750	1250	625	500	250	200	50	25
2-Butanone	CS#3B	25000	600	200	100	40	20	8	2	1
2-Hexanone		25000	600	200	100	40	20	8	2	1
4-Methyl-2-Pentanone		25000	600	200	100	40	20	8	2	1
Acetone		25000	600	200	100	40	20	8	2	1
Acrylonitrile		12500	300	100	50	20	10	4	1	0.5
2-Nitropropane		25000	600	200	100	40	20	8	2	1
Tetrahydrofuran		25000	600	200	100	40	20	8	2	1
Methyl-t-butyl Ether	CS#4C	5000	300	100	50	20	10	4	1	0.5
Ethyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Methyl Methacrylate		5000	300	100	50	20	10	4	1	0.5
Freon 113		5000	300	100	50	20	10	4	1	0.5
Hexane		5000	300	100	50	20	10	4	1	0.5
Heptane		5000	300	100	50	20	10	4	1	0.5
Cyclohexane		5000	300	100	50	20	10	4	1	0.5
Benzyl Chloride		5000	300	100	50	20	10	4	1	0.5
Methyl Iodide		5000	300	100	50	20	10	4	1	0.5
Carbon Disulfide		5000	300	100	50	20	10	4	1	0.5
2-Chloro-1,3-Butadiene		5000	300	100	50	20	10	4	1	0.5
di-Isopropyl Ether		5000	300	100	50	20	10	4	1	0.5
tert-Amyl Methyl Ether		5000	300	100	50	20	10	4	1	0.5
Ethyl-t-butyl Ether		5000	300	100	50	20	10	4	1	0.5
Bromomethane	Gas mix	2000	300	100	50	20	10	4	1	0.5
Chloroethane		2000	300	100	50	20	10	4	1	0.5
Chloromethane		2000	300	100	50	20	10	4	1	0.5
Dichlorodifluoromethane		2000	300	100	50	20	10	4	1	0.5
Trichlorofluoromethane		2000	300	100	50	20	10	4	1	0.5
Vinyl Chloride		2000	300	100	50	20	10	4	1	0.5
Cyclohexanone	CYC	6250	3750	1250	625	500	250	200	50	25
2-Chloroethyl Vinyl Ether	2CEVE	5000	300	100	50	20	10	4	1	0.5
1,3-Butadiene	1,3-BUT	1000	300	100	50	20	10	4	1	0.5

Theoretical Standard Concentrations
Initial Calibration for Large Curve
Purchased Standards
EPA SW846 Method 8260A/B/C

Compound name	std mix	Stock ppm	300 ppb	100 ppb	50 ppb	20 ppb	10 ppb	4 ppb	1 ppb	0.5 ppb
Acrolein	VACR	125000	3000	1000	500	200	100	40	10	5
Ethyl Ether	EE	1000	300	100	50	20	10	4	1	0.5
n-Pentane	n-PEN	1000	300	100	50	20	10	4	1	0.5
Freon 123a	Custom V	1000	300	100	50	20	10	4	1	0.5
Dichlorofluoromethane	LG Freon	1000	300	100	50	20	10	4	1	0.5
Hexachloroethane	VOA8	5000	300	100	50	20	10	4	1	0.5
2,2'-oxybis(1-Chloropropane)		5000	300	100	50	20	10	4	1	0.5
Ethanol	EOH	12500	7500	2500	1250	1000	500	250	62.5	31.25
1-Chlorohexane	1-CLHEX	1000	300	100	50	20	10	4	1	0.5

ppb of analytical standard = (stock ppm)(µL stock) / flask mL

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP LCS

Date: _____
Instrument: _____

QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C
QGASES= 1:40 Restek 502.2 "Q" Gas mix

Stock mix name	QVOA1	QCYC	QGASES	Final Volume	Prep Used
	____	____	_____		
20 ppb	25.0 µL	25.0 µL	25.0 ul	50 mL Flask	LCS

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP LCS

Compound name	std mix	Stock ppm	20 ppb
Methylene Chloride	QCS#1B	1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethybenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas mix	2000	20
Chloroethane		2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP LCS

Compound name	std mix	Stock ppm	20 ppb
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Cyclohexanone	QCYC	1000	500

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____ _____.
Date:_____ _____

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP MS/D

Date:_____
Instrument:_____

Stock mix name	QCS#1B Lt#_____ QCS#2B Lt#_____ QCS#3B Lt#_____ QCS#4C Lt#_____	TCLP QCYC _____	2000 ppm Restek 502.2 "Q" Gas mix Lt#_____	Final Volume
20ppb	17.2 ul	21.5 ul	8.6 ul	43 mL Vial then diluted to DF20 MS/D

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20
Isopropylbenzene (Cumene)		1000	20
p-Isopropyltoluene		1000	20

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP MS/D

Compound name	std mix	Stock ppm	20 ppb
Methylene Chloride	QCS#1B	1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Tricholroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethybenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	Gas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100

Theoretical Standard Concentrations
Quality Control for Large Curve
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
TCLP MS/D

Compound name	std mix	Stock ppm	20 ppb
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Cyclohexanone	QCYC	20000	500

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____
Date:_____

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
Water Prep

QVOA6= 1:25 QCS#6 Date:_____
QARC = 1: 25 QCS#1 B2CEVB, QACR stock Instrument:_____
QVOA1= 1:25 QCS#1B, QCS#2B, QCS3B, QCS#4C QGASES=1:50 Restek 502.2 "Q" Gas mix
Qn-pentane = 40ul of n-pentane lot# ___ to 960ul B&J Brand MEOH lot# _____
QBUT = 40ul of 1,3-Butadiene lot#_____ to 960ul B&J Brand MEOH lot# .
QMIX#4 = 40ul of Cust. Mix #4 lot#_____ to 960 ul B&J Brand MEOH lot#_____

Stock mix Name	QVOA1 _____ QARC _____ QMIX#4 _____	QVOA6 QEE QDEM	QEOH _____ QCYC QBUT _____	8260 SS 2500 ppm Lot#_____	QGASES Qn-pentane _____	Final Volume	MeOH Lot# _____	Used
20 ppb	2.5 µL	2.5 µL	2.5 µL	0.1 ul	2.5 µL	5 mL Syringe	.1 mL	
20 ppb	21.5 µL	21.5 µL	21.5 µL	-	21.5 µL	43 mL Vial	-	
20 ppb	25.0 µL	25.0 µL	25.0 µL	1.0 ul	25.0 µL	50 mL Flask	1 mL	

Compound name	std mix	Stock ppm	20 ppb
Benzene	QCS#1B	1000	20
Bromobenzene		1000	20
Bromodichloromethane		1000	20
Bromoform		1000	20
n-Butylbenzene		1000	20
sec-Butylbenzene		1000	20
tert-Butylbenzene		1000	20
Carbon Tetrachloride		1000	20
Chlorobenzene		1000	20
Chloroform		1000	20
2-Chlorotoluene		1000	20
4-Chlorotoluene		1000	20
Dibromochloromethane		1000	20
1,2-Dibromo-3-chloropropane		1000	20
1,2-Dibromoethane (EDB)		1000	20
Dibromomethane		1000	20
1,2-Dichlorobenzene		1000	20
1,3-Dichlorobenzene		1000	20
1,4-Dichlorobenzene		1000	20
1,1-Dichloroethane		1000	20
1,2-Dichloroethane		1000	20
1,1-Dichloroethene		1000	20
cis-1,2-Dichloroethene		1000	20
trans-1,2-Dichloroethene		1000	20
1,2-Dichloropropane		1000	20
1,3-Dichloropropane		1000	20
2,2-Dichloropropane		1000	20
1,1-Dichloropropene		1000	20
cis-1,3-Dichloropropene		1000	20
trans-1,3-Dichloropropene		1000	20
Ethylbenzene		1000	20
Hexachlorobutadiene		1000	20

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
Water, Low Soil, and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
p-Isopropyltoluene	QCS#1B	1000	20
Methylene Chloride		1000	20
Isopropylbenzene (Cumene)		1000	20
Naphthalene		1000	20
n-Propylbenzene		1000	20
Styrene		1000	20
1,1,1,2-Tetrachloroethane		1000	20
1,1,2,2-Tetrachloroethane		1000	20
Tetrachloroethene		1000	20
Toluene		1000	20
1,2,3-Trichlorobenzene		1000	20
1,2,4-Trichlorobenzene		1000	20
1,1,1-Trichloroethane		1000	20
1,1,2-Trichloroethane		1000	20
Trichloroethene		1000	20
1,2,3-Trichloropropane		1000	20
1,2,4-Trimethylbenzene		1000	20
1,3,5-Trimethylbenzene		1000	20
m-Xylene		1000	20
o-Xylene		1000	20
p-Xylene		1000	20
Bromomethane	QGas	2000	20
Chloroethane	mix	2000	20
Chloromethane		2000	20
Dichlorodifluoromethane		2000	20
Trichlorofluoromethane		2000	20
Vinyl Chloride		2000	20
Methacrylonitrile	QCS#2B	7500	150
Propionitrile		7500	150
trans-1,4-Dichloro-2-Butene		5000	100
t-Butyl Alcohol		10000	200
2-Propanol		7500	150
Isobutyl Alcohol		25000	500
n-Butanol		50000	1000
1,4-Dioxane		25000	500
2-Butanone	QCS#3B	7500	150
2-Hexanone		5000	100
4-Methyl-2-Pentanone		5000	100
Acetone		7500	150
Acrylonitrile		5000	100
2-Nitropropane		1000	20
Tetrahydrofuran		5000	100

Theoretical Standard Concentrations
Quality Control
Purchased Standards
HP Capillary Column
EPA SW846 Method 8260A/B
Water, Low Soil, and NJ MeOH Prep

Compound name	std mix	Stock ppm	20 ppb
Methyl-t-butyl Ether	QCS#4C	1000	20
Ethyl Methacrylate		1000	20
Methyl Methacrylate		1000	20
Freon 113		1000	20
Hexane		1000	20
Heptane		1000	20
Cyclohexane		1000	20
Benzyl Chloride		1000	20
Methyl Iodide		1000	20
Carbon Disulfide		1000	20
2-Chloro-1,3-Butadiene		1000	20
di-Isopropyl Ether		1000	20
tert-Amyl Methyl Ether		1000	20
Ethyl-t-butyl Ether		1000	20
Pentachloroethane	QCS#6	1000	20
Allyl Chloride		1000	20
Bromochloromethane		1000	20
Methyl Acetate		1000	20
Methylcyclohexane		1000	20
2-Methylnaphthalene		1000	20
1,2,3-Trimethylbenzene		1000	20
1,2-Diethylbenzene		1000	20
1,3-Diethylbenzene		1000	20
1,4-Diethylbenzene		1000	20
Dichlrofluoromethane Freon 123a	QMIX#4	1000	20
Acrolein	QACR	7500	150
2- Chloroethyl Vinyl Ether	QCS#1B 2CEVE	1000	20
Cyclohexanone	QCYC	1000	500
Ethyl Ether	QEE	40	20
n-Pentane	Qn-PEN	40	20
Diethoxymethane	QDEM	40	20
1,3-Butadiene	QBUT	40	20
Ethanol	QEOH	1000	500

ppb of analytical standard = (stock ppm)(µl stock) / final volume

Analyst:_____
Date:_____

Compound Name	Primary Ion	Secondary Ion
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
1,1-Dichloroethene	96	61,63
Acetone	43	58
Carbon Disulfide	76	78
Methylene Chloride	84	49,86
1,1-Dichloroethane	63	65,83
trans-1,2-Dichloroethene	96	61,63
cis-1,2-Dichloroethene	96	61,63
2-Butanone	43	72
Chloroform	83	85
1,2-Dichloroethane	62	98
1,1,1-Trichloroethane	97	61,99
Carbon Tetrachloride	117	119
Benzene	78	
Trichloroethene	95	130,132
1,2-Dichloropropane	63	76
Bromodichloromethane	83	85
cis-1,3-Dichloropropene	75	77,110
trans-1,3-Dichloropropene	75	77,110
1,1,2-Trichloroethane	97	83,85
Dibromochloromethane	129	127
Bromoform	173	175
4-Methyl-2-pentanone	43	58
Toluene	92	91
Tetrachloroethene	166	131,164
2-Hexanone	43	58
Chlorobenzene	112	77
Ethylbenzene	91	106
Xylene (total)	106	91
Styrene	104	78
1,1,2,2-Tetrachloroethane	83	85,131
Dibromofluoromethane	113	111
1,2-Dichloroethane-d4	102	104
Fluorobenzene	96	70
Toluene-d8	98	100
Chlorobenene-d5	117	82
4-Bromofluorobenzene	95	174
1,4-Dichlorobenzene-d4	152	115

eurofins	Always check on-line for validity. **Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS**	Level: **Work Instruction**
Document number: **T-MET-WI8636**		
Old Reference: **1-P-QM-WI-9015160**		
Version: **27**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **01-JUL-2022**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Basic Principles
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Procedure
Block Digestor Instructions
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 27	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Basic Principles and Procedure	Clarification	Added notes about sample splitting process

	Revision: 26	**Effective date:** 11.MAY.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version

	Revision: 26	**Effective date:** 11.MAY.2021
Section	**Justification**	**Changes**
LIMS ID	Enhancement	Added TALS method codes
Cross Reference	Enhancement	Added Data Verification SOP
Definitions	Clarification	Removed redundant definitions; added SQAR
Apparatus and Equipment	Reflects current procedure	Removed reference to LLENS
Procedure	Reflects current procedure	Removed reference to the LLENS
Quality Assurance/Quality Control	Reflects current procedure	Removed reference to individual analysis SOPs; added in reference to Data Verification SOP

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3050B, December 1996.

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A (aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI11931	Metals by Inductively Coupled Plasma Atomic Emissions Spectroscopy for SW-846 Methods 6010B/C (aqueous, solid, tissue) and EPA 200.7(aqueous)
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
T-MET-WI35797	Metals Data Verification Process

Purpose

This digestion procedure is for the preparation of solid samples for analysis by ICP and ICP/MS following SW-846 protocol.

Scope

This method is used for preparation of metals in solid samples for analysis by ICP and ICP/MS.

Basic Principles

Soil and solid samples are mixed and aliquoted during soil sample splitting by Sample Administration staff or by metals staff. Full homogenization must be requested additionally by clients.

A representative sample is digested with repeated additions of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2). Hydrochloric acid (HCl) is added to the initial digestate and the sample is refluxed. The resultant digestate is diluted and analyzed.

This method is not a total digestion technique for most samples; it is a very strong acid digestion that dissolves almost all elements that could become "environmentally available." By design, elements bound in silicate structures are not normally dissolved by this procedure.

Definitions

1. SQAR = Sludge Quality Assurance Regulations

Interferences

When analyzing sample by ICP-MS using this digestion procedure we follow the instrument manufacturer's guidelines to eliminate polyatomic interferences typically caused by Chlorine. The process we follow involves the use of a collision/reaction cell on the ICP-MS. Below is a description of how the collision/reaction cell works.

Reaction Process - The primary method of interference removal is through a reaction event. When using a reaction gas, either the target interference is more reactive than the target analyte, leading to preferential removal of the interferent or (less commonly) the target analyte is more reactive and is converted to a new species at a different mass which is free from any existing or newly-formed overlap.

Collision Process - The primary method of interference removal is through a non-reactive event. This process of interference removal is kinetic energy discrimination (KED). Energy Discrimination is most commonly used with an inert gas, which means the interference removal process is not affected by reactions in the cell.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

> **Nitric acid (HNO3)** – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.
>
> **Hydrochloric acid (HCl)** – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.
>
> **Hydrogen peroxide (H2O2)** - This is a strong oxidizing agent and causes severe burns. Avoid contact with skin.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.
Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill

pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four LCSs that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCSs or one blind sample.

Sample Collection, Preservation, and Handling

Solid samples require no chemical preservation.

Samples must be submitted in glass or plastic containersand stored at 0° to 6°C, not frozen, prior to digestion. Samples must be analyzed within 6 months of sample collection.

Digested samples are stored in polypropylene bottles at room temperature.

Apparatus and Equipment

1. Polypropylene containers and covers (digestion vessels) - certified clean and Class A equivalent

2. Whatman No. 41 filter paper or equivalent

3. Funnels

4. Environmental Express HotBlock (block digestor) - adjustable and capable of maintaining a temperature of 90 to 100°C

5. Balance capable of reading 0.01 g

6. Chemware Ultra-Pure PTFE boiling stones, or equivalent.

7. Computer and software TALS

8. Sieves size depending upon client request

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see Form *T-MET-WI9082*.

1. Nitric acid (HNO_3) – Fisher, Trace Metal Grade, or equivalent. Store at room temperature. Re-evaluate annually.

2. Nitric acid (1:1) – Add 500 mL of HNO_3 to 500 mL of reagent water. Store in polypropylene at room temperature. Expires 6 months from date of preparation. (Different volumes are acceptable but ratios must stay the same.)

3. Hydrogen peroxide, 30% (H2O2) – Fisher, Certified ACS or equivalent. Store at room temperature. Re-evaluate annually.

4. Hydrochloric acid (HCl) – Baker Instra-Analyzed, or equivalent. Store at room temperature. Re-evaluate annually.

NOTE: It is acceptable to prepare using multiples of indicated weights and volumes if ratios are maintained.

Procedure

A. Soil Sample Digestion

1. Turn block digestor on and allow block to reach the Control Point setting that provides 90° to 95°C sample temperature. (The block temperature setting is not necessarily the sample temperature.) See below for **Block Digestor Instructions** section.

   Note: Soil samples for metals typically go through soil splitting. Mixing and aliquoting is performed in soil splitting, and splits are delivered to the metals preparation laboratory in the digestate tube. Solids are mixed. Full homogenization must be requested additionally by the client.

2. Collect samples and batch from the split bins. If a sample is not located in split bin, weigh 1.00 to 1.50 g (to the nearest 0.01 g) of a well-mixed sample into a polypropylene digestion vessel. (If the sample is watery use 5.00 to 5.50 grams for analysis. Additional information on non-standard matrices is found at the end of the procedure section.) Add 1.00 to 1.49 g of Chemware Ultra-Pure PTFE boiling stones to the digestion vessel for the blank and LCS. Enter the blank and LCS weight as 1.0000 to 100.0000 final volume in theworksheet tab of the TALS prep batch. In the Notes field, record the true weight measured.For sample batch spiking procedures see *T-MET-WI9082*. All spiking must be performed prior to starting the digestion procedure.

3. Add 10mL of (1:1) HNO_3, swirl to mix, and cover with a polypropylene cover.

4. Place sample vessel in block digestor. Heat (reflux) the sample at 90°to 100°C for 10 to15 minutes without boiling.

5. Add 5 mL of concentrated HNO_3. Add 20 mL of reagent water. Replace cover, return vessel to digestion block and heat for 30 minutes.

6. **NOTE**: If brown fumes are generated (indicating oxidation of the sample by HNO_3) continue the process of adding 5mL HNO_3 and heating until no brown fumes are given off by the sample. This indicates that the reaction with HNO_3 is complete. Add the same amount of HNO_3 to the entire digestion batch.

7. With cover on, heat at 90° to 100°C without boiling for 2 hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if necessary).

8. Remove vessel from digestion block and allow sample to cool.

9. Add 2 mL of reagent water and 3 mL of 30% H_2O_2. With cover on, return vessel to digestion block and heat until effervescence subsides. Care must be taken to ensure that losses do not occur due to excessively vigorous effervescence.

10. Continue to add 30% H_2O_2 in 1 mL aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged.

11. **NOTE:** Do not add more than a total of 10mL 30% H_2O_2.

12. With cover on, continue heating the acid-peroxide digestate at 90°to 100°C without boiling for 2hours. Maintain a covering of solution over the bottom of the vessel at all times (add reagent water if

necessary).

13. Remove sample vessel from digestion block and allow to cool.

14. Add 10 mL of HCl. With the cover on, return vessel to digestion block and heat at 90°to 100°C for 15 minutes.

15. Remove sample vessel from digestion block.

16. If floating particulate is evident after digestion, the sample must be filtered.

    a. Filter through Whatman No. 41 filter paper into a polypropylene container.

    b. Wash sample vessel, residue, and paper thoroughly with reagent water.

    c. If any samples are filtered, the MB and LCS must also be filtered.

17. Adjust volume to the 100 mL mark on the digestion vessel with reagent water and mix. Seal vessel with a screw cap. The sample is now ready for analysis.

NOTE: When special limits of quantitation are required by the client, use more sample weight.

B. For wipe samples:

When wipes are digested by this method, one blank media each must be used for the batch preparation blank, the LCS, and the LCSD. Refer to Form *T-MET-WI9082* for the spiking of the LCS and LCSD. Digest wipes in their own batch. Use reagent water to rinse any particulate matter from the wipe container into the vessel containing the wipe before digesting. If brown fumes are evolved during wipe sample digestion, perform only two 5 mL HNO_3 additions with 30-minute refluxing each; add the same amount of HNO_3 to the entire batch. Proceed with digestion.

C. For tissue samples:

When fish tissues or other tissue samples are digested by this method, refer to Form *T-MET-WI9082* for the spiking of the LCS, LCSD (if needed), matrix spike (MS), and matrix spike duplicate (MSD). Add 1.00 to 1.49g of Chemware Ultra-Pure PTFE boiling stones to the digestion vessel for the blank and LCS. Digest tissue samples in their own batch.

D. For soil samples that need to be dried and sieve prior to digestion.

1. Lay out sample on a clean surface of either glass or aluminum foil.

2. Allow sample to dry. When sample is done drying, but is dried in a large chunk take appropriate clean tools to break down the large chunk in order to sieve the sediment.

3. Pour entire sample that has been laid out to dry into the appropriate sieve size defined by client and shake sieve to get sample to fall through.

4. Take the sieved sample and place into the appropriate bottle needed for analysis.

5. Rinse the sieve and the sieve filter with reagent water until no particulate is left on sieve.

6. Dry sieve in open air or in an oven until no reagent water is present.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. PRESS and hold STAR (*) key.

4. The display shows Control Point temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used. If necessary, adjust Control Point temperature to the proper setting as instructed below.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations
Not applicable.

Statistical Information/Method Performance
Not applicable to this procedure. See analysis method.

Quality Assurance/Quality Control

For sample batch spiking instructions see form *T-MET-WI9082*. Refer to ICP section when prepping ICP analysis. Refer to ICP/MS section when prepping ICP/MS analysis. Prepare a method blank, sample duplicate, MS, MSD, and LCS with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP. If any samples are filtered the prep blank and LCS must also be filtered.

Any extra digestion step done on one sample in a batch must be done to batch QC as well. Example if 1 mL of H_2O_2 is added to a sample it must also be added to the batch QC.

Refer to *T-MET-WI35797* for sample batch quality control requirements, acceptance criteria and corrective action.

11931 Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
11933 Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)
35797 Metals Data Verification Process
9082 Working Instructions for Prep Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
25	06.MAR.2019		
26	11.MAY.2021		
27	21.JUN.2022		

eurofins	Always check on-line for validity. **Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS**	Level: **Work Instruction**
Document number: **T-MET-WI8639**		
Old Reference: **1-P-QM-WI-9015133**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **24-AUG-2021**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_ICP-MS Prep, 6_EUUSLA_Metals_ICP-MS Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Block Digestor Instructions
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 19	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure A	Reflect current protocol	Added procedure for leachate samples

	Revision: 18	**Effective date:** 13.MAY.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout documents	Reflects current protocol	Added references to ICP-MS

	Revision: 18	**Effective date:** 13.MAY.2021
Section	**Justification**	**Changes**
Scope	Reflects current protocol	Removed reference to 3010

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846 Method 3005A, July 1992.

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11931	Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7(aqueous)
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
QA-SOP11178	Demonstrations of Capability

Scope

This acid digestion procedure is used to prepare wastewater, surface water, and groundwater samples for measurement of total recoverable metals by inductively coupled plasma optical emission spectroscopy (ICP-OES) and inductively coupled plasma mass spectrometry following SW-846 protocol.

Basic Principles

Samples are heated with nitric and hydrochloric acids with a substantial reduction in volume during digestion to dissolve metals.

Reference Modifications

1. A 50-mL sample aliquot and final volume is used instead of 100-mL to improve digestion throughput, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses or reflux caps are not used during evaporation; samples are heated without watch glasses in non-metallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

3. Samples are heated at 90° to 95°C on hot plates or HotBlocks.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes or use the designated dispensing equipment.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to *QA-SOP11178* for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of <2 with HNO_3. (Samples to be analyzed for soluble metals requiring filtration at the lab must be submitted unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Samples must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent
2. 250-mL beakers, 400-mL beakers (or other volumes as appropriate)
3. 100-mL graduated cylinders (or other volumes as appropriate)
4. 100-mL Class A volumetric flasks (or other volumes as appropriate)
5. 125-mL Nalgene bottles (or other volumes as appropriate)
6. Hot plates or HotBlocks adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see *T-MET-WI9082*.

1. Nitric acid, HNO_3 - Fisher, Trace Metal Grade, or equivalent. Store at room temperature and re-evaluate annually.

2. Hydrochloric acid, HCl - Fisher, Trace Metals Grade, or equivalent. Store at room temperature and reevaluate annually.

3. Nitric acid (1:1) – Add 500 mL of HNO_3 to 500mL of reagent water. Store at room temperature. Expires in 6 months.

4. Hydrochloric acid (1:1) – Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this method.

Procedure

This SOP has been set up to outline the procedures for HotBlock, hot plate, and auto-digester (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. HotBlocks

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: When insoluble matter is present after digestion, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the MB and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The MB and LCS must also be prepared with filtered reagent water.

See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust control point temperature to the proper setting as instructed below.

1. Shake sample well. For non-leachate samples, transfer 50 mL of well-mixed sample into a 68-mL digestion vessel. For leachate samples, transfer 5-mL of well-mixed sample into a 68-mL digestion vessel and bring to 50-mL using DI water. After the sample has been poured, add the spiking solution. For sample batch spiking procedures, see *T-MET-WI9082*. For sample batch quality control requirements see *T-MET-WI11931*. LCS/LCSD and MS/MSD samples for leachate batches use 5 mL of SPLP or TCLP fluid brought to 50-mL with DI water.

2. Add 2 mL of (1:1) HNO_3 and 5 mL of (1:1) HCl.

3. Heat the solution in a HotBlock at about 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Adjust volume to the 50-mL mark on the digestion vessel with reagent water, cap, and mix.

6. The sample is now ready for analysis.

B. Hot Plates:

NOTE: If boron (B) is requested on a sample, use Teflon vessels.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the MB and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The MB and LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

1. Shake sample well. Transfer 50-mL of well-mixed sample into a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see *T-MET-WI9082*. For sample batch quality control requirements see *T-MET-WI11931*.

2. Add 2 mL of (1:1) HNO_3 and 5 mL of (1:1) HCl.

3. Heat the solution on a hot plate at 90° to 95°C until sample volume is reduced to between 15 and 20 mL, making certain the sample does not boil.

4. Allow to cool.

5. Transfer the solution to a 50-mL volumetric flask. Adjust volume to the 50-mL mark with reagent water and mix.

6. Transfer the solution to a 125-mL Nalgene container and cap.

7. The sample is now ready for analysis.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold Star (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrows keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations

Not applicable to this procedure.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

A method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample must be performed for every SW-846 digestion batch. A batch is 20 samples or less.

Each piece of batch QC is digested following the procedures in this SOP.

For sample batch quality control requirements see *T-MET-WI11931* for ICP and *T-MET-WI11933* for ICP-MS

11178 Demonstrations of Capability
11931 Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
11933 Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)
9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
17	30.NOV.2020		
18	13.MAY.2021		
19	16.AUG.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **T-PEST-WI9232**	**Analysis of Pesticides by 8081B in Solid Samples using GC-ECD**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015108**		
Version: **8**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **25-FEB-2022**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Extraction
Gas Chromatographic Conditions
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 8	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Removed references to old LIMS analyte names
Throughout Document	Reflects current practice	Removed references to obsolete work instruction T-PEST-WI10011
Personnel Training and Qualifications	8000D	Added 8000D IDOC criteria (4 LCS)

Revision: 7	**Effective Date:**	31-MAR-2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Removed references to old LIMS analysis numbers
Throughout Document	Reflects current practice	Removed references to obsolete work instructions T-PEST-WI10016 and T-PEST-WI10022
Apparatus and Equipment	Reflects current practice	Removed Restek columns
Reagents and Standards	New LIMS	Removed references to the standards database and replaced with references to the reagents module in the LIMS
Calibration J.	Reflects current practice	Removed step to set up aroclor calibration in the custom datalog program
Calibration J.3.b.(2)	Superfluous	Six points are already prepared and analyzed as part of the calibration curve – removed 'prepare a sixth point somewhere within the established calibration range listed in the standards preparation section.'

Revision: 7	**Effective Date:**	31-MAR-2021
Section	**Justification**	**Changes**
Calibration J.4.c.	Superfluous	All information contained here matched the information contained in J.3. so removed all steps and referred the reader to step 3 of the initial calibration section.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081B, February 2007 (Update IV).
2. Determinative Chromatographic Separations, SW-846, Method 8000C, March 2003
3. Determinative Chromatographic Separations, SW-846, Method 8000D, July 2014
4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-PEST-WI10926	Microwave Extraction Method 3546 for Pesticides in a Solid Matrix
T-OE-PEST-WI10939	Ultrasonic Extraction for Pesticides in a Solid Matrix by Method 3550
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring of QC Data Acceptance Limits
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is used for identifying and quantitating the following Pesticides in solid samples by SW846 Method 8081B. Solid matrices other than soil can also be analyzed as long as the sample can be handled through the sonication or microwave technique for extracting. Typically solids are reduced to small pieces for extracting (e.g. concrete, wood, other plant material etc.). Tissue samples are ground and homogenized prior to extracting. Tissue samples may be whole fish, filets, or other miscellaneous species (usually aquatic, but not necessarily). Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitation of the same peak as a pesticide and PCB can be avoided.

Compound	LOQ (µg/kg)
alpha-BHC	0.83
beta-BHC	1.0
delta-BHC	0.90
heptachlor	0.83
aldrin	0.83
heptachlor epoxide	0.83
endosulfan I	0.83
endosulfan II	1.7
endosulfan sulfate	1.7
dieldrin	1.7
endrin	1.7
4,4'-DDE (*p,p*)	1.7
2,4'-DDE (*o,p*)	1.7
4,4'-DDD (*p,p*)	1.7
2,4'-DDD (*o,p*)	1.7
4,4'-DDT (*p,p*)	1.7
2,4'-DDT (*o,p*)	1.7

Compound	LOQ (µg/kg)
endrin aldehyde	1.7
endrin ketone	1.8
methoxychlor	6.7
chlordane	17
Cis-chlordane (alpha-chlordane)	0.83
Trans-chlordane (gamma-chlordane)	0.83
toxaphene	33.
kepone	7
mirex	1.7
Isobenzan (telodrin)	1.2
hexachlorobenzene(HCB)	0.83
Total Endosulfan (I + II)	0.83
Total DDTs	1.7

The following Pesticides in tissue samples are also identified and quantitated: **NOTE**: based on an initial sample volume of 15g to final volume 10mL

Compound	LOQ (µg/kg)
alpha-BHC	1.7
beta-BHC	3
delta-BHC	5
gamma-BHC (lindane)	7.5
heptachlor	1.7
aldrin	1.7
heptachlor epoxide	1.8
endosulfan I	1.7
endosulfan II	3.4
endosulfan sulfate	3.4
dieldrin	3.4
endrin	3.4
4,4'-DDE (*p,p*)	3.4
2,4'-DDE (*o,p*)	5
4,4'-DDD (*p,p*)	3.6
2,4'-DDD (*o,p*)	5
4,4'-DDT (*p,p*)	3.4
2,4'-DDT (*o,p*)	5
endrin aldehyde	3.4
endrin ketone	3.4
methoxychlor	13
Chlordane	34
Cis-chlordane (alpha-chlordane)	1.7
Trans-chlordane (gamma-chlordane)	1.7
toxaphene	34
mirex	4
hexachlorobenzene(HCB)	3

Limit of Quantitations (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

HCB, Isobenzan, and Kepone are additional compounds offered by special request.

Basic Principles

The sample is extracted using sonication or microwave with 50% hexane/acetone. The extract is dried, concentrated, and exchanged to hexane. The pesticides are then identified and quantitated using gas chromatography with an electron capture detector (GC-ECD). Florisil, GPC, or copper cleanups may be employed to reduce matrix interferences which introduce large, unresolvable peaks into the chromatogram, specifically elemental sulfur.

Reference Modifications

Gas Chromatography conditions differ from those listed in 8081. However, all quality control (QC) criteria are met.

Interferences

1. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.
2. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.
3. An electron capture detector is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.
4. Extracts may require further cleanup if interferents are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.
   a. Use Florisil cleanup to reduce organics that can interfere (polar compounds).
   b. Use GPC to remove sulfur and higher molecular weight organics.
   c. Use copper cleanup to remove elemental sulfur.
5. For solid samples, a 1:1 mixture of methylene chloride/acetone has been shown to introduce many extraneous interfering peaks due to reactions that occur between the solvents during the heated concentration process. Therefore, hexane/acetone is used for extraction.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management,and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Lab coats and safety glasses must be worn around the GC where solvents and sample extracts are handled.

All GC vials and vials containing extracts are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory that is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in solvent waste containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation (per EPA 8000D, the statistical LCS window and RPD </= 20%)). Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass containers with Teflon™-lined caps and kept cool at 0° to 6°C, not frozen. The extraction must be performed within 14 days of collection, and sample analysis must be performed with 40 days of extraction. Extracts are stored at ≤-10ºC.

Apparatus and Equipment

1. HP 6890 gas chromatograph equipped with dual electron capture detectors or equivalent
2. Columns:
   a. Phenomenex MR1 30 m × 0.32 mm × 0.5 µm
   b. Phenomenex MR2 30 m × 0.32 mm × 0.25 µm
   c. RTX– CLPesticides – 30 m × 0.32 mm × 0.5 µm
   d. RTX – CLPesticides II – 30 m × 0.32 mm × 0.25 µm
3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.
4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents

1. Hexane for autosampler rinse vials. Stored at room temperature for up to 1 year.
2. UPC (ultra pure carrier) helium for carrier gas
3. UPC nitrogen for detector make-up gas
4. UPC hydrogen for carrier, either bottled or from a generator

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.
2. All weights are made on an analytical balance.
3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
4. All prepared standard solutions are stored at ≤-10°C, except as noted.
5. See the reagents module of the LIMS for the compound lists and concentrations contained in the various mixes.
6. Mix A – Restek Catalog #32292. Equivalent to the CLP (SOW OLMO3.2) Mix A and B, contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.

7. Mix E – Restek Custom Mix #55992. Contains additional organochlorine pesticides such as kepone, the 2,4 isomers of DDT, DDD, DDE, mirex, Isobenzan, and hexachlorobenzene.

8. Toxaphene stock – Restek Catalog #32005 at 1,000,000 ppb. Prepare an intermediate by placing 2 mL into a 25-mL volumetric and bring to volume with hexane.

9. Chlordane stock (CAS # 57-74-9) – Restek 32021(1,000,000 ppb in hexane).

10. Surrogate Stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetra-chloro-meta-xylene (TCX) at 200,000 ppb each in acetone.

11. Pest MS stock – Supelco Catalog #48796, #48196. All compounds in Mix A (#7 above)

12. PEM stock – Ultra Scientific CLP-25D. Equivalent to CLP performance evaluation mix (PEM).

13. ICV stocks – These must always be from different lot numbers (or vendors) than the working calibration standards.

    a. Accustandard Cat. #M-8081-SC and Accustandard Cat. #P-064S-10x for Methoxychlor. Prepare an intermediate by diluting 0.1 mL of stock into a 10 mL volumetric flask with hexane using the M-8081-SC stock.

14. Instrument Blank (PIBLK) – surrogate stock (SS) – Restek 32000 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

15. Prepare working standards using the reagents module of the LIMS as a guide.

    a. In the reagents module, first enter the reagents in this section as 'source' reagents.

    b. Then select 'intermediate' reagent and load the most recent version of the working standard you wish to create for editing, or create a new standard if the working standard has not yet been prepared in LIMS.

    c. The module contains the following information: reagent description (ex. AR161), source reagent code, amount used, final amount, solvent used and solvent lot, concentration of each compound in solution, and expiration date. The standards are prepared in hexane. All standards are stored in glass bottles with Teflon™-lined caps in the freezer at ≤-10ºC. The working standards have an expiration date of 6 months.

    d. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level. The CCV and ICV are at the level 4 concentration of the ICAL. The MDL standard is prepared at 2 to 5 times below the low level standard of the ICAL.

    e. The following table is used for the preparation scheme of the matrix spike solution and the surrogate solution used during the extraction. The SS standard is prepared in a volumetric flask and stored in 8 separate 250 mL clear glass bottles in the standard refrigerator at 0º to 6°C, not frozen. The MS standard is prepared in a volumetric flask and stored in 9 separate 12 mL amber vials in the standard refrigerator at 0º to 6°C, not frozen.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
SW-846 SS	SS Stock	3.0	2000	Acetone or methanol	SW-846 Water Surrogate – identical to that prepared for PCB analyses
SW-846 MS	MS Stock	2.0	100	Acetone or methanol	SW-846 Water spike for single component organochlorines in TCL/PPL list

16. Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitiation of the same peak as a pesticide and PCB can be avoided.

Extraction

See organic extraction work instructions T-OE-Pest-WI10939 for sonication extraction and T-OE-Pest-WI10926 for microwave extraction.

Gas Chromatographic Conditions

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity and/or improve the separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Detector	ECD
Detector Temp	330°C
Oven Temp	140°C, no hold, 25°C/min to 250°C, then 22°C/min to 300°C, hold 3 min
Carrier Gas	Hydrogen at constant flow of 3.4 ml/min Helium may also be substituted
Makeup Gas	N2 at 55 mL/min
Injection Size	1 µL, direct injection
Injector Temp	225°C

Calibration

A. The pesticide analysis is run as a dual column approach. One injection is split onto two analytical columns. All initial and continuing calibration criteria listed below applies to both analytical columns.

B. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

C. Prepare a sequence using the following recommended order of injections:

1. Conditioner
2. PEM (evaluation)
3. PIBLK (instrument blank)
4. IC MIXA1
5. IC MIXA2
6. IC MIXA3
7. ICRT MIXA4
8. IC MIXA5
9. IC MIXA6
10. IC Mixe1*
11. IC MIXE2*
12. IC MIXE3*
13. ICRT MIXE4*
14. IC MIXE5*
15. IC MIXE6*
16. IC TOX1
17. IC TOX2
18. IC TOX3
19. ICRT TOXA4
20. IC TOX5
21. IC TOX6
22. IC CHL1
23. IC CHL2
24. IC CHL3
25. ICRT CHL4
26. IC CHL5
27. IC CHL6
28. ICV MIXA
29. ICV MIXE
30. ICV TOX
31. ICV CHL
32. ICVL MIXA (MDL std for Mix A)
33. ICVL MIXE
34. ICVL TOX
35. ICVL CHL
36. AR 164
37. AR 2154
38. AR 484

39. Blank
40. LCS
41. 1234567
42. 1234567ms
43. 1234567msd
44–54. Continue running samples for a 12-hour period from last standard
55. PEM
56. CCV MIXA (CCV)
57. CCV MIXE4* (CCV)
58. CCV TOXA4 (CCV)
59. CCV CHLD4 (CCV)

D. The conditioner injection is usually a standard or sample that has already been injected.

1. The conditioner is used to prime the system.

2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

E. Hexane blanks can also be injected to allow the GC to go through some temperature programs and/or check the cleanliness of the system.

F. Inject initial instrument blank (PIBLK) after the conditioners and PEM but before the initial calibration. It is used to determine that the instrument is free of background noise or contamination.

G. Run a breakdown evaluation standard (PEM) at the start of an ICAL to ensure the breakdown of DDT and endrin meets the method acceptance criteria.

1. Sample analysis cannot be performed if the breakdown exceeds 15% for either DDT or endrin.

2. Breakdown check is run ongoing throughout the run after every 12 hours.

3. The sum of the peak heights of DDE, and DDD divided by the total peak heights of DDT/DDD/DDE cannot exceed 15%.

4. The sum of the peak heights endrin aldehyde and endrin ketone divided by the total peak heights of endrin/endrin aldehyde/endrin ketone cannot exceed 15%.

H. *MIX E is only needed when analyzing for additional pesticide including 2,4-DDE, 2,4-DDD, 2,4-DDT, kepone, mirex, HCB, and Isobenzan.

I. The order of injections for the Aroclor multi-components is not critical as long as they are all run before sample analysis. Aroclors are only used to identify possible PCB patterns which may interfere with the pesticide detections.

J. Initial Calibration (ICAL)

1. Calibrate using the 5-6 levels of the single component pesticides contained in MIX A and E. Run 5-6 levels for chlordane and toxaphene.

2. An external standard calibration is used with average calibration factor (AVGCF) for all analytes where the %RSD is ≤20%.

3. If the RSD is > 20%, use a calibration curve.

a. Attempt a linear fit first. Use this fit if the correlation coefficient is >0.99.

b. If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) A six-point calibration must be run to use quadratic.

(2) Quadratic fit can not be used to extend the calibration range or bypass instrument maintenance

(3) For samples from South Carolina, a quadratic fit may not be used.

c. For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore.

d. The criteria for % error of standard levels at or below the LOQ is +/- 50%. The criteria for % error of all other standard levels is +/-30%.

e. If the 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels appear to be off.

(2) Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time.

(3) Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

f. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.

4. Set up the toxaphene and chlordane calibration data.

a. The retention time of the peaks to use for identifying and quantifying these multi-component pesticides are entered into the calibration file along with the corresponding peak heights and concentrations.

b. Each individual peak used for Toxaphene and chlordane must meet the 20% RSD criteria.

c. Alternatively, when these criteria are not met (RSD is >20%), a linear fit or quadratic fit is used.

d. A linear fit will be tried first. Use this fit if the correlation coefficient is >0.99.

e. If the correlation coefficient is less than 0.99, a quadratic fit will be tried.

(1) Quadratic fit cannot be used to extend the calibration range or bypass instrument maintenance.

(2) For samples from South Carolina, a quadratic fit may not be used.

f. For either curve type, extrapolate or force to zero is not allowed. Set the zero to ignore.

5. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

6. Set the scaling of chromatograms and peak integration parameters so that the peaks for each compound of interest are detected and integrated at the concentration of the MDL. This ensures that the LOQ and MDL can be met.

K. Initial Calibration Verification (ICV)

1. Verify the calibration curve using the ICV mixtures injected directly after the corresponding curve.

2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration.

L. Continuing Calibration Verification (CCV)

1. Analyze a set of check standards after each set of injections in a 12-hour period, or 20 samples, whichever comes first (samples, QC, blanks, etc.).

a. Use a mid level single component standard to evaluate the response of single component analytes.

b. Use a mid level standard for toxaphene and chlordane.

c. Run the breakdown evaluation mix (PEM). Analysis cannot proceed if either compound exceeds 15%.

2. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration.

3. Samples must be bracketed by compliant standards.

4. When confirmation of target analytes is needed, the initial calibration criteria must be met and the second column should meet the 20% continuing calibration criteria.

5. When a continuing calibration verification standard (CCV) fails to meet the QC criteria, all samples that were injected after the last CCV that passed must be re-injected.

a. Exception: If the CCV fails high and those targets are not detected in the associated samples, the samples can be reported.

b. If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

6. The instrument blank (PIBLK) may be injected after each set of continuing calibration verifications.

   a. This is optional but frequently requested for projects.

   b. It must be evaluated as a water matrix against the water MDL/LOQs.

   c. The PIBLK must not have any target compounds above the reporting limits.

      (1) If a target analyte is detected in the PIBLK, any associated samples with a detection for that same target must be evaluated.

      (2) Unless the concentration in the sample is more than 10x the PIBLK value, the sample must be reinjected

      (3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up the instrument.

7. Retention time (RT) windows

   a. Established as 3× the standard deviation determined over 72 hours, or at no less than .02 minutes, applied to the initial calibration standard, usually Level 3.

   b. If the RTs for a continuing calibration standard fall outside the RT window, update the midpoint RT using that standard.

      (1) Save this under the appropriate name to indicate an update has occurred.

      (2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

      (3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Make injections via an auto sampler.

2. Samples are analyzed according to the sequence in the calibration section above.

3. Retention times of peaks in the samples are compared to the standard RT windows. Peaks present on both columns (and that are also in the correct ratios to represent an aroclor) are quantitated and the high value is reported unless there are chromatographic anomalies. See *T-PEST-WI9954*.

4. There are several compounds that coelute on one column and not the other; whether a compound coelutes or not is instrument and column dependent. Compounds known to coelute are contained in different standards. One standard is named MIXA and the other standard is MIXE. Refer back to the ICAL to note which compounds coelute and on which column they coelute before evaluating the sample data. If there is a detection for one of the coeluting compounds on the column where this compound does not coelute and the detection is greater than the MDL, look at the other column and note if the coeluting compound is present. If the coeluting column is present and within the +/-0.02 retention time units of the detected coleluting compound from the other column, calculate the concentration using the appropriate response factor. Calculate the RPD between the two columns and report as per routine protocol.

5. Continue running groups of samples/injections followed by check standards every 12 hours or every 20 injections, whichever comes first.

6. If significant interference is present, schedule florisil cleanup. If elemental sulfur is present, copper cleanup the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract, analyze, and adjust the LOQs accordingly.

7. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

A. See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration.

B. Calculation of results is performed according to the following procedures:

1. Single-component compounds

   a. Using AVGCF from initial calibration

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IW} \times DF = \mu g/kg \text{ as received}$$

   b. Using linear curve from initial calibration:

$$[(\text{Sample Height} - Y - \text{intercept})/\text{Slope}] \times \frac{FV}{IW} \times DF = \mu g/kg \text{ as received}$$

Where:

FV = final volume (in mLs)

IW = initial weight (in grams)

DF = dilution factor, as needed

2. Multi-component compounds

The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each quantitation peak used for toxaphene and chlordane.

Usually the five major peaks are chosen for quantitation. Include cis-chlordane and trans-chlordane as two of the five major peaks for the calibration of chlordane. Sample concentrations are calculated per peak using Average Calibration Factor (AVG CF).

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IW} \times DF = \mu g/kg \text{ as received}$$

Where:

FV = final volume (in mLs)

IW = initial weight (in grams)

AF = additional factor, based on cleanups (i.e., 2 mL extract florisiled to 25 mL = 12.5)

DF = dilution factor, as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(\text{Result 1} + \text{Result 2} + \ldots + \text{Result } n) / n = \text{Average Result}$$

3. A breakdown mix (PEM) containing 4,4-DDT and Endrin is run to check for breakdown. The breakdown must not exceed 15% for either compound. Breakdown is calculated as:

$$\text{\% Breakdown for } p,p'\text{-DDT} = \frac{\text{pk ht (area) of } p,p'\text{-DDE} + p,p'\text{-DDD}}{\text{pk ht (area) of } p,p'\text{-DDE} + p,p'\text{-DDD} + p,p'\text{-DDT}} \times 100$$

$$\text{\% Breakdown for Endrin} = \frac{\text{pk ht (area) of Endrin Aldehyde} + \text{Endrin Ketone}}{\text{pk ht (area) of Endrin Aldehyde} + \text{Endrin Ketone} + \text{Endrin}} \times 100$$

If breakdown fails, injector maintenance must be performed. Analysis cannot proceed until breakdown check passes.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

Each extraction batch (up to 20 samples) must contain a method blank, a laboratory control spike sample (LCS), and either an unspiked background sample (US), a matrix spike (MS), a matrix spike duplicate (MSD) or an LCS/LCSD.

The TCL single-component pesticides of interest for each analysis are routinely spiked. Mirex, 2,4-DDE/DDD/DDT, Isobenzan, kepone, and HCB are not spiked since this would result in co-elution with the other spiked compounds. These can be spiked at a client's request for special projects, within our scope of accreditation.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

10007 Preventative and Corrective GC Maintenance
10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10926 Microwave Extraction Method 3546 for Pesticides in a Solid Matrix
10939 Ultrasonic Extraction for Pesticides in a Solid Matrix by Method 3550
11892 Determining Method Detection Limits and Limits of Quantitation
9847 Common Equations Used During Chromatographic Analyses
9954 Interpretation of Chromatographic Data
9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information	
6	29.MAR.2018		
7	17.MAR.2021		
8	25.FEB.2022		

eurofins	Always check on-line for validity. **Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9238**		
Old Reference: **1-P-QM-WI-9015109**		
Version: **8**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **02-OCT-2021**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Extraction
Gas Chromatographic Conditions
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Appendix I

Revision Log

Revision: 8	**Effective Date:**	31 March 2021
Section	**Justification**	**Changes**
Throughout Document	SOP obsolete	Removed all references to T-PEST-WI9980
Personnel Training and Qualifications	Clarifications	Add 8000D reference for IDOC LCSs
Reagents and Standards	Enhancement	Add calibration standard scheme. Update 'or near' RL to 'or below' RL for low level standard
Statistical Information/Method Performance	TNI2016 requirements are more stringent.	Removed 8000D specific language.

Revision: 7	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced all references to old LIMS with references to new LIMS
Throughout Document	SOPs obsolete	Removed references to T-PEST-WI10016 and T-PEST-WI10022

Reference

1. T*est Methods for Evaluating Solid Waste*, SW-846, Method 8082A, February 2007.
2. Determinative Chromatographic Separations, SW-846, Method 8000D, July 2014
3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-PEST-WI10920	Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses

Scope

This method is useful for identifying and quantitating the following polychlorinated biphenyls (PCBs) as Aroclors in aqueous matrices:

Compound	LOQ (µg/L)
Aroclor 1016	0.5
Aroclor 1221	0.5
Aroclor 1232	0.5
Aroclor 1242	0.5
Aroclor 1248	0.5
Aroclor 1254	0.5
Aroclor 1260	0.5

The following aroclors can also be analyzed for upon request by the client, usually on a project basis. Since aroclors 1262 and 1268 contain peaks that elute much later than 1260, the GC run time needs to be extended to ensure the entire pattern has eluted.

Compound	LOQ (µg/L)
Aroclor 1262	0.5
Aroclor 1268	0.5
Aroclor 5422	1.0
Aroclor 5432	1.0
Aroclor 5460	1.0

See Appendix I for GC operating conditions and calibration information when analyzing for Aroclor 5422, 5432, and/or 5460.

Limits of Quantitiation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Basic Principles

A portion of an aqueous sample is extracted serially with methylene chloride. The volume of sample extracted can be adjusted depending on the physical appearance of the sample and the amount sent for analysis. The extract is dried, concentrated, and exchanged into hexane. The PCBs are then identified and quantitated using gas chromatography (GC) with an electron capture detector (ECD). The extract may require further cleanup (by florisil, sulfuric acid, or copper) to reduce matrix interferences that introduce large, unresolvable peaks in the chromatogram (due to interferents such as phthalates, oxygenated organics, unsaturated organics, or elemental sulfur).

Reference Modifications

Gas Chromatography conditions are different than those listed in Method 8082A however, all QC criteria are met.

Interferences

1. Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

2. Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

3. An electron capture detector (ECD) is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

4. Extracts may require further cleanup if interferents are present. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Interfering materials can introduce large, unresolvable peaks into the chromatogram.

   a. Use Florisil cleanup to reduce organics that can interfere (polar compounds).

   b. Use GPC to remove sulfur and higher molecular weight organics.

   c. Use copper or TBA cleanup to remove elemental sulfur.

5. Common single component pesicides such as DDT, DDD, and DDE may cause interference with the aroclor pattern. To ensure that the analyst is aware of this, a standard containing DDE/DDD/DDT will be run with each initial calibration.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Safety glasses must be worn around the GC where solvents and sample extracts are handled.

GC vials are disposed of in the designated lab container and subsequently lab packed for final disposal. All solvent waste is placed in designated containers in the laboratory then taken to the lab-wide facility by personnel trained in hazardous waste disposal.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the LCS acceptance criteria, per EPA 8000D section 9.3.3.2. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCSs, one blind sample, or one ICAL with 4 ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples are collected in 1 L or 250 mL amber glass containers with Teflon-lined caps and kept cool at 0° to 6°C, not frozen.

PCBs have no maximum recommended holding time for the extraction. Some agencies or projects may require a specific hold time for the extraction. If the hold time is specified in the project, this hold time must be followed. Sample analysis must be performed with 40 days of extraction. Extracts are stored in the freezer at ≤-10°C.

Apparatus and Equipment

1. HP 7890 gas chromatograph equipped with an electron capture detector, or equivalent

2. Columns:

   a. Phenomonex MultiRes I – 30 m × 0.32 mm × 0.5 µm, or equivalent

   b. Phenomonex MultiRes II – 30 m × 0.32 mm × 0.25 µm, or equivalent

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.

4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents

1. Follow manufacturer's guidelines for storage conditions.

2. Hexane for autosampler rinse vials. Stored at room temperature up to 1 year.

3. UPC (Ultra Pure Carrier) helium for carrier gas.

4. UPC nitrogen for detector make-up gas.

5. UPC hydrogen carrier gas, either bottled or from a generator.

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.

2. All weights are made on an analytical balance.

3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.

4. All prepared standard solutions are stored at <-10° C in labeled containers for up to 6 months. If comparison with check standards indicates a problem prior to expiration date, the standards must be replaced.

5. Aroclor 1016 stock – Restek 32006 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane.

6. Aroclor 1016/1260 stock – Restek 32039 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane.

7. Aroclor 1221 stock – Restek 32007 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

8. Aroclor 1232 stock – Restek 32008 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

9. Aroclor 1242 stock – Restek 32009 at 100,000 ppb in hexane. Two separate lots are kept on hand to provide a second source.

10. Aroclor 1248 stock – Restek 32010 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane. Two separate lots are kept on hand to provide a second source.

11. Aroclor 1254 stock – Restek 32011 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 to 10 mL of hexane. Two separate lots are kept on hand to provide a second source.

12. Initial calibration Verification standard (ICV) Stocks:

a. Aroclor 1016 - Accustandard cat # C-216S-H-10X at 1,000,000 ppb

Aroclor 1260 Accustandard Cat# C-260S-H-10x at 1,000,000 ppb

Prepare an intermediate by diluting 1mL of each to 10 mL of hexane.

b. Aroclor 1248 - Accustandard cat# C-248S-H-10X at 1,000,000 ppb.

Prepare an intermediate by diluting 0.5 mL to 5 mL of hexane

c. Aroclor 1254 – Accustandard cat#C-254S-H-10X at 1,000,000 ppb.

Prepare an intermediate by diluting 0.5 mL to 5mL of hexane.

13. Surrogate stock (SS) – Supelco 861284 containing DCB/TCX at 200,000 ppb in acetone.

14. 1016/1260 Matrix spike (MS) stock: Restek 32039. Each at 1,000,000 ppb in hexane. Also used as a second source stock. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

15. Aroclor 1262 stock – Restek #32409 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

16. Aroclor 1268 stock – Restek #32410 at 1,000,000 ppb in hexane. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

17. Instrument Blank (IBLK) – Surrogate Stock (SS) – Supelco #861284 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

18. Prepare working standards using the reagent module in the LIMS as a guide.

a. In the reagent module, first enter the reagents in this section as 'source' reagents.

b. Then select 'intermediate' reagent and load the most recent version of the working standard you wish to create for editing, or create a new standard if the working standard has not yet been prepared in TALS.

c. The module contains the following information: reagent description (ex. AR161), source reagent code, amount used, final amount, solvent used and solvent lot, concentration of each compound in solution, and expiration date. The working standards have an expiration date of 6 months.

d. The calibration scheme begins at or below the reporting limit through a 20 fold of the initial calibration level:

Calibration Standard	**INT standard 10,000 ug/L Vol. (mL)**	**Surrogate GCS_ARpestssr Vol. (mL)**	**Final Vol. (mL)**	**Aroclor conc. (ug/L)**	**DCB/TCX Conc. (ug/L)**
GCS_AR161 (1016/1260)	0.025	0.025	100	25	2.0
GCS_AR162 (1016/1260)	0.05	0.05	100	50	4.0
GCS_AR163 (1016/1260)	0.1	0.25	100	100	20
GCS_AR164 (1016/1260)	0.2	0.5	100	200	40
GCS_AR165 (1016/1260)	0.5	0.76	100	500	61
GCS_AR166 (1016/1260)	1.0	1.0	100	1000	80

Standard Name	**Parent Solution**	**Aliquot (mL)**	**Final Vol. (mL)**	**Final Conc. (ug/L)**	**Solvent**	**Description**
GCS_MD16	GCS_AR1660ING	0.01	200	5.0	Hexane	1016/1260 MDL Standard
	GCSARpestssr	0.01		0.4		
GCS_IC16	GCS_IC16INT	1.0	200	200	Hexane	Second Source ICV Check Standard
	GCS_ARpestssr	0.4		40		
GCS_IBLKpcb	GCS_PESTSUR	0.05 mL	500	20	Hexane	SW-846 Water Surrogate - identical to that prepared for the Pesticides/PCBs analysis

e. For 1L preps (3510C):

Standard Name	**Parent Solution**	**Aliquot (mL)**	**Final Vol. (mL)**	**Final Conc. (ug/L)**	**Solvent**	**Description**
OP_PCB_MS	Aroclor 1016/1260 stock	1.25	250	5000	Acetone or methanol	PCB Spike used for extraction

Standard Name	Parent Solution	Aliquot (mL)	Final Vol. (mL)	Final Conc. (ug/L)	Solvent	Description
OP_SW_SS	Pest Surr mix	3	2000	300	Acetone or methanol	SW846 surrogate standard used for extraction
OP_PCB_MS	stock	1.25	250	5000	Acetone or methanol	PCB Spike used for extraction

f. For 250mL preps (3510C_LVI):

Standard Name	Parent Solution	Aliquot (mL)	Final Vol. (mL)	Final Conc. (ug/L)	Solvent	Description
OP_SW_SS	Pest Surr mix	3	2000	300	Acetone or methanol	SW846 surrogate standard used for extraction
OP_MINIPCB_MS	OP_PCB_MS	12.5	50	1250	Acetone or methanol	PCB Spike used for extraction
OP_SW_SS	Pest Surr mix	0.375	1000	75	Acetone or methanol	SW846 surrogate standard used for extraction

The MS and SS working solutions are stored <-10°C.

19. An initial calibration verification standard must also be prepared at a concentration at the mid-point of the calibration for 1016, 1260, 1248, 1254 using a stock solution purchased from a different vendor or different lot than that used for the calibration standards.

20. Additional standards and preparations are listed in Appendix I for Aroclor 5442, 5432, and 5460 (PCT analysis).

Extraction

See organic extraction procedure *T-OE-PEST-WI10920*.

Gas Chromatographic Conditions

The conditions listed are usually the optimum operating conditions but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

A Merlin microseal can be used in place of traditional septum.

Detector	ECD
Detector Temperature	330°C
Oven Temperature	110°C 40°C/min. to 250°C 20°C/min. to 280°C 30°C/min to 330°C Hold until DCB elutes ~ 2 min.
Column A	MR I
Column B	MR II
Carrier	Hydrogen at 12 psi, 5ml/min constant flow. (Can be substituted with Helium)
Makeup gas	N2 at 80 mL/min. for Agilent GCs
Injection size	1 µL, direct injection
Injection Temperature	225°C

Calibration

A. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

B. Prepare a sequence using the following order of injections:

1. Conditioner
2. IBLK
3. EVAL
4. AR161
5. AR162
6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15. AR486
16. AR541
17. AR542
18. AR543
19. AR544
20. AR545
21. AR546
22. AR214
23. AR324
24. AR424
25. AR624
26. AR684
27 AR16X
28. MD16 (MDL)
29. IC16X (ICV)
30. IC48X (ICV)
31. IC54X (ICV)
32. Blank
33. LCS
34. 1234567
35. 1234567ms
36. 1234567msd
37.- 47. Continue running samples
48. AR164 (CCV)
49. IBLK

1. Note for our routine PCBs: The AR21, AR32, and AR42 are level 4s in the ICAL and are entered as AR214 and AR424 in the ICAL. Also the AR62 and AR68 are both level 4s and are listed as AR624 and AR684 in the sequences.

2. A single point of Aroclor 1016 is analyzed with the calibration to aid in better pattern recognition in the samples. Aroclor 1016 and 1242 have similar patterns with the exception of the smaller trailing peaks at the end of the Aroclor 1242 pattern. This is identified in the sequence as AR16X.

3. A DDT/Endrin breakdown standard is run with each ICAL in order to provide the retention times of p,p-DDE, p,p-DDD, and p,p-DDT which may interfere with the pattern for aroclor 1254, 1248, and 1260.

4. See Appendix I for a sequence example when the analysis of PCTs (Aroclors 5442, 5432, and 5460) is requested.

D. Continue running groups of samples/injections. Each bracket must contain no more than 20 samples/injections and last no more than 12 hours for Method 8082A. Each bracket is followed by the continuing calibration check standard and an instrument blank (IBLK).

E. The conditioner injection is usually a standard or sample that has already been injected.

1. The conditioner is used to prime the system.

2. It is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

F. Hexane blanks can also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

G. Instrument blanks (IBLK) may also be run with the continuing calibration standards. This is optional but frequently requested for projects.

1. The instrument blank (IBLK) is injected after the conditioners but before the initial calibration.

2. It is used to determine that the instrument is free of background noise or contamination.

H. For projects where a known aroclor is present and at the request of clients other aroclors can be run for the continuing check standard. For instance, a set of continuing standards can be AR484, AR164, and IBLK.

I. Aroclor 1262 and 1268 can be analyzed when requested. A full six point curve can also be run, depending on the project requirements.

J. Initial Calibration (ICAL)

1. Calibrate for the aroclors using the six levels of 1016, 1260, 1248, and 1254. Use the single point for 1221, 1232, 1242, 1262, and 1268 when needed. As an option, 1248 and 1254 can use a single point calibration.

2. An external standard calibration based on the average calibration factor (AVG CF) for all analytes is used for quantitation where the %RSD is ≤20%.

3. The surrogate standards are calibrated using the AR16 levels using AVGCF unless the %RSD is >20%.

4. If the RSD is > 20%, use a calibration curve.

a. Use a linear fit.

b. The correlation coefficient must be >0.99 to be a valid fit.

c. Extrapolate or force to zero is not allowed. Set the zero to ignore.

When 8000D is referenced and curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100). All individual peaks used to calculate the aroclor pattern must meet the %E criteria.

5. If the 0.99 curve coefficient cannot be met:

a. Inspect the data points to see if one or more calibration level became concentrated due to solvent evaporation or degraded over time.

b. Reinject or remake the standard if a specific calibration level has concentrated due to solvent evaporation, or degraded over time..

c. Perform instrument maintenance as needed. See *T-PEST-WI10007* for troubleshooting linearity problems.

6. The calibration range for the aroclors is 50ug/L to 1000 µg/L. Level 1 is equivalent to the Limit of Quantitation.

7. Set up the aroclor calibration data in LIMS. The retention times of the peaks to use for identifying and quantifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations.

8. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

9. Set the scaling of chromatograms and peak integration parameters so that the size of the peaks for each compound of interest are approximately 2 to 3 mm in height at the concentration of the method detection limit (MDL).

a. Ensure all peaks in the MDL standard are integrated.

b. By running the 1016/1260 MDL standard, the majority of peaks of all aroclors are represented.

K. Initial Calibration Verification (ICV)

1. Verify the calibration curves using the ICV mixtures injected directly after the full ICAL.

2. The % difference of the concentrations for these must be within 20% difference of the nominal concentration. All the individual peaks used in the ICAL for the PCB pattern must meet this criteria.

a. If this criteria is not met, reinject the ICV.

b. If the criteria is not met again, then prepare a new standard.

c. If the criteria is not met after analyzing the new ICV standard, then a recalibration is performed.

L. Continuing Calibration Verification (CCV)

1. Calibration verification is performed after each set of twenty injections (samples, QC, blanks, etc.) or 12 hours, whichever comes first.

2. Use AR16 to evaluate the calibration of the aroclors (or other aroclors as requested for particular clients or projects).

3. Other aroclors can also be used along with AR16. This must be done if a site has prior history of containing a specific aroclor, or as requested for client projects or to meet other regulatory requirements.

4. The concentration quantitated for the continuing calibration check standards must be within 20% difference (%D) of the nominal concentration for each compound. All the individual peaks used in the ICAL for the PCB pattern must meet this criteria.

5. Samples must be bracketed with compliant standards.

a. Exception: If the standard following a sample is outside the ±20% but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected. A comment must be added to the analytical report.

b. If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

c. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria, as well as all initial calibration criteria. if either of these are not met, a comment must be added to the analytical report.

6. The instrument blank (IBLK) is injected after each set of continuing calibration verifications when requested.

a. It must be evaluated as a water matrix against the water MDL/LOQs.

b. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be reinjected after another compliant IBLK.

(3) Instrument maintenance, like baking the system or injection port maintenance is usually necessary to clean up instrument.

7. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours or at no less than ±0.02 min, applied to the mid-point initial calibration standard.

b. If the RTs for a CCV fall outside the RT window, update the mid-point RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Make injections via an auto sampler.

2. Samples are analyzed according to the sequence in the calibration section above, along with the appropriate check standards.

3. Retention times of peaks in the samples are compared to the standard RT windows.

Peaks present on both columns that are also in the correct ratios to represent an aroclor are quantitated and the high value is reported unless chromatographic anomalies are observed. See *T-PEST-WI9954*.

4. Use a minimum of three to six peaks for quantitation, with the exception of certain mixes where it can be more accurate to use less peaks to avoid excessive overlap of patterns.

5. If significant interference is present, schedule florisil and/or sulfuric acid cleanup. If elemental sulfur is present, copper treat the extract. If these techniques do not reduce the matrix problems, dilute the extract with hexane, analyze, and adjust the LOQs accordingly. Also, the reporting limit for individual aroclors may be raised in instances where matrix interference hinders the recognition of an aroclor pattern in the specified retention time window. The reporting limit is calculated by averaging the concentration of at least 3 peaks in the pattern.

6. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

A. See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration.

B. Calculation of results is performed according to the following procedures:

1. The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each aroclor. Usually, the six major peaks that are unique to each aroclor are chosen for quantitation with the exception of 1221 where only three peaks are available.

2. Sample concentrations are calculated per peak using average calibration factor (AVG CF) from the initial calibration for 1016, 1260, 1248, and 1254 where a multi-point calibration is run, single point CF for 1221, 1232, 1242, (a multi-point calibration can also be run for these as requested or necessary to meet client or regulatory agency requirements). Do not use individual peaks that have values <MDL in quantitation.

3.

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

Where:

FV = Final volume – 2 or 10 mL

IV = Initial volume – 250 or 1000 mL

DF = Dilution factor, as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

4. The surrogate results are determined using either AVGRF or linear curve:

$$(\text{Result 1} + \text{Result 2} + \ldots + \text{Result } n) \;/\; n = \text{Average Result}$$

a. Using AVGCF from the initial calibration:

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

b. Using linear curve from the initial calibration:

$$[(\text{Sample Height} - Y - \text{intercept})/\text{Slope}] \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

Where:
FV = Final volume – 2 or 10 mL
IV = Initial volume – 250 or 1000 mL
DF = Dilution factor, as needed

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements, are analyzed quarterly, and are evaluated annually. Refer to *QA-*

SOP11892 for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

A reagent water blank and a reagent water spike (LCS) are analyzed each day with every batch of samples (batch size is 20). An MS/MSD is performed per batch as long as there is ample volume of a sample in the batch. If an MS/MSD cannot be performed, an LCSD must be extracted.

Aroclor 1016 and 1260 are routinely spiked, however, other aroclors can be spiked as requested by clients.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

Appendix I

PCT Analysis (Aroclor 5442, 5432, and 5460)

A. Standards:

PCT-Stocks - Aroclor 5432 (Accustandard T-4325), 5442, and 5460(Accustandard T-460S) purchased as individually ampulated solutions from Accustandard at 35,000ug/L.

MS stock of Aroclor 5442 - Absolute Cat. #71791. 1000ug/mL in Methanol.

Prepare working standards using the reagent module of the LIMS as a guide.

1. In the reagents module, first enter the reagents in this section as 'source' reagents.

2. Then select 'intermediate' reagent and load the most recent version of the working standard you wish to create for editing or create a new standard if the working standard has not yet been prepared in TALS.

3. The module contains the following information: reagent description (ex. AR161), source reagent code, amount used, final amount, solvent used and solvent lot, concentration of each compound in solution, and expiration date. The working standards have an expiration date of 6 months.

4. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

5. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below. The MS and SS working solutions are stored at <-10° C.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
MS	5422 MS Stock	0.625	125	Acetone or methanol	PCT Water Spike
SS	SS Stock	3	2000	Acetone or methanol	PCB surrogate

B. GC Chromatographic Conditions

Detector: ECD
Detector temp: 300°C
Oven Temp: 110°C to 250°C at 40°C/min, 280ºC to 330°C at 30°C/min, hold 9 min.
Carrier: Hydrogen at 5.0 mL/min
Makeup gas: N2 at 80mL/min or equivalent
Injection size: 1-uL, direct injection
Injection temp: 225°C

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make any changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity, and/or improve separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

C. Sequence

1. Conditioner
2. IBLK
3. EVAL
4. AR161
5. AR162
6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15. AR486
16. AR541
17. AR542
18 AR543
19. AR544
20. AR545
21. AR546
22. PCT1
23. PCT2
24. PCT3
25. PCT4
26. PCT5
27. A4421
28. A4422
29. A4423
30. A4424
31. A4425
32. AR214
33. AR324
34. AR423
35. AR624
36. AR684
37. MD16
38 MDPCTX
39. IC16
40. IC48
41. IC54
42. Blank
43. LCS
44. 1234567

45. 1234567MS
46. 1234567MSD
47-61. Continue running samples
62. AR164
63. PCT3
64. A4424
65. IBLK

10007 Preventative and Corrective GC Maintenance
10011 QC Data Acceptability and Corrective Action
10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10920 Separatory Funnel Extraction by Method 3510C, 608, or 608.3 for Pesticides and PCBs in a Wastewater
9847 Common Equations Used During Chromatographic Analyses
9954 Interpretation of Chromatographic Data

End of document

Version history

Version	Approval	Revision information	
6	29.MAR.2018		
7	17.MAR.2021		
8	22.SEP.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **T-SVOA-WI9617**	**Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015100**		
Version: **12.1**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **26-APR-2021**	Document users: **5_EUUSLA_GC/MS Semivolatiles_All**	Responsible: **5_EUUSLA_GC/MS Semivolatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
Table II
Table III
Table IV

Revision Log

Revision: 12	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Method not applicable to procedure	Removed TALS method 8270C
Throughout document	Clarification	Removed all references to footnotes regarding qualified data and drafted a general statement addressing data qualification as a means to differentiate between data that needs to be qualified and instances that require corrective action

Revision: 11	**Effective Date:**	17-MAR-2020
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	New analyses	Added LIMS ID for malononitrile (12987) and state-specific master 14960
Reference	Reflects current practice	Removed reference to method 8000C
Cross Reference	Enhancement	Added references to extractables SOPs
Basic Principles	Enhancement	Added references to extractables SOPs; made volume of injections less specific to allow for variation
Interferences	Enhancement	Added discussion of sample matrix as a possible interference

Revision: 11	**Effective Date:**	17-MAR-2020
Section	**Justification**	**Changes**
Personnel Training and Qualifications	Enhancement	Added specific information regarding IDOC spiking and acceptance criteria. Added additional DOC option
Sample Collection, Preservation, and Handling	Reflects current practice	Added specific information regarding collection containers and enhanced extract storage conditions
Reagents and Standards	Formatting requirements	Added chemical names for methylene chloride
Procedure E.2.	Removing duplicate	Both DFTPP tables were identical so one was removed
Procedure F.1.	Enhancement	Added tables addressing MDLs and ICVs; provided additional corrective actions; discussed the dropping of calibration points
Procedure F.2.	Clarification	Clarified that COD failure exceptions are not to be used for compliance samples and data reported under a calibration with a failed COD must be qualified
Procedure G.	Clarification	Clarified that low failures require analysis of a sensitivity check; added what can be done in the case of high failures; removed two consecutive CCV requirement as this was removed in 2016 TNI update – this was replaced with new TNI requirements
Procedure	Enhancement	Added sample analysis step and re-numbered section accordingly
Procedure	Clarification	Added acceptability of use of a certified reference library for reference spectra
Calculations	Ease of use	Removed all calibrations from this section and referred the reader to *T-SVOA-FRM9602*
Statistical Information and Method Performance	Clarification	Re-worded entire section
Quality Assurance/Quality Control	Clarification	Clarified when LCS/D is used as opposed to LCS/MS/MSD; added spike concentrations of compounds, internals, and surrogates; clarified that high surrogate recoveries in method blanks are OK when there aren't detections in the method blank; clarified when data would be qualified with a comment; added use of marginal exceedance; added MDL and LOQ information

Reference

1. SW-846 Test Method 8270E: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Rev. 6, June 2018.
2. SW-846 Test Method 8270D: Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, Rev. 5, February 2015.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000D, Rev. 5, July 2018.
4. *Federal Register*, Vol. 57, No. 227, November 24, 1992, p. 55114 (TCLP).
5. *Federal Register*, Vol. 57, No. 160, August 18, 1992, p. 37203 (CCW).
6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-SVOA-WI10917	Waste Dilution, EPA 3580A for Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix
T-OE-SVOA-WI10916	Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix
T-OE-SVOA-WI10928	Microwave Extraction by Method 3546 for Semivolatiles
T-OE-SVOA-WI10935	Separatory Funnel Extraction (Method 3510C) or Waste Dilution (Method 3580A) of Base Neutrals and Acid Extractables in Leachates
T-OE-SVOA-WI11432	Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater
T-SVOA-FRM9602	Dept 4026 Calculations
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance
T-SVOA-WI9604	Monitoring GC/MS Semivolatile QC Data Acceptance Limits
Q-EQA-FRM6869	Nonconformance Form
QA-SOP11178	Demonstrations of Capability
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is suitable for the determination of the concentration of certain semivolatile organic compounds (priority pollutant list, target compound list, Appendix IX list, TCLP list, and CCW list) found in soils, tissues, waters, and leachates. Typical limits of quantitation (LOQ) achieved are 33 µg/kg for soils, 132 µg/kg for tissues, 1 µg/L for waters, and 0.002 mg/L for leachates. Specific compound lists and associated method detection limits (MDLs) and LOQs can be found in the Laboratory Information Management System (LIMS) under the analysis numbers listed in the header of this SOP.

Basic Principles

Water samples are extracted according to *T-OE-SVOA-WI11432*. Soil samples are extracted according to T-OE-SVOA-WI10925 or *T-OE-SVOA-WI10928*. Leachates are extracted according to *T-OE-SVOA-WI10935*. Non-water soluble matrices are extracted according to *T-OE-SVOA-WI10917*.

An environmental sample (soil, water, sludge, etc.) is solvent extracted and then analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS). A predetermined aliquot of an extract containing organic compounds in solvent is injected onto a fused silica capillary column coated with a relatively non-polar stationary phase, which is enclosed in a temperature controlled oven. A carrier gas, which is ultra-pure helium, passes continuously through the column. The GC oven is temperature programmed and the organic mixture separates into its individual components as it moves along the length of the column. This separation is the function of the polarity and boiling point of the individual compounds. This column empties into a mass selective detector. When a compound reaches the detector, it is bombarded by high-energy electrons (70eV). This causes the compounds to fragment, forming ions. By applying various voltages to the lens, the positive ions are thrust into a quadrupole mass analyzer, which selects for a given mass fragment at a given time. These selected fragments reach an electron multiplier that detects and generates a signal for each mass fragment. The signals are amplified and sent to a computer. Target compounds are identified on the basis of relative retention times and spectral match to standards that are injected every 12 hours on the same system.

Quantification is achieved via use of the internal standard calibration technique. The average relative response factor of a multi-point calibration is used for quantification when the appropriate criteria are met.

Interferences

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in the processing of samples. All glassware is solvent rinsed before use and a method blank is performed with each extraction batch to demonstrate that the extraction system is free of contamination.

Sample matrices can have an effect on the ability of the GC/MS system to resolve the individual masses used for quantification. Samples may require dilutions, a reduction in the extraction volume/weight used, a raised final extraction volume, or extract clean-up using various techniques in order to achieve proper target separation and determination.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound and reagent should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by

whatever means are available such as fume hoods, safety glasses, lab coats, and gloves.

All solvent waste generated from this analysis must be collected for recycling (if applicable) or must be disposed of in designated containers. These are then transferred to a lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) must be disposed of in the normal solid waste collection containers or sharps containers, as applicable.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently perform daily maintenance, calibrate the instrument, change the column, clean the source, interpret chromatograms, perform calculations, review data, and enter data into the LIMS. The analyst is also trained on the preparation of dilutions and calibration standards. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are spiked at a concentration that is 1-4x the LOQ and are carried through all steps of the procedure. The defined acceptance criteria must be met. The criteria include the calculation of mean accuracy and standard deviation. The mean accuracy for all compounds must fall within the laboratory's most recent statistically derived LCS limits ±20% and must exhibit a standard deviation =20%.

Various options are available for a DOC and can include four laboratory control samples, one blind sample, or 1 valid initial calibration curve combined with four valid continuing calibration checks. Refer to *QA-SOP11178* for more guidance on these options.

Sample Collection, Preservation, and Handling

Water samples are collected in 250mL or 1L glass amber glass containers with PTFE-lined lids and may be preserved with sodium thiosulfate ($Na_2S_2O_3$). They are stored at 0ºC to 6ºC, not frozen, prior to extraction and must be extracted within 7 days of collection.

Solid samples are collected in glass wide-mouth jars with PTFE-lined lids and are not preserved. They are stored at 0ºC to 6ºC, not frozen, prior to extraction and must be extracted within 14 days of collection.

All sample extracts must be stored at ≤-10ºC (freezer) and protected from light using amber glass vials. All samples, sample extracts, and standards must be stored separately and in an area free from contamination. All extracts must be analyzed within 40 days of extraction.

Apparatus and Equipment

1. Hewlett-Packard Model 5890 (Series I and II) or Hewlett-Packard/Agilent 6890 or 7890 Gas Chromatograph or equivalent
2. Hewlett-Packard Models 5971, 5972, and Hewlett-Packard/Agilent 5973, 5975 Mass Selective Detector or equivalent
3. Hewlett-Packard ChemStation Software
4. Thru-Put Systems Target Acquisition Software/Oracle Database or equivalent
5. Column – 20 M × 0.18 mm ID × 0.18 µm, Agilent DB-5MS or equivalent
6. Column - 30M × 0.25 mm ID x 0.25 µm df, J&W Scientific DB-5MS or equivalent
7. Hamilton Gastight syringe, or equivalent – various volumes
8. Amber GC vials with crimp caps

Reagents and Standards

A. Reagents - All reagents are stored per manufacturer guidelines unless otherwise noted. Reagent vendors are subject to change without notification.

1. Helium carrier gas, UPC grade
2. Methylene chloride ($MeCl_2$ or CH_2Cl_2) – Baker Ultra Resi-Analyzed

B. Standards

1. Supelco Equity Semivolatile Internal Standard Mix, Part #46955-U or equivalent, 1000 µg/mL in methylene chloride. Ampulated solutions are maintained under refrigeration (0° to 6°C, not frozen) until consumed or manufacturer determined expiration date. Working solution is maintained at room temperature and is replenished daily from ampulated solutions. For 250 mL aqueous analyses Supelco Equity Semivolatile Internal Standard Mix is diluted 4x to make a 250 µg/mL in methylene chloride solution. This solution is maintained under refrigeration (0° to 6°C, not frozen) for up 6 months.

2. Refer to *T-SVOA-WI11998* for the preparation and storage of tuning, calibration, and spiking solutions.

Calibration

See Procedure F for initial calibration processing and Procedure G for continuing calibration check processing.

Procedure

A. Standard preparation – Solutions are used to standardize the GC/MS system every 12 hours and are prepared approximately every 20-30 days or more frequently if needed based on consumption. See *T-SVOA-WI11998* for standard preparation. Calibration standard solutions may be used up to the labeled expiration date or until component degradation is observed. Degradation is determined by the inability to pass continuing calibration checks or by observations of unacceptable chromatography.

B. Internal standard mix is added to all standards and subsequent samples at a concentration of 20 µg/mL (5 µg/mL for 250 mL aqueous analyses). Using a 25-µL syringe, 20 µL of Supelco Equity Semivolatile Internal Standard Mix or equivalent, 1000 µg/mL (250 µg/mL for 250 mL aqueous analyses) in methylene chloride are added to 1 mL of standard or sample extract. If only 0.5 mL of sample is in the vial, 10 µL of internal spiking solution is added to the sample. See Table II for the list of compounds calibrated for and the internal standard that is assigned to each.

C. Daily maintenance – Refer to *T-SVOA-WI9598* for this procedure.

D. Instrument conditions

Equip a GC/MS (such as referenced under Apparatus and Equipment) in one of the two following manners:

1. For a 5890/5971 or 5972 and 6890/5973 or 5975

   a. Column – 30M × 0.25 mm ID x 0.25 µm df, J&W Scientific DB-5MS or equivalent

   b. Injector – Split/splitless operated in splitless mode

   c. Injector Temp – 275°C

   d. Detector Temp – 300°C

   e. Gas – Helium at approximately 1.5 mL/min, constant flow mode

   f. Oven Temp – 45°C for 3 minutes, ramp at 8°C/minute to 225°C, then ramp at 12°C/minute to 300°C and hold for 7.5 minutes.

2. For a 6890/5973 or 5975

   a. Column – 20M × 0.18 mm ID x 0.18 µm df, J&W Scientific DB-5MS or equivalent

   b. Injector – Split/splitless operated in split mode, 20:1 split

   c. Injector Temp – 275°C

   d. Detector Temp – 280°C

   e. Gas – Helium at approximately 1.0 mL/min, constant flow mode

   f. Oven Temp – 40°C for 1 minute, ramp at 25°C/minute to 100°C, then ramp at 30°C/minute to 280°C, followed by another ramp at 25°C/minute to 320°C, hold for 2 minutes.

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions may be used to improve the linearity, sensitivity, overall chromatography, and performance required by the method on each GC/MS system.

E. Tuning

1. The DFTPP tune check standard is used to assess GC column performance and injection port inertness as well as mass spectrometer performance. The GC/MS system's tune is checked by inspecting the mass spectrum of the DFTPP peak and column performance and injection port inertness is evaluated with pentachlorophenol, benzidine, and DDT.

2. The GC/MS should be tuned using a predetermined aliquot of a 50 ng/µL or 12.5 ng/µL solution of DFTPP containing decafluorotriphenylphosphine, pentachlorophenol, benzidine, and DDT. This solution is prepared as indicated in *T-SVOA-WI11998*. See the tables below for acceptance criteria and corrective actions.

DFTPP Frequency	Acceptance Criteria	Corrective Action
Prior to initial calibration and every 12 hours prior to continuing calibration standard	1. Criteria in Table I 2. DDT breakdown ≤20%* 3. Tailing factors: - Benzidine ≤ 2 - Pentachlorophenol ≤ 2	1. Re-tune. Analysis cannot proceed until tune meets criteria. 2. More aggressive injection port maintenance. 3. Clean the source. 4. Change the column.

***NOTE:** DDT breakdown greater than 20% may be acceptable if you are calibrating for polynuclear aromatic hydrocarbon compounds only. Consult your supervisor when this situation occurs.

3. Use only the background-subtracted spectrum of the following when evaluating the DFTPP:

A three scan average of the apex of the scan, the apex of the scan −1 and the apex of the scan +1.

NOTE: All standards, samples, and associated quality control samples with a particular tune must use the identical conditions of the mass spectrometer.

F. Initial calibration (ICAL)

1. Perform standardization by analyzing at least five levels of calibration standards ranging from 0.5 µg/mL to 120 µg/mL or from 0.125 µg/mL to 30 µg/mL for mini-sep waters analysis. (Refer to *T-SVOA-WI11998* for the preparation of calibration standards.) Use the internal standard calibration technique to generate an average relative response factor for each target compound and surrogate. The relative standard deviation (%RSD) of the response factors determines the suitability of the average relative response factor for calculation of compound concentration. At the end of the calibration standard injections, inject a Method Detection Limit (MDL) standard and an initial calibration verification (ICV) standard. See the tables below for acceptance criteria and corrective actions.

ICAL Frequency	Acceptance Criteria	Corrective Action
Initially and when the daily calibration standard fails criteria.	1. Minimum response factors must be met in all levels of the calibration – especially in the lowest level of the calibration (see table IV).** 2. %RSD for each compound must be ≤20%. If more than 10% of the compounds in the ICAL exceed 20% RSD and/or also do not meet the minimum correlation coefficient for alternate fits (ie, the correlation coefficient is <0.990) then the analysis cannot proceed. 3. For any compound on a linear or quadratic fit the % error is measured between the calculated and expected amounts of the compound(s) at each calibration level to determine the calibration function acceptability for linear and non-linear curves. The % error must be ≤50% for the low calibration point. For calibration points above the LOQ the % error must be ≤30%. 4. The relative retention times of the target compounds must agree within 0.06 relative retention time units. 5. Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	1. Any target compound with a %RSD <20% will use the average RRF. For any compound in which the %RSD >20%, use a first degree (linear) fit provided the correlation coefficient (CC; r) is ≥0.995 or the coefficient of determination (COD;r^2) is ≥0.99. If the linear fit fails to meet this criteria, then a second order (quadratic) fit may be used*** provided the coefficient of determination is ≥0.99. If use of both the linear fit and the quadratic fit is acceptable using this criteria for any given compound, then use the fit with the smallest negative y-intercept. When using a quadratic fit, if the y-intercept quantifies to be greater than the MDL, consult your supervisor immediately or re-calibrate. See below for corrective action if the coefficient of determination for a quadratic fit is <0.99.* 2. Re-inject any levels that appear to be outliers due to an injection error. 3. If standard levels on the outside of the curve appear to be outliers for individual compounds and are throwing off the calibration curve, they can be dropped from the calibration keeping the following in mind: a. If a low calibration point is dropped, the analyst must ensure that the compound is still being calibrated to or below its LOQ. b. If a high calibration point is dropped, any detections must recover below the new upper calibration limit. 4. Re-prep calibration standards. 5. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*See USEPA Method 8000D for the calculations associated with non-linear fit types.
**Minimum response factors are not required to be met for method 8270E. They are provided for guidance.
***Quadratic fits are not permitted when analyzing samples from South Carolina.

MDL Frequency	Acceptance Criteria	Corrective Action
Immediately following an initial calibration and before sample analysis	1. The system must be able to detect all compounds in the MDL standard.	1. If any compounds are not detected in the MDL standard, analysis can proceed if the compound is detected at or below its MDL in a higher concentration level. 2. If the system does not detect the compound(s), then the tuning and/or calibration procedure must be repeated under conditions that will yield a detection for the compound(s) or the MDL must be raised for the compound(s). 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

ICV Frequency	Acceptance Criteria	Corrective Action
Immediately following an initial calibration and before sample analysis	1. The ICV must be prepared using a second source standard. 2. %Drift for each compound must be ≤30% 3. The EICP area for each internal standard must fall within the window of -50% to +100% of the areas from the mid-level calibration standard produced during the initial calibration.	1. Re-prep and re-analyze the ICV. 2. If the recovery for any compound fails these criteria low, the compound cannot be analyzed for under the calibration until a new calibration has been established or a passing ICV has been analyzed. 3. If the recovery for any compound fails these criteria high, the compound may be analyzed for but any samples with detections should be re-analyzed under a valid ICAL or will be reported with a qualifying comment. 4. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

With supervisory approval, the following problematic compounds can be allowed to fail the 0.99 coefficient of determination criteria for a quadratic fit. If the COD is less than 0.99 for any other compound, the system should be inspected for problems and re-calibrated. Supervisory approval is required for exceptions to these guidelines.

1,4-Phenylenediamine
4-Aminobiphenyl
3,3'-Dimethylbenzidine
4,4'-Methylenebis(2-chloroaniline)
4-Nitroquinoline-1-oxide
1,4-Naphthoquinone
methapyrilene

Note that this allowance is not to be used for compliance samples, and any data reported under the calibration must be qualified.

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

3. Six levels of calibration standards must be used if a quadratic (second-order) type calibration fit is used.

4. One of the calibration standards must be at a concentration at or below the limit of quantitation (LOQ). The other concentrations correspond to the expected range of concentrations found in samples or should define the working range of the GC/MS system.

5. The concentration of the MDL standard may require modification dependent upon the current MDL values.

G. Continuing Calibration Verification (CCV)

1. Perform a continuing calibration verification (CCV) by injecting a predetermined aliquot of a calibration standard at a concentration near the mid-point of the calibration, not to exceed ½ the highest level in the calibration.

CCV Frequency	Acceptance Criteria	Corrective Action
1. Every 12 hours. 2. The CCV is analyzed each day a curve is not analyzed. 3. The CCV is analyzed after the DFTPP.	Target compounds must meet the minimum response factor criteria (see Table IV).* 1. The maximum % drift for all target compounds is 20%. No more than 20% of the target compounds can be greater than 20% drift. All target compounds that exceed 20% drift must be less than or equal to 50% drift. 2. The relative retention times of the internal standards must be within 10 seconds of the retention times from the mid-level calibration standard of the last initial calibration. The exception would be in the case of column maintenance. 3. The EICP area for each internal standard must fall within the window of -50% to +100% from the areas of the mid-level standard produced during the last initial calibration. 4. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs. The resolution should be verified on the mid-point concentration of the ICAL as well as the check standard.	1. In cases where compound(s) recover >20%D low, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compound(s) at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values. 2. In cases where compound(s) recover >20%D high, analysis may continue, but any samples with detections should be re-analyzed under a valid CCV or the results will be qualified. 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*Minimum response factors are not required to be met for method 8270E. They are provided for guidance.

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

2. In the event that a CCV fails and the cause is not obvious such as in the case of a concentrated standard or a mis-injection, corrective action must be taken. The corrective action must be documented in the form of a non-conformance memo or with an internal non-conformance form (*Q-EQA-FRM6869*). If the CCV does not pass after corrective action, a new initial calibration must be established.

H. Analysis of Samples:

1. All sample extracts are stored at ≤-10°C and protected from light from the time of sample extraction.

2. Prior to sample analysis, add 20 µL of internal standard to each 1.0 mL of sample extract. Concentration of internal standards in extract is 20 ng/µL (5 ng/µL for 250 mL aqueous analyses).

3. Analyze a predetermined aliquot of each sample extract under the same conditions used for the initial and continuing calibrations.

4. At the conclusion of data acquisition, use the same software to tentatively identify peaks within the retention time window of interest. Examine the ion abundances of components in the chromatogram. If the ion abundance of the target ion used for quantitation exceeds the calibration range, dilute the aliquot and reanalyze. When preparing dilutions, add sufficient internal standard to maintain the same concentration as that of the ICAL.

Dilution criteria:

1) Initial dilutions are recommended in the following situations:

i. More than three internal standard recoveries are <-50%

ii. Either of the last two internal standard recoveries are <-80%.

iii. The analyst's judgment of a sample extract's color or viscosity indicates possible matrix interference.

2) Secondary dilutions are required to bring all target compounds into the calibration range of the GC/MS.

I. Qualitative analysis

A compound is identified by comparison of the following parameters with those of a standard of the suspected compound (standard reference spectra). The reference mass spectrum used for this comparison should be generated by the laboratory using the conditions of the method, but the laboratory may also use a certified reference library. In order to verify identification, the following criteria must be met:

1. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum.

2. The sample component relative retention time must compare within ±0.06 RRT units of the RRT of the standard component.

3. The relative intensities of the qualifier ion(s) should agree within 30% of the relative intensities of these ions in the reference spectrum.

NOTE: N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine. For this reason, it is acceptable to report the combined result for both n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration.

NOTE: 1,2-Diphenylhydrazine is unstable even at room temperature and readily converts to azobenzene. Given the stability problems, it would be acceptable to calibrate for 1,2-diphenylhydrazine using azobenzene. Under these poor compound separation circumstances the results for either of these compounds should be reported as a combined concentration.

J. Quantitative analysis

Once a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion. The list of primary characteristic ions and secondary ions can be found in Table III.

Calculations

Refer to *T-SVOA-FRM9602* for all calculations.

Statistical Information/Method Performance

LCS, MS, surrogate, and RPD recoveries are compared to the limits stored in the LIMS. LCS and surrogate limits are statistically derived every six months in accordance with *T-SVOA-WI9604*. All RPDs are set to a default value of 30%. MS limits are set equal to LCS limits.

Historical data for MS/Ds, LCS/Ds, surrogates, and measurement of uncertainty is reviewed at least annually.

Refer to the QA/QC section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

Quality Assurance/Quality Control

A. Batch QC

1. Each extraction batch of ≤20 samples must contain a method blank, a laboratory control sample (LCS) and an unspiked background sample (US), a matrix spike (MS), and a matrix spike duplicate (MSD).

2. A laboratory control sample/laboratory control sample duplicate (LCS/LCSD) is prepared with the extraction batch if adequate sample volume is not provided to prepare a matrix spike and matrix spike duplicate.

3. Additional QC samples may be required to meet project or state certification requirements.

B. QC and sample spiking

1. The LCS/D and MS/D are spiked at a concentration of 50 µg/L with the exception of the following (in µg/L):

Hexachlorocyclopentadiene	100	Benzoic acid	100
2,4-Dinitrophenol	100	1-Naphthylamine	100
2-Naphthylamine	100	3,3'-Dimethylbenzidine	100
Benzidine	250	3-Methylphenol	25
4-Methylphenol	25		

2. All samples are spiked with surrogates by the organic extraction group to evaluate the extraction process. Acid extractable surrogates are spiked at a concentration of 200 ng/µL and base/neutral extractable surrogates are spiked at a concentration of 100 ng/µL.

3. Prior to analysis each extract is spiked with an internal standard mix at a concentration of 20 ng/µL.

4. All spiking concentrations are 4x lower for 250 mL aqueous analyses.

C. QC items, acceptance criteria, and corrective actions.

NOTE: If any client, state, or agency has more stringent QC, QC limits, or batch requirements, these must be followed instead.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards	1. Peak area within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then re-inject sample(s). 2. If re-injection meets the criteria, report this injection. 3. If re-injection still shows the same problem, report first injection. 4. If there is substantial matrix interference, the analyst may dilute the extract as outlined in Procedure H.4.
Method Blank	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All target compounds must be less than the reporting limit for the associated samples.	1. Inspect system for possible problems and reanalyze. 2. If the surrogates are out of spec high data can be used provided there aren't detections in the method blank. 3. If the surrogates are out of spec low and there aren't detections in the associated samples, the data can be used.* 4. If the method blank contains target compounds and the associated samples do not contain these compounds, no corrective action is required. 5. If the target compounds in the blank are also in the associated samples at a concentration <10x that in the blank, the samples are re-extracted unless the detection does not interfere with project data requirements. 6. If the target compounds in the blank are also in the associated samples at a concentration >10x than in the blank the data is usable.
Instrument Blank**	1. Must run after the CCV if no clean method blank is analyzed at the beginning of a 12-hour analytical period. 2. Must meet internal standard criteria. 3. All target compounds must be less than the reporting limit for the associated samples.	1. Inspect system for possible problems and reanalyze. 2. If the instrument blank contains target compounds and the associated samples do not contain these compounds, no corrective action is required. If the target compounds in the blank are also in the associated samples, the samples should be re-extracted unless it does not interfere with project data requirements or if sample detections are at a level 10x higher than the detections in the blank.

Quality Control Item	Acceptance Criteria	Corrective Action
Laboratory Control Sample/Laboratory Control Sample Duplicate	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. % Recoveries within QC limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 4. RPDs within QC limits.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD recoveries are still outside acceptance limits, one of the following actions must be taken: a. if recoveries are outside acceptance limits low, the sample(s) must be re-extracted. b. if recoveries are outside acceptance limits high, data may be usable if the compounds that recovered above QC limits are not detected in samples. c. if recoveries are outside acceptance limits high and there are detections for the failing compounds, the sample(s) must be re-extracted. 4. If RPDs fail but recoveries are within QC limits, no further action is required. 5. If surrogates fail to meet criteria but all target compounds are within specification, data is usable.* 6. Marginal exceedance limits, as defined in the NELAC standards, may be used if the defined requirements have been met.
Matrix Spike/Matrix Spike Duplicate(MS/MSD)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. % Recoveries within LCS limits. Refer to the analysis number in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 4. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries or RPDs out of spec, consult supervisor. BKG, MS, MSD may need to be re-extracted.
Surrogates	% Recoveries within QC limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If no problem is found, re-extract and reanalyze. 4. If surrogates are out of spec high and no targets are detected in the sample no corrective action is required. 5. For samples analyzed only at a dilution ≥10x, no further action is required for surrogate failures.

*Requires approval of supervisor
**Method blank or instrument blank in each 12-hour analytical period required for 8270E.

NOTE: Any failures without corrective action require approval of supervisor and completion of a non-conformance memo (NCM).

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

D. Lower Limit of Quantitation (LLOQ)

1. Refer to *QA-SOP11892* for initial and ongoing LLOQ requirements.

E. Method Detection Limit (MDL)

1. Refer to *QA-SOP11892* for initial and ongoing MDL requirements.

F. Limit of Quantitation (LOQ)

1. Refer to *QA-SOP11892* for initial and ongoing LOQ requirements.
2. Until the laboratory has sufficient data to determine the acceptance limits, the LLOQ criteria is ± 20% of the statistically determined LCS limits.

Table I

DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	10% to 80% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	10% to 80% of mass 198
197	<2% of mass 198
198	Base peak, or >50% of mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198
365	>1% of mass 198
441	Present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

Table II

Semivolatile Internal Standard with Corresponding Compounds Assigned for Quantitation

1,4-Dichlorobenzene-d_4	Naphthalene-d_8	Acenaphthene-d_{10}
Acrylamide		
Aniline	Acetophenone	Acenaphthene
Benzyl alcohol	Benzoic acid	Acenaphthylene
Bis(2-chloroethyl) ether	Bis(2-chloroethoxy)methane	1-Chloronaphthalene
Bis(2-chloroisopropyl) ether	4-Chloroaniline	2-Chloronaphthalene
2-Chlorophenol	4-Chloro-3-methylphenol	4-Chlorophenyl phenyl ether
1,3-Dichlorobenzene	2,4-Dichlorophenol	Dibenzofuran
1,4-Dichlorobenzene	2,6-Dichlorophenol	Diethyl phthalate
1,2-Dichlorobenzene	α,α-Dimethylphenylamine	Dimethyl phthalate
Ethyl methanesulfonate	2,4-Dimethylphenol	2,4-Dinitrophenol
2-Fluorophenol (surr)	Hexachlorobutadiene	2,4-Dinitrotoluene
Hexachloroethane	Isophorone	2,6-Dinitrotoluene
Methyl methanesulfonate	2-Methylnaphthalene	Fluorene
2-Methylphenol	Naphthalene	2-Fluorobiphenyl (surr)
4-Methylphenol	Nitrobenzene	Hexachlorocyclopentadiene
N-Nitrosodimethylamine	Nitrobenzene-d5 (surr)	1-Naphthylamine
N-Nitroso-di-n-propyl amine	2-Nitrophenol	2-Naphthylamine
Phenol	N-Nitrosodi-n-butylamine	2-Nitroaniline
Phenol-d6 (surr)	N-Nitrosopiperidine	3-Nitroaniline
2-Picoline	1,2,4-Trichlorobenzene	4-Nitroaniline

1,4-Dioxane	1-Methylnaphthalene	4-Nitrophenol
Pyridine	O,O,O-triethylphosphorothioate	Pentachlorobenzene
		1,2,3,4-Tetrachlorobenzene
		1,2,3,5-Tetrachlorobenzene
Acetophenone	Hexachlorpropene	1,2,4,5-Tetrachlorobenzene
o-Toluidine	1,4-Phenylenediamine	2,3,4,6-Tetrachlorophenol
N-Nitrosomethylethylamine	Safrole	2,4,6-Tribromophenol (surr)
N-Nitrosodiethylamine	(2-Bromoethyl)benzene	2,4,6-Trichlorophenol
N-Nitrosopyrrolidine	Caprolactam	2,4,5-Trichlorophenol
N-Nitrosomorpholine	1, 3, 5 – Trichlorobenzene	1,1'-Biphenyl
N,N-dimethyl formamide	1, 2, 3 – Trichlorobenzene	Diphenyl ether
N,N-dimethyl acetamide	1, 2, 3, 4 – Tetrachlorobenzene	Isosafrole
Benzaldehyde	1 – Chloro-4-Nitrobenzene	1,4-Naphthoquinone
Malononitrile	2-chlorobenzaldehyde	1,4-Dinitrobenzene
		1,3-Dinitrobenzene
		Thionazin
		5-Nitro-o-toluidine
(surr) = surrogate		2-chlorobenzalmalononitrile

Phenanthrene-d_{10}	Pyrene-d_{10}	Perylene-d_{12}
4-Aminobiphenyl	Benzidine	Benzo(b)fluoranthene
Anthracene	Benzo(a)anthracene	Benzo(k)fluoranthene
4-Bromophenyl phenyl ether	Bis(2-ethylhexyl) phthalate	Benzo(g,h,i)perylene
Di-n-butyl phthalate	Butyl benzyl phthalate	Benzo(a)pyrene
4,6-Dinitro-2-methylphenol	Chrysene	Dibenz(a,j)acridine
Fluoranthene	3,3'-Dichlorobenzidine	Dibenz(a,h)anthracene
Hexachlorobenzene	p-Dimethylaminoazobenzene	Indeno(1,2,3-cd)pyrene
N-Nitrosodiphenylamine	Pyrene	Di-n-octylphthalate
Octachlorostyrene		
Pentachlorophenol	Terphenyl-d_{14} (surr)	3-Methylcholanthrene
Pentachloronitrobenzene	7,12-Dimethylbenz(a)anthracene	
Phenacetin	Chlorobenzilate	
Phenanthrene	2-Acetylaminofluorene	
Pronamide	3,3'-Dimethylbenzidine	
1-Nitronaphthalene	4,4'-Methylenebis(2-Chloroaniline)	
1,2-Diphenylhydrazine	3-Quinuclidinyl benzilate	
Carbazole		
Tetraethyldithiopyrophosphate		
1,3,5-Trinitrobenzene		
Diallate trans/cis		
Phorate		
Dimethoate		
Methyl parathion		
Parathion		
4-Nitroquinoline-1-oxide		
Methapyrilene		
Isodrin		
Atrazine		
(surr) = surrogate		
Benzophenone		

Table III

Characteristic Ions for Semivolatile Compounds

Compound	Primary Ion	Secondary Ions
2-Picoline	93	66, 92
Aniline	93	66, 65
Phenol	94	65,66
Bis(2-chloroethyl) ether	93	63,95
2-Chlorophenol	128	64,130
1,3-Dichlorobenzene	146	148, 113
1,4-Dichlorobenzene-d_4 (IS)	152	150,115

Characteristic Ions for Semivolatile Compounds

Compound	Primary Ion	Secondary Ions
1,4-Dichlorobenzene	146	148, 113
Benzyl alcohol	108	79,77
1,2-Dichlorobenzene	146	148, 113
N-Nitrosomethylethylamine	88	42,43,56
Bis(2-chloroisopropyl) ether	45	77, 121, 79
Methyl methanesulfonate	80	79,65,95
N-Nitrosodi-n-propylamine	70	42,101,130
Hexachloroethane	117	201,199
Nitrobenzene	77	123,65
Isophorone	82	95,138
N-Nitrosodiethylamine	102	42,57,44,56
2-Nitrophenol	139	109,65
2,4-Dimethylphenol	107	122, 121
Bis(2-chloroethoxy)methane	93	95,123
Benzoic acid	105	122,77
2,4-Dichlorophenol	162	164,98
Ethyl methanesulfonate	109	79,97,45,65
1,2,4-Trichlorobenzene	180	182,145
Naphthalene-d_8 (IS)	136	68
Naphthalene	128	129,127
Hexachlorobutadiene	225	223,227
4-Chloro-3-methylphenol	107	144,142
2-Methylnaphthalene	142	141, 115
2-Methylphenol	108	107,77,79,90
Hexachloropropene	213	211, 215, 117, 141
Hexachlorocyclopentadiene	237	235,272
N-Nitrosopyrrolidine	100	41,42,68,69
Acetophenone	105	71,51,120
4-Methylphenol	108	107,77,79,90
2,4,6-Trichlorophenol	196	198, 200
o-Toluidine	106	107,77,51,79
3-Methylphenol (as 4-Methylphenol)	108	107,77,79,90
2-Chloronaphthalene	162	127,164
N-Nitrosopiperidine	114	42,55,56,41
1,4-Phenylenediamine	108	80,53,54,52
1-Chloronaphthalene	162	127,164
2-Nitroaniline	138	92, 65
Dimethyl phthalate	163	194,164
Acenaphthylene	152	151,153
2,6-Dinitrotoluene	165	63,89, 121
Phthalic anhydride	104	76,148
3-Nitroaniline	138	108,92
Acenaphthene-d_{10} (IS)	164	162,160
Acenaphthene	153	154, 152
2,4-Dinitrophenol	184	63, 154, 107
2,6-Dinitrophenol	162	164,126,98,63

Characteristic Ions for Semivolatile Compounds

Compound	Primary Ion	Secondary Ions
4-Chloroaniline	127	129,65,92
Isosafrole	162	131,104,77,51
Dibenzofuran	168	139
2,4-Dinitrotoluene	165	63,89, 182
4-Nitrophenol	109	139,65
2-Naphthylamine	143	115,116
1,4-Naphthoquinone	158	104,102,76,130
Diethyl phthalate	149	177,150
Fluorene	166	165,167
N-Nitrosodi-n-butylamine	84	57,41,116,158
4-Chlorophenyl phenyl ether	204	206,141
4,6-Dinitro-2-methylphenol	198	51, 105, 182, 77
N-Nitrosodiphenylamine	169	168,167
Safrole	162	104,77,103,135
Diphenylamine	169	168,167
1,2,4,5-Tetrachlorobenzene	216	214,179,143,218
1-Naphthylamine	143	115,89,63
4-Bromophenyl phenyl ether	248	250,141
2,4,5-Trichlorophenol	196	198,97,132,200
Hexachlorobenzene	283	142,249
Pentachlorophenol	266	264,268
5-Nitro-o-toluidine	152	77,79,106,94
Thionazin	107	96,97,143,79
4-Nitroaniline	138	65,108,92,80
Phenanthrene-d_{10} (IS)	188	94,80
Phenanthrene	178	179,176
Anthracene	178	176,179
1,4-Dinitrobenzene	168	75,50,76,92
1,3-Dinitrobenzene	168	76,50,75,92
Diallate (cis or trans)	86	234,43,70
Pentachlorobenzene	250	252,248,215,254
5-Nitro-o-anisidine	168	79,52,138,153,77
Pentachloronitrobenzene	237	142,214,249,295
4-Nitroquinoline-1-oxide	190	160, 116, 114
Di-n-butyl phthalate	149	150,104
2,3,4,6-Tetrachlorophenol	232	131,230,166,234
Fluoranthene	202	101, 203, 100
1,3,5-Trinitrobenzene	213	74,75,120,91
Benzidine	184	92,185
Pyrene	202	101,203
Phorate	75	121,97,93,260
Phenacetin	108	179,109,137,80
Dimethoate	87	93,125,143,229
4-Aminobiphenyl	169	168,170,115
Pronamide	173	175,145,109,147
Dinoseb	211	163,147,117,240

Characteristic Ions for Semivolatile Compounds

Compound	Primary Ion	Secondary Ions
Disulfoton	88	97,89,142,186
Butyl benzyl phthalate	149	91,206
Methyl parathion	109	125,263,79,93
Dimethylaminoazobenzene	225	120,77,148,42
Benz(a)anthracene	228	229,226
Chrysene-d_{12} (IS)	240	120,236
3,3'-Dichlorobenzidine	252	254,126
Chrysene	228	226,229
Parathion	109	97,291, 186
Bis(2-ethylhexyl) phthalate	149	167,279
3,3'-Dimethylbenzidine	212	106,196,180
Methapyrilene	97	58, 72, 191, 261
Isodrin	193	66, 195, 263, 265,
Di-n-octyl phthalate	149	167,43, 150
2-Aminoanthraquinone	223	167, 195, 139
Aramite	185	191,319,334,197,321
Benzo(b)fluoranthene	252	253,125
Benzo(k)fluoranthene	252	253,125
Chlorobenzilate	139	251, 253, 111, 141
Benzo(a)pyrene	252	253,125
Perylene-d_{12} (IS)	264	260,265
7,12-Dimethylbenz(a)anthracene	256	241,239,120
2-Acetylaminofluorene	181	180,223,152
4,4'-Methylenebis(2-chloroaniline)	231	266, 140, 195
3-Methylcholanthrene	268	252,253,126,134
Indeno(1,2,3-cd)pyrene	276	138,227
Dibenz(a,h)anthracene	278	139,279
Benzo(g,h,i)perylene	276	138,277
1,2-Diphenylhydrazine	77	105, 182, 51
Endosulfan I	195	33
2-Fluorobiphenyl (surr)	172	171
2-Fluorophenol (surr)	112	64, 92
Nitrobenzene-d_5 (surr)	82	128,54
N-Nitrosodimethylamine	74	42,44
Phenol-d_6 (surr)	99	42,71
Terphenyl-d_{14} (surr)	244	122,212
2,4,6-Tribromophenol (surr)	330	332,141
N,N-dimethyl formamide	73	44,42
N,N-dimethyl acetamide	87	72,44,42
(2-Bromoethyl)benzene	184	77,91,105,186
Atrazine	200	173,215
Benzaldehyde	77	105, 106
Caprolacatam	113	55,56
1,1-Biphenyl	154	153,152,76
Carbazole	167	166,139

Characteristic Ions for Semivolatile Compounds

Compound	Primary Ion	Secondary Ions
1,3,5-Trichlorobenzene	180	182,145,109
1,2,3-Trichlorobenzene	180	182,145,109
1,2,3,4-Tetrachlorobenzene	216	214,218,179
1-Chloro-4-Nitrobenzene	157	111,75,99
IS = internal standard		
surr = surrogate		
Acrylamide	71	55, 44
Octachlorostyrene	308	343, 380, 273
1,2,3,5-tetrachlorobenzene	216	214, 218, 179, 143
1,2,3,4-tetrachlorobenzene	216	214, 218, 179, 143
2-chlorobenzaldehyde	139	111, 140, 76
Benzophenone	105	182, 77, 51
3-Quinuclidinyl benzilate	183	126, 337, 110
2-chlorobenzalmalononitrile	153	188, 126
Malononitrile	<66	38,39

Table IV

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification Using the Suggested Ions from Table III

Semivolatile Compounds	Minimum Response Factor (RF)
Benzaldehyde	0.010
Phenol	0.800
Bis(2-chloroethyl)ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxy)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification Using the Suggested Ions from Table III

Semivolatile Compounds	Minimum Response Factor (RF)
Hexachlorocyclopentadiene	0.050
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethylphthalate	0.010
2,6-Drintrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dintirophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4Dinitrotoluene	0.200
Diethylphthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-Chlorophenyl-phenylether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenylether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
3,3'-Bichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification Using the Suggested Ions from Table III

Semivolatile Compounds	Minimum Response Factor (RF)
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octlyphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010

10916 Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix
10917 Waste Dilution, EPA 3580A for Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix
10928 Microwave Extraction by Method 3546 for Semivolatiles
10935 Separatory Funnel Extraction (Method 3510C) of Base Neutrals and Acid Extractables in Leachates
11178 Demonstrations of Capability
11432 Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater
11892 Determining Method Detection Limits and Limits of Quantitation
11998 Semivolatile Spiking and Calibration Standards
6869 Nonconformance Form
9598 GC/MS Preventative and Corrective Maintenance
9602 Dept 4026 Calculations
9604 Monitoring GC/MS Semivolatile QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information	
11	17.MAR.2020		
12	10.JUN.2020		
12.1	26.APR.2021	Reviewed 06/06/2022 - WS2991	

eurofins	Always check on-line for validity. **New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID**	Level: **Work Instruction**
Document number: **T-GC-WI9736**		
Old Reference: **1-P-QM-WI-9012863**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-OCT-2021**	Document users: **6_EUUSLA_EPH/Misc. GC_All Management/Verifier/Prin, 6_EUUSLA_EPH/Misc. GC_EPH Chemist, 6_EUUSLA_EPH/Misc. GC_Screens Chemist**	Responsible: **5_EUUSLA_EPH/Misc. GC_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Attachment I
Table I
Table II

Revision Log

	Revision: 10	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision log up to the previous version
Reagents and Standards	Reflect current naming	Added information and TALS reagent name for Fuel Linearity Stock.
Calibration	Enhancement	Removed example sequence and replaced with directions.
Attachment I	Enhancement	Added ICV standard information.

	Revision: 09	**Effective date:** May 26, 2021
Section	**Justification**	**Changes**
Cross Reference	Archived document	Removed reference to T-GC-WI9683 Interpretation and Integration of Chromatographic Data
Basic Principles	Enhancement	Description of NJEPH_Calc method added
Apparatus and Equipment	Reflect current equipment	Added RTX - Mineral Oil Column, Test America Chrom PeakReview ©, and re-numbered section.
Reagents and Standards	Clarification	Added TALS reagent names
Calibration	Enhancement	Reflect current procedures. Updated section with tables for acceptance criteria.

	Revision: 09	**Effective date:** May 26, 2021
Section	**Justification**	**Changes**
Procedure B	Reflect current requirements	Removed individual PAH highest peak calibration standard area requirement.
Quality Assurance /Quality Control	Process Change	Added criteria for individual compounds, reflecting requirement of the method.
Attachment 1	Enhancement and Process Change	Added TALS reagent names, restructured section, added tables listing acceptance criteria.

Reference

1. Analysis of Extractable Petroleum Hydrocarbons in Aqueous and Soil/Sediments/Sludge Matrices, NJDEP EPH, 10/08.

2. New Jersey Department of Environmental Protection Site Remediation Program, Extractable Petroleum Hydrocarbons Methodology, August 2010, Revision 3

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-GC-WI10879	Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
T-OE-GC-WI10914	Separatory Funnel Extraction for EPH in waters by Massachusetts, New Jersey, and Louisiana Protocol
T-OE-GC-WI10883	Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix
T-GC-WI9689	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation
T-GC-WI9657	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is designed to quantitate extractable aliphatic and aromatic petroleum hydrocarbons in water and solid samples by the New Jersey Department of Environmental Protection Extractable Petroleum Hydrocarbons (NJDEP EPH) method. Data is reported for four hydrocarbon ranges for both aliphatic and aromatic fractions.

NJ screening protocol is also covered by this method (See Attachment I). The non-fractionated extract is analyzed to obtain a total extractable hydrocarbon result. If the screen analysis shows detectable hydrocarbons above the NJ regulatory limit, then the client decides if the sample extract is to be fractionated and run as per the NJDEP EPH method.

Below is a list of the analytes and the reporting limits used to report this work:

Analyte	Soil LOQ (mg/Kg)	Water LOQ (µg/L)
C_9 - C_{12} Aliphatic	10	100
>C_{12} - C_{16} Aliphatic	10	100
>C_{16} - C_{21} Aliphatic	10	100
>C_{21} - C_{40} Aliphatic	10	100
C_{10} - C_{12} Aromatic	10	100
>C_{12} - C_{16} Aromatic	10	100
>C_{16} - C_{21} Aromatic	10	100
>C_{21} - C_{36} Aromatic	10	100
Total Aliphatics	10	100
Total Aromatics	10	100
Total EPH	10	100

Limits of Quantitation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Basic Principles

Samples are extracted with methylene chloride using a separatory funnel or a microwave extractor and solvent exchanged into hexane. An aliquot of the sample extract is fractionated and the resultant aliphatic and aromatic extracts are analyzed separately by capillary gas chromatography using flame ionization detection (GC-FID). The aliphatic and aromatic chromatograms are integrated for the method defined ranges using forced baseline integration. Quantitation is based on average response factors determined by 5-point external standard calibration curves using a group of normal alkanes and target aromatics (PAHs) representative of the entire chromatographic method range.

The NJEPH_Calc method is a method by which a summation of Total Aromatics and Total Aliphatics is performed and results are reported as Total EPH. This method does not require an additional analysis, but does require creation of a separate "analytical" batch. Up to 20 samples can be included on one "analytical" batch for the NJEPH_Calc method.

Interferences

The FID is a non-selective detector. Although the silica gel cleanup/fractionation procedure of this method reduces the detection of non-hydrocarbon compounds, which elute in the target ranges, the potential still exists for many non-target organic compounds to interfere with analysis.

Safety Precautions and Waste Handling

1. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

2. All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and state laws and regulations.

3. The toxicity and carcinogenicity of each reagent used in this method has not been precisely defined. Therefore, each chemical compound must be treated as a potential health hazard. Exposure to these compounds must be reduced to the lowest possible level by whatever means are available. Information concerning the known toxicity, properties, or any special handling precautions can be found in the material safety data sheets (MSDS) available from the Safety Officer. Good laboratory practices must be employed at all times.

4. Expired standards and extracts are disposed of as hazardous waste. Waste GC vials must be placed in a designated container for storage until they are lab packed for disposal. Sample extracts and sample dilutions are disposed of by transfer to a designated container for waste methylene chloride.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of seven laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. Individual aliphatic and aromatic compounds must meet a mean recovery of 40-140% for water and 60-140% for all compounds for soil, and a %RSD $\leq$25%. A higher %RSD is allowed for n-Nonane, but the value must be documented. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

Aqueous samples must be collected in two 1-L amber glass bottles, preserved, without headspace, and stored at 0° to 6°C, not frozen. Water samples must be preserved at the time of sampling by the addition of a suitable acid to reduce the sample pH to less than 2. HCl is the preferred preservation acid.

Solids must be collected in a glass container (minimum 150 mL) with minimal headspace and stored at 0° to 6°C, not frozen.

Samples must be extracted within 14 days of collection and analyzed within 40 days of extraction.

Apparatus and Equipment

1. Hewlett-Packard HP7890 Gas Chromatograph, or equivalent, capable of performing automated direct injection capillary chromatography with temperature and pressure programming and flame ionization detection

Detector:	FID, hydrogen at 30 mL/min, air at 400 mL/min
Detector Temp:	320°C
Oven Temp:	50°C, 2 min, 20°C/min to 320°C, hold for 2.5 min

Carrier:	Hydrogen at constant flow of 10 mL/min in constant flow mode
Makeup Gas:	N_2 at 20 mL/min
Injection Size:	1µL, direct injection
Injection Conditions:	300°C, septum purge 5 mL/min ±0.5 mL/min

Note: The conditions listed are usually the optimum operating conditions, but may vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

2. GC column – 30 meters × 0.32 mm ID fused silica capillary lined with a 0.25-µm film of ZB-5 (Phenomenex), RTX-5 (Restek), or equivalent
3. GC column – 15 meters × 0.32 mm × 0.15-µm film RTX - Mineral Oil (Restek), or equivalent
4. Data acquisition system such as Chrom Perfect® by Justice Laboratory Software, or equivalent.
5. Test America Chrom PeakReview © 2014 or equivalent.
6. GC autosampler vials – 2-mL glass with Teflon-lined crimp caps
7. Disposable Pasteur pipettes
8. Various sizes of Class-A volumetric flasks and pipettes
9. Microsyringes – 50-, 100-, 250-, 500-, 1000-µL
10. Analytical balance – An analytical balance capable of weighing 0.0001 g

Reagents and Standards

A. Reagents

1. Methylene Chloride (CH_2Cl_2) – Pesticide quality or equivalent. Stored at room temperature.
2. Hexane – Pesticide quality or equivalent. Stored at room temperature.
3. Air – Provided by an in-house air generator or compressed air in tanks.
4. Ultra High Purity Hydrogen – Provided by a generator or compressed air tanks.

B. Standards

Store unopened ampules according to the vendor's instructions. Unopened ampules are stable until the expiration date provided by the vendor.

Store all prepared standard solutions in a freezer at ≤-10°C unless otherwise indicated.

1. Naphthalene (≥99% purity); Chem Service Catalog N-12643-250, or equivalent. LIMS reagent name is EPH_NAPHTH_NT.
2. 2-Methylnaphthalene (≥99% purity); Chem Service Catalog N-10427-10G, or equivalent. LIMS reagent name is EPH_2MNAP_NT.
3. *N*-Heneicosane (C_{21}; >99% purity); Chem Service Catalog N-12540-500, or equivalent. LIMS reagent name is EPH_HeicoC21.
4. Aliphatic Calibration Stock Mix: (Custom FL TRPH Stock) A certified, ampulated solution containing the target aliphatic compounds listed in Table I; 500 ppm in hexane; Restek Catalog #554128, or equivalent. LIMS reagent name is EPH_TRPHCRV.
5. Aromatic Calibration Stock Mix (WA EPH Aromatic Stock): A certified, ampulated solution containing the target aromatics/PAHs listed in Table II; 1000ppm in methylene chloride; Restek Catalog #31469, or equivalent. LIMS reagent name is EPH_NJARSTK.
6. Aliphatic Surrogate Stock: 1-Chlorooctadecane; 10,000 ppm in methylene chloride; Restek 31098, or equivalent. LIMS reagent name is EPH_ICODSURR.
7. Aromatic Surrogate Stock: *o*-Terphenyl; 10,000 ppm in methylene chloride; Restek 31097, or equivalent. LIMS reagent name is EPH_OTERPSS.
8. Fractionation Surrogate Stock Mix: 2-Fluorobiphenyl and 2-Bromonaphthalene; 4,000 ppm in hexane; Restek 31480, or equivalent. LIMS Reagent name is EPH_NJ_SS.
9. Initial Calibration Verification Standards: Agilent Aliphatic and Aromatic stocks, Cat SMA-300 and SMA 310, components at 1000 µg/ml each. Aromatics in methylene chloride and aliphatics in hexane. LIMS reagent name for the Aromatic stock is GCS_MASS_AROM. LIMS reagent name for the Aliphatic stock is GCS_MASS_ALIP.
10. #2 Fuel Oil Linearity Stock - #2 Diesel Fuel, Restek Cat # 31259, or equivalent. 50,000 µg/mL in methylene chloride. LIMS reagent name is EPH_2FUELCRV.

Naphthalene(s) and *N*-Heneicosane/C_{21} Stock Solution (2000 ppm)

On an analytical balance, weigh 0.02 g (±0.0050 g) each Naphthalene (Standard 1), 2-methylnaphthalene (Standard 2) and *N*-heneicosane/C_{21} (Standard 3) in a 10-mL volumetric flask. Bring to volume in hexane. Store in freezer at ≤-10°C, expiration date is set at 1 year. LIMS reagent name is EPH_NJALSTK.

Working Aliphatic Calibration Standard Solutions

The working linear range for the individual aliphatic hydrocarbons for this method is 1 to 50 ppm, for each individual component, in solution. The working 5-point calibration curve consists of solutions that contain the aliphatic hydrocarbons at 1, 5, 10, 25, and 50 ppm in hexane.

The working aliphatic calibration solutions also contain 1-Chlorooctadecane (surrogate), *N*-Heneicosane, Naphthalene and 2-methylnaphthalene at comparable concentrations for each level.

The working solutions are stored at ≤-10°C and expire in 6 months.

Use the guideline below for preparing the working aliphatic calibration.

Level	**Aliquot of Stock (mL)**			Final Volume (mL)	Final Concentration (ppm each)
	Naphthalene(s)/C_{21} Solution	1-Chlorooctadecane	Aliphatics		
EPH_NJAL5	0.250	0.050	1.00	10	50
EPH_NJAL4	0.125	0.025	0.50	10	25
EPH_NJAL3	0.050	0.010	0.20	10	10
EPH_NJAL2	0.025	0.005	0.10	10	5
EPH_NJAL1	0.005	0.001	0.02	10	1

Working Aromatic Calibration Standard Solutions

The working linear range for the individual aromatic (PAH) hydrocarbons for this method is 1 to 50 ppm for each individual component in solution. The working 5-point calibration curve consists of solutions that contain the aromatic hydrocarbons at 1, 5, 10, 25, and 50 ppm in methylene chloride.

The working aromatic calibration solutions also contain 2-Fluorobiphenyl and 2-Bromonaphthalene (fractionation surrogates); and *o*-Terphenyl (surrogate) at comparable concentrations for each level.

The working solutions are stored at ≤-10°C and expire in 6 months.

Use the guideline below for preparing the working aromatic calibration.

Level	**Aliquot of Stock (mL)**			Final Volume (mL)	Final Concentration (ppm each)
	Fractionation Surrogate Mix	*o*-Terphenyl	Aromatics/PAHs		
EPH_NJAR5	0.1250	0.050	0.50	10	50
EPH_NJAR4	0.0625	0.025	0.25	10	25
EPH_NJAR3	0.0250	0.010	0.10	10	10
EPH_NJAR2	0.0125	0.005	0.05	10	5
EPH_NJAR1	0.0025	0.001	0.01	10	1

Continuing Calibration Standards (10 ppm)

This is prepared in the same manner as Level 3 of the initial calibration standards above. Store in freezer at ≤-10°C, expiration date set at 6 months for the aromatic standard and 6 months for the aliphatic standard.

Working Fractionation surrogate (2-Fluorobiphenyl, 2-Bromonaphthalene) for sample preparation (40 ppm each)

Prepare by pipetting 1.0 mL Fractionation stock mix (Standard 8) to final volume 100 mL hexane and mix. Store in refrigerator 0 - 6°C, not frozen, with an expiration date 90 days from preparation date. LIMS reagent name is OP_NJFRAC_SS.

Working surrogate (1-chlorooctadecane and *o*-terphenyl) solution (20 ppm each)

Pipette 0.5 mL of each surrogate stock (Standards 6 and 7) into a 250-mL volumetric flask. Bring to volume with acetone and mix. Store in refrigerator 0 - 6°C, not frozen, with an expiration date 90 days from preparation date. LIMS Reagent name is OP_MASS/NJ_SS.

1.0 mL is added to each sample prior to extraction.

Working Speciation Matrix Spike Solution (40 ppm)

Pipette 2.0 mL of the WA EPH aromatic stock OP_NJEPH_STK, 4 mL of the custom FL TRPH stock OP_CUSFL_STK, and 4 mL of the OP_C21NJ_INT into a 50-mL volumetric flask. Bring to volume with acetone and mix. Store in refrigerator 0 - 6°C, not frozen, with an expiration date 90 days from preparation date. LIMS reagent name is OP_NJEPH_MS.

1.0 mL is added to each NJEPH QC sample (LCS/LCSD and MS/MSD) prior to extraction

Initial Calibration Verification Standard (10 ppm)

Dilute each (Standard 9) to a working standard concentration of 10 ppm for each component (equivalent to Level 3 ICAL standards) in methylene chloride for the aromatic and hexane for the aliphatic. LIMS reagent names are EPH_NJAL3 and EPH_NJAR3.

Store in a freezer at ≤-10°C: expiration is 6 months for the aromatic ICV and 6 months for the aliphatic ICV.

#2 Fuel Oil Calibration Standards for Linearity

Using the #2 Fuel Oil Linearity Stock (standard 10), prepare the #2 Fuel Oil Calibration standards (use the chart as a guideline). The working solutions are stored at ≤-10°C and expire in 6 months. LIMS reagent name is EPH_1FUL.

Standard Code (Levels)	#2 Fuel Oil Linearity Stock aliquot (mL)	Final volume (mL)	Solvent	Final concentration (ppm)
1FUL1	0.45 of level 4	10	CH_2Cl_2	72
1FUL2	0.08	10	CH_2Cl_2	400
1FUL3	0.8	50	CH_2Cl_2	800
1FUL4	0.32	10	CH_2Cl_2	1600
1FUL5	0.7	10	CH_2Cl_2	3500

Calibration

A. Set the gas chromatographic system to the conditions using the guidelines listed in the gas chromatographic conditions section of this procedure.

B. Allow the system to stabilize. Fill the autosampler rinse vials with clean solvent.

C. Inject several methylene chloride blanks until the system is stable.

D. If necessary, make a compensation run according to the HP manual instructions and program the GC to use the run for background subtraction.

E. If needed prior to calibrating, inject mid-level continuing calibration standards to establish retention times for individual compounds/surrogates and start and stop times for each range.

F. Prepare a sequence using the following as guidance:

1. First inject at least one conditioner injection. This could be a Methylene Chloride blank or a previously analyzed sample or standard. If the instrument has been idle for a period of time, more than one conditioner may be needed.
2. Inject retention time checks (continuing calibration standards)
3. Run an instrument blank (IBLK) to ensure the instrument is free from interference.
4. Inject sequentially the initial calibration standards EPH_NJAR1 through 5, followed by EPH_NJAL1 through 5.
5. Inject sequentially the #2 Fuel Oil Linearity standards 1FUL1 through 5.
5. Inject a Methylene Chloride blank.
6. Inject the aliphatic and aromatic initial calibration verifications using separate injections.
7. Inject the extracted aliphatic and aromatic method blanks using separate injections.
8. Inject the extracted aliphatic and aromatic Laboratory Control Sample using separate injections.
9. Inject aliphatic and aromatic sample and batch QC extracts as separate injections, up to 20 injections or 24 hours, whichever comes first.
10. Inject an aromatic continuing calibration standard, followed by an aliphatic continuing calibration standard.
11. Continue with another set of 20 injections, followed by aliphatic and aromatic continuing calibration injections as necessary.

G. Initial calibration procedure:

1. The working linear range of the system is determined for the surrogates, eight hydrocarbon ranges and several individual aliphatic and aromatic compounds by injection of five levels of the working calibration standards.

2. The start and stop times for the four initial calibration ranges are defined as -0.1 minute from the retention time of the marker compound for the start of the range, and +0.1 minute from the retention time of the marker compound for the end of the range unless otherwise indicated in the table below.

Marker compounds are as follows.

Range	Start Compound	End Compound
C_9 – C_{12} Aliphatic	*n*-nonane	*n*-dodecane
C_{12} – C_{16} Aliphatic	*n*-dodecane + 0.1 min	*n*-hexadecane
C_{16} – C_{21} Alphatic	*n*-hexadecane + 0.1 min	*n*-heneicosane
C_{21} – C_{40} Aliphatic	*n*-heneicosane + 0.1 min	*n*-tetracontane
C_{10} – C_{12} Aromatic	1,2,3-Trimethylbenzene	Naphthalene
C_{12} – C_{16} Aromatic	Naphthalene + 0.1 min	Acenaphthene
C_{16} – C_{21} Aromatic	Acenaphthene + 0.1 min	Pyrene
C_{21} – C_{36} Aromatic	Pyrene + 0.1 min	Benzo(g,h,i)perylene + 0.1 min

3. The ratio of peak area to amount (total mass) injected is determined for each surrogate, compound and range and is defined as the average calibration factor (AVG CF) for that surrogate/compound/range. The calibration file is set-up using the area versus concentration in mg/L.

4. When determining the total area for each range during calibration, the surrogates must be subtracted from the area of the range in which they elute. Also, any areas associated with 2-methylnaphthalene and naphthalene in the aliphatic range must be subtracted out.

5. See the tables below for ICAL and ICV acceptance criteria and corrective actions. Curve types and criteria can be altered to meet client or project specific requirements, as well as any regulatory agency requirements, which may differ from those listed here.

ICAL Frequency	**Acceptance Criteria**	**Corrective Action**
Initially and when the daily calibration standard fails criteria. NOTE: The level 1 calibration standard also serves as the MDL standard.	1. %RSD of the CF for each individual hydrocarbon component, surrogate, and each carbon range must be ≤25%.	1. Inspect the data points to see if one or more calibration levels appear to have been mis-injected or mis-prepared. Reinject or remake the standard if this is the cause. 2. Alternate calibration curves are not recommended for this analysis, therefore if the acceptance criteria are not met, perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

6. 5 levels of diesel/#2fuel oil are analyzed as part of the initial calibration process to determine linearity of the analytical system for petroleum fuel/product. This is used to determine if the concentration of fuel or product in a sample exceeds the linear range and needs diluted.

H. Initial calibration Verification (ICV)

ICV Requirements	**Acceptance Criteria**	**Corrective Action**
1. Analyze immediately following an initial calibration and before sample analysis. 2. The ICV is prepared using the second source matrix spike/ICV stock.	1. The recovery of each carbon range must be ±25% D. 2. The recovery of the individual components and must be ±30% D.	1. If the acceptance criteria cannot be met, analysis cannot continue. **Exception:** If the ICV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. Reinject or remake the standard. 3. Perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

I. Continuing calibration verification (CCV)

CCV Requirements	**Acceptance Criteria**	**Corrective Action**
1. Analyze immediately following an initial calibration and before sample analysis.	1. The recovery of each carbon range must be ±25% D.	1. If the acceptance criteria cannot be met, reinject or remake the standard.

	2. The recovery of the individual components and surrogates must be ±30% D. 3. For non-#2 Fuel/Diesel analyses, the mass discrimination of C_{30}/C_{20} shall be $\geq$0.8. Calculation: AR C_{30}/AR C_{20}. This must be performed on the first CCV of each day.	**Exception:** If the CCV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. If method criteria cannot be met in two consecutive/sequential CCVs, corrective action must be taken, which can include instrument maintenance. Two consecutive/sequential CCVs must meet method criteria in order for analysis to continue. 3. Perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

1. In order to ensure that the system is free of discrimination between each hydrocarbon, the discrimination calculation is performed on the first aliphatic CCV performed each day.

The actual LIMS mass discrimination calculation appears as follows in the reports:

% recovery - (Area Breakdown Cpnds/Total Area Breakdown Cpnds) * 100.
Mass discrimination is reported as a percentage, and any result above 80% passes.
For example, if the area of Icosane is 277686118, and the area of Triacontane is 244450411,
then (244450411/277686118) *100 = 88.03%. Min. Limit: 80% Passed

The LIMS uses the same mass discrimination calculation for multiple method requirements, and the Total Area Breakdown Cpnds in the calculation above could include multiple compounds as necessary in other applications.

2. CCVs are performed after twenty injections (samples, QC, blanks,etc.) or every 24 hours, whichever comes first, using the calibration standards.

3. Samples must be bracketed with compliant standards.

4. When calculating the continuing calibration recoveries, the surrogate areas must be subtracted from the area of the range in which they elute.

5. The ranges and retention time markers used for calculation of the continuing calibration standards are the same as those used for the initial calibration.

J. Retention time (RT) windows

1. Established as 3x the standard deviation determined over a 72-hour period, or at no less than ±0.03 min, applied to the mid-point initial calibration standard.

2. If the RTs for a continuing calibration standard fall outside the windows, update the midpoint RT using that standard.

   a. Save this under an appropriate name to indicate an update has occurred.

   b. All subsequent continuing standards run within a 24-hour period must fall within this window.

   c. RTs cannot be updated more than once per day.

   d. If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

The extraction is performed following *T-OE-GC-WI10883* for soils and *T-OE-GC-WI10914* for waters. The fractionation is performed following *T-OE-GC-WI10879*.

A. After the initial calibration, inject an extraction batch.

1. As a general guideline, inject batch QC (method blanks, LCS/LCSD) before sample extracts, followed by background and MS extracts.

2. If batch QC is within specification, run sample extracts.

3. Clear, “cleaner” looking extracts must be injected first to avoid system contamination/carryover.

4. Solvent cleanup blanks are run as often as the analyst feels is appropriate for the extracts being analyzed.

B. If the concentration in the sample exceeds the linearity range:

1. The sample must be diluted and reanalyzed.

2. Exceeding the linear range includes any truncation of individual peaks or exceeding the total area count for any target range as compared to the highest calibration standard from the #2 fuel oil calibration.

C. Peak area integration for the ranges

1. Must be from baseline (i.e., must include the unresolved “hump” area from complex mixtures).

2. It may be necessary to smooth baselines using manual integration techniques found in the Peak Review application of Chrom.
3. For the integration of surrogates and individual compounds, a point-to-point (or "valley-to-valley") technique is used.
4. The Chrom data system determines the total area eluting in the specific ranges.
   a. Chrom uses the retention time windows for the ranges that are entered in the method to determine integration start/stop times.
   b. For samples and QC, the surrogate areas must be subtracted from the area of the range in which they elute.

Calculations

A. If an average response factor is used for quantitation, the following calculation is used to determine the concentration of target analytes and ranges in samples.

$$Cs = \frac{Ax}{As} \times \frac{Vt}{Vs} \times DF$$

Where:

Cs = Concentration of target analyte, range or surrogate (µg/L or mg/kg)
Ax = Response for the target analyte, range or surrogate in the sample, units in area
As = Average calibration factor for the target analyte, range or surrogate, units expressed as area/concentration of analyte or range
Vt = Final volume of sample extract, units in mL
Vs = Volume or weight of sample extracted, units in mL or g
Df = Dilution factor; this applies to dilutions performed on the sample extract by the analyst.

Dilutions may be needed to bring target PAH components or ranges into the calibration range(s) of the system.

B. If a linear fit calibration curve is used for quantitation, a linear regression analysis using the following equation is performed:

$$Cs = \frac{As - B}{M} \times \frac{Vt}{Vs} \times DF$$

Where:

Cs = Concentration of the target analyte or range (mg/L or mg/kg) in the sample
As = Response for the target analyte or range in the sample, units expressed as area/concentration of analyte or range
B = Y intercept, units of area
M = Slope of the calibration line, units expressed as area/concentration of analyte or range
Vt = Final volume of sample extract, units in mL
Vs = Volume or weight of sample extracted, in mL or g
Df = Dilution factor/ this applies to dilutions performed on the sample extract by the analyst.

Dilutions may be needed to bring target PAH components or ranges into the calibration range(s) of the system.

C. Breakthrough

% Naphthalene Breakthrough = Nap in aliphatic fraction ÷ (Nap aromatic + Nap aliphatic) x 100.

Also see *T-GC-WI9657* for details on calculations.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS and are defined by the method. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

A blank, duplicate laboratory control samples (LCS/LCSD), a sample duplicate, and a randomly selected MS are analyzed with each batch (samples analyzed within a 24-hour period) of 20 or less samples. The reagent blank matrix is sodium sulfate for solid samples and reagent water for water samples. 1-Chlorooctadecane and *o*-Terphenyl are added as surrogates to each sample and QC to monitor the efficiency of the extraction and fractionation, the operation of the autosampler, and to monitor retention times throughout the GC run. 2-Fluorobiphenyl and 2-Bromonaphthalene are added to monitor the accuracy of the fractionation process.

The statistical limits are generated annually for comparison.

The QC windows are defined by the NJ EPH method:

1. Blank: Value less than the limit of quantitation for all target analytes and ranges

2. LCS/LCSD: 40% to 140% recovery for all individual compounds, ranges and surrogates; less than 25% RPD. Any individual compound recovery that is outside the 40 to 140% acceptance range (25% to 140% for C9) requires a comment in the final report.

3. Sample duplicate: less than 50% RPD

4. Matrix Spike: 40% to 140% recovery for all individual compounds, ranges and surrogates.

5. 1-Chlorooctadecane surrogate recovery: 40% to 140%

6. o-Terphenyl surrogate recovery: 40% to 140%

7. 2-Fluorobiphenyl and 2-Bromonaphthalene surrogate recovery: 40% to 140%

8. The chromatogram must be signed for all work associated with the state of New Jersey.

For all samples requiring fractionation, each field and QC sample must be evaluated for potential breakthrough on a sample-specific basis by quantitating the concentrations of Naphthalene and 2-Methylnaphthalene in both the aliphatic and aromatic fractions of the LCS and LCSD. If either the concentration of Naphthalene or 2-Methylnaphtahlene in the aliphatic fraction exceeds 5% of the total concentration for Naphthalene (aliphatic and aromatic fraction) and 2-Methylnaphthalene (aliphatic and aromatic fraction) in the LCS or LCSD, then fractionation must be repeated on all samples associated with the batch.

Calculate % Naphthalene Breakthrough = Nap in aliphatic fraction ÷ (Nap aromatic + Nap aliphatic) x 100.

Breakthrough determination for 2-Methylnaphthalene would be the same, substituting 2-Methylnaphthalene concentrations for Naphthalene. Breakthrough is reported as an analytical comment via a nonconformance memo (NCM) for each sample.

Additionally, if the fractionation surrogate recovery is outside the 40 – 140% for any sample extract without a reasonable explanation then the sample is reextracted and re-fractionated. Consideration is taken into account for sample matrix as well as the surrogate results of the screen analysis.

Attachment I

NJ Screen

A. Gas Chromatography conditions:

Detector	FID, hydrogen at 30 mL/min, air at 400 mL/min
Detector Temp:	320°C
Oven Temp:	50°C, 2 min, 30°C/min to 340°C, hold for 2 min
Carrier:	Hydrogen at constant flow of 10 mL/min in constant flow mode
Makeup Gas:	N_2 at 20 mL/min
Column:	30 meters × 0.32 mm ID × 0.25-µm film of ZB-5 (Phenomenex), RTX-5 (Restek), or equivalent
Injection Size:	1 µL, direct injection
Injection Conditions:	300°C, septum purge 5 mL/min ±0.5 mL/min

B. Standards:

1. Aliphatic Calibration Stock Mix: A certified, ampulated solution containing the target aliphatic compounds listed in Table I. 500 ppm in hexane; Restek Catalog #554128, or equivalent. LIMS reagent name is EPH_TRPHCRV.

2. Aliphatic Surrogate Stock: 1-Chlorooctadecane; 10,000 ppm in methylene chloride; Restek cat# 31098, or equivalent. LIMS reagent name is GCS_ICODSURR.

3. Aromatic Surrogate Stock: *o*-Terphenyl; 10,000 ppm in methylene chloride; Restek cat# 31097, or equivalent. LIMS reagent name is EPH_OTERPSS.

4. Instrument detection limit standard (IDL)/#2 Fuel Oil Linearity Stock: #2 Fuel oil; 50,000 ppm in methylene chloride; Restek cat#31259 or equivalent. LIMS reagent name is EPH_2FUELCRV.

5. Prepare and analyze 5 levels of diesel/#2 fuel oil to determine linearity of the analytical system for petroleum fuel/product. This is used to determine if the concentration of fuel or product in a sample exceeds the linear range and needs diluted.

6. Working Speciation Matrix Spike Solution (40 ppm)

Pipette 4.0 mL of the FL TRPH stock OP_CUSFL_STK, and 4 mL of the OP_C21NJ_INT into a 50-mL volumetric flask. Bring to volume with acetone and mix. Store in refrigerator 0 - 6°C, not frozen, with an expiration date 90 days from preparation date. LIMS reagent name is OP_NJSCREEN.

1.0 mL is added to each NJEPH_Screen QC sample (LCS/LCSD and MS/MSD) prior to extraction.

7. ICV TRPH stock: A certified, ampulated solution containing the target aliphatic compounds listed in Table I. Restek, catalog # SFL-601, 500 ppm. TALS reagent name is GCS_TRPHICV.

8. ICV TRPH working standard: To prepare the ICV working standard, add 0.2 mL of GCS_TRPHICV, 0.01 mL of GCS_OTPSURR, and 0.01 mL of EPH_1CODSURR to a final volume of 10 mL in CH_2Cl_2.

C. Prepare a sequence using the following as guidance:

1. First inject at least one conditioner injection. This could be a Methylene Chloride blank ore a previously analyzed sample or standard. If the instrument has been idle for a period of time, more than one conditioner may be needed.

2. Run an instrument blank (IBLK) to ensure the instrument is free from interference.

3. Inject sequentially the initial calibration standards GCS_MTAL1 through 5.

4. Inject a Methylene Chloride blank.

5. Inject sequentially the #2 Fuel Oil Linearity standards GCS_1FUL1 through 5.

6. Inject the aliphatic initial calibration verification.

7. Inject a Methylene Chloride blank.

8. Inject the extracted aliphatic Laboratory Control Sample.

9. Inject the extracted unfractionated samples and batch QC extracts as separate injections, up to 20 injections or 24 hours, whichever comes first.

10. Inject an aliphatic continuing calibration standard.

11. Continue with another set of 20 injections, followed by an aliphatic continuing calibration injection as necessary.

The CCVs are prepared and can be the same as GCS_MTAL level 3 below.

D. Initial Calibration

1. The working linear range of the system is determined for the surrogates, hydrocarbon range C9-C40, and all individual aliphatic compounds by injection of five levels of the working calibration standards found in the table below.

Level	**Aliquot of Stock (mL)**			**Final Volume (mL)**	**Final Concentration (ppm each)**
	***o*-Terphenyl**	**1-Chlorooctadecane**	**Aliphatics**		
GCS_MTAL5	0.050	0.050	1.00	10	50
GCS_MTAL4	2.5 of level 5			5	25
GCS_MTAL3	0.050	0.050	0.5	25	10
GCS_MTAL2	0.5 of level 5			5	5
GCS_MTAL1	0.1 of level 5			5	1
IDL (EPH_1FUL1)	0.0144 of #2 Fuel Oil stock			10	72

2. 5 levels of diesel/#2fuel oil are analyzed as part of the initial calibration process to determine linearity of the analytical system for petroleum fuel/product. This is used to determine if the concentration of fuel or product in a sample exceeds the linear range and needs diluted. The standards are prepared according to the table below.

Standard Code (Levels)	**#2 Fuel Oil Linearity Stock aliquot (mL)**	**Final volume (mL)**	**Solvent**	**Final concentration (ppm)**
EPH_1FUL1	0.45 of level 4	10	CH_2Cl_2	72
EPH_1FUL2	0.08	10	$CH2Cl_2$	400
EPH_1FUL3	0.8	50	CH2Cl2	800
EPH_1FUL4	0.32	10	CH2Cl2	1600
EPH_1FUL5	0.7	10	CH2Cl2	3500

3. The start and stop times for the initial calibration range is defined as -0.1 minute from the retention time of the marker compound n-Nonane for the start of the range, and +0.1 minute from the retention time of the marker compound Tetracontane for the end of the range.

4. The ratio of peak area to amount (total mass) injected is determined for each surrogate, compound and range and is defined as the average calibration factor (AVG CF) for that surrogate/compound/range. The calibration file is set-up using the area versus concentration in mg/L.

5. When determining the total area for range C9-C40 during calibration, the area of the surrogates 1-Chlorooctadecane and o-Terphenyl must be subtracted from the area of the range.

6. See the tables below for ICAL and ICV acceptance criteria and corrective actions.

ICAL Frequency	**Acceptance Criteria**	**Corrective Action**
Initially and when the daily calibration standard fails criteria. NOTE: The level 1 calibration standard also serves as the MDL standard.	1. %RSD of the CF for each individual hydrocarbon component, surrogate, and each carbon range must be ≤25%.	1. Inspect the data points to see if one or more calibration levels appear to have been mis-injected or mis-prepared. Reinject or remake the standard if this is the cause. 2. Alternate calibration curves are not recommended for this analysis, therefore if the acceptance criteria are not met, perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

ICV Requirements	**Acceptance Criteria**	**Corrective Action**
1. Analyze immediately following an initial calibration and before sample analysis. 2. The ICV is prepared using the second source matrix spike/ICV stock.	1. The recovery of each carbon range must be ±25% D. 2. The recovery of the individual components and must be ±30% D.	1. If the acceptance criteria cannot be met, analysis cannot continue. **Exception:** If the ICV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. Reinject or remake the standard. 3. Perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

7. See the table below for Continuing Calibration Verification acceptance criteria and corrective actions.

CCV Requirements	**Acceptance Criteria**	**Corrective Action**
1. Analyze immediately following an initial calibration and before sample analysis.	1. The recovery of each carbon range must be ±25% D. 2. The recovery of the individual components and surrogates must be ±30% D. 3. For non-#2 Fuel/Diesel analyses, the mass discrimination of C_{30}/C_{20} shall be $\geq$0.8. Calculation: AR C_{30}/AR C_{20}. This must be performed on the first CCV of each day.	1. If the acceptance criteria cannot be met, reinject or remake the standard. **Exception:** If the CCV fails to meet the acceptance criteria but exhibits an increased response, analysis may proceed provided there are not detections in the samples. 2. If method criteria cannot be met in two consecutive/sequential CCVs, corrective action must be taken, which can include instrument maintenance. Two consecutive/sequential CCVs must meet method criteria in order for analysis to continue. 3. Perform instrument maintenance as outlined in *T-GC-WI9689* and re-calibrate.

QC metrics are the same for NJ screen as they are for NJ EPH. Calculation of breakthrough is not a requirement for non-fractionated samples.

Table I

Target Aliphatic Hydrocarbons	
Carbon Number	Compound
9	*n*-Nonane
10	*n*-Decane
12	*n*-Dodecane
14	*n*-Tetradecane
16	*n*-Hexadecane
18	*n*-Octadecane
20	*n*-Eicosane
21	*n*-Heneicosane

Target Aliphatic Hydrocarbons	
Carbon Number	Compound
1-Chlorooctadecane	surrogate
22	*n*-Docosane
24	*n*-Tetracosane
26	*n*-Hexacosane
28	*n*-Octacosane
30	*n*-Triacontane
32	*n*-Dotriacontane
34	*n*-Tetratriacontane
36	*n*-Hexatriacontane
38	*n*-Octatriacontane
40	*n*-Tetracontane

Table II

Target Aromatic (PAH) Analytes
Compounds
Naphthalene
2-Methylnaphthalene
2-Fluorobiphenyl (fractionation surrogate)
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
Anthracene
o-Terphenyl (surrogate)
Fluoranthene
Pyrene
Benzo(a)Anthracene
Chrysene
Benzo(b)Fluoranthene
Benzo(k)Fluoranthene
Benzo(a)Pyrene
Indeno(1,2,3,-cd)Pyrene
Dibenzo(a,h)Anthracene
Benzo(g,h,i)Perylene
1,2,3-Trimethylbenzene
2-Bromonaphthalene (fractionation surrogate)

10879 Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
10883 Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix
10914 Separatory Funnel Extraction for EPH in Waters by Massachusetts, New Jersey, and Louisiana Protocol
11892 Determining Method Detection Limits and Limits of Quantitation
9657 Common Equations Used During Chromatographic Analyses
9689 Maintenance and Troubleshooting Procedures for GC-FID Instrumentation

End of document

Version history

Version	Approval	Revision information	
8	04.MAR.2021		
9	26.MAY.2021		
10	29.OCT.2021		

eurofins	Always check on-line for validity. **DRO and ORO by 8015B/C/D in Water using GC-FID**	Level: **Work Instruction**
Document number: **T-GC-WI9786**		
Old Reference: **1-P-QM-WI-9015111**		
Version: **11**		Organisation level: **5-Sub-BU**
Approved by: **TYZ8** Effective Date: **06-SEP-2022**	Document users: **6_EUUSLA_EPH/Misc. GC_All Management/Verifier/Prin, 6_EUUSLA_EPH/Misc. GC_Chemist DRO Water, 6_EUUSLA_EPH/Misc. GC_Chemist DRO/Dx Mini Water**	Responsible: **5_EUUSLA_EPH/Misc. GC_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Appendix I - Standards Information for 1000 mL and 500 mL
Appendix II - Standards Information for 250 mL
Appendix III - Standards Information for 40 mL

Revision Log

	Revision: 11	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Name Change	Updated company name
Apparatus and Equipment	Obsolete equipment	Updated use of ChromPerfect; removed obsolete column and renumbered section
Appendix I	Reflects current practice	Changed "TALS" to "LIMS" and updated standard naming convention throughout
Appendix II	Reflects current practice	Changed "TALS" to "LIMS" and updated standard naming convention throughout
Appendix III	Reflects current practice	Changed "TALS" to "LIMS" and updated standard naming convention throughout

	Revision: 10	**Effective date:** 13-AUG-2021

Section	Revision 10	Effective date: 13-AUG-2021
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Section	**Justification**	**Changes**
Reference	Correction	Corrected 8000D revision date
Throughout document	Reflect current documents	Removed reference and hyperlinks to archived documents T-GC-WI9698 and T-GC-WI9749
Throughout document	Enhancement	Added information for mini-extraction and micro-extraction analyses
Apparatus and Equipment	Enhancement	Added table containing parameters
Reagents and Standards	Enhancement	Removed standards information and created separate Appendices.
Calibration	Enhancement	Replaced suggested order of injections with instructions; replaced calibration information with tables

Reference

1. Test Methods for Evaluating Solid Waste, EPA SW-846, Method 8015B, December 1996.
2. Test Methods for Evaluating Solid Waste, SW-846 Method 8015C, Rev. 3, February 2007.
3. Test Methods for Evaluating Solid Wastes, SW-846 Method 8015D, Rev. 4, June 2003.
4. Determinative Chromatographic Separations, SW-846, Method 8000D, Rev. 5, March 2018
5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-GC-WI10910	Quick Silica Gel Cleanup for Hydrocarbons by GC in Solid and Water Matrices
T-OE-GC-WI10911	Separatory Funnel Extraction by Method 3510C for DRO in Water by California Methodology
T-OE-GC-WI10944	Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater
T-OE-GC-WI10278	10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Soil and Water Matrices

Document	Document Title
T-OE-GC-WI10949	3g Silica Gel Column Cleanup for DRO
T-GC-WI9689	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation
T-GC-WI9657	Common Equations Used During Chromatographic Analyses
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

The work instructions contained in this document are used for the analysis of samples extracted using various volumes of water including one liter (by Method 3510C), 500 mL (by Method 3510C), 250 mL (mini-extraction by Method 3510C using a large volume injection), and 40 mL (micro-extraction by Method 3511 using a large volume injection) for Diesel Range Organics (DRO) and Oil Range Organics (ORO). DRO corresponds to a range of C_{10} normal hydrocarbons through C_{28} normal hydrocarbons. ORO corresponds to a range of >C_{28} normal hydrocarbons through C_{40} normal hydrocarbons.

Analysis of samples requiring the ORO range >C28-C40 is not recommended for 40 mL samples utilizing Method 3511 as the extraction method. The heavier compounds in his range are not considered volatile or semi-volatile compounds.

Various state and regionally defined DRO and ORO normal hydrocarbon ranges including Los Angeles region hydrocarbon range C_{13} through C_{22}, State of Wyoming hydrocarbon range C_{10} to C_{32}, and State of Louisiana extended hydrocarbon range to C_{35} can also be reported.

The analyses can also be performed on extractions that have undergone cleanup procedures following Method 3630C.

All Limits of Quantitation (LOQ, or Reporting Limit (RL)) and Method Detection Limits are stored in the LIMS and are subject to change. Samples can be reported to the regulatory limit of 50 µg/L, if requested.

Basic Principles

One liter, 500 mL, and 250 mL samples are extracted with methylene chloride using a separatory funnel extraction. Sample extracts are analyzed by capillary gas chromatography (GC) using a flame ionization detector (FID). 250 mL samples are analyzed using Large volume Injection (LVI). 40 mL samples are extracted in Hexane and are analyzed using LVI by GC-FID.

Quantitation is performed by comparing the area of all chromatographic peaks (including resolved and unresolved components) eluting between the requested hydrocarbon range(s) with the total peak area between C10 and C28 normal hydrocarbons of the #2 Fuel Oil standard solution.

Reference Modifications

1. GC conditions differ from those listed in 8015B/C/D. However, all QC criteria are met.

2. The start time and stop time for the fuel ranges are established using the following criteria. This ensures consistency throughout different instruments in the laboratory. The marker includes C_8 – C_{40} (even hydrocarbons) and C_9.

   a. C_8 – C_{40} (even hydrocarbon) – the start and stop time would be ± 0.1 minutes. An exception of 0.15 minutes is used for the stop time for C_{40}.

   b. > even hydrocarbon as the start point would be 0.1 minutes after the indicated marker.

   c. Odd numbered hydrocarbon as the start point would be 0.1 minutes after the previous even hydrocarbon.

   d. > odd hydrocarbon as the start point would be 0.1 minutes less than next even hydrocarbon.

   e. The exception for an odd hydrocarbon is C_9 since this is included in the marker.

Examples:

$>C_{23}$ – C_{40} would be determined as 0.1 minutes $<C_{24}$ to 0.15 minutes $>C_{40}$
C_{12} – C_{23} would be determined as 0.1 minutes $<C_{12}$ to 0.1 minutes $<C_{24}$
C_{23} – C_{30} would be determined as 0.1 minutes $>C_{22}$ to 0.1 minutes $>C_{30}$

Interferences

Non-petroleum organics will also be detected by these methods and may interfere with petroleum product characterization and/or LOQ. Cleanup techniques may be employed to reduce background contribution from polar organics that are not related to target hydrocarbon fractions. Options for extract cleanup include a quick silica gel cleanup, a 3-gram column cleanup, and a 10-gram column cleanup. When a cleanup is employed, all related batch QC must go through the same cleanup protocol.

The FID is a non-selective detector. There is potential for many non–target organic compounds present in samples to interfere with this analysis. A cleanup procedure is not performed on 40-mL sample extracts.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity and carcinogenicity of each reagent used in this method has not been precisely defined. Therefore, each chemical compound must be treated as a potential health hazard. Exposure to these compounds must be reduced to the lowest possible level by whatever means are available. Good laboratory practices must be employed at all times. Waste GC vials must be placed in a designated

container for storage until they are lab packed for disposal. Sample extracts and sample dilutions are disposed of by transfer to a designated container for solvent waste.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

Water samples to be extracted by 3510C are collected in amber glass containers and are stored at 0° to 6°C, not frozen. Waters do not require preservation but samples submitted preserved with HCl to pH <2 can be analyzed for this analysis. Samples must be extracted within 7 days of collection.

Water samples to be extracted by Method 3511 are collected in HCl preserved vials with no headspace and stored at 0° to 6°C, not frozen. Waters collected in HCl preserved 40-mL vials to a pH <2 must be extracted within 14 days of collection.

Extracts are stored in a freezer at ≤ -10° C. All extracts must be analyzed within 40 days of extraction.

Apparatus and Equipment

1. Hewlett-Packard HP6890 Gas Chromatograph, or equivalent, capable of performing automated direct injection capillary chromatography with temperature programming and flame ionization detection

The conditions listed are usually the optimum operating conditions, but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system.

Extraction Method	3510C	3510C_LVI	3511
Detector	FID, H2 at 40 mL/min, air at 400 mL/min	FID, H2 at 30-40 mL/min, air at 300-400 mL/min. Air to H2 should be a 10:1 flow ratio	FID, H2 at 30-40 mL/min, air at 300-400 mL/min. Air to H2 should be a 10:1 flow ratio
Detector Temp	320° C	320° C	320° C
Oven Temp	60° C 1 min., 15° C/min to 190° C, 30° C/min to	60° C 2 min., 18° C/min to 190° C, 30° C/min to	60° C 2 min., 18° C/min to 190° C, 30° C/min to

	340° C, hold 2 min.	340° C, hold 3 min.	340° C, hold 3 min.
Carrier	H2 10 mL/min in constant flow mode	H2 10 mL/min in constant flow mode	H2 10 mL/min in constant flow mode
Makeup Gas	N2 at 20-30 mL/min	N2 at 30-35 mL/min	N2 at 35 mL/min
Injection Size	2 µL, direct injection	4 µL, pulsed splitless injection	10 µL, pulsed splitless injection (50 µL syringe)
Injection Conditions	300° C, with 15 mL/min septum purge, 40 psi pulse pressure for 1 min.	300° C, with 50 mL/min septum purge at 0.25 min., 40 psi pulse pressure for 0.75 min.	300° C, with 50 mL/min septum purge at 0.25 min., 40 psi pulse pressure for 0.75 min.

GC conditions differ from those listed in Methods SW-846 8015B/C/D; however, all QC criteria are met.

2. Data acquisition system such as Chrom Perfect® by Justice Laboratory Software, or equivalent.

3. Test America Chrom PeakReview © 2014 or equivalent.

4. GC column - 30 meters x 0.32 mm ID fused silica capillary lined with a 0.25 µm film of 5% diphenyl/95% dimethyl polysiloxane

5. Various sizes of Class A volumetric pipettes, flasks, and syringes.

6. Analytical balance

7. Disposable Pasteur Pipettes

8. GC autosampler vials – 2 mL glass with Teflon-lined caps

Reagents and Standards

A. Reagents

1. Methylene chloride (CH_2Cl_2 or $MeCl_2$) – Pesticide quality or equivalent, store at room temperature.

2. Ultra high purity hydrogen – Provided by a generator or compressed Hydrogen cylinders.

3. Air – Provided by a zero air generator or compressed air cylinders.

4. Acetone – Pesticide quality or equivalent; store at room temperature.

5. Hexane – Pesticide quality or equivalent; store at room temperature.

6. Nitrogen - Provided through in-house supply.

B. Standards

All standards are prepared using class A volumetric flasks, pipettes, and syringes, are weighed on an analytical balance, and prepared according to the instructions found in the Reagents application of Analyst Desktop II in the LIMS. All unopened ampulated standards are stored according to the vendor's instructions and are stable until the expiration date provided by the vendor. All prepared standard solutions are stored at ≤ -10° C in labeled containers unless otherwise noted. Working standards and intermediates prepared in Methylene Chloride or Acetone expire in 6 months or when the vendor's expiration date has been reached, whichever is more recent, unless otherwise noted. Working standards and intermediates prepared in Hexane expire in 6 months or when the vendor's expiration date has been reached, whichever is more recent, unless otherwise noted.

1. For standards information applying to 1000 mL and 500 mL sample volumes, see Appendix I.

2. For standards information applying to 250 mL sample volume, see Appendix II.

3. For standards information applying to 40 mL sample volume, see Appendix III.

Calibration

A. Prior to starting a new calibration:

1. Fill the autosampler rinse vials with clean solvent or replace vials which appear dirty.

2. Make several injections of methylene chloride to stabilize the system.

3. If necessary, make a compensation run according to the HP manual instructions and program the GC to use the run for background subtraction.

4. Prepare a sequence using the following suggested order of injections:

a. First inject conditioner injections or methylene chloride blanks.

(1) The conditioner injections are usually standards or samples that have already been injected. They are used to prime the system and are best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

(2) Methylene chloride blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

b. Next inject an instrument blank followed by standards for the Capric Acid, TPH component and surrogate, and fuel calibrations . Inject a methylene chloride blank prior to injecting the MDL and ICV standards.

c. Inject a method blank followed by all batch QC, client samples, and bracketing check standards.

d. Continue running groups of 10 injections followed by calibration verification check standards.

e. The check standards include a mid-level TPH standard to check surrogate recoveries and mark retention times for the hydrocarbon markers, and a mid-level fuel standard to evaluate DRO/ORO response.

B. Initial Calibration (ICAL)

1. The GC is calibrated using 5 levels of #2 fuel oil, C10-C28 normal hydrocarbons, and *o*-terphenyl surrogate.

2. The total area between C10 and C28 in the #2 fuel pattern is used for the quantitation of all ranges (i.e. C10-C28, >C28-C35, >C28-C40, C10-C32).

NOTE: C13-C22 is calibrating separately. C13 is set at 0.1 min after C12 and C22 is set at 0.1 min after C22.

3. The TPH standards contain sixteen hydrocarbon components from C10 to C40, and *o*-terphenyl. This standard is used for the *o*-terphenyl calibration.

4. The working hydrocarbon component standard is used to establish the retention times for all of the marker hydrocarbons.

5. The Capric Acid calibration is used to evaluate the Silica gel cleanups (10g, 3g). This calibration quantitates the recovery of the reverse surrogate. A Capric Acid calibration is not performed for 40 mL sample volume since the extracts do not undergo a cleanup procedure.

6. The calibration file is set-up using the area versus concentration in mg/L.

7. Sample analysis can proceed once an acceptable calibration and ICV are attained.

8. See the tables below for acceptance criteria and corrective actions. Curve types and criteria can be altered to meet client or project specific requirements, as well as any regulatory agency requirements, which may differ from those listed here.

ICAL Frequency	Acceptance Criteria	Corrective Action
Initially and when the daily calibration standard fails criteria.	1. All ranges must exhibit a %RSD ≤20%. If this criterion is met, the external standard calibration is used with the average response factor (AVGCF). 2. Extrapolate or force zero is not allowed. Set the zero to ignore. 3. When a linear fit is used, the % error is measured between the calculated and expected amounts at each calibration level to determine the calibration function acceptability for linear curves. The % error must be ≤50% for standard levels at or below the LOQ. For standard levels above the LOQ the % error must be ≤30%.	1. If the %RSD is >20%, a linear calibration curve is used provided the correlation coefficient is ≥0.99. 2. If this criterion cannot be met, inspect the data points to see if one or more calibration levels appear to be off. A specific calibration level may have concentrated due to solvent evaporation or degraded over time. 3. Re-inject or remake the standard(s) if this is the cause. 4. Perform system maintenance as outlined in *T-GC-WI9689* and re-calibrate.

MDL Frequency	Acceptance Criteria	Corrective Action

Immediately following an initial calibration and before sample analysis	The scaling of chromatograms and peak integration parameters must be set so that a standard at the concentration of the Method Detection Limit (MDL) gives a pattern that is discernible from the baseline and can be integrated properly. This ensures that the quantitation limits and MDLs can be met.	Perform system maintenance as outlined in *T-GC-WI9689* and re-calibrate.

ICV Frequency	Acceptance Criteria	Corrective Action
An alternate source #2 Fuel Oil ICV is required after the ICAL and before sample analysis	**8015B** 1. The concentration in the ICV standard must be within ± 15% difference (%D) of the nominal concentration when compared to the calibration. **8015C/D** 2. The concentration in the ICV standard must be within ± 20% difference (%D) of the nominal concentration when compared to the calibration.	1. Re-inject or remake the standard. 2. Perform system maintenance as outlined in *T-GC-WI9689* and re-calibrate.

C. Continuing Calibration Verification (CCV)

CCV Frequency	Acceptance Criteria	Corrective Action
1. The CCV is analyzed each day a curve is not analyzed. 2. The CCV is performed prior to the analysis of any samples and then at least every 12 hours throughout the sequence using the mid-level standard.	1. The concentration of the #2 fuel in the CCV must be within the method defined % difference (%D) of the nominal concentration. NOTE: The #2 fuel standard is evaluated using the area eluting between and including C10 through C28. 2. The surrogate (*o*-terphenyl) response in the mid-level standard must also meet the defined method criterion. a. 8015B: ±15% b. 8015C/D: ±20%	1. For opening CCV failure, re-inject or remake the standard. 2. If the bracketing CCV fails the acceptance criterion by exhibiting a decreasing response, the samples must be reanalyzed. 3. If the bracketing CCV fails the acceptance criterion by exhibiting an increasing response, the samples before it do not need to be reanalyzed if the target analytes are not

3. A capric acid standard (level 3) is analyzed once per sequence with silica gel samples for retention time purposes.	3. The hydrocarbon components are used to monitor the retention times for the ranges throughout the run. 4. Samples must be bracketed with compliant standards.	detected. A comment must be added to the analytical report.

NOTE: If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

D. Retention time (RT) windows

1. RT windows are established for the retention time marker hydrocarbons and surrogate in the hydrocarbon/surrogate mix (which is injected throughout the analytical sequence at every check standard point) by using ±3 standard deviation from the mean retention time for three standards injected over a 72-hour period.

2. These marker hydrocarbons are used to determine the starting and stopping points for the DRO range to be quantitated.

3. If the RTs for continuing mid-level hydrocarbon/surrogate standard fall outside the RT windows, update the hydrocarbon(s) midpoint retention times using that standard, the window will stay the same.

   a. Also update the start and stop times used for the DRO/ORO range using the same standard.

   b. Save under the appropriate calibration name to indicate an update has occurred.

   c. All subsequent standards run within a 24-hour period must be within this window.

   d. Retention times cannot be updated more than once per day.

4. If RTs are not consistent, the cause should be investigated and corrective action taken.

Procedure

See *T-OE-GC-WI10944* and/or *T-OE-GC-WI10911* for extraction procedure.

1. Establish the area of all chromatographic peaks (including resolved and unresolved components) eluting between, and including, the hydrocarbon range specific to that analysis number.

2. Quantitate samples by comparing the area of the chromatographic peaks to the appropriate #2 fuel oil calibration.

   a. A horizontal baseline is projected from the lower limit of the retention time window for C_{10} to after the upper retention time window of C_{28}, C_{35}, or C_{40} if reporting DRO/ORO.

(1) When volatile petroleum products eluting earlier than the beginning retention time are present, the baseline should be projected prior to the methylene chloride solvent front.

(2) Additional baseline adjusting may be needed, to ensure accurate integration of total area in the hydrocarbon range.

(3) The total area is determined from this chromatogram.

b. A second integration of the plot is done using a baseline determination that follows the true baseline in a point-to-point manner.

The area for the *o*-terphenyl peak is determined from this and subtracted from the range in which it elutes.

3. Dilutions

a. Perform as necessary for any truncated ("flattened") peaks and/or to bring total sample response within the working linear range of a #2 fuel oil calibration.

b. Any single range of a sample whose total area exceeds that of the upper level fuel standard must be diluted into the working range of the fuel calibration. The dilutions are performed using methylene chloride.

Calculations

1. Using AVGCF

$$\frac{\text{Total DRO Sample Area}}{\text{AVGCF}} \times \frac{FV}{IV} \times DF = mg/L \text{ as received}$$

2. Using linear curve

$$[(\text{Total DRO Sample Area Y Intercept}) / \text{Slope}] \times \frac{FV}{IV} \times DF = mg / L \text{ as received}$$

Where:

Total DRO Sample Area = Total area in established RT range minus surrogate area
FV (final volume) = mL waters
IV (initial volume) = mL
DF (dilution factor) = as needed

3. Also see *T-GC-WI9657* for details on calculations for calibration and QC samples.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

A lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have one at least every three years.

Quality Assurance/Quality Control

A batch is defined as the samples extracted on any given shift and processed as a unit but not to exceed 20 field samples. If more than 20 samples are prepared in a day, then an additional batch with QC must be extracted.

For each batch of samples extracted a reagent blank, LCS (reagent blank spike with #2 fuel and carried through the entire procedure) and an MS/MSD must be extracted. The reagent blank matrix is reagent. If there is limited sample volume that prevents the preparation of an MS/MSD, then an LCSD must be prepared instead. Also, if the batch contains only field or equipment blank samples, the LCS/LCSD pairing must be used.

o-Terphenyl is added as a surrogate to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

If any client, agency or state has more stringent QC or batch requirements, these must be followed instead.

Appendix I - Standards Information for 1000 mL and 500 mL

1. Capric Acid Neat – Chem Service Catalog # N-11574-1G, or equivalent. TALS Reagent name is EPH_CAPR_Neat.

a. Capric Acid Spiking Stock – Weigh approximately 0.1 g of Capric Acid Neat into a 10 mL volumetric flask. Dilute to volume with $MeCl_2$. Concentration is approximately 10,000 ppm.

b. Capric Acid Calibration Standards – Prepare the calibration standards according to the following table using $MeCl_2$ as the solvent:

Calibration Level	Capric Acid Stock (mL)	Final Volume (mL)	Concentration (ppm)
EPH_CAPR1	0.005	10	5
EPH_CAPR2	0.010	10	10
EPH_CAPR3	0.0375	25	15
EPH_CAPR4	0.020	10	20
EPH_CAPR5	0.025	10	25

2. Diesel/#2 Fuel Spiking Stock – 50,000 µg/mL in $MeCl_2$. Restek Catalog # 31259, or equivalent. LIMS Reagent name is OP_DIESEL_2.

a. For 1000 mL sample volumes:

1. Dilute 1.6 mL of the spiking stock to a final volume of 50 mL and bring to volume with Acetone. The final concentration is 1,600 ppm. LIMS Reagent name is OP_DROW#2_MS.

2. 1.0 mL of OP_DROW#2_MS reagent is spiked into the Laboratory Control sample, Laboratory Control sample duplicate, Matrix Spike and Matrix Spike duplicate (if applicable) during the extraction process.

b. For 500 mL sample volumes (client specific Low Level requests):

1. Dilute 0.8 mL of the spiking stock to a final volume of 50 mL and bring to volume with Acetone. The final concentration is 800 ppm. LIMS Reagent name is OP_LOWCA_MS.

2. 1.0 mL of OP_LOWCA_MS reagent is spiked into the Laboratory Control sample, Laboratory Control sample duplicate, Matrix Spike and Matrix Spike duplicate (if applicable) during the extraction process.

c. #2 Fuel Calibration Standards - Prepare the calibration standards according to the following table using $MeCl_2$ as the diluent:

Calibration Level	EPH_2FUELCRV Stock (mL)	Final Volume (mL)	Concentration (ppm)
EPH_2FUL1	0.05 of 2FUL5 standard	10	25
EPH_2FUL2	0.04	10	200
EPH_2FUL3	0.2	10	1000
EPH_2FUL4	2.5	50	2500
EPH_2FUL5	1.0	10	5000
EPH_2FMDLX	0.04 of 2FUL3 standard	5	8

3. Initial Calibration Verification #2 Fuel Stock – an ampulated stock of #2 fuel oil prepared in $MeCl_2$ at a concentration of 50,000 µg/mL. Ultra Scientific catalog # RGO-616, or equivalent. LIMS Reagent name is EPH_2FUELICV.

4. #2 Fuel Oil Initial Calibration Verification working standard (ICV) – Dilute 0.16 mL of EPH_2FUELICV to a final volume of 10 mL using $MeCl_2$ as the solvent. Final concentration is 800 ppm. LIMS Reagent name is EPH_1FLKX.

5. #2 Fuel Oil Continuing Calibration Verification Check Standard (CCV) – dilute 2.5 mL of EPH_2FUELCRV stock into 50 mL of $MeCl_2$. Final concentration is 2500 ppm. Same as level 4 of the initial calibration.

6. Hydrocarbon Component mix calibration stock solution – A certified, ampulated stock solution containing all even-numbered normal hydrocarbons from C8 (n-Octane) through C40 (n-Tetracosane), inclusive. A concentration of 500 µg/mL for each hydrocarbon is recommended. The solvent may be Hexane or Methylene Chloride. Custom Florida TRPH Standard from Restek, catalog # 554128, or equivalent. LIMS Reagent name is EPH_TRPHCRV.

7. Surrogate Stocks – Certified ampulated stock solutions.

a. Chlorobenzene – 10,000 µg/mL prepared in a solvent of Hexane or Methylene Chloride. Restek catalog # 558353, or equivalent. LIMS Reagent name is OP_CHLBEN_STK.

b. O-Terphenyl - 10,000 µg/mL prepared in a solvent of Hexane or Methylene Chloride. Restek catalog # 31097, or equivalent. LIMS Reagent name is OP_O-TERP_STK.

8. Working surrogate Solutions

a. For 1000 mL sample volumes:

1. Pipette 1.2 mL of each surrogate stock above into a 500 mL volumetric flask. Bring to volume using Acetone as the solvent and mix thoroughly. Approximate concentration is 24 ppm. LIMS Reagent name is OP_DROW#2_SS.

2. 1.0 mL of OP_DROW#2_SS is added to 1000 mL water samples or lab reagent water in the case of method blanks, Matrix Spikes, and Laboratory Control Samples during the extraction process.

b. For 500 mL sample volumes:

1. Pipette 0.30 mL of each surrogate stock above into a 500 mL volumetric flask. Bring to volume with Acetone and mix thoroughly. Approximate concentration is 6 ppm. LIMS Reagent name is OP_LOWCA_SS.

2. 1.0 mL of OP_LOWCA_SS is added to 500 mL water samples or lab reagent water in the case of method blanks, Matrix Spikes, and Laboratory Control Samples during the extraction process.

9. TPH Calibration Standards - Prepare the calibration standards according to the following table using $MeCl_2$ as the diluent. The level 3 TPH calibration standard is used as the continuing calibration verification check standard (CCV) for o-terphenyl.

Calibration Level	Stocks used (mL)		Final Volume (mL)	Concentration (ppm) Surrogates, Hydrocarbons
	Florida TRPH	o-Terphenyl		
EPH_2TPH5	0.4	0.02	10	20
EPH_2TPH4	0.32	0.016	10	16
EPH_2TPH3	0.8	0.04	50	8
EPH_2TPH2	0.08	0.004	10	4
EPH_2TPH1	1.0 mL of EPH_2TPH5 standard		10	2

10. Instrument Blank (IBLK) – Prepare an instrument blank by accurately measuring 0.1 mL of EPH_OTERPSS stock into a 50 mL volumetric flask. Bring to volume with methylene chloride. LIMS

Reagent name is EPH_DROIBLK.

Appendix II - Standards Information for 250 mL

1. Capric Acid Neat – Chem Service Catalog # N-11574-1G, or equivalent. LIMS Reagent name is EPH_CAPR_Neat.

a. Capric Acid Spiking Stock – Weigh approximately 0.1 g of Capric Acid Neat into a 10 mL volumetric flask. Dilute to volume with $MeCl_2$. Concentration is approximately 10,000 ppm.

b. Capric Acid Calibration Standards – Prepare the calibration standards according to the following table using $MeCl_2$ as the solvent:

Calibration Level	Capric Acid Stock (mL)	Final Volume (mL)	Concentration (ppm)
EPH_4CAP1	0.25 mL of level 5	5	0.5
EPH_4CAP2	0.50 mL of level 5	5	1
EPH_4CAP3	0.003	10	3
EPH_4CAP4	2.5 mL of level 5	5	5
EPH_4CAP5	0.01	10	10

2. Diesel/#2 Fuel Spiking Stock – 50,000 µg/mL in MeCl2. Restek Catalog # 31259, or equivalent. LIMS Reagent name is OP_DIESEL_2.

a. Dilute 0.15 mL of the spiking stock to a final volume of 50 mL and bring to volume with Acetone. The final concentration is 150 ppm. LIMS Reagent name is OP_MINIDRO_MS.

b. 1.0 mL of OP_MINIDRO_MS reagent is spiked into the Laboratory Control sample, Laboratory Control sample duplicate, Matrix Spike and Matrix Spike duplicate (if applicable) during the extraction process.

c. #2 Fuel Calibration Standards - Prepare the calibration standards according to the following table using $MeCl_2$ as the diluent:

Calibration Level	EPH_2FUELCRV Stock (mL)	Final Volume (mL)	Concentration (ppm)
EPH_4FL1	0.05 of 2FUL5 standard	5	10
EPH_4FL2	0.02	5	200
EPH_4FL3	0.5	50	500
EPH_4FL4	0.08	5	800
EPH_4FL5	0.1	5	1000
EPH_4FMDX	0.04 of 4FL3 standard	5	4

3. Initial Calibration Verification #2 Fuel Stock – an ampulated stock of #2 fuel oil prepared in $MeCl_2$ at a concentration of 50,000 µg/mL. Ultra Scientific catalog # RGO-616, or equivalent. LIMS Reagent name is EPH_2FUELICV.

4. #2 Fuel Oil Initial Calibration Verification working standard (ICV) – Dilute 0.05 mL of EPH_2FUELICV to a final volume of 5 mL using $MeCl_2$ as the solvent. Final concentration is 500 ppm. LIMS Reagent name is EPH_4FLK_ICV.

5. #2 Fuel Oil Continuing Calibration Verification Check Standard (CCV) – dilute 0.5 mL of EPH_2FUELCRV stock into 50 mL of $MeCl_2$. Final concentration is 500 ppm. Same as calibration level 3.

6. Hydrocarbon Component mix calibration stock solution – A certified, ampulated stock solution containing all even-numbered normal hydrocarbons from C8 (n-Octane) through C40 (n-Tetracosane), inclusive. A concentration of 500 µg/mL for each hydrocarbon is recommended. The solvent may be Hexane or Methylene Chloride. Custom Florida TRPH Standard from Restek, catalog # 554128, or equivalent. LIMS Reagent name is EPH_TRPHCRV.

7. Surrogate Stock – an ampulated certified stock of o-Terphenyl at 10,000 ug/mL prepared in a solvent of hexane or methylene chloride. Restek catalog # 31097, or equivalent. LIMS Reagent name is OP_O-TERP_STK.

8. Working surrogate Solution - Pipette 0.15 mL of o-terphenyl surrogate stock into a 250 mL volumetric flask. Bring to volume using Acetone as the solvent and mix thoroughly. Approximate concentration is 6 ppm. LIMS Reagent name is OP_MINIDRO_SS. 1.0mL of surrogate is added to each sample and batch QC during extraction.

9. TPH Calibration Standards - Prepare the calibration standards according to the following table using $MeCl_2$ as the diluent:

a. It is necessary to prepare an intermediate reagent for o-Terphenyl for the 250mL surrogate calibration. To prepare this solution, accurately pipette 0.25 mL of the o-Terphenyl stock into a 5mL volumetric flask. Bring to volume with methylene chloride. The final concentration is 500 ppm. LIMS Reagent name is EPH_MiniOTP.

b. The level 3 TPH calibration standard is used as the continuing calibration verification check standard (CCV) for o-terphenyl.

Calibration Level	Stocks used (mL)		Final Volume (mL)	Concentration (ppm) Surrogates, Hydrocarbons
	Florida TRPH	o-Terphenyl Intermediate		
EPH_4SS5	0.1	0.1	5	10
EPH_4SS4	0.05	0.05	5	5
EPH_4SS3	0.3	0.3	50	3
EPH_4SS2	0.01	0.01	5	1
EPH_4SS1	0.25 mL of 4SS5 standard		5	0.5

10. Instrument Blank (IBLK) – Prepare an instrument blank by accurately measuring 0.004 mL of EPH_OTERPSS stock into a 10 mL volumetric flask. Bring to volume with methylene chloride. LIMS Reagent name is EPH_MINIIBLK.

Appendix III - Standards Information for 40 mL

1. Diesel/#2 Fuel Spiking Stock – 50,000 µg/mL in $MeCl_2$. Restek Catalog # 31259, or equivalent. LIMS Reagent name is OP_DIESEL_2.

a. Dilute 2.0 mL of the spiking stock to a final volume of 10 mL and bring to volume with Acetone. The final concentration is 10,000 ppm. LIMS Reagent name is OP_MICDRO_MS.

b. 0.01 mL of OP_MICDRO_MS reagent is spiked into the Laboratory Control sample, Laboratory Control sample duplicate, Matrix Spike and Matrix Spike duplicate (if applicable) during the extraction process.

2. #2 Fuel Calibration Standards – 5,000 ug/mL in methylene chloride. Restek Catalog # 31233, or equivalent. LIMS Reagent name is EPH_LL2FULCRV. Prepare the calibration standards according to the following table using Hexane as the diluent:

Calibration Level	EPH_LL2FULCRV Stock (mL)	Final Volume (mL)	Concentration (ppm)
EPH_10FL1	0.05 mL of level 3	5	1
EPH_10FL2	0.01	5	10
EPH_10FL3	0.5	25	100
EPH_10FL4	0.4	5	400
EPH_10FL5	0.8	5	800
EPH_10MDL	0.175 mL of level 2	5	0.35

3. Initial Calibration Verification #2 Fuel Stock – an ampulated stock of #2 fuel oil prepared in $MeCl_2$ at a concentration of 50,000 µg/mL. Ultra Scientific catalog # RGO-616, or equivalent. LIMS Reagent name is EPH_2FUELCRV.

4. #2 Fuel Oil Initial Calibration Verification working standard (ICV) – Dilute 0.01 mL of EPH_2FUELCRV stock to a final volume of 5 mL using hexane as the solvent. Final concentration is 100 ppm. LIMS Reagent name is EPH_10FLK.

5. #2 Fuel Oil Continuing Calibration Verification Check Standard (CCV) – dilute 0.5 mL of EPH_LL2FULCRV stock into 25 mL of hexane. Final concentration is 100 ppm. Same as level 3 of the calibration.

6. Hydrocarbon Component mix calibration stock solution – A certified, ampulated stock solution containing all even-numbered normal hydrocarbons from C_8 (n-Octane) through C_{40} (n-Tetracosane), inclusive. A concentration of 500 µg/mL for each hydrocarbon is recommended. The solvent may be Hexane or Methylene Chloride. Custom Florida TRPH Standard from Restek, catalog # 554128, or equivalent. LIMS Reagent name is EPH_TRPHCRV.

7. Surrogate Stock – an ampulated certified stock of o-Terphenyl at 10,000 ug/mL prepared in a solvent of hexane or methylene chloride. Restek catalog # 31097, or equivalent. LIMS Reagent name is OP_O-TERP_STK.

8. Working surrogate Solution - Pipette 1.0 mL of o-terphenyl surrogate stock into a 50 mL volumetric flask. Bring to volume using Acetone as the solvent and mix thoroughly. Approximate concentration is 200 ppm. LIMS Reagent name is OP_MICDRO_SS. 0.01 mL of surrogate is added to each sample and batch QC during extraction.

9. TPH Calibration Standards - Prepare the calibration standards according to the following table using hexane as the diluent:

a. It is necessary to prepare an intermediate reagent for o-Terphenyl for the 40 mL surrogate calibration. To prepare this solution, accurately pipette 0.25 mL of the o-Terphenyl stock into a 5mL volumetric flask. Bring to volume with methylene chloride. The final concentration is 500 ppm. LIMS Reagent name is EPH_MiniOTP.

b. The level 3 TPH calibration standard is used as the continuing calibration verification check standard (CCV) for o-terphenyl.

Calibration Level	Stocks used (mL)		Final Volume (mL)	Concentration (ppm) Surrogates, Hydrocarbons
	Florida TRPH	o-Terphenyl Intermediate		
EPH_10SS5	0.04	0.04	5	4
EPH_10SS4	0.02	0.02	5	2
EPH_10SS3	0.05	0.05	25	1
EPH_10SS2	0.004	0.004	5	0.4
EPH_10SS1	0.125 mL of level 5		5	0.1

10. Instrument Blank (IBLK) – Prepare an instrument blank by accurately measuring 0.08 mL of the o-terphenyl intermediate reagent EPH_MiniOTP into a 10 mL volumetric flask. Bring to volume with hexane. LIMS Reagent name is EPH_MICROIBLK.

10278 10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
10910 Quick Silica Gel Cleanup by Methods 3630C and ECY 97-602 for Hydrocarbons by GC in Solid and Water Matrices
10911 Separatory Funnel Extraction by Method 3510C for DRO in Water by California Methodology
10944 Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater
10949 3 g Silica Gel Column Cleanup for DRO by Method 3630C
11892 Determining Method Detection Limits and Limits of Quantitation
9657 Common Equations Used During Chromatographic Analyses
9689 Maintenance and Troubleshooting Procedures for GC-FID Instrumentation

End of document

Version history

Version	Approval	Revision information	
9	03.OCT.2019		
10	26.JUL.2021		
11	23.AUG.2022		

eurofins	Always check on-line for validity. **Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection**	Level: **Work Instruction**
Document number: **T-PEST-WI9981**		
Old Reference: **1-P-QM-WI-9029396**		
Version: **7**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **13-JUL-2022**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_Explosive Chem**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental Testing and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Aparatus and Equipment
Reagents and Standards
Extraction Procedure
HPLC Instrument Conditions
Calibration
Retention Time Windows
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
LCS ISM
Table 2

Revision Log

Revision: 7	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Cross Reference	Formatting	Removed SOP WI9980
Header	Formatting	Updated company name
Reagents and Standards 11.	Reflects current practice	Updated standard name in LIMS system

Revision: 7	**Effective Date:**	This version
Section	**Justification**	**Changes**
Calibration 1.	Reflects current practice	Updated naming in sequence
Throughout Document	Formatting	Updated SOP naming to the correct SOP
Personnel Training and Qualifications	Reflects current practice	Added LCS and RSD criteria
Calculations	Reflects current practice	changed peak ht/height to peak area

Revision: 6	**Effective Date:**	05 May, 2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reagents and Standards	Clarification	Reagents: Added additional reagent Standards (9.e): revised volume requirement
LIMS ID	Current process	Updated to LIMS method codes
LCS ISM	Current process	Updated to current LIMS terminology

Reference

1. *Test Methods for Evaluating Solid Wastes*, EPA SW-846, Method 8330B, Rev. 2, October 2006

2. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014

3 *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-PEST-WI10942	Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Water
T-OE-PEST-WI10943	Sonication Extraction of Nitroaromatics and Nitroamines by Method 8330/A/B in Solids
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI10008	Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department
T-PEST-WI9954	Interpretation of Chromatographic Data
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

The method is applicable for the determination of trace levels of nitroaromatics and nitroamines from explosives in soil and water samples. Table I lists these compounds and their limits of quantitation (LOQ).

Basic Principles

Soil samples are extracted with acetonitrile in an ultrasonic bath. Aqueous samples with low concentrations of explosive residues are extracted with a solid phase extraction procedure using Porpak RDX SPE cartridges and acetonitrile.

Separation of the nitroaromatics and nitroamines is performed using reversed-phase chromatography with a water/methanol mobile phase on a Phenyl-Hexyl column. The explosive residues are detected by their ultraviolet absorbance at 254 nm and 214nm. A second dissimilar column is used to confirm any positive identification of the analytes made on the primary column.

Reference Modifications

Method 8330B recommends an expiration for intermediate dilutions of 1 year and fresh preparation of calibration standards on the day of calibration. Our ongoing verification of working standards using an initial verification standard has shown that the standards are stable over a 60 day timeframe.

Interferences

Method interferences are caused by impurities in solvents, reagents, glassware or other hardware used in sample processing. The UV detector is a general detector and many organics responds. All glassware is rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the system is free of contaminants.

Tetryl decomposes rapidly in methanol/water solutions, as well as with heat. All samples expected to contain tetryl should not be exposed to temperatures above room temperature.

Safety Precautions and Waste Handling

1. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

2. All laboratory waste is accumulated, managed, and disposed of in accordance with all federal and state laws and regulations.

3. Avoid inhaling solvents and chemicals and getting them on the skin. Wear gloves when handling neat materials.

4. Samples suspected of being high in explosives must be handled carefully. (Method 8510 can be used to screen for high levels of explosives.)

5. Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives (see Calculation section).

   a. If samples are found to contain greater than this level, wet weight results must be reported.

   b. If moisture determination is deemed safe, contact client services to add moisture analysis to the sample.

6. All HPLC vials and solvent waste is disposed of in designated vial collection bins and solvent waste containers in the laboratory. Each of these is then emptied into appropriate designated containers in the lab-wide storage facility for subsequent disposal.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up

sequences, perform the calculations, interpret data, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the LCS acceptance criteria and RSD </=20%. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples (waters and solids) must be collected in amber glass jars with Teflon™-lined lids and stored in the dark at 0° to 6° C, not frozen.

Each water extraction requires a 500 mL sample which must be extracted within 7 days of collection. Each soil extraction requires 10 g of soil which must be extracted within 14 days of collection. HPLC analysis must be within 40 days of extraction.

Aparatus and Equipment

1. HPLC with dual high-pressure pump and gradient capabilities – HP1260 or equivalent
2. HPLC autosampler – HP1260 or equivalent
3. HPLC oven – HP1260 or equivalent
4. 2-HPLC UV detectors – Agilent Mutiwavelength Detector collecting 254nm and 214nm
5. Chrom Perfect data system or equivalent
6. Phenomenex: Synergi Hydro-RP: 250mm x 4.6 mm x 4um (confirmation column) or equivalent
7. Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um (primary column) or equivalent
8. Analytical balance

Reagents and Standards

A. Reagents

1. Acetonitrile (CH_3CN) – HPLC grade
2. Methanol (CH_3OH) – HPLC grade
3. Calcium chloride ($CaCl_2$) – Reagent grade; prepare an aqueous solution of 5 g/L. Store in glass for up to 1 year at room temperature.
4. Reagent water, HPLC water, or Milli-Q water
5. 50:50 ACN: $CaCl_2$ Solution - Mix 200 mL of 5g/L $CaCl_2$ Solution with 200 mL of ACN. Store in glass for up to 6 months at room temperature

B. Standards

1. Stock standard mixes of the nitroaromatic and nitroamine compounds listed in this method can be purchased from Restek and Accustandard.

NOTE: Because of the reactive nature of these compounds and the danger from explosion, it is recommended that the neat compounds not be purchased.

2. All standards are prepared using Class-A volumetric pipettes, flasks, and syringes.

3. The ampulated stocks are stored according to the manufacturer's instructions and are valid until manufacturer's expiration date.

4. Working standards are prepared in 50:50 acetonitrile/$CaCl_2$ solution (5 g/L).

5. All standards must be stored at 0° to 6°C, not frozen.

6. Intermediate dilutions are prepared every 60 days and calibration standards are made every 60 days. Surrogates and matrix spikes are prepared every 6 months for all methods.

7. Standards are sonicated or shaken vigorously prior to bottling fresh daily. This helps warm the standards up to room temperature and gives the standards mixing as well.

8. Stock Standards:

Stock	**Description**	**Vendor**	**Cat #**	**Concentration µg/ml**
1	8330B Explosives Mix	Restek	33204	1000
2	Nitroglycerin Standard	Restek	31498	1000
3	PETN Explosives Standard	Restek	31600	1000
4	3,5-DNA (ICV)	Restek	31661	1000
5	2-NMX	Chemservice	S-10114T5	2000
6	8330 Explosive (ICV)	Restek	33905	1000
7	PETN (ICV)	Accustandard	M-8330-ADD-2	100
8	Nitroglycerin (ICV)	Accustandard	M-8330-ADD-1	100
9	2,4-Diamino-6-NT	Accustandard	M-8330-ADD-12	100
10	2,6-Diamino-4-NT	Accustandard	M-8330-ADD-13	100

9. Intermediate solutions:

a. Intermediate 8330B – Add 1mL stock 1 in 10 mL volumetric flask. Dilute to volume with acetonitrile.

b. Intermediate PETN/Nitro –Add 0.1mL of stock 2 and stock 3 to a 10 mL volumetric flask. Dilute to volume with acetonitrile.

c. Intermediate 2-NMX - Add 1mL of stock 5 to 10mL volumetric flask. Dilute to volume with acetonitrile.

d. Intermediate 8330B (ICV) – Add 0.5mL of stocks 4 and 6 to a 5 mL volumetric flask. Dilute to volume with acetonitrile.

e. Intermediate 5 (Diamino intermediate) – Add 1 mL of stock 9 and stock 10 to a 5 mL volumetric flask. Dilute to volume with acetonitrile.

10. Working Standard Preparation, Surrogates and Spikes:

Standard ID	Intermediate 8330 (mL)	PETN/Nitro (mL)	2-NMX int.	Solvent	FV (mL)	µg/L *
8330 Level 6	0.2	0.33	0.3	1:1 ACN/$CaCl_2$	10	2000
8330 Level 5	0.15	0.24	0.22	1:1 ACN/$CaCl_2$	10	1500

Standard ID	Intermediate 8330 (mL)	PETN/Nitro (mL)	2-NMX int.	Solvent	FV (mL)	µg/L *
8330 Level 4	0.1	0.16	0.15	1:1 ACN/$CaCl_2$	10	1000
8330 Level 3	0.125	0.15	0.19	1:1 ACN/$CaCl_2$	25	500
8330 Level 2	0.01	0.04	0.015	1:1 ACN/$CaCl_2$	10	100
8330 Level 1	0.125 of Level 6	0.015	0.009	1:1 ACN/$CaCl_2$	10	25
MDL	1.0 of Level 2	0.004	0.006	1:1 ACN/$CaCl_2$	10	10

* Concentrations for PETN, Nitroglycerin, and 2-NMX are higher concentrations.

	ICV int (mL)	2-NMX int	PETN icv stock	NG stock	FV (mL)	ug/L
ICV	0.05	0.075	0.2	0.2	10	

	2,4 stock (mL)	2,6 stock (mL)	FV (mL)	Solvent	ug/L
Diamino Level 6	0.2	0.2	10	1:1 ACN/$CaCl_2$	2000
Diamino Level 5	0.15	0.15	10	1:1 ACN/$CaCl_2$	1500
Diamino Level 4	0.1	0.1	10	1:1 ACN/$CaCl_2$	1000
	Intermediate				
Diamino Level 3	0.625		25	1:1 ACN/$CaCl_2$	500
Diamino Level 2	0.05		10	1:1 ACN/$CaCl_2$	100
Diamino Level 1	0.015		10	1:1 ACN/$CaCl_2$	30
Diamino MDL STD	0.005		10	1:1 ACN/$CaCl_2$	10

Diamino Water Matrix Spike	Stock 9	0.1	25	1:1 ACN/$CaCl_2$
	Stock 10	0.1		
Diamino Soil Matrix Spike	Stock 9	0.18	25	1:1 ACN/$CaCl_2$
	Stock 10	0.18		
8330 Soil Matrix Spike	Stock 3	0.75	25	1:1 ACN/$CaCl_2$
	Stock 2	0.75		
	Stock 1	0.25		
8330 Water Matrix Spike	Stock 3	1.6	25	1:1 ACN/$CaCl_2$
	Stock 2	1.6		
	Stock 1	0.5		

11. Standards Database Entry:

Enter each working standard into the system as follows:

IBLANK: GCS_XIBLK

Level 1: GCS_83301
Level 2: GCS_83302
Level 3: GCS_83303
Level 4: GCS_83304
Level 5: GCS_83305
Level 6: GCS_83306
Level ICV: GCS_8330ICV

Level MDL: GCS_8330MDL

Level 1: GCS_DIAM1 (Diamino compounds)
Level 2: GCS_DIAM2
Level 3: GCS_DIAM3
Level 4: GCS_DIAM4
Level 5: GCS_DIAM5
Level 6: GCS_DIAM6
Level MDL: GCS_DIAMMDL

Extraction Procedure

See T-OE-PEST-WI10942 for the extraction of water samples and T-OE-PEST-WI10943 for the extraction of solid samples.

HPLC Instrument Conditions

A. Dual column analysis

Below are the recommended chromatographic conditions for the reversed-phase separation. Modifications to these conditions can be made at the discretion of the analyst to improve resolution or the chromatographic process. In general, a simultaneous dual column approach must be used. Single column conditions are listed as well.

Connect a T splitter to the autosampler exit line, then to short lines connected to each of two columns. The primary column must be directed into a multiwavelegth detector acquiring at 254 nm and 214 nm. The confirmation column must be connected to a multiwavelength detector acquiring at 254 and 214nm. There must be a total of four channels of data on chromperfect. There must be two start signals, using stacked connections.

Primary channels:	Phenomenex: Luna Phenyl-Hexyl: 250mm x 4.6mm x 5um. Mutliwavelenghth detector at 254 nm and 214 nm
Confirmation channels:	Phenomenex: Synergi Hydro-RP: 250mm x 4.6mm x 4um. Mutliwavelength detector at 254 nm and 214 nm
Gradient:	55% MeOH hold to 2 min, 71% MeOH at 22 min, 90% MeOH at 28 min, 55% MeOH at 30 min..
Total Flow:	2.8mL/min
Oven:	Primary 23° C, Confirmation 27° C
Injection Size:	70 µL

Calibration

1. Prepare a sequence using the following suggested order of injections:

    1. Conditioner
    2. Conditioner
    3. PIBLX (IBLK)
    4. IC 83301
    5. IC 83302
    6. ICRT 83303
    7. IC 83304
    8. IC 83305
    9. IC 83306
    10. ICVL 8330 (MDL Standard)

11. ICV 8330 (ICV Standard)
12. IC Diam1
13. IC Diam2
14. IC Diam3
15. IC Diam4
16. IC Diam5
17. IC Diam6
18. ICVL Diam (MDL Standard)
19. BLANKA
20. LCSA
21. LCSDA
22. SAMPLE1
23. SAMPLE1 MS
24. SAMPLE1 MSD
25. – 28. SAMPLE2 – 6
29. CCV 8330
30. CCV Diam
31. – 40. TEN SAMPLES
41. CCV 8330
42. CCV Diam
43. – 52. TEN SAMPLES
53. 83303
54. Diam3

Diam ICAL standards and check standards are run as needed when 2,4-diamino-6-nitrotoluene and/or 2,6-diamino-4-nitrotoluene are requested target analytes.

2. Initial Calibration (ICAL)

a. An external 6-point calibration is performed by injecting working standards at 6 levels.

An example chromatogram of a midlevel standard is shown in Figure 1A, for the primary column.

b. If the relative standard deviation (RSD) from these 6-response factors is less than or equal to 20%, then the overall average response factor is used to calculate unknown analyte concentrations from the peak heights.

c. If the RSD is > 20%, a linear fit is used.

d. Do not force or extrapolate to zero.

e. The coefficient of determination (r^2) must meet ≥0.99 for the curve to be valid.

f. Samples cannot be analyzed until a compliant ICAL is achieved.

g. See *T-PEST-WI10008* if instrument maintenance is needed to troubleshoot and/or correct any problems.

When curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet ±50%, standards above the LOQ must meet ±30%. (%error = (true concentration - calculated concentration)/true concentration)*100).

3. Initial Calibration Verification (ICV)

a. Inject the ICV after the ICAL and evaluate prior to sample analysis. An initial verification standard must be bottled fresh on the day of calibration to ensure no degradation of the target analytes has occurred when running method 8330B.

b. The concentration for each analyte must be within ± 30% from the nominal value.

4. Continuing Calibration Verification (CCV)

   a. A continuing calibration is run after each set of ten samples.

   b. CCV uses the Level 3 calibration standard

   c. The concentration quantitated for the calibration check standards must be within 20% difference (%D) of the nominal concentration.

   d. Exception: If the standard following a sample is outside the 20% but exhibits increasing response, the samples before it do not have to be reinected if the target analytes are not detected. A comment must be added to the analytical report.

   e. If two consecutive/sequential CCVs fail, corrective action must be taken. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

   f. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria, as well as all initial calibration criteria. If either of these are not met, a comment must be added to the analytical report.

5. The scaling of chromatograms and peak integration parameters is set so that the peaks for each compound of interest are detected and integrated at the concentration of the Method Detection Limit (MDL). This ensures that the quantitation limits and MDLs can be met.

Retention Time Windows

1. Established as 3x the standard deviation determined over a 72-hour period, or at no less than ±0.1 min, applied to the mid-point initial calibration standard.

2. If the RTs for a continuing calibration standard fall outside the windows, update the midpoint RT using that standard.

   a. Save this under an appropriate name to indicate an update has occurred.

   b. All subsequent continuing standards run within a 24-hour period must fall within this window.

   c. RTs cannot be updated more than once per day.

   d. If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Analyze the samples using the chromatographic conditions listed in the HPLC Instrument Conditions section and the sequence listed in the Calibration section of this document.

2. Peaks are identified by matching retention times within retention time windows established for the target analytes.

3. All positive identifications for target compounds made on the Primary Luna Phenyl -Hexyl column must be confirmed by injection on the Synergi.

4. For analytes that are detected on both columns, See T-PEST-WI9954.

   a. Report the result from the primary column.

   b. There are cases, however, where use of confirmatory data is necessary.

For example, if a target compound detected on the primary column is not detected on the confirmation column, the result is reported as “not detected” using the confirmation data. If there are interferences on

the primary column masking the result for a target analyte, the result may need to be reported from the confirmation data. All initial and continuing calibration requirements apply to the second column data.

5. See Figures 1A, 1B, 2A, and 2B for identification of compounds.

6. If the response for any target compound exceeds the upper calibration standard, a dilution must be performed which brings the response into the upper end of the calibration curve.

Calculations

1. Waters

$$\frac{\text{Peak Area} \times \text{FV} \times \text{DF}}{\text{RF} \times \text{IV}} = \text{Concentration } (\mu g/L)$$

Where:

Peak area = Peak area found in sample

RF = Average response factor [peak area/(µg/L)] from the initial calibration

FV = Final volume of sample extract in mL (normally 10 for waters)

DF = Dilution factor if applicable

IV = Initial volume of sample extracted in liters (500 mL)

2. Soils:

$$\frac{\text{Peak Area} \times \text{FV} \times \text{DF}}{\text{RF} \times \text{IW}} = \text{Concentration } (\mu g/kg)$$

Where:

Peak area = Peak area found in sample

RF = Average response factor [peak area/(µg/L)] from the initial calibration

FV = Final volume of sample extract in mL (normally 10 mL for soils)

DF = Dilution factor if applicable (normally 2 for soils)

IW = Initial weight of soil extracted in grams

NOTE: Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives. Percent by weight is calculated by dividing the ppm value by 10,000.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

An annual lower limit of quantification (LLOQ) verification is required annually on at least one instrument. All instruments must have an LLOQ verification performed every three years.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, an MS, and MSD must be extracted. If there is limited sample which prevents the preparation of the MS/MSD, then an LCSD must be prepared instead.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

2NMX is added as a surrogate to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the HPLC run.

See *T-PEST-WI10011* for more information on QC acceptance criteria and corrective action.

Table I

LOQs of Nitroaromatics/Nitroamines

			Limit of Quantitation (LOQ)	
Compound	CAS	Abbrev.	Soil (µg/kg)	Water (µg/L)
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	2691-41-0	HMX	300	0.6
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4	RDX	120	0.6
1,3,5-Trinitrobenzene	99-35-4	1,3,5-TNB	120	0.6
1,3-Dinitrobenzene	99-65-0	1,3-DNB	120	0.6
Methyl-2,4,6-trinitrophenylnitramine	479-45-8	TETRYL	300	0.6
Nitrobenzene	98-95-3	NB	300	0.6
2,4,6-Trinitrotoluene	118-96-7	2,4,6-TNT	120	0.6
4-Amino-2,6-dinitrotoluene	1946-51-0	4-Am-DNT	120	0.6
2-Amino-4,6-dinitrotoluene	355-72-78-2	2-Am-DNT	120	0.6
2,4-Dinitrotoluene	121-14-2	2,4-DNT	300	0.6
2,6-Dinitrotoluene	606-20-2	2,6-DNT	120	0.6
2-Nitrotoluene	88-72-2	2-NT	120	0.6
3-Nitrotoluene	99-08-1	3-NT	120	0.6
4-Nitrotoluene	99-99-0	4-NT	120	0.6
Pentaerythritol tetranitrate	1607-17-6	PETN	2400	10
Nitroglycerin	55-63-0	NG	2400	10
3,5-Dinitroaniline	618-87-1	3,5-DNA	120	0.6
2,4-Diamino-6-nitrotoluene	6629-29-4		300	0.6
2,6-Diamino-4-nitrotoluene	59229-75-3		300	0.6

LOQs in this table are subject to change. The LIMS contains the most current LOQs.

LCS ISM

1. Custom Organic Standard purchased from Phenova - 5mL spiking solution to be applied to 500g solid matrix, containing 17 analytes requested at a final spiked concentration of 2000 ug/kg (with Nitroglycerin and PETN at a final spiked concentration of 10,000 ug/kg), solvent will be Acetonitrile, and each standard will be provided as a premeasured 5.00mL spike flame sealed in a 10mL amber ampoule, designed for "snap and spike" use where quantitative transfer of 100% of the 5mL is applied to 500g solid matrix.

2. The 500 grams is then puck milled by SA and 10 gram aliquots are weighed out to use as the LCS ism required for this method. The LCS ism has surrogate added to the 10ml aliquot after puckmilling and then is extracted as per the prep SOP.

Compound	Certified value (ug/kg)	Final Spiked Concentration
4-Amino-2,6-dinitrotoluene	947	2000
2-Amino-4,6-dinitrotoluene	650	2000
1,3-Dinitrobenzene	1010	2000
2,4-Dinitrotoluene	638	2000
2,6-Dinitrotoluene	1320	2000
HMX	620	2000
Nitrobenzene	1400	2000
2-Nitrotoluene	1460	2000
3-Nitrotoluene	1020	2000
4-Nitrotoluene	1830	2000
RDX	587	2000
1,3,5-Trinitrobenzene	701	2000
2,4,6-Trinitrotoluene	808	2000
Nitroglycerine	1000	10000
Pentaerythritol tetranitrate (PETN)	1000	10000
3,5-Dinitroaniline		2000
Tetryl		2000

Triplicate

To assess if the grinding, mixing, and subsampling adequately addressed the compositional and distribution heterogeneity in the sample, triplicate subsamples should be removed and analyzed for every 5 to 20 samples processed. A unique sample number is entered for each triplicate. The data for each triplicate is entered into a spreadsheet to determine the %RSD. The spreadsheet is included with the batch data for scanning. See Table 2.
An NCM must be added to the sample with the following wording: “This sample was used for the ISM triplicate. The individual %RSD is included in the data package for review.”

The RSD for results above the LOQ must not exceed 20%. If above 20%, examine the project specific requirements. Contact the client to determine what additional measures are to be taken. If reported per the client, apply J-flag if acceptance criteria are not met and explain in case narrative.

Table 2

Triplicate summary form

Sample #	8886374	8886375	8886376			
compound	result (ug/kg) trial1	result (ug/kg) trial2	result (ug/kg) trial3	AVERAGE	std dev	%rsd
4-AM-2,6-DNT	0	0	0	0	0	#DIV/0!
2-AM-4,6-DNT	0	0	0	0	0	#DIV/0!
1,3-DNB	0	0	0	0	0	#DIV/0!
2,4-DNT	0	0	0	0	0	#DIV/0!
2,6-DNT	0	0	0	0	0	#DIV/0!
HMX	0	0	0	0	0	#DIV/0!
Nitrobenzene	0	0	0	0	0	#DIV/0!
2-NT	0	0	0	0	0	#DIV/0!
3-NT	0	0	0	0	0	#DIV/0!
4-NT	0	0	0	0	0	#DIV/0!
RDX	0	0	0	0	0	#DIV/0!
1,3,5-TNB	0	0	0	0	0	#DIV/0!
2,4,6-TNT	0	0	0	0	0	#DIV/0!
Nitroglycerin	0	0	0	0	0	#DIV/0!
PETN	0	0	0	0	0	#DIV/0!
Tetryl	0	0	0	0	0	#DIV/0!
3,5-DNA	0	0	0	0	0	#DIV/0!

Attachment:
Figure 1A (.doc)
Figure 1B (.doc)
Figure 2A (.doc)
Figure 2B (.doc)

10008 Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department
10011 QC Data Acceptability and Corrective Action
10942 Extraction of Nitroaromatics and Nitroamines by Method 3535A in Water
10943 Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330B in Solids
11892 Determining Method Detection Limits and Limits of Quantitation
9954 Interpretation of Chromatographic Data

End of document

Version history

Version	Approval	Revision information	
5	14.MAY.2019		
6	05.MAY.2021		
7	29.JUN.2022		

eurofins	Always check on-line for validity. **Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS**	Level: **Work Instruction**
Document number: **T-SVOA-WI9995**		
Old Reference: **1-P-QM-WI-9015192**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date **03-JUN-2022**	Document users: **5_EUUSLA_GC/MS Semivolatiles_All**	Responsible: **5_EUUSLA_GC/MS Semivolatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
Table II
Table III
Table IV
Table V
Table VI

Revision Log

Revision: 19	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Header	Reflects current Naming	Updated to current company name
Basic Principles	Updated SOP #s	Added T-OE-SVOA -WI11432 and T-OE-SVOA-WI19916
Personnel Training and Qualifications	Reflects current practice	Updated IDOC criteria for 8270 and 625.1
Procedure	Clarification	Added wording for clarification on certain processes.
Statistical Information/Method Performance	Text duplicated	Removed duplicated text; revised statement about which methods use statistical surrogate limits
Quality Assurance/Quality Control	Clarification	Clarified that marginal exceedance is only used for 8270C/D/E
Table I	Removed	Method 8270C was added to the existing Table II. All table numbering was then renumbered accordingly.

Revision: 18	**Effective Date:**	APR. 27.2021
Section	**Justification**	**Changes**

Revision: 18	**Effective Date:**	APR. 27.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout document	Clarification	Removed all references to footnotes regarding qualified data and drafted a general statement addressing data qualification as a means to differentiate between data that needs to be qualified and instances that require corrective action
LIMS ID	Reflects current LIMS	Removed Parallax analysis numbers
Cross Reference	Updated title	*T-OE-SVOA-WI10947* - removed 625 from title and added 612
Personnel Training and Qualifications	Reflects current practice	Revised the standard deviation criteria for 625.1 DOC to use the limits in Table VI, removed option to use 1CCV and 4 CCVs as an ongoing DOC as these do not include the preparation step
Procedure	Updated process	Laboratory will begin using ICV/CCV acceptance criteria put forth by the method rather than in-house limits
Statistical Information/Method Performance	Text duplicated	Removed duplicated text; revised statement about which methods use statistical surrogate limits
Quality Assurance/Quality Control	Clarification	Clarified that marginal exceedance is only used for 8270C/D/E
Table VII	New table	Added surrogate table containing method-specific surrogate limits for method 625.1

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270C (SIM), December 1996
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8270D (SIM), July 2014
3. Hazardous Waste Test Method, SW-846 Test Method 8270E (SIM), June 2018
4. Test Methods for Evaluating Solid Wastes, SW-846 Method 8000D, July 2014
5. USEPA, 40 CFR Part 136, Method 625.1, December 2016 (SIM); MUR Effective September 2017
6. *Hewlett-Packard Operations Manuals*
7. *Chemical Hygiene Plan*, current version

Cross Reference

Document	Document Title
T-OE-SVOA-WI10916	Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix
T-OE-SVOA-WI10928	Microwave Extraction by Method 3546 for Semivolatiles
T-OE-SVOA-WI11432	Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater
T-OE-SVOA-WI10947	Separatory Funnel Extraction for BNAs in Wastewater by Method 612 or 625.1
T-SVOA-FRM9602	Dept 4026 Calculations
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance

Document	Document Title
T-SVOA-WI9604	Monitoring GC/MS Semivolatile QC Data Acceptance Limits
QA-SOP11178	Demonstrations of Capability
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is suitable for the determination of low-level semivolatile compounds in soils and waters by selected ion monitoring (SIM) Gas Chromatography/Mass Spectrometry (GC/MS). The analysis applies to a concentration range that spans from an MDL of 0.01 µg/L in water (0.33 µg/kg for soil) to an upper calibration concentration of 10 µg/L in water (330 µg/kg for soil). Specific compound lists and their associated MDLs/LOQs are found in the Laboratory Information Management System (LIMS) under the analysis numbers listed on the front page of this SOP.

Basic Principles

Water samples are extracted according to *T-OE-SVOA-WI11432* for 8270 analysis or *T-OE-SVOA-WI10947* for 625.1 analysis. Soil samples are extracted according to either *T-OE-SVOA-WI10928* or *T-OE-SVOA-WI10916*.

An environmental sample (soil, water, sludge, etc.) is solvent extracted and then analyzed by electron impact gas chromatography/mass spectrometry (EI GC/MS). A predetermined aliquot of an extract containing organic compounds in solvent is injected onto a fused silica capillary column coated with a relatively non-polar stationary phase, which is enclosed in a temperature controlled oven. A carrier gas, which is ultra-pure helium, passes continuously through the column. The GC oven is temperature programmed and the organic mixture separates into its individual components as it moves along the length of the column. This separation is the function of the polarity and boiling point of the individual compounds. This column empties into a mass selective detector. When a compound reaches the detector, it is bombarded by high-energy electrons (70 eV). This causes the compounds to fragment, forming ions. By applying various voltages to the lens, the positive ions are thrust into a quadrupole mass analyzer, which selects for a given mass fragment at a given time. These selected fragments reach an electron multiplier that detects and generates a signal for each mass fragment. The signals are amplified and sent to a computer. By analyzing for specific masses over a narrow mass range, SIM analysis allows for longer dwell times at specific masses. This allows for significantly greater sensitivity of analysis with a small reduction in specificity of analysis.

Target compounds are identified on the basis of spectral match and relative retention times as they compare to standards that are injected every 12 hours on the same system. Quantification is achieved via use of the internal standard calibration technique. The average relative response factor of a multi-point calibration is used for quantification when the appropriate criteria are met.

Interferences

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in the processing of samples. All glassware is solvent rinsed before use and a method blank is extracted with each extraction batch to demonstrate that the extraction system is free of contamination.

Sample matrices can have an effect on the ability of the GC/MS system to resolve the individual masses used for quantification. Samples may require dilutions, a reduction in the extraction volume/weight used, a raised final extraction volume, or extract clean-up using various techniques in order to achieve proper target separation and determination.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See Chemical Hygiene Plan for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; therefore, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as the use of fume hoods, lab coats, safety glasses, and gloves.

All solvent waste generated from this analysis must be collected for recycling (if applicable) or must be disposed of in designated containers. These will then be transferred to a lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, and pH paper) must be disposed of in the normal solid waste collection containers or sharps containers, as applicable.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently perform daily maintenance, calibrate the instrument, change the column, clean the source, interpret chromatograms, perform calculations, review data, and enter data into the LIMS. The analyst is also trained on the preparation of dilutions and calibration standards. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

For 8270C/D/E the IDOC consists of four laboratory control samples that are spiked at 1-4x the LOQ and are carried through all steps of the procedure. For 625.1, the IDOC is spiked near the midpoint of the calibration. The defined acceptance criteria must be met. The criteria include the calculation of mean accuracy and standard deviation. The mean accuracy for all compounds must fall within the laboratory's most recent statistically derived LCS limits ±20% and must exhibit a standard deviation ≤20% for methods 8270C/D/E. The mean accuracy for all compounds must fall within the limits listed in table V under 'X' and must exhibit a standard deviation less than or equal to the limits listed in Table V under 's' for method 625.1. Analytes not listed in table V in 625.1 use statistically derived limits. See statistical info/method performance for more information.

Various options are available for a DOC and can include four laboratory control samples or one blind sample. Refer to *QA-SOP11178* for more guidance on these options.

Sample Collection, Preservation, and Handling

Water samples are collected in 250mL or 1L glass amber containers with PTFE-lined lids and may be preserved with sodium thiosulfate ($Na_2S_2O_3$). They are stored at 0°C to 6°C, not frozen, prior to extraction and must be extracted within 7 days of collection.

Solid samples are collected in glass wide-mouth jars with PTFE-lined lids and are not preserved. They are stored at 0°C to 6°C, not frozen, prior to extraction and must be extracted within 14 days of collection.

All sample extracts must be stored at ≤-10°C (freezer) and protected from light using amber glass vials. All samples, sample extracts, and standards must be stored separately and in an area free from contamination. All extracts must be analyzed within 40 days of sample extraction.

Apparatus and Equipment

1. Hewlett-Packard Model 6890 Gas Chromatograph or equivalent

2. Hewlett-Packard Model 5973 and 5975 Mass Selective Detector or equivalent

3. Hewlett-Packard ChemStation Software or equivalent

4. Chrome Peak Review data system or equivalent

5. Column:

30 m x 0.25 mm x 0.5 µm film thickness, Restek Rxi-5Sil MS or equivalent
30 m x 0.25 mm x 0.25 µm film thickness, Agilent DB-5MS or equivalent

6. Hamilton Gastight syringe, or equivalent – various volumes

7. Amber GC vials with crimp caps

Reagents and Standards

Refer to *T-SVOA-WI11998* for all standard preparation information.

Calibration

Calibration is accomplished using an internal standard calibration technique. Calibration standards at five or more concentration levels are analyzed. See Procedure F for the initial calibration process and criteria and see Procedure G for the continuing calibration process and criteria. If any client, state, or agency has more stringent calibration criteria, these must be followed instead.

NOTE: South Carolina does not allow the use of quadratic fits.

Procedure

A. Standard preparation

Solutions are used to standardize the GC/MS system every 12 hours. Refer to *T-SVOA-WI11998* for standard preparation. Calibration solutions may be used up to the labeled expiration date or until component degradation is observed. Degradation is determined by the inability to pass continuing calibration checks or by observations of unacceptable chromatography.

B. Internal standards

Internal standard mix is added to all standards and subsequent samples at a concentration of 1 µg/mL for soil and 1L analyses, and 0.25 µg/mL for 250 mL analyses. Using a 25 µL syringe, add 10 µL of internal standard to 1 mL of sample extract or standard. See Table III for the list of compounds calibrated for and the internal standard that is assigned to each.

C. Daily maintenance

Refer to *T-SVOA-WI9598* for this procedure

D. Instrument conditions

1. The GC/MS system must be capable of meeting the following specifications:

Mass range:	35 to 500 amu
Scan time:	1 scan/sec
GC column:	30 m x 0.25 mm x 0.5 µm film Restek Rxi – 5 or equivalent
Injector temperature and mode:	250° to 300°C; splitless
Transfer line temperature:	250° to 300°C
Detector temperature:	300°C
EI condition:	70 eV
Mass scan:	Capable of SIM scanning (see manufacturer's instructions)
Carrier gas:	Helium at approximately 30 cm/sec.
GC Oven temperature program:	Initial temperature – 35°C Initial hold time – 1.82 minutes GC Ramp #1 – 20°C/minute to 310°C GC Ramp #2 – 4°C/minute to 325°C Final hold time – 4.30 minutes

NOTE: It is not necessary to use the exact parameters listed above. Equivalent columns and conditions may be used to improve the linearity, sensitivity, overall chromatography, and performance required by the method on each GC/MS system.

2. Prior to analysis by SIM, a check standard must be analyzed in the full scan mode to determine where the specific start and stop times are for each of the groups. Each time column maintenance is performed, the scan times are reviewed to ensure that all ions are included. The GC/MS is configured in the SIM mode with a total cycle time (including voltage reset time) of 1 second or less. Set the Low Res to "N" and the Start Time for each group. In the m/z field, enter the ions for each group from the following tables:

GROUP 1 (Dwell – 60 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
1,4-Dioxane	Target	88	58
N-Nitrosodimethylamine	Target	74	42

GROUP 2 (Dwell – 40 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Quinoline	Target	129	102
1,4-Dichlorobenzene-d4	ISTD	152	115
Naphthalene-d8	ISTD	136	68
Naphthalene	Target	128	129,102
Bis(2-chloroethyl)ether	Target	93	63

GROUP 3 (Dwell – 40-50 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Dimethylphthalate	Target	163	194
2-Methylnaphthalene	Target	142	141
1-Methylnaphthalene	Target	142	141
1-Methylnaphthalene-d10	Surrogate	152	76
Acenaphthylene	Target	152	76
Acenaphthene-d10	ISTD	164	162
Acenaphthene	Target	154	152

GROUP 4 (Dwell – 25-30 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Dibenzofuran	Target	168	139
Diethylphthalate	Target	149	177
Fluorene	Target	166	165
Hexachlorobenzene	Target	284	142

GROUP 4 (Dwell – 25-30 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
N-Nitrosodiphenylamine	Target	169	168
Phenanthrene-d10	ISTD	188	94
Phenanthrene	Target	178	176
Anthracene	Target	178	176

GROUP 5 (Dwell – 50 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Di-n-butylphthalate	Target	149	150
Fluoranthene	Target	202	101
Pyrene	Target	202	101
Flouranthene-d10	Surrogate	212	106

GROUP 6 (Dwell – 40 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Butylbenzylphthalate	Target	149	91
Benzo(a)anthracene	Target	228	229
Chrysene-d12	ISTD	240	236
Chrysene	Target	228	229
Bis(2-ethylhexyl)phthalate	Target	149	167
Di-n-octylphthalate	Target	149	150
Benzo(b)fluoranthene	Target	252	253
Benzo(k)fluoranthene	Target	252	253
Benzo(e)pyrene	Target	252	253
Benzo(a)pyrene	Target	252	253
Perylene-d12	ISTD	264	260
Benzo(a)pyrene-d12	Surrogate	264	132
Perylene	Target	252	253

GROUP 7 (Dwell – 100 msec)			
Compound	**Type**	**Quant Ion (m/z)**	**Monitor Ion (m/z)**
Indeno(1,2,3-cd)pyrene	Target	276	138
Dibenz(a,h)anthracene	Target	278	139
Benzo(g,h,i)perylene	Target	276	138

NOTE: Each program must be identical for the Temperature and Pressure programs so that the peak retention times are the same.

E. Tuning

1. The DFTPP tune check standard is used to assess GC column performance and injection port inertness as well as mass spectrometer performance. The GC/MS system's tune is checked by inspecting the mass spectrum of the DFTPP peak and column performance and injection port inertness is evaluated with pentachlorophenol, benzidine, and DDT.

2. The GC/MS should be tuned using a 50 ng/µL solution (12.5 ng/µL for 250 mL analyses) of DFTPP containing decafluorotriphenylphosphine, pentachlorophenol, benzidine, and DDT. This solution is prepared as indicated in *T-SVOA-WI11998*. See the table below for acceptance criteria and corrective actions.

Frequency	**Acceptance Criteria**	**Corrective Action**
Prior to initial calibration and every 12 hours prior to continuing calibration standard **NOTE**: Analysis of DFTPP, the LCS, and the blank are outside of the 12-hour analysis shift for method 625.1. The total time for DFTPP, the LCS, the blank,	1. Ion Acceptance Criteria in Table I 2. DDT breakdown ≤20%* 3. Tailing factors: a. 8270C: - Benzidine ≤3 - Pentachlorophenol ≤5**	1. Re-tune. Analysis cannot proceed until tune meets criteria. 2. More aggressive injection port maintenance. 3. Clean the source.

and the 12-hour shift must not exceed 15 hours.	b. 8270D/E: - Benzidine ≤2 - Pentachlorophenol ≤2** c. 625.1: - Benzidine <2 - Pentachlorophenol <2**	4. Change the column.

*DDT breakdown greater than 20% may be acceptable if calibrating for polynuclear aromatic hydrocarbon (PAH) compounds only. Consult supervisor when this situation occurs.

**Unless project requirements dictate otherwise, the PCP tailing factor may fail acceptance criteria as only compounds with basic or neutral properties are targets of interest by SIM.

3. Use only the background-subtracted spectrum of the following when evaluating the DFTPP:

A three scan average of the apex of the scan, the apex of the scan -1, and the apex of the scan +1.

NOTE: All standards, samples, and associated quality control samples analyzed within a particular tune must use the identical conditions of the mass spectrometer.

F. Initial calibration (ICAL)

1. The initial calibration consists of analyzing standards at 6 concentration levels (0.05, 0.2, 0.5, 1, 5, and 10 ng/µL for solid and 1L water analyses) (0.01, 0.05, 0.1, 0.5, 1, and 2.5 ng/µL for 250-mL analyses). The initial calibration for 8270D soil and 1L water extractions includes an additional calibration point at 0.01 ng/µL. Response factors are produced for each level. An average response factor is then generated for each compound and surrogate. The relative standard deviation (%RSD) of the response factors determines the suitability of the average relative response factor for calculation of compound concentration. Use of the average relative response factor requires at least four calibration levels. If an alternate fit is required for any compound, at least five calibration levels are required for linear fits, and six calibration levels are required for quadratic fits. At the end of the calibration standard injections, inject the Method Detection Limit (MDL) standard and an initial calibration verification (ICV) standard. See the tables below for acceptance criteria and corrective actions.

ICAL Frequency	Acceptance Criteria	Corrective Action
1. Initially establish with at least 6 levels of standards. 2. When % drift in the daily continuing calibration check standard fails criteria.	1. %RSD requirements (if these criteria are met, then calculate concentrations based upon the average response factor fit): a. 8270C: %RSD ≤15% b. 8270D/E: %RSD ≤20% c. 625.1: %RSD ≤35% 2. The relative retention time of each target compound in each calibration standard should agree within 0.06 relative retention time units. 3. Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer-peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs. 4. 8270D/E: See table II for minimum response factors for each compound. It is not necessary to meet these specifications. They are provided merely as guidance. 5. The %Error is measured between the calculated and expected amounts of a compound at each calibration	1. If the %RSD for any compound is greater than the defined acceptance criteria, use a first degree(linear) fit provided the correlation coefficient (CC; r) is ≥0.995 or the coefficient of determination (COD;r2) is ≥0.99. If the linear fit fails to meet this criteria, then a second order (quadratic) fit may be used provided the coefficient of determination is ≥0.99.* If use of both the linear fit and the quadratic fit is acceptable using these criteria for any given compound, then use the fit with the smallest negative y-intercept. When using a quadratic fit, if the y-intercept quantifies to be greater than the MDL, consult your supervisor immediately or re-calibrate. 2. Re-inject any levels that appear to be outliers due to an injection error. 3. If standard levels on the outside of the curve appear to be outliers for individual compounds and are throwing off the calibration curve, they can be dropped from the calibration keeping the following in mind: a. If a low calibration point is dropped, the analyst must ensure that the compound is still being calibrated down to or below its RL.

	level to determine the calibration function acceptability for linear and quadratic curve fits. The % error must be ≤50% for the low calibration point. For calibration points above the LOQ the % error must be ≤30%. **NOTE:** For 625.1 calibrations, only the low calibration point and the mid-point need to be evaluated.	b. If a high calibration point is dropped, any detections must recover below the new upper calibration limit. 4. Re-prep calibration standards. 5. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

*South Carolina does not allow the use of quadratic fits.

MDL Frequency	Acceptance Criteria	Corrective Action
Immediately following an initial calibration and before sample analysis	1. The system must be able to detect all compounds in the MDL solution.	1. If any compounds are not detected in the MDL standard, analysis can proceed if the compound is detected at or below its MDL in a higher concentration level. 2. If the system does not detect the compound(s), then the tuning and/or calibration procedure must be repeated under conditions that will yield a detection for the compound(s) or the MDL must be raised for the compound(s). 3. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

NOTE: 625.1 does not require the analysis of an MDL standard as part of the initial calibration.

ICV Frequency	Acceptance Criteria	Corrective Action
Immediately following an initial calibration and before sample analysis	1. The ICV must be prepared using a second source standard 2. %D requirements: a. 8270C/D/E: ±30%D b. 625.1: Criteria listed under Q in Table V of this SOP 3. The EICP area for each internal standard must fall within the window of -50% to +100% of the areas from the mid-level calibration standard produced during the initial calibration. Surrogate compounds must be included in the processing list for analysis 625.1 and must meet the same criteria as target compounds.	1. Re-prep and re-analyze the ICV. 2. If the recovery for any compound fails these criteria low, the compound cannot be analyzed for under the calibration until a new ICV has been analyzed. 3. If the recovery for any compound fails these criteria high, the compound may be analyzed for but any samples with detections should be re-analyzed under a valid ICAL or will be reported with a qualifying comment. 4. Perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* and re-calibrate.

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

2. One of the calibration standards must be at a concentration at or below the limit of quantitation (LOQ). The other concentrations correspond to the expected range of concentrations found in samples or should define the working range of the GC/MS system.

3. The concentration of the MDL standard may require modification dependent upon the current MDL values.

G. Continuing calibrations

Perform the continuing calibration verification (CCV) by injecting a predetermined aliquot of a calibration standard at a concentration near the mid-point of the calibration, not to exceed ½ the highest level in the calibration. See the table below for acceptance criteria and possible corrective actions.

CCV Frequency	Acceptance Criteria	Corrective Action
1. Every 12 hours. 2. The CCV is analyzed each day a curve is not analyzed. 3. The CCV is analyzed after DFTPP.	1. %Drift: a. 8270C/D/E: ≤20% b. 625.1: Criteria listed under Q in Table V of this SOP 2. The relative retention times of the internal standards must be within 10 seconds of the retention times from the mid-level calibration standard of the last initial calibration. The exception would be in the case of column maintenance. 3. The EICP area for each internal standard must fall within the window of -50% to +100% of the areas from the mid-level calibration standard produced during the last initial calibration. 4. 8270D/E: See Table II for minimum response factors for each compound. It is not necessary to meet these specifications. They are provided merely as guidance. 5. Structural isomers that produce very similar mass spectra are identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved when the height of the valley between two isomer peaks is <25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.	1. If the CCV fails and the cause is obvious such as in the case of a concentrated standard or a mis-injection, re-inject the CCV, making sure to select another standard vial if a bad standard is suspected. 2. If the %Drift for any compound is >20% high and it is not detected in samples, data can be reported. 3. If the %Drift for any compound is >20% low, perform more aggressive system maintenance as outlined in *T-SVOA-WI9598* or adjust the tune file. Document the corrective action in the form of a non-conformance memo. Re-inject DFTPP and the calibration standard. If the CCV does not pass after corrective action, a new initial calibration must be established. **NOTE:** For method 8270D, in cases where compounds recover >20%D low, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compounds at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values.

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

H. Analysis of Samples

1. All sample extracts are stored at ≤-10°C and protected from light from the time of sample extraction.

2. Prior to sample analysis, add 10 µL of internal standard to each 1.0 mL of sample extract.

3. Analyze a predetermined aliquot of each sample extract under the same conditions used for the initial and continuing calibrations.

4. At the conclusion of data acquisition, use the same software to tentatively identify peaks within the retention time window of interest. Examine the ion abundances of components of the chromatogram. If the ion abundance of the target ion used for quantitation exceeds the calibration range, dilute the aliquot and reanalyze. When preparing dilutions, add sufficient internal standard to maintain the same concentration as that of the ICAL.

a. Dilution criteria

I. Initial dilutions are recommended in the following situations:

i. More than three internal standard recoveries are <50%.

ii. Either of the last two internal standard recoveries are <20%.

iii. The analyst's judgment of a sample extract's color or viscosity indicates possible matrix interference.

iv. Raised final prep volume can also be indicative of potential matrix interference

I. Secondary dilutions are required to bring all target compounds into the calibration range of the GC/MS.

A. Qualitative Analysis:

A compound is identified by comparison of the following parameters with those of a standard of the suspected compound (standard reference spectra). The reference mass spectrum used for this comparison should be generated by the laboratory using the conditions of the method. In order to verify identification, the following criteria must be met:

1. The sample component relative retention time should compare within ±0.06 RRT units of the RRT of the standard component.
2. The intensities of the characteristic ions of the compound must maximize in the same scan or within one scan of each other. The characteristic ions from the reference mass spectrum are defined to be the three ions of greatest relative intensity, or any ions over 20% relative intensity if less than three such ions occur in the reference spectrum.
3. The relative intensities of the characteristic ions:
   a. 8270C/D/E - The relative intensities of the characteristic ions must agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)
   b. 625.1 - The relative intensities of the characteristic ions must agree within 50% to 200% (0.5 to 2 times) for the quantitation and secondary m/z's in the reference mass spectrum stored in the data system. For example, if a peak has an intensity of 20% relative to the base peak, the analyte is identified if the intensity of the peak in the sample is in the range of 10% to 40% of the base peak. Analyst discretion is used to determine compound identification.
4. The above criteria apply to detections greater than or equal to the LOQ. For detections between the MDL and the LOQ, the above criteria and analyst discretion are used to determine compound identification. If identification is ambiguous, an experienced spectrometrist must determine the presence or absence of the compound.

B. Quantitative Analysis:

When a compound has been identified, quantitation is based on the internal standard technique and the integrated abundance from the extracted ion current profile (EICP) of the primary characteristic ion.

Calculations

Refer to *T-SVOA-FRM9602* for all departmental calculations.

Statistical Information/Method Performance

LCS, MS, surrogate, and RPD recoveries are compared to the limits stored in the LIMS. The surrogate recoveries will be compared to statistically generated limits for acceptance criteria for 8270C/D/E and for the surrogate in Table IV for 625.1. The LCS and MS recoveries will be compared to statistically generated limits for 8270C/D/E and for all 625.1 compounds contained in Table IV. For any compounds not contained in table IV, the LCS and MS recoveries will be compared to limits contained in Table V and the surrogate recoveries will be compared to limits contained in Table VI for 625.1.

For 8270C/D/E LCS and surrogate limits are statistically derived every six months in accordance with *T-SVOA-WI9604*. For 625.1 limits are derived anually. All RPDs are set to a default value of 30%, and MS limits are set equal to LCS limits.

All current and historical limit data is stored in the LIMS under the methods listed in the header of this SOP. The historical data for MDLs, MS/D, LCS/D, and measurement of uncertainty is reviewed at least annually and kept on file. Refer to the QA/QC section of this SOP and the criteria listed throughout this procedure for additional information on the performance of this method.

Quality Assurance/Quality Control

A. Batch QC

1. Each extraction batch of ≤20 samples must contain a method blank, a laboratory control sample (LCS) and an unspiked background sample (US), a matrix spike (MS), and a matrix spike duplicate(MSD).
2. A laboratory control sample/laboratory control sample duplicate (LCS/LCSD) is prepared with the extraction batch if adequate sample volume is not provided to prepare a matrix spike and matrix spike duplicate.
3. Additional QC samples may be required to meet project or state certification requirements.

B. QC and sample spiking

1. The LCS/D and MS/D are spiked at a concentration of 1 ppm.
2. All samples are spiked with surrogates at a concentration of 1 ppm by the extraction group to evaluate the extraction process.
3. Prior to analysis each sample extract is spiked with an internal standard mix.
4. All spiking concentrations are 4x lower for 250-mL aqueous analyses.

C. QC items, acceptance criteria, and corrective actions.

NOTE: If any client, state, or agency has more stringent QC, QC limits, or batch requirements, these must be followed instead.

Quality Control Item	Acceptance Criteria	Corrective Action
Internal Standards	1. Peak area within -50% to +100% of the area in the associated reference standard. 2. Retention time (RT) within 30 seconds of RT for associated reference standard.	1. Check instrument for possible problems and then re-inject sample(s). 2. If re-injection meets the criteria, report this injection. 3. If re-injection still shows the same problem, report first injection. 4. If there is substantial matrix interference, the analyst may dilute the extract as outlined in Procedure H.4.
Method Blank	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. All target compounds must be less than the reporting limit for the associated samples. 4. For 625.1 the method blank must be analyzed immediately after the LCS and before the MS/D.	1. Inspect system for possible problems and reanalyze. 2. If the surrogates are out of spec high data can be used provided there aren't detections in the method blank. 3. If the surrogates are out of spec low and there aren't detections in the associated samples, the data can be used.* 4. If the method blank contains target compounds and the associated samples do not contain these compounds, no corrective action is required. 5. If the target compounds in the blank are also in the associated samples at a concentration <10x that in the blank, the samples are re-extracted unless the detection does not interfere with project data requirements. 6. If the target compounds in the blank are also in the associated samples at a concentration >10x that in the blank the data is usable. 7. Phthalates may be detected in the method blank and data reported as long as the phthalate detection is <LOQ.
Instrument Blank**	1. Must run after the CCV if no clean method blank is analyzed at the beginning of the 12-hour analytical period. 2. Must meet internal standard criteria. 3. All target compounds must be less than the reporting limit for the associated samples.	1. Inspect system for possible problems and reanalyze. 2. If the instrument blank contains target compounds and the associated samples do not contain these compounds, no corrective action is required. 3. If the target compounds in the blank are also in the associated samples, the samples should be re-extracted unless it does not interfere with project data requirements or if sample detections are at a level 10x higher than the detections in the blank.

Quality Control Item	Acceptance Criteria	Corrective Action
Laboratory Control Sample/Laboratory Control Sample Duplicate	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. % Recoveries within QC limits. Refer to the analysis numbers in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 4. RPDs within QC limits.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If LCS/LCSD recoveries are still outside acceptance limits, one of the following actions must be taken: a. if recoveries are outside acceptance limits low, the sample(s) must be re-extracted. b. if recoveries are outside acceptance limits high, data may be usable if the compounds that recovered above QC limits are not detected in samples. c. if recoveries are outside acceptance limits high and there are detections of the failing compounds, the sample(s) must be re-extracted. 4. If RPDs fail but recoveries are within QC limits, no further action is required. 5. If surrogates fail to meet criteria but all target compounds are within specification, data is usable.* 6. Marginal exceedance limits, as defined in the NELAC standards, may be used if the defined requirements have been met for 8270C/D/E. 7. South Carolina requires an aqueous LCS recovery criterion of 70-130% for PAH SIM analysis.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	1. Must meet internal standard criteria. 2. Must meet surrogate criteria. 3. % Recoveries within LCS limits. Refer to the analysis number in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis. 4. RPDs within QC limits.	1. If LCS within QC limits, proceed with sample analysis. 2. If most recoveries or RPDs out of spec, consult supervisor. BKG, MS, MSD may need to be re-extracted.
Surrogates	1. %Recoveries within QC limits. Refer to the methods in the header of this document in LIMS for acceptance limits. These are reviewed and updated on a semiannual basis.	1. If non-compliant, check for calculation or preparation errors. 2. If no errors found, check system for problems and reanalyze. 3. If no problem is found, re-extract and reanalyze. 4. If surrogates are out of spec high and no targets are detected in the sample no corrective action is required. 5. For samples analyzed only at a dilution ≥10x, no further action is required for surrogate failures.

*Requires approval of supervisor.

**Method blank or instrument blank in each 12-hour analytical period required for 8270E. (an instrument blank is recommended for all methods to demonstrate the instrument is free of contamination)

NOTE: Any failures without corrective action require approval of supervisor and completion of a non-conformance memo (NCM).

NOTE: All data associated with failed quality control will be qualified on the final report. QC outlier qualifiers are added to the associated sample results on the report by the LIMS.

D. Lower Limit of Quantitation (LLOQ)

1. The lower limit of quantitation (LLOQ) is verified annually through the extraction and analysis of an LCS at 0.5 to 2 times the established LLOQ.
2. The LLOQ is performed on similar analytical instruments such that all are included, at a minimum, within a 3 year time period.
3. Until the laboratory has sufficient data to determine the acceptance limits, the LLOQ criteria is ± 20% of the LCS limits.
4. Refer to *QA-SOP11892* for additional initial and ongoing LLOQ requirements.

E. Method Detection Limit (MDL)

1. Initial MDL studies must contain at least seven replicates and must be prepped across three different calendar days.
2. The MDLs must be analyzed on every instrument used for that analysis across three different calendar days.
3. Two ongoing MDLVs are analyzed and confirmed quarterly on each instrument, and MDLs are updated, if necessary, after enough points have been collected.
4. All compounds in the ongoing MDL verifications must be spiked at the same concentration level as the initial study.
5. Refer to *QA-SOP11892* for additional initial and ongoing MDL requirements.

F. Limit of Quantitation (LOQ)

1. Initial LOQ studies are spiked with compounds at the laboratory assigned LOQ and are analyzed on every instrument used for that analysis.
2. One ongoing LOQV is analyzed and confirmed quarterly on each instrument, and the LOQs are updated, if necessary.
3. Until the laboratory has sufficient data to determine the acceptance limits, the LOQ criteria is ±20% of the LCS limits.
4. Refer to *QA-SOP11892* for additional initial and ongoing LOQ requirements.

Table I

DFTPP Key Ion Abundance Criteria (8270C/D/E/625.1)

Mass	Ion Abundance Criteria
51	10% to 80% of mass 198
68	less than 2% of mass 69
70	less than 2% of mass 69
127	10% to 80% of mass 198
197	less than 2% of mass 198
198	base peak, or >50% mass 442
199	5% to 9% of mass 198
275	10% to 60% of mass 198
365	greater than 1% of mass 198
441	present but less than 24% of mass 442
442	Base peak, or >50% of mass 198
443	15% to 24% of mass 442

Table II

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification (8270D)

Semivolatile Compounds	Minimum Response Factor (RF)

Recommended Minimum Response Factor Criteria for Initial and Continuing Calibration Verification (8270D)

Semivolatile Compounds	Minimum Response Factor (RF)
Naphthalene	0.700
2-Methylnaphthalene	0.400
Dimethylphthalate	0.010
Acenaphthylene	0.900
Acenaphthene	0.900
Dibenzofuran	0.800
Diethylphthalate	0.010
Fluorene	0.900
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Phenanthrene	0.700
Anthracene	0.700
Di-n-butylphthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butylbenzylphthalate	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Benzo(a)anthracene	0.800
Bis(2-ethylhexyl)phthalate	0.010
Di-n-octlyphthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500

Table III

Semivolatile Internal Standard with Corresponding Analytes Assigned for Quantitation

1,4-Dichlorobenzene-d_4	Naphthalene-d_8	Acenaphthene-d_{10}
1,4-Dioxane	Quinoline	Acenaphthene
N-Nitrosodimethylamine	2-Methylnaphthalene	Acenaphthylene
	Naphthalene	Diethyl phthalate
	Bis(2-chloroethyl)ether	Dimethyl phthalate
	1-Methylnaphthalene	Fluorene
	1-Methylnaphthalene-d10 (surr)	Dibenzofuran

Phenanthrene-d_{10}	Chrysene-d_{12}	Perylene-d_{12}
Anthracene	Pyrene	Benzo(b)fluoranthene
Phenanthrene	Benzo(a)anthracene	Benzo(k)fluoranthene
Di-n-butyl phthalate	Bis(2-ethylhexyl) phthalate	Benzo(g,h,i)perylene
Fluoranthene	Butyl benzyl phthalate	Benzo(a)pyrene
Hexachlorobenzene	Chrysene	Benzo(a)pyrene-d12 (surr)
N-Nitrosodiphenylamine		Dibenz(a,h)anthracene

Semivolatile Internal Standard with Corresponding Analytes Assigned for Quantitation

Fluoranthene-d10 (surr)

Indeno(1,2,3-cd)pyrene
Di-n-octylphthalate
Benzo(e)pyrene
Perylene

(surr) = surrogate

Table IV

625.1 Analytes and Surrogate that use statistical limits

1,4-Dioxane
1-Methylnaphthalene
2-Methylnaphthalene
Dibenzofuran
N-Nitrosodimethylamine
1-Methylnaphthalene-d10 (surr)

(surr) = surrogate

Table V

Table 6 – QC Acceptance Criteria – Method 625 [1]					
Analyte	**Range for Q (%) [2]**	**Limit for s (%) [3]**	**Range for X (%) [3]**	**Range for P_1, P_2(%) [3]**	**Limit for RPD (%)**
Acenaphthene	70-130	29	60-132	47-145	48
Acenaphthylene	60-130	45	54-126	33-145	74
Anthracene	58-130	40	43-120	27-133	66
Benzo(a)anthracene	42-133	32	42-133	33-143	53
Benzo(b)fluoranthene	42-140	43	42-140	24-159	71
Benzo(k)fluoranthene	25-146	38	25-146	11-162	63
Benzo(a)pyrene	32-148	43	32-148	17-163	72
Benzo(ghi)perylene	13-195	61	10-195	10-219	97
Benzyl butyl phthalate	43-140	36	10-140	10-152	60
bis(2-Chloroethyl)ether	52-130	65	43-126	12-158	108
bis(2-Ethylhexyl) phthalate	43-137	50	29-137	10-158	82
Chrysene	44-140	53	44-140	17-168	87
Dibenz(a,h)anthracene	13-200	75	10-200	10-227	126
Di-n-butyl phthalate	52-130	28	10-120	10-120	47
Diethyl phthalate	47-130	60	10-120	10-120	100
Dimethyl phthalate	50-130	110	10-120	10-120	183
Di-n-octyl phthalate	21-132	42	19-132	10-146	69
Fluoranthene	47-130	40	43-121	26-137	66
Fluorene	70-130	23	70-120	59-121	38
Hexachlorobenzene	38-142	33	10-142	10-152	55
Indeno(1,2,3-cd)pyrene	13-151	60	10-151	10-171	99
Naphthalene	70-130	39	36-120	21-133	65

Phenanthrene	67-130	24	65-120	54-120	39
Pyrene	70-130	30	70-120	52-120	49

[1] Acceptance criteria are based upon method performance data in Table 7 and from EPA Method 1625. Where necessary, limits for recovery have been broadened to assure applicability to concentrations below those used to develop Table 7.
[2] Test concentration = 100 µg/mL
[3] Test concentration = 100 µg/L
Q = Calibration verification
s = Standard deviation for four recovery measurements in the DOC test.
X = Average recovery for four recovery measurements in the DOC test.
P_1, P_2 = MS/MSD recovery.
RPD = MS/MSD relative percent difference.

Table adapted from EPA method 625.1

Table VI

Surrogate Standard Acceptance Limits - Method 625		
Surrogate	**Range for Surrogate Recovery (%) [1]**	
	Calibration verification	**Recovery from samples**
Benzo(a)pyrene-d12	32-194	32-194
Fluoranthene-d10	47-215	30-187

[1] Recovery from samples is the wider of the criteria in the CLP SOW for organics or in Method 1625

QA-SOP11178 Demonstrations of Capability
QA-SOP11892 Determining Method Detection Limits and Limits of Quantitation
T-OE-SVOA-WI10916 Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix
T-OE-SVOA-WI10928 Microwave Extraction by Method 3546 for Semivolatiles
T-OE-SVOA-WI10947 Separatory Funnel Extraction for BNAs in Wastewater by Method 612 or 625.1
T-OE-SVOA-WI11432 Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater
T-SVOA-FRM9602 Dept 4026 Calculations
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9594 GC/MS Semivolatile Audit Process
T-SVOA-WI9598 GC/MS Preventative and Corrective Maintenance
T-SVOA-WI9604 Monitoring GC/MS Semivolatile QC Data Acceptance Limits

---

End of document

Version history

Version	Approval	Revision information	
18	07.JUL.2020		
18.1	27.APR.2021	Version 18.1 published for editorial changes only.	
19	20.MAY.2022		

eurofins	Always check on-line for validity. **Pesticides in Water by Method 8081A and 8081B using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI9998**		
Old Reference: **1-P-QM-WI-9015066**		
Version: **17**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-MAY-2022**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Extraction
Gas Chromatographic Conditions
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Appendix I

Revision Log

Revision: 17	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reagents and Standards B. 7. & 10.	Reflects current practice	Updated Toxaphene stocks
Header	Clarification	Updated Company name
Calibration J.	Reflects current practice	Added Procedure for Removal or Replacement of Calibration Standards

Revision: 16	**Effective Date:**	09-Nov-2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Title	Reflects current practice	Added 8081B
Throughout document	Transition to new LIMS	Added TALS LIMS IDs and removed Parallax references
Cross Reference	Formatting requirement	Updated to D4 nomenclature
Reference Modifications	Clarification	With the addition of 8081B, clarified that the method exception applied to 8081A only
Reagents and Standards B.8.	Reflects current practice	Updated chlordane stock information
Reagents and Standards B.12.	Reflects current practice	Updated IBLK SS stock information
Reagents and Standards B.14.a.	Reflects current practice	Updated Pest Surrogate Mix information
Gas Chromatographic Conditions	Reflects current practice	Changed oven temperature program
Calibration C.	Reflects current practice	Added sixth calibration level to all curves, moved ICVs up in the sequence after each respective curve, updated closing CCVs to level4, added that IBLK must follow EVALX in the ICAL and re-ordered sequence
Calibration I.	Reflects current practice	Noted that usually 6 levels are used for all curves
Calibration 7.b.	Reflects current practice	Removed preparation and addition of sixth calibration point as the calibration process already uses 6 point
Calibration J.1.	Reflects current practice	Added that ICVs are injected directly after each of their respective curves
Calibration K.1.a.,c.	Reflects current practice	Changed mid-level from 3 to 4
Calibration K.6.a.	Reflects current practice	RT windows updated from level 4 not level 5
Appendix I	New LIMS	Removed references to Parallax-specific requirements and removed requirement to use microwave extraction as this is a water SOP
Throughout Document	SOP obsolete	Removed all references to T-PEST-WI9980
Calibration I. 7.e., 11-15	Reflects current practice	Removed datalog portion of the ICAL with the aroclors, toxaphene, and chloradane. Added removal of a calibration level
Statistical Information/Method Performance	Updated requirements	Updated 8000D requirements to TNI2016

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081A, December 1996.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8081B, February 2007.

3. State of Connecticut Department of Environmental Protection, Recommended Reasonable Confidence Protocols for Pesticides by 8081, SW-846, version 2.0 July 2006.

4. Determinative Chromatographic Separations, SW-846, Method 8000D, July 2014

5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10920	Separatory Funnel Extraction by Method 3510C, 608, 608.3 or 622 for Pesticides and PCBs in a Wastewater
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI11971	Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses
T-PEST-WI9954	Interpretation of Chromatographic Data
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation

Scope

This method is used for identifying and quantitating the following pesticides in aqueous samples using Gas Chromatography with an Electron Capture Detector (GC-ECD):

Compound	LOQ (µg/L)
alpha-BHC	0.01
beta-BHC	0.01
delta-BHC	0.01
gamma-BHC (lindane)	0.01 (.05)
Heptachlor	0.01 (.05)
Aldrin	0.01
Heptachlor epoxide	0.01 (.05)
Endosulfan I	0.01
Endosulfan II	0.03
Endosulfan sulfate	0.02
Dieldrin	0.02
Endrin	0.02 (0.1)
4,4'-DDE (*p,p*)	0.02
2,4'-DDE (*o,p*)	0.02
4,4'-DDD (*p,p*)	0.02
2,4'-DDD (*o,p*)	0.02
4,4'-DDT (*p,p*)	0.02
2,4'-DDT (*o,p*)	0.02
Endrin aldehyde	0.1

Compound	LOQ (µg/L)
Endrin ketone	0.02
Methoxychlor	0.1 (0.5)
Chlordane	0.5 (2.5)
alpha-chlordane	0.01
gamma-chlordane	0.02
Toxaphene	1 (15)
Kepone	0.2
Mirex	0.05
Telodrin	0.01
Hexachlorobenzene (HCB)	0.01
Alachlor	0.04
Total Endosulfans	0.01

Limits of Quantitation (LOQs) are based on annual statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Method 8081B is for Connecticut RCP work. See Appendix 1 for CT specific requirements.

Standards for the PCBs are run during this analysis since some of the PCB peaks may coelute or overlap with the pesticide peaks of interest. The information is used for proper identification and interpretation of the peaks observed for each sample. Quantitation of the same peak as a pesticide and PCB can be avoided.

Basic Principles

A portion of sample is extracted serially with methylene chloride. The volume of sample can be adjusted depending on the physical appearance of the sample and the amount submitted for analysis. The extract is dried, concentrated, and exchanged to hexane. Florisil, GPC, or copper cleanups may be employed to reduce matrix interferences such as oxygenated organics, unsaturated organics, or elemental sulfur that introduce large, unresolvable peaks into the chromatogram. The pesticides are then identified and quantitated using a GC-ECD.

Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure. Refer to *T-OE-PEST-WI10920* for the extraction.

Reference Modifications

For method 8081A: GC operating conditions differ from those listed in SW-846 8081A; however, all Quality Control (QC) criteria are met.

Interferences

Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

Cross-contamination can occur when any sample is analyzed immediately after a sample containing high concentrations of chlorinated pesticides; or large amounts of water-soluble materials, suspended solids, or high boiling point compounds. Review the prescreen data to choose the correct dilution factor prior to analysis to minimize cross-contamination.

An electron capture detector is very sensitive to compounds that contain halogens and also responds to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur. Use Florisil cleanup to reduce organics that can interfere (polar compounds), use GPC to remove sulfur and

higher molecular weight organics and use copper cleanup to remove elemental sulfur. All of these interfering materials can introduce large, unresolvable peaks into the chromatogram.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Lab coats and safety glasses must be worn around the GC where solvents and sample extracts are handled.

All GC vials and vials containing extracts are placed in a hazardous waste container for lab pack disposal. There is a satellite container in the laboratory, which is then emptied into the main laboratory waste collection drums. All solvent waste is disposed of in solvent waste containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, one blind sample, or one ICAL with ICVs and/or CCVs.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass containers with Teflon®-lined caps, preserved with 0.008% sodium thiosulfate, and stored at 0° to 6°C, not frozen. Samples must be extracted within 7 days of collection, and analyzed within 40 days of extraction. Sample extracts are stored at ≤-10°C.

Apparatus and Equipment

1. HP 6890 gas chromatograph equipped with dual electron capture detectors, or equivalent

2. Columns:

   a. Phenomenex MR1 30 m × 0.32 mm × 0.5 µm

   b. Phenomenex MR2 30 m × 0.32 mm × 0.25 µm

   Alternatively, Restek columns can also be used, and are in use for scan 1954 to achieve separation of alachlor

   c. RTX – CLPesticides – 30 m × 0.32 mm × 0.5 µm

d. RTX – CLPesticides II – 30 m × 0.32 mm × 0.25 µm

3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent.

4. Various sizes of Class-A volumetric pipettes, flasks, and syringes

Reagents and Standards

A. Reagents

1. Hexane for autosampler rinse vials. Pesticide grade or better stored at room temperature.

2. UPC (ultra pure carrier) helium for carrier gas

3. UPC nitrogen for detector make-up gas

4. UPC hydrogen for carrier gas, bottled or from a generator

B. Standards

1. Store unopened ampules according to the manufacturers' instructions.

2. Prepare standards using Class-A volumetric pipettes, flasks, and syringes.

3. Store all prepared standards in the freezer at ≤-10°C for up to 6 months. If comparison with check standards indicates a problem prior to expiration date, the standards must be replaced.

4. PCB standards are identical to those outlined in *T-PEST-WI11971*.

PCB standards are analyzed along with the pesticides and are used to identify aroclor peaks that may interfere with the target pesticides.

5. Mix A – Restek Catalog #32292. Equivalent to the CLP (SOW-OLMO3.2) Mix A and B, contains all single component pesticides and surrogates in the TCL and PPL organochlorine lists.

6. Mix E – Restek Custom Mix #55992. Contains additional organochlorine pesticides such as kepone, hexachlorobenzene, the *o,p* isomers of DDT, DDD, DDE, telodrin, and mirex.

7. Toxaphene stock – Restek Catalog #32005 at ~1,000,000 ppb. Prepare an intermediate by placing 1 mL into a 25-mL volumetric and bring to volume with hexane.

8. Chlordane stock (CAS #57-74-9)– Restek cat# 32021, 1,000,000 ppb in hexane.

a. Prepare an intermediate stock by bringing 1.0 mL of chlordane stock to a final volume of 10.0 mL using hexane.

9. EVAL stock – Ultra Scientific cat# CLP-250. Equivalent to CLP performance evaluation mix (PEM).

10. Initial Calibration Verification (ICV) stocks – These must be from lot numbers (or vendors) different than those used for working calibration standards. UltraScientifc CLP-216 and CLP-226B or equivalent. Accustandard Cat. #P-093S-H-10X or equivalent.

11. Alachlor stock – Accustandard Catalog #P-1025-10X, 1000 µg/mL in hexane.

12. Instrument Blank (IBLK) – surrogate stock (SS) – Restek cat# 32000 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 200,000 ppb each in acetone.

13. Prepare working standards using the electronic standard database as a guide.

a. In the database, choose the category (i.e. working spike, surrogate, intermediate, etc) and the required standard.

b. The database contains the following information: solution description (ex. MIXA1), parent solution name, aliquot used, final volume, solvent used, concentration of each compound in the solution, and expiration date. The working standards have an expiration date of 6 months.

c. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

14. Prepare the spiking solutions using the prep scheme in the table below:

a. Pest Surrogate Mix – Accustandard cat# CLP-032-R containing DCB/TCX at 2,000,000 ppb in acetone.

b. Pest Std Mix A – Supelco #487996 containing Gamma-BHC (lindane), heptachlor, alpha-BHC,Alpha endosulfan, 4,4-DDT, dieldrin, 4,4-DDD, endrin , and methoxychlor.

c. Pest Std Mix B – Supelco #48196 containing Beta-BHC, heptachlor epoxide, endosulfan sulfate, beta-endosulfan, endrin ketone, 4,4-DDE, endrin aldehyde, Aldrin, Alpha-chlordane, delta-BHC, gamma-chlordane.

d. TCLP Pest Mix – Restek #571010 containing gamma-BHC, heptachlor, heptachlor epoxide, endrin, methoxychlor

e. Alachlor stock - Accustandard Catalog #P-1025-10X, 1000 µg/mL in hexane

Standard Name	Parent Solution	Aliquot (mL)	Final Vol. (mL)	Solvent	Description	Expiration Date
SW-846 SS	Pest Surrogate Mix	1.5	1000	methanol	SW-846 Water Surrogate-identical to that prepared for PCB analyses	6 months
SW-846 MS	Pest Mix A	2	100	methanol	SW-846 Water Spike	6 months
	Pest Mix B	2				
TCLP Pest MS	TCLP Pest Mix	0.5	250	methanol	SW-846 Water Spike for single component organochlorines in the TCL/PPL list	6 months
Alachlor Matrix spike	Alachlor stock	0.05	50	acetone	Matrix spike, use 1 mL	6 months
IBLK	SS Stock	0.1	1000	Hexane	SW-846 Water Surrogate - identical to that prepared for the Pesticides/PCBs analysis	6 months

Extraction

See *T-OE-PEST-WI10920*

Gas Chromatographic Conditions

Detector: ECD

Detector Temp:	330°C
Oven Temp:	150°C, no hold, 45°C/min to 200°C,
	then 15°C/min to 230°C, then 30°C/min to 330°C, hold 1.5 min
Carrier:	Hydrogen at constant flow of 3.4 ml/min
	Helium may also be substituted.
Makeup Gas:	N2 at 55 mL/min
Injection Size:	1 µL, direct injection
Injector Temp:	225°C

The conditions listed above serve as a guideline and are typically the optimum operating conditions. The analyst may make changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity and/or improve the separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Calibration

A. The pesticide analysis is run as a dual column approach. One injection is split onto two analytical columns. All initial and continuing calibration criteria listed below applies to both analytical columns.

B. Fill the autosampler rinse vials with clean solvent or replace vials that appear dirty.

C. Prepare a sequence in the Chrom Perfect® datafile using the following order of injections. NOTE: If the IBLK is to be reported or included in a data deliverable, it must follow the EVALX analysis in the ICAL sequence.

1. Conditioner
2. EVALX
3. IBLK
4. MIXA1
5. MIXA2
6. MIXA3
7. MIXA4
8. MIXA5
9. MIXA6
10. ICMAX (ICV)
11. MIXE1
12. MIXE2
13. MIXE3
14. MIXE4
15. MIXE5
16. MIXE6
17. ICMEX (ICV) if needed
18. TOXA1
19. TOXA2
20. TOXA3
21. TOXA4
22. TOXA5
23. TOXA6
24. ICTX (ICV)
25. CHLD1
26 CHLD2
27. CHLD3
28. CHLD4
29. CHLD5

30. CHLD6
31. ICCH (ICV)
32. AR164
33. AR2154
34. AR484
35. MDLA
36. MDLE
37. MDTX
38. MDCH
39. Blank
40. LCS
41. 1234567
42. 1234567MS
43. 1234567MSD
44. – 54. Continue running samples for a 12-hour period from last standard
55. EVALX
56. MIXA4
57. MIXE4
58. TOXA4
59. CHLD4

D. Inject conditioner to prime the system.

1. Conditioner is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

2. The conditioner is typically a standard or sample that has already been injected.

3. Hexane blanks can be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system after the instrument has set idle.

E. Inject instrument blank (IBLK) after the conditioners and before the initial calibration to confirm that the instrument is free of background noise or contamination.

IBLK may also be run with the continuing check standards - this is optional but frequently requested for projects.

F. Endrin / DDT Breakdown:

1. Run a breakdown evaluation standard (EVAL) at the start of an ICAL.

(The EVAL is also used throughout the run. See the continuing calibration Step K of this section.)

2. Inject and analyze the EVALX solution using the same GC parameters used for client samples.

3. Evaluate the degradation products of 4,4-DDT and Endrin

4. The breakdown for each compound cannot exceed 15%.

a. The sum of the heights of DDE, and DDD divided by the total height of DDT/DDD/DDE cannot exceed 15%.

b. The sum of the heights of endrin aldehyde and endrin ketone divided by the total height of endrin/endrin aldehyde/endrin ketone cannot exceed 15%.

5. If the breakdown check fails, perform injector maintenance. Analysis cannot proceed until the breakdown check passes.

G. The order of injections for the multi-components is not critical as long as they are all run before sample analysis. They are only used to identify possible PCB patterns which may interfere with the pesticide

detections.

H. Alachlor standards are needed for Method 8081B.

I. Initial Calibration (ICAL)

1. Calibrate the GC with at least 5 levels of the single component pesticides contained in MIX A. Also analyze 5 Levels of MIX E if the associated samples require those compounds. Analyze at least 5 levels for chlordane and toxaphene. Usually 6 levels are used for all curves.

a. Inject aroclor standards for pattern recognition only.

b. Use the aroclor standard to determine if any of the aroclor peaks overlap with the target pesticides.

2. The lowest standard must be at the LOQ. The remaining standards bracket the analyte concentrations expected in the sample extracts, or define the working range of the detector.

3. Analyze each calibration standard from low concentration to high. The data system tabulates the response against the concentration for each analyte.

4. Analyze the calibration standards on both columns.

5. Calculate the calibration factor (CF) for each analyte at each concentration, the mean CF, and the relative standard deviation (RSD) of the CFs.

6. Use an external standard calibration, if the %RSD for each analyte is ≤20%, the response of the instrument is considered linear and the average calibration factor (AVGCF) can be used to quantitate results.

7. Alternatively, if the %RSD is >20%, a calibration curve is used.

a. Attempt a linear fit. Use this fit if the correlation coefficient is ≥0.99.

b. If the correlation coefficient is <0.99 and the compound has historically exhibited a nonlinear response, quadratic fit may be used provided all six calibration points are being used. It can not be used to extend the calibration range or bypass instrument maintenance.

(1) Typically the pesticides in this method do not require a quadratic fit.

NOTE: For samples from South Carolina, a quadratic fit may not be used.

c. Set the zero to ignore within Chrom Perfect®. To extrapolate or force to zero is not allowed for either curve type. See T-PEST-WI-10016 for more details.

d. Inspect the data points if the minimum 0.99 curve coefficient is not met to determine if one or more calibration levels appear to be off. A specific calibration level may have concentrated due to solvent evaporation or analyte degradation over time. Reinject or remake the standard if this is the cause. Otherwise, the instrument may need maintenance. T-PEST-WI-10007 for troubleshooting linearity problems.

e. The laboratory may remove an entire single standard calibration level from the interior of the calibration curve when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed. A laboratory that chooses to remove a calibration standard from the interior of the calibration shall remove that particular standard calibration level for all analytes. Removal of calibration points from the interior of the curve is not to be used to compensate for lack of maintenance or repair to the instrument.

8. Curve types and criteria can be altered to meet client or project specific requirements as well as any regulatory agency requirements that may differ from those listed here.

9. If the curve fails on both columns for any analyte, corrective action is necessary. Corrective actions include, but are not limited to: injector/column maintenance, preparation of new calibration standards,

installation of new columns, and/or refurbishment of the ECDs.

10. If the calibration fails for only one standard and no samples have been analyzed the standard can be re-injected and the calibration criteria re-calculated.

11. Ensure the peaks in the standards are labeled properly, including the surrogates in all injections that contain them.

12. Set the scaling of chromatograms and peak integration parameters so that the peaks for each compound of interest are detected and integrated at the concentration of the Method Detection Limit (MDL). This ensures that the LOQ and MDLs can be met.

13. When 8000D is referenced and curve fits are used in the initial calibration, percent error (%E) must be calculated for each calibration level. Standard levels at or below the LOQ must meet +/- 50%, standards above the LOQ must meet +/-30%. (%error = (true concentration - calculated concentration)/true concentration)*100). All individual peaks used to calculate the multicomponent pattern must meet the %E criteria.

J. Procedure for Removal or Replacement of Calibration Standards

1. The laboratory may remove individual analyte calibration levels from the lowest and/or highest levels of the curve. Multiple levels may be removed, but removal of interior levels is not permitted.
2. The laboratory may remove an entire single standard calibration level from the interior of the calibration curve when the instrument response demonstrates that the standard was not properly introduced to the instrument, or an incorrect standard was analyzed. A laboratory that chooses to remove a calibration standard from the interior of the calibration shall remove that particular standard calibration level for all analytes. Removal of calibration points from the interior of the curve is not to be used to compensate for lack of maintenance or repair to the instrument.
3. The laboratory shall adjust the LOQ/reporting limit and quantitation range of the calibration based on the concentration of the remaining high and low calibration standards.
4. The laboratory shall ensure that the remaining initial calibration standards are sufficient to meet the minimum requirements for number of initial calibration points as mandated by this Standard, the method, or regulatory requirements.
5. The laboratory may replace a calibration standard provided that:
    a. The laboratory analyzes the replacement standard within twenty-four (24) hours of the original calibration standard analysis for that particular calibration level;
    b. The laboratory replaces all analytes of the replacement calibration standard if a standard within the interior of the calibration is replaced;
    c. The laboratory limits the replacement of calibration standards to one calibration standard concentration.
6. The laboratory shall document a technically valid reason for either removal or replacement of any interior calibration point.

K. Initial Calibration Verification (ICV)

1. Verify the calibration curve using the ICV mixtures injected directly after each of their respective curves.

2. The % difference of the concentrations for each individual target analyte must be within 15% difference of the nominal concentration.

L. Continuing Calibration Verification (CCV)

1. Analyze a set of check standards after each set of injections in a 12-hour period, or 20 injections, whichever comes first (samples, QC, blanks, etc).

a. Use (MID LEVEL) Level 4 of MIXA and MIXE (if needed) to evaluate the response for the single component analytes.

b. Run the breakdown evaluation mix (EVAL). See Endrin/DDT Breakdown Section F. for details on acceptance and actions relative to the EVAL standard.

c. Run Toxaphene and Chlordane, level 4.

2. The concentration quantitated for each target analyte in the continuing calibration check standards must be within 15% difference (%D) of the nominal concentration.

3. Samples must be bracketed by compliant standards.

4. When confirmation of target analytes is needed, the initial calibration criteria must be met and the second column should meet the 15% continuing calibration criteria. See *T-PEST-WI9954* for details on reporting data.

5. If the CCV fails high and those target compounds are not detected in the associated samples, the samples can be reported.

6. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours, or at no less than 0.02 minutes, applied to the initial calibration standard, usually Level 4.

b. If the RTs for a continuing calibration standard fall outside the RT window, update the midpoint RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) Retention times cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Samples are analyzed according to the sequence listed in the Calibration Section.

2. Retention times of peaks in the samples are compared to the standard RT windows.

a. Peaks present on both columns (and that are also in the correct ratios to represent toxaphene or chlordane) are quantitated.

b. The high value is reported unless there are chromatographic anomalies. See *T-PEST-WI9954* for more information.

3. Continue running groups of samples/injections followed by check standards every 12 hours or every 20 injections, whichever comes first.

4. Positive results ≥ the LOQ must be confirmed by second column.

5. Carefully examine the results of all samples that follow a high concentration sample for possible carryover.

6. If significant interference is present, ensure proper cleanups have been scheduled such as florisil cleanup. If elemental sulfur is present, copper cleanup the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract, analyze, and adjust the LOQs accordingly.

7. Dilute samples as necessary to put the peak height of the target pesticide within the range of the initial calibration. Dilutions are prepared using hexane.

8. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

See *T-PEST-WI9847* for details on all calculations/equations used to evaluate the initial and continuing calibration. Calculation of results is performed according to the following procedures:

A. Single-component compounds

1. Using AVGCF from initial calibration

$$\frac{\text{Sample Height}}{\text{AVGCF}} \times \frac{FV}{IV} \times DF = \mu g/L \quad \text{as received}$$

2. Using linear curve from initial calibration:

$$[(\text{Sample Height} - Y - \text{intercept})/\text{Slope}] \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

Where:

FV (final volume) = mLs

IV (initial volume) = mLs

DF (dilution factor) = as needed

B. Multi-component compounds

The peak heights generated by the integration system are used to calculate the Calibration Factors (CF) for peaks of interest for each aroclor. Usually the six major peaks that are unique to toxaphene and chlordane (including alpha chlordane, gamma chlordane, and heptachlor) are chosen for quantitation. Sample concentrations are calculated per peak using Average Response Factor (AVGRF).

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IV} \times DF = \mu g/L \text{ as received}$$

Where:

FV (final volume) = mLs

IV (initial volume) = mLs

DF (dilution factor) = as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(\text{Result 1} + \text{Result 2} + \ldots + \text{Result } n) \;/\; n = \text{Average Result}$$

C. A breakdown mix (EVALX) containing p,p¢-DDT and Endrin is run to check for breakdown. The breakdown must not exceed 15% for either compound. Breakdown is calculated as:

$$\begin{array}{c}\%\ Breakdown \\ for\ p,p'\text{-}DDT\end{array} = \frac{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD}{pk\ ht\ (area)\ of\ p,p'\text{-}DDE + p,p'\text{-}DDD + p,p'\text{-}DDT} \times 100$$

$$\begin{array}{c}\%\ Breakdown \\ for\ Endrin\end{array} = \frac{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone}{pk\ ht\ (area)\ of\ Endrin\ Aldehyde + Endrin\ Ketone + Endrin} \times 100$$

If breakdown fails, injector maintenance must be performed. Analysis cannot proceed until breakdown check passes.

Statistical Information/Method Performance

LCS, MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

When TNI2016 is referenced, an annual lower limit of quantification (LLOQ) verification is required quarterly on at least one instrument (1 spike per instrument). All instruments must have one at least every three years.

Quality Assurance/Quality Control

Each extraction batch (up to 20 samples) must contain a method blank, an LCS, and either an unspiked background sample (US), an MS, an MSD or an LCS/LCSD.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated every 6 months and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

All single component pesticides of interest for each analysis are routinely spiked with the exception of Mirex, *o,p*-DDE/DDD/DDT, telodrin, kepone, and HCB. These analytes are not spiked since this would result in coelution with the other spiked compounds. These can be spiked at a client's request for special projects.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed. For example, MS/MSD is performed at a frequency of 10% for South Carolina.

See Appendix 1 for CT RCP criteria.

Appendix I

Guidelines for CT RCP for Pesticides

No use of grand mean

Multiple trials are reported. If a dilution is needed, report all compounds from both injections (no more than 2).

Comments are needed to explain any raised limits (does not need precursor comment).

Alachlor is part of the routine scan. HCB is only asked for as a project-specific analyte. PCBs are always separate.

In House statistically determined percent recovery limits must be between 40–140% except for difficult analytes, which must be between 30-140% for the LCS.

Surrogate recovery limits can be statistical limits which must fall within 30-150%

10007 Preventative and Corrective GC Maintenance
10011 QC Data Acceptability and Corrective Action
10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10920 Separatory Funnel Extraction by Method 3510C, 608, or 608.3 for Pesticides and PCBs in a Wastewater
11892 Determining Method Detection Limits and Limits of Quantitation
11971 Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
9847 Common Equations Used During Chromatographic Analyses
9954 Interpretation of Chromatographic Data

End of document

Version history

Version	Approval	Revision information	
15	29.DEC.2020		
16	09.NOV.2021		
17	27.MAY.2022		

eurofins	Always check on-line for validity. **Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD**	Level: **Work Instruction**
Document number: **T-PEST-WI10004**		
Old Reference: **1-P-QM-WI-9015110**		
Version: **11**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **01-JUN-2022**	Document users: **6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Pesticide Residue Analysis_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Extraction
Gas Chromatographic Conditions
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Appendix I

Revision Log

Revision: 11	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Personnel Training and Qualifications	Clarification	Added LCS as IDOC criteria per 8000D
Calibration 8	Clarification	Updated iblk injection to before or after based on client requirement
Statistical Information/Method Performance	Current process	LOQ verification is included in the MDLs SOP.

Revision: 10	**Effective Date:**	16.MAR.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Removed references to old LIMS analysis numbers
Throughout Document	Reflects current practice	Removed references to obsolete work instructions T-PEST-WI10016 and T-PEST-WI10022
Reagents and Standards B.18	New LIMS	Updated reagent database information

Revision: 10	**Effective Date:**	16.MAR.2021
Section	**Justification**	**Changes**
Calibration 5.f.(3)	Enhancement	SOP mentioned that quadratic fit may not be used for SC samples, but use of quadratic fit was not discussed. Added discussion about quadratic fit requirements.
Appendix I	New LIMS	Updated reagent database information

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846, Method 8082A, February 2007.
2. Determinative Chromotographic Separations, SW-846, Method 8000D, July 2014
3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-PEST-WI10922	Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550C
T-OE-PEST-WI10927	Microwave Extraction Method 3546 for PCBs in a Solid Matrix
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-PEST-WI10011	QC Data Acceptability and Corrective Action
T-PEST-WI9954	Interpretation of Chromatographic Data
T-PEST-WI10007	Preventative and Corrective GC Maintenance
T-PEST-WI9980	Monitoring QC Data Acceptance Limits
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses

Scope

This method is used for identifying and quantitating the following PCBs in solid samples and wipes using SW846 8082A:

Compound	Soil LOQ (µg/kg)	Wipes LOQ (µg)	Tissue LOQ (µg/kg)
Aroclor 1016	17	0.5	34
Aroclor 1221	17	0.5	34
Aroclor 1232	17	0.5	34
Aroclor 1242	17	0.5	34
Aroclor 1248	17	0.5	34
Aroclor 1254	17	0.5	34
Aroclor 1260	17	0.5	34
Aroclor 1262	17	0.5	34
Aroclor 1268	17	0.5	34

Aroclors 5422, 5432, and 5460 can be analyzed upon request of the client. See Appendix I for GC operating conditions and calibration information.

Compound	Soil LOQ (µg/kg)
Aroclor 5422	33
Aroclor 5432	33
Aroclor 5460	33

Limits of Quantitiation (LOQs) are based on statistical evaluation of laboratory data and are subject to change. The current Method Detection Limits (MDLs) and LOQs are maintained in the LIMS.

Basic Principles

A solid sample or entire wipe is extracted using sonic probe with 1:1 methylene chloride:acetone, or microwave extraction with hexane. The extract is dried, concentrated, and exchanged to hexane. A florisil and sulfuric acid cleanup is utilized to reduce any matrix interferences. The PCBs are then identified and quantitated using gas chromatography (GC) with electron capture detector (ECD). Copper cleanup may also be employed to reduce elemental sulfur or other matrix interferences which introduce large, unresolvable peaks into the chromatogram. Refer to *T-OE-PEST-WI10281* for details on each cleanup procedure.

Solid matrices other than soil can also be analyzed as long as the sample can be handled through the extraction technique. Typically solids are reduced to small pieces for extracting (concrete, wood, other plant material etc). Tissue samples are ground and homogenized prior to extracting. Tissue samples may be whole fish, filets, or other miscellaneous species (usually aquatic but not necessarily). Wipe samples are analyzed by taking the entire wipe sample and any solvent in the sample container.

Reference Modifications

Gas Chromatography conditions are different than those listed in Method 8082A, however, all QC criteria are met.

Interferences

Avoid contact with any plastic material during the extraction and analysis procedures to minimize interferences from phthalate esters.

Scrupulously clean all glassware to minimize interferences caused by laboratory contaminants.

An electron capture detector (ECD) is very sensitive to compounds that contain halogens and will also respond to many other compounds and materials including oxygenated organics, unsaturated organics, and elemental sulfur.

Extracts may require further cleanup by sulfuric acid, florisil, or copper if interferents such as oxygenated organics, unsaturated organics, and elemental sulfur are present. Refer to *T-OE-PEST-WI10281*
for details on each cleanup procedure.

Common single component pesicides such as DDT, DDD, and DDE may cause interference with the aroclor pattern. To ensure that the analyst is aware of this, a standard containing DDE/DDD/DDT will be run with each initial calibration.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for generalinformation regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Gloves, lab coats, and safety glasses must be worn when preparing standards. Safety glasses must be worn around the GC where solvents and sample extracts are handled.

GC vials are disposed of in the designated lab container and subsequently lab packed for final disposal. All solvent waste is placed in designated containers in the laboratory then taken to the lab-wide facility by personnel trained in hazardous waste disposal.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the chromatography data system to set up sequences, perform the calculations, interpret chromatograms, perform instrument maintenance, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation (per EPA 8000D the criteria are the statistical LCS window, and RPD </= 20%). Various options are available for a DOC and can include four laboratory control samples or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass containers with Teflon™-lined caps and kept cool at 0° to 6°C, not frozen.

PCBs have no maximum recommended holding time for the extraction. Some agencies or projects may require a specific hold time for the extraction. If the hold time is specified in the project, this hold time must be followed. Sample analysis must be performed within 40 days of extraction. Extracts are stored in the freezer at ≤-10°C

Apparatus and Equipment

1. HP 7890 gas chromatograph equipped with an electron capture detector or equivalent
2. Columns:
   a. Phenomonex MultiRes I – 30 m × 0.32 mm × 0.5 µm or equivalent
   b. Phenomonex MultiRes II – 30 m × 0.32 mm × .25 µm or equivalent
   c. Alternatively, Restek columns can be used.
3. Integrating system such as Chrom Perfect® by Justice Laboratory Software, or equivalent. Chrom Perfect® is a data system capable of storing and reintegrating chromatographic data and determining peak areas using a forced baseline, area summation, baseline projection, and performing baseline compensation as required.
4. Various sizes of Class A volumetric flasks, pipettes, and syringes

Reagents and Standards

A. Reagents

1. Hexane for autosampler rinse vials, stored at room temperature.
2. UPC (Ultra pure carrier) helium for carrier gas
3. UPC nitrogen for detector make-up gas
4. UPC hydrogen for carrier, either bottled or from a generator

B. Standards

1. All standards are prepared using Class A volumetric pipettes, syringes, and flasks.
2. An analytical balance is used to measure all weights.
3. Unopened ampules are stored according to the manufacturer's instructions and are stable until the expiration date provided by the manufacturer.
4. All prepared standard solutions are stored at ≤-10°C in labeled containers or vessels.
5. Aroclor 1016 & 1260 stock – Restek #32039 at 1,000,000 ppb in isooctane or equivalent. Prepare a ten-fold dilution for an intermediate.
6. Aroclor 1016 ICV Stock – Accustandard Cat# C-2165-H-10X at 1,000,000 ppb in Hexane.
7. Aroclor 1260 ICV Stock - Accustandard Cat# C-2605-H-10X at 1,000,000 ppb in Hexane.
8. Aroclor 1221 stock – Restek #32007 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.
9. Aroclor 1232 stock – Restek #32008 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.
10. Aroclor 1242 stock – Restek #32009 at 100,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source.
11. Aroclor 1248 stock – Restek #362010 at 1,000,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

12. Aroclor 1254 stock – Restek #32011 at 1,000,000 ppb in isooctane or equivalent. Two lots are kept on hand to provide a second source. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

13. Surrogate stock (SS) – Supelco #861284 containing DCB/TCX at 200,000 ppb in acetone or equivalent. Prepare an intermediate by diluting 1.0 mL to 25 mL of hexane for AR1016/1260, AR1254, AR1248.

14. 1016/1260 Matrix spike (MS) stock – Restek #32039 at 1,000,000 ppb in hexane or equivalent.

15. Aroclor 1262 stock – Restek #32409 at 1,000,000 ppb in hexane or equivalent. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

16. Aroclor 1268 stock – Restek #32410 at 1,000,000 ppb in hexane or equivalent. Prepare an intermediate by diluting 1 mL to 10 mL of hexane.

17. Instrument Blank (IBLK) – Surrogate Stock (SS) – Restek #32000 containing Decachlorobiphenyl (DCB) and Tetrachlorometaxylene (TCX) at 2000,000 ppb in acetone or equivalent.

18. Prepare working standards using the reagents module of the LIMS as a guide.

    a. In the reagents module, first enter the reagents in this section as 'source' reagents.

    b. Then select 'intermediate' reagent and load the most recent version of the working standard you wish to create for editing, or create a new standard if the working standard has not yet been prepared in TALS.

    c. The module contains the following information: reagent description (ex. AR161), source reagent code, amount used, final amount, solvent used and solvent lot, concentration of each compound in solution, and expiration date. The working standards have an expiration date of 6 months.

    d. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.

    e. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below.

Standard Name	**Parent Solution**	**Aliquot (mL)**	**Final Volume (mL)**	**Solvent**	**Description**
PCB Spike	Aroclor 1016/1260 MS Stock	1.25	250	Acetone	PCB Spike
SS	Pest Surr Stock	1.5	1000	Methanol	SW-846 Water surrogate – identical to that prepared for Pest/PCB analyses

19. An initial calibration verification standard must also be prepared at a concentration at the mid-point of the calibration for 1016, 1260,1248 and 1254 using a stock solution purchased from a different source other than that used for the calibration standards.

20. Additional standards and preparations are listed in Appendix I for Aroclor 5442, 5432, and 5460 (PCT analysis).

Extraction

See organic extraction work instruction T-OE-Pest-WI10922 for sonication extraction and T-OE-Pest-WI10927 for microwave extraction.

Gas Chromatographic Conditions

The conditions listed are usually the optimum operating conditions but can vary to improve the sensitivity, linearity, and overall chromatography or shorten run times on each GC system. A Merlin microseal may be used in place of a traditional septum.

Detector	ECD
Detector Temperature	330°C
Oven Temperature	110°C 40°C/min to 250°C 20°C/min to 280°C 30°C/min. to 330°C Hold until DCB elutes ~ 2 min.
Carrier	Hydrogen at 12 psi, 5ml/min constant flow (Can be substituted with Helium)
Makeup gas	N2 at 30 mL/min. for Varian GCs N2 at 55 mL/min. for HP GCs
Injection size	1 µL, direct injection

Injection Temperature	225°C

Calibration

1. Fill the autosampler rinse vials with clean solvent or replace vials which appear dirty.
2. Prepare a sequence using the following suggested order of injections:

    1. Conditioner
    2. IBLK
    3. EVAL
    4. AR161
    5. AR162
    6. AR163
    7. AR164
    8. AR165
    9. AR166
    10. AR481
    11. AR482
    12. AR483
    13. AR484
    14. AR485
    15. AR486
    16. AR541
    17. AR542
    18. AR543
    19. AR544
    20. AR545
    21. AR546
    22. AR214
    23. AR324
    24. AR424
    25. AR624
    26. AR684
    27. AR16xx
    28. MD16 (MDL)
    29. IC16x (ICV)
    30. IC48x (ICV)
    31. IC54x (ICV)
    32. Blank
    33. LCS
    34. 1234567
    35. 1234567ms
    36. 1234567msd
    37-47. Continue running samples
    48. AR164(CCV)
    49. IBLK

    a. For routine PCBs:

        (1) The AR21, AR32, and AR42 are level 4 in the cal and are entered at AR214, AR324, and AR424 in the cal.

        (2) AR62 and AR68 are both level 4 and are listed as AR624 and AR684 in the sequences.

        (3) A single point of Aroclor 1016 is analyzed with the calibration to aid in better pattern recognition in the samples. Aroclor 1016 and 1242 have similar patterns with the exception of the smaller trailing peaks at the end of the Aroclor 1242 pattern. This is identified in the sequence as AR16xx.

        (4) A DDT/Endrin breakdown standard is run with each ICAL in order to provide the retention times for p,p-DDE, p,p-DDD, and p,p-DDT which may interfere with the pattern for aroclor 1248, 1254, and 1260.

    b. See Appendix I for a sequence example when the analysis of PCTs (Aroclors 5442, 5432, and 5460) is requested.

3. Inject conditioner to prime the system.

    a. The conditioner injection is usually a standard or sample which has already been injected.

b. It is used to prime the system and is best utilized when the GC has not been running and there is a gap in time prior to starting a set of injections.

c. Hexane blanks may also be run to allow the GC to go through some temperature programs and/or to check the cleanliness of the system.

4. An instrument blank (IBLK) is always run prior to a new calibration to confirm that the instrument is free of background noise or contamination. IBLK may also be run with the continuing check standards - this is optional but frequently requested for projects.

5. Initial Calibration (ICAL)

a. Calibrate for the aroclors using the six levels of 1016, 1260, 1248, and 1254 (calibration range of 50 µg/L through 1000 µg/L) and using the single point for 1221, 1232, 1242, and 1262 and 1268 when needed (200 µg/L standard used).

b. As an option, 1248 and 1254 may use a single point calibration.

c. An external standard calibration based on the average calibration factor (AVG CF)for each individual peak chosen in the pattern is used for quantitation where the %RSD is ≤20%.

d. The surrogate standards are calibrated using the AR16 levels and the calibration is also performed using AVG CF unless the %RSD is >20%.

e. When the % RSD criteria is not met (i.e. >20%), a linear calibration curve is used.

(1) The curve must meet a correlation coefficient of 0.99 to be a valid fit.

(2) Extrapolate or force to zero is not allowed. Set the zero to ignore.

(3) North Carolina and 8000D requires calculation of % error for any linear fits. The criteria for % error of standard levels at or below the LOQ is +/- 50%. The criteria for % error of all other standard levels is +/-30%.

%error = ((true – calc)/true) x 100

f. If the %RSD criteria or 0.99 curve coefficient cannot be met:

(1) Inspect the data points to see if one or more calibration levels may have concentrated due to solvent evaporation or degraded over time.

(2) Reinject or remake the standard if this is the cause.

(3) Use a quadratic fit provided six points are used in the calibration and the curve meets a correlation coefficient of 0.99. The % error must be calculated and meet the criteria defined in e.4. **NOTE:** A quadratic fit may not be used for South Carolina samples.

(4) Perform instrument maintenance as needed.

(5) See *T-PEST-WI10007* for troubleshooting linearity problems.

g. Set up the aroclor calibration data in a custom program under Datalog. The retention times of the peaks to use for identifying and quantifying the aroclors are entered into the calibration file along with the corresponding peak heights and concentrations (in µg/L).

h. Ensure the surrogate peaks in the standards are labeled properly.

i. Set the scaling of chromatograms so that the size of the peaks of interest for each aroclor are approximately 2 to 3 mm in height at the concentration of the method detection limit (MDL).

(1) Ensure all peaks in the MDL standard are integrated.

(2) By running the 1016/1260 MDL standard, the majority of peaks for all aroclors should be represented.

6. Initial Calibration Verification (ICV)

a. Verify the calibration curves using the ICV mixtures injected directly after the full ICAL.

b. The % difference of the concentrations of each individual peak used to calculate the Aroclor must be within 20% difference of the nominal concentration.

7. Continuing Calibration Verification (CCV)

a. Calibration verification is performed after each set of twenty injections (samples, QC, blanks, etc.) or 12 hours, whichever comes first.

b. Use AR16 to evaluate the calibration of the aroclors (or other aroclors as requested for particular clients or projects).

c. The concentration quantitated for each individual peak used to calculate the Aroclor in the continuing calibration verification standards must be within 20% difference (%D) of the nominal concentration for each peak/surrogate.

d. Samples must be bracketed by compliant standards.

(1) Exception: If standard following a sample is outside the ±20% but exhibits increasing response, the samples before it do not have to be reinjected if the target analytes are not detected. A comment must be added to the analytical report.

(2) If two consecutive/sequential CCVs fail, corrective action must be taken, which can include performing injection port maintenance, baking the instrument or other types of maintenance. Two consecutive/sequential CCVs must meet the criteria or an initial calibration must be performed before sample analysis can continue.

e. If confirmation of target analytes is needed, then the second column should meet the 20% continuing calibration criteria, as well as all initial calibration criteria. If either of these are not met, a comment must be added to the analytical report.

8. The instrument blank (IBLK), if requested for, is injected before or after each set of continuing calibration verification, depending on project specifications/project notes.

a. It must be evaluated as a water matrix against the water MDL/LOQs.

b. The IBLK must not have any target compounds above the reporting limits.

(1) If a target analyte is detected in the IBLK, any associated samples with a detection for that same target must be evaluated.

(2) Unless the concentration in the sample is more than 10x the IBLK value, the sample must be injected after another compliant IBLK.

(3) Instrument maintenance, i.e., baking the system or injection port maintenance is usually necessary to clean up the instrument.

9. Retention time (RT) windows

a. Established as 3× the standard deviation determined over 72 hours, or at no less than ±0.02 min, applied to the midpoint initial calibration standard.

b. If the RTs for a continuing calibration verification standard fall outside the RT window, update the midpoint RT using that standard.

(1) Save this under the appropriate name to indicate an update has occurred.

(2) RTs cannot be updated more than once per day. All subsequent standards run within a 24-hour period must be within this window.

(3) If RTs are not consistent, the cause must be investigated and corrective action taken.

Procedure

1. Prepare a sequence of injections as suggested in the Calibration Section, along with the appropriate check standards.

2. Retention times of peaks in the samples are compared to the standard RT windows.

a. Peaks present on both columns that are also in the correct ratios to represent an aroclor are quantitated, and the high value is reported unless chromatographic anomalies are observed. See *T-PEST-WI9954*.

b. Use a minimum of three to six peaks for quantitation, with the exception of certain mixes where it may be more accurate to use less peaks to avoid excessive overlap of patterns.

3. Continue running groups of samples/injections followed by check standards every 12 hours or 20 injections, whichever comes first.

a. For projects where a known aroclor is present and at the request of clients, other aroclors can be run for the continuing check standard. For instance, a set of continuing standards may be AR484, AR164, IBLK.

b. Aroclor 1262 and 1268 can be analyzed when requested. A full six point curve can also be run, depending on the project requirements.

4. If significant interference is present, schedule florisil and/or sulfuric acid cleanup. If elemental sulfur is present, TBA or copper the extract or have it put through GPC cleanup. If these techniques do not reduce the matrix problems, dilute the extract with hexane and adjust LOQs accordingly.

5. Report the results for the least dilute sample where the concentration measured is within the acceptable calibration range.

Calculations

1. The peak heights generated by the integration system are used to calculate the calibration factors (CF) for peaks of interest for each aroclor.

   Usually, the six major peaks that are unique to each aroclor are chosen for quantitation, with the exception of 1221 where only three peaks are available.

2. Sample concentrations are calculated per peak using average calibration factor (AVG CF) from the initial calibration.

$$\frac{\text{Sample Height}}{\text{AVG CF (CF)}} \times \frac{FV}{IW} \times DF = \mu g/kg \text{ as received per peak}$$

Where:

FV = Final volume (mL)

IW = Initial weight (g)

DF = Dilution factor, as needed

The final result that is reported is determined as the average of the result for each peak chosen for quantitation:

$$(\text{Result 1} + \text{Result 2} + \ldots + \text{Result } n) \;/\; n = \text{Average Result}$$

3. The surrogate results are determined using either AVGRF or linear curve:

   a. Using AVGCF from the initial calibration:

$$\frac{\text{Sample Height}}{\text{AVCRF (CF)}} \times \frac{FV}{IW} \times DF = \mu g/kg \quad \text{as received}$$

   b. Using linear curve from the initial calibration:

$$[(\text{Sample Height} - Y - \text{intercept})/\text{Slope}] \times \frac{FV}{IW} \times DF = \mu g/kg \text{ as received}$$

Where:

FV = Final volume

IW = Initial weight

DF = Dilution factor, as needed

4. See *T-PEST-WI9847* for all other equations related to the analysis.

Statistical Information/Method Performance

LCS,MS, and RPD are compared to the limits stored in the LIMS. The limits for LCS and MS are statistically derived. Historical data for MS/Ds, LCS/Ds, measurement of uncertainty, is reviewed at least annually. Acceptance limits are generated according to *T-PEST-WI9980*. Reporting limits including method detection limits (MDLs) and limits of quantitation (LOQs) are set according to EPA method requirements and are evaluated annually. Refer to *QA-SOP11892* for specific guidelines and procedures. Updates to the LIMS are made as needed by the QA Department and only as directed by the manager. The department database is updated via a download from the LIMS.

Quality Assurance/Quality Control

QC Acceptance limits are established as statistical limits. See *T-PEST-WI9980* for further information on monitoring and establishing limits.

A sodium sulfate blank and a sodium sulfate spike (LCS) are analyzed with every group of samples up to a maximum of 20. An MS/MSD is performed per batch. For wipes and when an MS/MSD cannot be performed, an LCSD will be extracted.

Aroclor 1016 and 1260 are routinely spiked; however, other aroclors can be spiked as requested by clients.

DCB and TCX are added as surrogates to each sample and QC to monitor the efficiency of the extraction, the operation of the autosampler, and to monitor retention times throughout the GC run.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

See *T-PEST-WI10011* for details on QC acceptance criteria and corrective action.

Appendix I

PCT Analysis (Aroclor 5422, 5432, and 5460)

A. Standards:

1. PCT Stocks- Aroclor 5432, 5442, and 5460 are purchased as individually ampulated solutions from Accustandard at 35,000 ug/L.
2. Surrogate Stock- Ultra ISM-320 containing TCX/DCB at 200,000ppb in acetone. Prepare an intermediate by diluting 0.25mL to 25mL of hexane.
3. MS stock of Aroclor 5442 - Absolute cat# 71791, 1000ug/L in Methanol.
4. Prepare working standards using the reagents module of the LIMS as a guide.
   a. In the reagents module, first enter the reagents in this section as 'source' reagents.
   b. Then select 'intermediate' reagent and load the most recent version of the working standard you wish to create for editing, or create a new standard if the working standard has not yet been prepared in TALS.
   c. The module contains the following information: reagent description (ex. AR161), source reagent code, amount used, final amount, solvent used and solvent lot, concentration of each compound in solution, and expiration date. The working standards have an expiration date of 6 months.
   d. The calibration scheme begins at or near the reporting limit through a 20 fold of the initial calibration level.
   e. The scheme for preparing the matrix and surrogate spiking solutions used in the extraction process are listed below.

Standard Name	Parent Solution	Aliquot (mL)	Final Volume (mL)	Solvent	Description
MS	Aroclor 5422 Stock	0.75	100	Acetone	Aroclor 5442 PCT Spike
SS	Pest Surr mix	1.5	1000	methanol	SW 846 surrogate

B. GC Chromatographic Analysis:

The conditions listed serve as a guideline only and are typically the optimum operating conditions. The analyst may make any changes to the chromatographic conditions to improve the speed of analysis, linearity, sensitivity, and/or improve separation if initial and continuing calibration criteria and quality assurance criteria listed within this analysis document are met.

Detector	ECD
Detector temp	330°C
Oven Temp	110°C to 250° at 40°C/min, to 280°C at 20°C/min, to 330°C at 30°C/min, hold 9 min.
Carrier	Hydrogen at 3.6 mL/min
Makeup gas	N2 at 60mL/min or equivalent
Injection size	1-uL, direct injection
Injection temp	225°C

C. Example of a Sequence:

1. Conditioner
2. IBLK
3. EVAL
4. AR161
5. AR162
6. AR163
7. AR164
8. AR165
9. AR166
10. AR481
11. AR482
12. AR483
13. AR484
14. AR485
15 AR486
16. AR541
17. AR542
18. AR543
19. AR544
20. AR545
21. AR546
22. PCT1
23. PCT2
24. PCT3
25. PCT4
26. PCT5
27. A4421
28. A4422
29. A4423
30. A4424
31. A4425
32. AR213
33. AR323
34. AR423
35. AR623
36. AR683
37. AR16xx
38. MDPCTX
39. MD16
40. IC16
41. IC48
42. IC54
43. Blank
44. LCS
45. 1234567
46. 1234567MS
47. 1234567MSD

48-62. Continue running samples

63. AR163
64. PCT3
65. A4423
66. IBLK

10007 Preventative and Corrective GC Maintenance
10011 QC Data Acceptability and Corrective Action
10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10922 Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550B and 3550C
10927 Microwave Extraction Method 3546 for PCBs in a Solid Matrix
9847 Common Equations Used During Chromatographic Analyses
9954 Interpretation of Chromatographic Data
9980 Monitoring QC Data Acceptance Limits

End of document

Version history

Version	Approval	Revision information	
9	29.MAR.2018		
10	16.MAR.2021		
11	18.MAY.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-WC-WI10085**	**Cyanide (Total and Amenable) Distillation in Waters and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011**	**Work Instruction**
Old Reference: **1-P-QM-WI-9011694**		
Version: **20.1**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **22-JUN-2021**	Document users: **6_EUUSLA_ Instrumental Water Quality _Prep Analyst, 6_EUUSLA_ Instrumental Water Quality _Prep Verifie**	Responsible: **5_EUUSLA_Instrumental Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Procedure
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 21		**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Reference	MUR 2021		Updated to include new SM

Revision: 20		**Effective Date:**	Dec 31, 2020
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout	Current Process		Updated to new version of LIMS
Throughout	Enhancement Not required by program		Combined this SOP with distillation SOP 11622 Removed reference to distilled ICV - this is not in MAMCP or NJ DKQP technical documents.

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012A, December 1996.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012B, August 2002.

3. Method 335.4, Methods for Chemical Analysis of Water and Wastes USEPA 600 Revision 1.0, 1993

4. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500 CN G-1999.

5. Standard Methods for the Examination of Water and Wastewater, Method 4500-CN G-2011.

6. Standard Methods for the Examination of Water and Wastewater, Method 4500-CN G-2016.

7. Method 335.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

8. Method 335.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.

9. Department of Defense *Quality Systems Manual for Environmental Laboratories*, Version 5.3, 2019

10. LabCrest Midi-Dist Cyanide Distillation System Operation Manual.

11. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI11629	Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by Methods SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011

Scope

This method covers the distillation of solids and waters for cyanide analysis, and the pretreatment of a sample aliquot for amenable cyanide determination. This procedure is a preparation for colorimetric determination of cyanide by automated flow analyzer.

Methods within the same Batching Group in LIMS are treated by the same procedure:

WC - Cyanide Prep
- 9012A_Prep
- 9012B_Prep
- 9012B_Prep_DOD5
- Distill_CN

WC - Non-Amen CN Prep
- 9012A_P_NonAmen
- 9012B_P_NonAmen

Basic Principles

Cyanide in a sample is converted to hydrogen cyanide (HCN) by liberation from an acidified sample by distillation followed by absorption in a NaOH scrubber. The cyanide ion in the absorbing solution is then determined by automated UV colorimetry.

For amenable cyanide, a portion of the sample is pretreated with chlorine to release the dissociable cyanide. Both treated and untreated portions of the sample are distilled and analyzed, and the difference between the two results is the cyanide amenable to chlorination.

Reference Modifications

Chlorine interference is removed by the addition of ascorbic acid, except for amenable cyanide samples. The residual chlorine in amenable cyanide samples is removed with a H2O2 solution and a Na2S2O3 solution.

There are no procedural differences between EPA 335.1, or 3 and EPA 335.4.
There are no procedural differences between amenable cyanide by EPA 335.1, 3, or 4 and SM20 4500-CN-G.

Interferences

Sulfides adversely affect the procedure because sulfide will convert CN to CNS at high pH. Oxidizing agents, primarily chlorine, will decompose cyanides. Prior to distillation, the sample is checked and treated for residual chlorine and sulfide (S-SS-WI10695). When water samples are treated for sulfide, they must be distilled separately from other samples. This treated batch must have its own QC, including an LCS, LCSD, and a prep blank. The calibration standards must also be distilled in this manner. Test by placing a drop of sample on lead acetate paper. If darkening occurs, add 5 mL zinc acetate solution to the sodium hydroxide in the scrubber. The testing and treating procedure is performed by Department 4027 for solid samples. For water samples, the sample preservation group tests and treats for sulfide using lead carbonate to eliminate the sulfide interference.

High results may be obtained for samples that contain nitrate and/or nitrite. During distillation, NO3 and NO2 will form nitrous oxide, combining with some organic compounds to form oximes that decompose under test conditions to form HCN. The possible interference of nitrate and nitrite is eliminated by pretreatment with sulfamic acid.

Some unidentified organic chemicals may oxidize or form breakdown products during chlorination giving higher results for cyanide after treatment than before.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Always use caution when handling any chemicals, solvents, solutions, or reagents. Avoid inhalation and contact. Take special care when handling the concentrated sulfuric acid and the sodium hydroxide solution. Check the vacuum hoses each time distillations are finished to ensure that no

leaks are evident and that the hoses vent into the hood. The amenable cyanide pretreatment must be done in the hood, with the hood on. Inspect the glassware before use. Discard or send for repair any glassware that is chipped, flawed, or broken.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four aliquots spiked at 1-4X the RL (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples may be collected in glass or plastic containers. Samples are preserved to pH >12 with NaOH and stored at 0° to 6°C, not frozen, from time of collection to analysis. Holding time is 14 days from collection to analysis.

Apparatus and Equipment

1. Reflux distillation apparatus

2. pH meter

3. Analytical balance, pan balance, or equivalent.

4. Adjustable hand-held automatic pipette or equivalent.

5. Stir plate

Reagents and Standards

NOTE: All chemicals used must be ACS reagent grade unless otherwise noted.

See QA-SOP11188 for the appropriate labeling and documentation of reagent and standard preparation.

Different volumes or weights may be used in the preparation of reagents or standards as long as the ratios remain equivalent.

1. Sulfuric acid, (50%), H2SO4

    a. Carefully add 1000 mL of concentrated sulfuric acid (H2SO4) to approximately 1000 mL of chilled reagent water.

    b. Dilute to 2000 mL.

c. Prepare every 6 months.

d. Store in glass container at room temperature.

2. Magnesium chloride reagent

a. Dissolve 510 ± 5 g of $MgCl_2 \cdot 6H_2O$ in reagent water and dilute to 1 L.

b. Prepare every 6 months.

c. Store in glass container at room temperature.

3. Sodium hydroxide (1 N NaOH) - **WC-PR-1NNaoh**

a. Dissolve 80 ± 0.8 g of NaOH pellets in approximately 1500-mL reagent water.

b. Dilute to 2 L.

c. Prepare yearly.

d. Store in glass container at room temperature.

4. Sodium hydroxide solution, 0.25 N

a. Slowly add 20 ± 0.5 g of NaOH to 1600 mL reagent water and mix.

b. Dilute to 2 L with reagent water.

c. Prepare every 6 months.

d. Store in glass container at room temperature.

5. Sulfamic acid

a. Dissolve 40 ± 0.5 g of sulfamic acid in reagent water.

b. Dilute to 1 L.

c. Prepare every 6 months.

d. Store at room temperature in glass container.

6. 1000 mg/L Cyanide Stock (CN-) - **WC_FL_CN_VeriS** - purchased.
Alternate Preparation instructions:
Potassium cyanide (KCN) 1.255 ± 0.005 g
Potassium hydroxide (KOH) 1 ± 0.05 g

a. Dissolve 1.255 ± 0.005 g of KCN in 400 mL reagent water containing 1 ± 0.05 g of KOH.

b. Dilute to 500 mL with reagent water (1.00 mg CN-/mL).

c. Prepare every 30 days.

d. Keep refrigerated at 4 ± 2ºC in an amber glass bottle.

e. If the standard is prepared in-house, it must be standardized weekly.

7. KCN spiking solution, 20 mg/L - **WC-PR20mg/lQC**

a. Pipet 1 mL of WC_FL_CNVeriS (1000mg/L CN-) and 1 mL of WC-PR-1Naoh into approximately 45 mL of reagent water in a 50-mL Class A volumetric flask. Dilute to 50 mL with reagent water.

b. Prepare fresh daily in a volumetric kept at room temperature.

NOTE: Calculate the compensated amount of spiking solution to be used if using lab prepared standards:

$$\frac{1000}{CN - mg/L} = Amount\ of\ solution\ added$$

Example: If the value of the stock standard is 1,025 mg/L, pipette .96 mL of solution using a calibrated autopipette.

8. Hydrogen peroxide (3%), H2O2 – Purchased. Store at room temperature. See label for expiration date.

9. Sea sand, purchased, stored at room temperature.

NonAmenable Cyanide pretreatment:

10. Potassium iodide starch paper

11. Zinc acetate

a. Dissolve 110 ± 1 g zinc acetate in reagent water.

b. Dilute to 500 mL.

c. Prepare every 6 months.

d. Store at room temperature in glass container.

12. Calcium hypochlorite

a. Dissolve 5 ± 0.1 g of calcium hypochlorite (Ca[OCl]2) in reagent water.

b. Dilute to 100 mL with reagent water.

c. Prepare every month.

d. Store in the dark at room temperature in an amber glass container.

13. Sodium thiosulfate solution (500 g/L), Na2S2O3

a. Dissolve 5 g Na2S2O3 per 10 mL reagent water.

b. Prepare every 30 days.

c. Store in plastic container at room temperature.

Procedure

NOTE: Do not pipette directly from sample containers with glass pipettes.

A. Sample Preparation

WC - Non-Amen CN Prep Methods (9012A_P_NonAmen, 9012B_P_NonAmen)
WC - Cyanide Prep Methods (9012A_Prep, 9012B_Prep, 9012B_Prep_DOD5, Distill_CN)

For each preparation batch of up to 20 samples:

1. Measure out a 50-mL aliquot, or a volume diluted to 50 mL, of sample into a 120 mL plastic container if the sample is a solid, weigh out 2.0 ± 0.2 g and place in the beaker along with 50 mL of reagent water.

2. Prepare a laboratory control sample (LCS) and when required, a lab control sample duplicate (LCSD), by spiking 50 mL of reagent water with 0.5 mL of the spiking solution WC-PR20mg/lQC (20 mg/L CN-). A solid LCS is prepared by weighing out 1.0 ± 0.1 g of sand, and spiking with 0.5 mL of WC-PR20mg/lQC. Pipette the spiking solution directly into the sand prior to adding 50 mL reagent water.

3. Prepare the batch blank (PB) by pouring 50 mL of reagent water into a 150-mL beaker. A solid PBS is prepared by weighing out 2.0 ± 0.2 g of sand and adding 50 mL of reagent water.

4. Prepare a matrix spike (MS) for every 10 samples by taking equal portions of sample and spiking one portion with 0.5 mL of WC-PR20mg/lQC. For solids, pipette the spiking solution directly into the sample prior to adding 50 mL reagent water.

5. Prepare a duplicate (DU) every 10 samples by preparing equal portions of sample.

6. **9012B_Prep_DOD5:** Prepare a High Level laboratory control sample (HLCS) and a Low Level laboratory control sample (LLCS).

a. **HLCS**: Spike 50 mL of reagent water with 0.5 mL of the spiking solution WC-PR20mg/lQC (20 mg/L CN-). A solid LCS is prepared by weighing out 1.0 ± 0.1 g of sand, and spiking with 0.5 mL of WC-PR20mg/lQC. Pipette the spiking solution directly into the sand prior to adding 50 mL reagent water.

b. LLCS: Spike with 0.125 mL of WC-PR20mg/lQC into 50 mL of reagent water or into 1.0 g sand followed by 50 mL reagent water for a solid LLCS.

7. For NonAmenable CN batches, proceed to Procedure B. For Total CN batches, proceed to Procedure C.

B. Sample Pretreatment (NonAmenable Preparation only)
WC - Non-Amen CN Prep Methods (9012A_P_NonAmen, 9012B_P_NonAmen)

1. Begin stirring sample on a stir plate in an operating fume hood.

2. Add enough calcium hypochlorite solution dropwise to turn the potassium iodide starch paper dark blue (indicating an excess of chlorine) while maintaining the pH of the solution between 11 and 12 with sodium hydroxide.

NOTE: Addition of the calcium hypochlorite must be performed in an operating fume hood.

9. Maintain the excess residual chlorine for 1 hour, continuing agitation. Check the sample every 15 minutes and, if necessary, add additional hypochlorite solution. If you do add more calcium hypochlorite, be sure to check the pH to be between 11 and 12. If necessary, adjust with NaOH.

9. After 1 hour, remove residual chlorine by addition of 8 drops of H2O2 (3%), followed by 4 drops Na2S2O3 solution (500 g/L). Test with KI-starch paper until there is no color change.

10. Distill the samples and associated QC samples following Procedure C., and subsample into a properly labeled vials.

C. Distillation of Samples
WC - Non-Amen CN Prep Methods (9012A_P_NonAmen, 9012B_P_NonAmen)
WC - Cyanide Prep Methods (9012A_Prep, 9012B_Prep, 9012B_Prep_DOD5, Distill_CN)

1. Measure out 50.0 mL of 0.25N NaOH solution in a Class A graduated cylinder. Place the solution in the scrubber tube.

2. Set up the distillation apparatus, see Figure 1,Vacuum grease may be used if an adequate seal cannot be obtained.

3. Place 50 mL of sample or an aliquot diluted to 50 mL with reagent water in the reaction tube. (Note in the databook the reason[s] why less sample was taken). If the sample is a solid, weigh 2 ± 0.2 g (note in the databook the reason[s] why less sample was taken, if necessary) and place in the reaction tube along with 0.25N NaOH.

4. Turn "ON" coolant flow to the Microtip condensers and the vacuum. Adjust the vacuum to allow approximately 3 bubbles per second to appear in the reaction tube.

5. Add 5 mL of sulfamic acid solution through the air inlet tube. Allow to mix 3 minutes.

6. Slowly add 5 mL of 50% sulfuric acid solution through the air inlet tube. Allow to mix for 5 minutes.

7. Add 2 mL of the magnesium chloride solution through the air inlet tube.

8. Turn "ON" the heating block and set the timer to 105 minutes. This allows a warm-up time of 15 minutes and a reflux time of 90 minutes. Heat the solution to boiling, taking care to prevent the solution from backing up into the air inlet tube. This can be done by adjusting the vacuum valve on the front of the unit.

9. After the set time, the heat will turn off automatically. Allow the airflow and coolant in the condensers to continue at least another 15 minutes.

10. After cooling, disconnect the air inlet and outlet tube from the scrubber tube.

11. Subsample the final solution into one 40-mL vial. Label the vial with the LIMS labels created from the batch.

Store the vial of each sample in the Instrumental Water Quality subsample refrigerator. If the sample requires locked storage, create a chain of custody and return all subsamples to the locked storage area.

Statistical Information/Method Performance

Refer to *T-WC-WI11629*.

Quality Assurance/Quality Control

NOTE: For evaluation and corrective actions, see *T-WC-WI11629*.

For each preparation batch (NonAmenable CN preps and Total CN preps), the following QC are required. Refer to the Procedure for preparation instructions:

QC Type	Frequency
Method Blank (MB) Laboratory Control Sample (LCS)	One per batch of up to 20 samples
Sample Duplicate (DU) Matrix Spike (MS)	One every 10 samples (do not use a field blank)
Laboratory Control Sample Duplicate (LCSD)	Per client or regulatory program requirement
High Level LCS (HLCS) - 20 mg/L CN- Low Level LCS (LLCS) - 0.5 mg/L CN-	**9012B_Prep_DOD5 only:** One per batch of up to 20 samples

11629 Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by Methods SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011

End of document

Version history

Version	Approval	Revision information	
19	01.OCT.2018		
20	22.DEC.2020		
20.1	22.JUN.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-PEST-WI10281**	**Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)**	**Work Instruction**
Old Reference: **1-P-QM-PRO-9015477; DOD-SOP-OE-004**		
Version: **15**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **16-MAR-2022**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_DP 24 Cleanups, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Background Information
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I

Revision Log

Revision 14		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	Update	Changed references to the old LIMS to the new LIMS
Procedure B6	Reflects current process	Only fill the cartridge up 1/3 full instead of a full cartridge
Procedure B11	Clarification	Added "Remove the florisil cartridges and dispose of them."

Revision 14		**Effective Date:**	April 8,2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
LIMS ID	Reflects current process.		Added the prep analysis number associated with the cleanups procedures in this document.
Reference	No longer applicable Reflects applicable document		Removed references to CLP Methodologies Updated revision for SW-846, Chapter 2.
Reference	Reflects current process		Added 608 and 608.3
Cross Reference	Reflects current process		Added analysis scan numbers associated with the cleanup procedures in this document.
Scope	Clarification		Added wording to clarify that solid and aqueous samples are getting cleanups performed.
Personnel Training and Qualifications	Clarification		Added wording to define the DOC and IDOC
Sample Collection, Preservation, and Handling	Reflects Current Process		Changed storage temperature from $4^{o} \pm 2^{o}$ C to 0° to 6° C, not frozen
Apparatus and Equipment 16	Enhancement		Added vorexer/mixer.
Procedure A.1	Clarification		Clarified what volume of concentrated sulfuric acid is need for the cleanup.
Procedure A.5	Clarification		Changed the procedures to be performed after the Acid cleanup to the correct Procedure section.
Procedure A.5	Clarification		Added wording to reflect that the extract is added directly into the florisil or florisil/copper.
Procedure B.4	Clarification		Changed the solvent to hexane and added amount to be added to approximately 6 mL.
Procedure B.6	Clarification		Changed the solvent amount to approximately 6 mL.
Procedure B.11	Clarification		Changed the volume of elution solvent to be added to approximate volumes.
Procedure C.12 and 13	Enhancement		Added wording to reflect the use of vacuum to drain samples and elution solvent.
Procedure C. 14	Enhancement		Added reference to copper cleanup.
Procedure D	Clarification		Changed order of steps in process.
Procedure E.4	Enhancement		Replaced hand shaking of vials with vortexer.
Procedure F	Enhancement		Added Pesticide copper cleanup procedure.
Procedure F.4	Enhancement		Replaced hand shaking of vials with vortexer.

Reference

1. *Determination of PCBs in Transformer Fluid and Waste Oils*, Section 8.1, EPA-600/4-81-045.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 3660B, December 1996.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 3620C, February 2007.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 3665A, December 1996.

5. Test Methods for Evaluating Solid Wastes, SW-846, Chapter 2, Section 2.3.2. Rev. 5, July 2014.

6. USEPA, 40 CFR Part 136, Appendix A, Method 608.

7. USEPA, 40 CFR Part 136, Appendix A, Method 608.3, December 2016. MUR Effective September 2017.

8. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-PEST-WI11971	Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
T-PEST-WI18000	Polychlorinated Biphenyls (PCBs) by Method 608.3
T-PEST-WI9987	PCBs in Oil by SW-846 Method 8082/8082A
T-PEST-WI9238	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD
T-PEST-WI9961	Low Level PCBs in Water by Method 8082/8082A using GC-ECD
T-PEST-WI11972	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solid Samples and Wipes
T-PEST-WI9997	Pesticides in Aqueous Samples by Method 608
T-PEST-WI17994	Pesticides in Aqueous Samples by Method 608.3
T-PEST-WI9998	Pesticides in Water by Method 8081A and 8081B using GC-ECD
T-PEST-WI9992	Pesticides by Method 8081A in Solid Samples using GC-ECD
T-PEST-WI9843	Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD

Document	Document Title
T-PEST-WI9202	Analysis of Chlorinated Herbicides by 8151A in Water
T-PEST-WI9845	Chlorinated Herbicides by 8151A in Solids by GC-ECD

Purpose
The various cleanup techniques included in this SOP are used to remove interferences that inhibit or negatively impact the determination of various pesticide and PCB compounds. Specific preparation SOPs explain which of the procedures are applicable to the various preparation procedures. The techniques included in this SOP must be performed only by, or under the supervision of, experienced extraction technicians.

Scope
Through the use of florisil, acid, and/or copper cleanup, interferences for PCBs are minimized in extracts from aqueous and solid sample matrices. The use of florisil, gpc, or carbon minimizes or eliminates interferences for various organic analytes in extracts from aqueous and solid sample matrices. The decision to use these techniques depends on the color, odor, consistency, and several other factors that are sample-specific. If these techniques are used to treat a sample, the use of the procedure must be documented in the appropriate data log.

Background Information
Not applicable to this procedure.

Basic Principles
A variety of techniques are used to remove interferences from the extracts.

Reference Modifications
Not applicable to this procedure.

Definitions

Not applicable to this procedure.

Interferences

Impurities in solvents, reagents, glassware, and/or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

All extract waste and solvent waste must be disposed of in the appropriate solvent waste collection receptacle. This is transported to the solvent collection facilities provided by the safety department. All acid waste must be disposed of in the appropriate acid waste collection receptacle. This is transported to the acid collection facilities provided by the safety department. Any disposable pipettes, sodium sulfate, or other non-reusable solids are disposed of in the normal trash receptacle.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management and pollution prevention.

Personnel Training and Qualifications

All personnel performing these techniques must have documentation of reading, understanding and agreeing to follow the current version of this SOP and a documented Demonstration of Capability. Personnel must spend several days working with an experienced preparation technician. Several batches must be prepared under the direct observation to verify that the trainee is able to perform the procedure independently with acceptable analyte recoveries. The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined

acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in glass and stored at 0° to 6° C, not frozen, prior to extraction. Refer to individual analysis SOPs for holding times from collection to extraction.

Apparatus and Equipment

1. Screw-cap vials – various size glass vials, with Teflon-lined caps

2. Disposable Pasteur pipettes – various sizes

3. Glass wool - silanized

4. N-Evap system with temperature between 36° and 44°C

5. Graduated cylinders – Class A, assorted sizes

6. Volumetric pipettes – Class A, assorted sizes

7. Beakers - assorted

8. Crimp-cap GC vials

9. Test tubes – Kimax 16 mm × 125 mm with 20-mL capacity, or equivalent

10. Vacuum system for eluting multiple cleanup cartridges

    a. Vac elute manifold – Analytichem international, J.T. Baker or Supelco (or equivalent). The manifold design must ensure that there is no contact between plastics containing phthalates and sample extracts.

    b. Vacuum trap made from a 500-mL sidearm flask fitted with one-hole stopper and glass tubing

    c. Vacuum pressure gauge

    d. Rack for holding 10-mL volumetric flasks in the manifold

e. Teflon florisil parts

11. Kiln capable of maintaining 400°C

12. Class “A” volumetric flasks – assorted sizes

13. 250 mL amber glass bottle

14. Fisher Brand Pipette, Volume 1 – 5 mL, catalog #21377244 or equivalent

15. Finntip, 5 mL, catalog #9402060 or equivalent

16. Vortexer/Mixer - FIsher Multi-Tube Vortexer 120 or equivalent

Reagents and Standards

1. Sodium sulfate (Na_2SO_4) - Bake at approximately 400° for 4 hours prior to use to remove organic contaminants. Store in a glass jar for up to 1 year after baking.

2. Sulfuric acid (H_2SO_4) - concentrated, Fisher Chemical Certified ACS Plus or equivalent.

3. Florisil cartridges – 1g (catalog No. CUFLSA1M6, United Chemical Technologies or equivalent)

4. Hexane – Pesticide grade or equivalent

5. Acetone – Pesticide grade or equivalent

6. Methylene Chloride ($MeCl_2$)- pesticide grade or equivalent

7. Florisil – Fisher Scientific (or equivalent); 100 × 600 mesh baked at approximately 130°C for 16 hours to activate and clean up. Store in sealed glass containers that limit the potential for exposure to moisture. Store in glass jars after baking for no longer than 6 months.

8. Copper - granular (20-30 mesh), JT Baker 1720-01, or equivalent.

9. Carbon cartridges- Agilent 6ml/500mg, catalog number 12252201 or equivalent.

Calibration

Not applicable to this procedure.

Procedure

NOTE: If any samples in a batch are subjected to clean-up procedures the associated QC samples must undergo clean-up as well.

A. Sulfuric acid – for PCBs interference removal

1. Place approximately the same volume of concentrated sulfuric acid as the final volume of the sample extract in an appropriately sized vial with a Teflon-lined cap.

Example: samples that have a final volume of 10 mL would require 10 mL of concentrated sulfuric acid for the cleanup.

2. Transfer the entire extract to the vial containing the concentrated sulfuric acid.

Note: Make sure that no water inadvertently seeped into the ampule during concentration on the steam bath. If there is water in the extract there will be a separate distinct layer below the hexane layer in the ampule. If it is determined that water is in the ampule, the extract should be dried with sodium sulfate using a mini salt column prior to being brought to final volume. There is a potential for a violent reaction if an extract has water present and is transferred into the acid filled vial. Transferring the extract into the acid filled vial should be done in a hood with the sash down.

3. Cap the vial securely and shake for approximately 1 minute.

4. Allow the acid and solvent layers to separate. If distinct layers are not discernible, centrifuge the vial for about 2 to 3 minutes at approximately 1000 rpm.

5. Once a distinct solvent layer is visible (top layer), an aliquot of extract is added to a 4-mL disposable clear vial containing either florisil (see Procedure D, PCB Quick Florisil Cleanup, in this SOP) or copper and florisil (see Procedure E, PCB Quick Florisil/Copper Cleanup, in this SOP) using a disposable glass pasteur pipette.

B. Pesticide florisil cleanup

Note: See the specific extraction SOP for the correct initial/final florisil volumes.

1. Thoroughly rinse the vacuum chamber lid with acetone prior to assembling the chamber. The drip-tips and stopcocks must also be rinsed with acetone prior to use.

2. Volumetrically prepare the elution solution of 11% acetone in hexane (11-mL acetone to 89-mL hexane, or an equivalent ratio). Allow the solution to equilibrate to room temperature before bringing to final volume. Document this preparation in the reagent preparation logbook. The solution must not be stored for more than a day to ensure there is no loss of acetone. Do not use a squirt bottle for storage.

3. Screw the drip tips into the top of the manifold. Place the valves into the top of the drip tips. Place the florisil cartridges, labeled with the sample numbers, on top of the valve. Be certain the valves are closed.

4. Fill the cartridge with hexane (approximately 6 mL).

5. Elute the solvent through the cartridge stopping the flow before the meniscus reaches the florisil bed. The meniscus of solvent above the florisil bed keeps the cartridge from going dry.

6. Fill the cartridge approximately 1/3 of the way with 11% Acetone/Hexane. Make sure to keep a meniscus of solvent above the florisil bed. **Do not allow the column to go dry from this point forward.**

7. Remove the top from the chamber. Dispose of the solvent in the chamber into the appropriate waste container.

8. Place the labeled collection test tubes (numbered to match the florisil cartridges) into the tube holder. Place the assembled tube holder into the vacuum chamber. Place the top onto the vacuum chamber, being sure the drip tips go into the top of the test tubes.

9. Place 2.0 mL of the sample onto the cartridge using a Class A 2-mL pipette.

10. Slowly drain the sample into the test tube by opening the valves. A drip rate of approximately 5 to 6 mL per minute must be maintained. **Do not allow the column to go dry**.

11. Fill the cartridge to the top (approximately 6 mL) with 11% Acetone/Hexane and start slowly draining. Just prior to the elution solvent reaching the florisil bed, fill the cartridge approximately 1/2 full (approximately 3 mL) with 11% Acetone/Hexane and allow the cartridge to drip dry. Remove the florisil cartridges and dispose of them.

12. Remove the test tubes containing the extract and place the test tube on the N-Evap. The temperature of the N-Evap must not exceed 40°C to avoid low pesticide recovery. Using a **gentle** stream of nitrogen, blow the sample down to the appropriate volume. Once the volume is less than that required, transfer the contents to the appropriate size volumetric flask. Rinse

the test tube with hexane to assure a quantitative transfer. Dilute to a final volume of 2.0mL with hexane.

13. Thoroughly mix the samples in the volumetric flasks before transferring a portion of the extract to a GC autosampler vial. Store the remaining extract in the freezer in an appropriately sized vial labeled with the sample number.

14. Record the following information into the appropriate location in the LIMS:

    a. Volume florisiled

    b. Volume after florisiling

    c. Lot number of the florisil cartridges, as well as all solvent lot numbers.

15. Rinse the glass chamber and top of the manifold with methylene chloride and/or acetone to prevent contamination.

C. Carbon Cleanup

Note: See the specific extraction SOP for the correct initial/final carbon cleanup volumes.

1. Thoroughly rinse the vacuum chamber lid with acetone prior to assembling the chamber. The drip-tips and stopcocks must also be rinsed with acetone prior to use.

2. Volumetrically prepare the elution solution of 20% $MeCl_2$ in hexane (20-mL $MeCl_2$ to 80-mL hexane, or an equivalent ratio). Allow the solution to equilibrate to room temperature before bringing to final volume. Document this preparation in the reagent log book. This expiration date is one day from the date of creating the reagent.

3. Screw the drip tips into the top of the manifold. Place the valves into the top of the drip tips. Place the carbon cartridges, labeled with the sample numbers, on top of the valve. Be certain the valves are closed.

4. Add approximately 5 mL of acetone to each cartridge.

5. Elute the solvent through the cartridge stopping the flow before the meniscus reaches the carbon bed. The meniscus of solvent above the carbon bed keeps the cartridge from going dry.

6. Perform a second elution of the cartridge using 5 mL of acetone. Make sure to keep a meniscus of solvent above the carbon bed. **Do not allow the column to go dry from this point forward.**

7. Repeat steps 4, 5 and 6 using $MeCl_2$ as the elution solvent.

8. Repeat steps 4, 5 and 6 using hexane as the elution solvent. **Do not allow the column to go dry from this point forward.**

9. Remove the top from the chamber. Dispose of the solvent in the chamber into the appropriate waste container.

10. Place the labeled collection test tubes (numbered to match the carbon cartridges) into the tube holder. Place the assembled tube holder into the vacuum chamber. Place the top onto the vacuum chamber, being sure the drip tips go into the top of the test tubes.

11. Place 2.0 mL of the sample onto the cartridge using a volumetric pipette.

12. Slowly drain the sample into the test tube using vacuum by opening the valves to attain a drip rate of approximately 5 to 6 mL per minute. **Do not allow the column to go dry**.

13. Fill the cartridge to the top (approximately 6 mL) with the 20% $MeCl_2$/Hexane solution. Slowly drain the solvent using vacuum into the test tube by opening the valves. A drip rate of 5 to 6ml per minute must be maintained. Repeat the 20% $MeCl_2$/Hexane addition 2x for a total of approximately 18ml being added to the column.

14. Remove the test tubes containing the extract and place the test tube on the N-Evap. The temperature of the N-Evap must not exceed 40°C to avoid low pesticide recovery. Using a **gentle** stream of nitrogen, blow the sample down to the appropriate volume. Once the volume is less than that required, transfer the contents to the appropriate size volumetric flask. Rinse the test tube with hexane to assure a quantitative transfer. Dilute to volume with hexane. The extract is now ready for copper cleanup process in Procedure F of this SOP.

D. PCB quick florisil cleanup. See the specific extraction SOP for the correct initial/final florisil volumes.

1. Obtain one 4-mL vial and two GC vials for each sample to be cleaned.

2. Place approximately 0.1 grams of activated florisil into the 4-mL vial.

3. Place approximately 2 mL of the acid treated sample into the 4-mL vial using a pasteur pipette.

4. Place the 4-mL vials on a mixer/vortexer (Fisher Multi-Tube Vortexer 120 or equivalent) for 2 minutes. The vortex speed needs to be set high enough that the samples are vigorously mixed with the florisil.

5. Transfer approximately 1 mL of the cleaned extract into each of the two GC autosampler vials. (**Be sure to transfer only the liquid layer. Florisil crystals must not be transferred into the GC vial**).

6. Record the following information into the appropriate location in the LIMS:

   a. Volume florisiled

   b. Volume after florisiling (This is the same as volume florisiled since no dilution or concentration takes place in this cleanup).

   c. Lot number of the florisil

E. PCB quick florisil/copper cleanup

1. Obtain one 4-mL vial and two GC vials for each sample to be cleaned.

2. Place approximately 0.1 grams of florisil and 4 grams of copper into the 4-mL vial.

3. Place approximately 2 mL of the acid treated sample into the 4-mL vial using a pasteur pipette.

4. Place the 4-mL vials on a mixer/vortexer (Fisher Multi-Tube Vortexer 120 or equivalent) for 2 minutes. The vortex speed needs to be set high enough that the samples are vigorously mixed with the copper/florisil.

5. Allow the contents of the vial to settle, then pipette extract into a GC vial and cap.

6. Transfer approximately 1 mL of the cleaned extract into each of the two GC autosampler vials. (**Be sure to transfer only the liquid layer. Florisil crystals must not be transferred into the GC vial**).

F. Pesticide copper cleanup

1. Obtain one 4-mL vial and two GC vials for each sample to be cleaned.

2. Weigh out approximately 4 grams of copper into the 4-mL vial.

3. Place 2 mL of the carbon/florisil cleanup treated extract into the 4-mL vial using a pasteur pipette.

4. Place the 4-mL vials on a mixer/vortexer (Fisher Multi-Tube Vortexer 120 or equivalent) for 2 minutes. The vortex speed needs to be set high enough that samples are vigorously mixed with the copper.

5. Allow the contents of the vial to settle, then pipette extract into a GC vial and cap.

6. Transfer approximately 1 mL of the cleaned extract into each of the two GC autosampler vials.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
See Table I.

Quality Assurance/Quality Control
See the appropriate analysis SOP for quality control requirements.

Table I

Recovery of Pesticides After Sulfuric Acid Cleanup

Compound	% Recovery	Compound	% Recovery
alpha-BHC	100	HCB	96
Lindane	99	Diazinon	0
Heptachlor	100	beta-BHC	103
delta-BHC	99	Ronnel	25
Aldrin	99	Methyl parathion	0
Telodrin	100	Malathion	0
Oxychlordane	100	Ethyl parathion	0
Heptachlor epoxide	91	Endosulfan 1	74
o,p – DDE	98	Dieldrin	0
p,p – DDE	100	Endrin	0
o,p – DDD	103	Endosulfan 2	8
p,p – DDD	102	Ethion	0
o,p – DDT	100	Endosulfan sulfate	47
p,p – DDT	100	Endrin aldehyde	0
Trithion	0	PCB 1242	101
Mirex	102	PCB 1260	100
Methoxychlor	0	Toxaphene	100
Chlordane	101	-	-

-

11971 Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
11972 Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes
17994 Pesticides in Aqueous Samples by Method 608.3
18000 Polychlorinated Biphenyls (PCBs) by Method 608.3
9202 Analysis of Chlorinated Herbicides by 8151A in Water
9238 Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD
9843 CLIENT SPECIFIC - Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD
9845 Chlorinated Herbicides by 8151A in Solids by GC-ECD
9961 Low Level PCBs in Water by Method 8082/8082A using GC-ECD
9987 PCBs in Oil by SW-846 Method 8082/8082A
9992 Pesticides by Method 8081A in Solid Samples using GC-ECD
9997 Pesticides in Aqueous Samples by Method 608
9998 Pesticides in Water by Method 8081A and 8081B using GC-ECD

End of document

Version history

Version	Approval	Revision information	
13	04.AUG.2017		
14	08.APR.2019		
15	02.MAR.2022		

eurofins	Always check on-line for validity. **Flash Point for Liquids and Solids by ASTM D93, EPA 1010A or EPA 1010B**	Level: **Work Instruction**
Document number: **T-WC-WI10437**		
Old Reference: **1-P-QM-WI-9011689**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **13-SEP-2021**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision	12	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Reference 4.	Correction		Corrected year from 2020 to 2018
Cross Reference	Higher level documents not required to be referenced		Removed *QA-SOP11913*
Calibration	Reflect current process		Removed reference to laboratory notebooks
Procedure A.3.a	Enhancement		Added caution not to freeze
Procedure B.1	Correction		Added stir rate

Revision	11	**Effective Date:**	30-NOV-2020
Section	**Justification**		**Changes**

Revision	11	**Effective Date:**	30-NOV-2020
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout	Current Process		Updated for current LIMS terminology
References	Addition of EPA method		Added 1010B
Procedure A.8.	Clarity		Added "approximately
Procedure A.13	Current Process		Updated for current LIMS system
Procedure C.2	Current Process		Updated for current LIMS system

Reference

1. Annual Book of ASTM Standards, Method D93-07.

2. Annual Book of ASTM Standards, Method D93-90.

3. Test Methods for Evaluation Solid Wastes, SW-846 Method 1010, September 1986.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 1010A, August 2002.

5. Test Methods for Evaluating Solid Wastes, SW-846 Method 1010B, December 2018.

6. Annual Book of ASTM Standards, Method D93-80.

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI10360	Quality Control Data for Wet Chemistry
QA-SOP11183	Thermometer Use and Calibration

Scope

This method covers the determination of flash point by Pensky-Martens closed-cup tester of fuel oils, lube oils, suspensions of solids, liquids that tend to form surface film under test conditions, and other liquids over a temperature range of 20° to 700°F.

Procedure A is the default procedure for this analysis. Procedure B applies to samples whose viscosity would prevent them from being uniformly heated under Procedure A. Procedure C is used when flashpoint is requested for a solid sample.

Basic Principles

A sample is heated in a closed cup at a slow, constant rate while also being stirred at a specified rate. A small flame is lowered into the cup at regular intervals. The flash point is the lowest temperature corrected to a barometric pressure of 760 mm Hg at which introduction of the test flame causes the vapor above the sample to ignite. The barometric pressure used in the calculation is the ambient pressure for the lab at the time of the test.

Interferences

Flash point may not be accurate on materials not stored in sealed-glass or metal containers. This is due to the possibility of diffusion of volatile material through the walls of plastic containers.

Samples containing volatile, halogenated compounds, and/or large volumes of water may not give a well-defined flash.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

A fire extinguisher must be easily accessible to the operator of the flash point apparatus. Some liquid mixtures have a potential to superheat prior to their flash point and may boil out of the apparatus in flames. Show special precautions during the initial application of the test flame to a sample. Samples containing low-flashing material can give a strong flash when the test flame is first applied. *p*-xylene is extremely flammable and harmful if inhaled. Dispose of *p*-xylene in the solvent waste can.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

Analysts are considered proficient when they have successfully completed a documented Demonstration of Capability.

This consists of four laboratory control standards that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Demonstration of Capability is performed annually and documentation is in each individual's training records.

Sample Collection, Preservation, and Handling

Collect samples for flash point in glass or metal containers and store at 0° to 6°C, not frozen, until analyzed. Holding time is not specified. Do not store in gas-permeable containers. Do not open containers unnecessarily to avoid loss of volatile material.

Apparatus and Equipment

Refer to *QA-SOP11183* for information on thermometer use and calibration.

1. Pensky-Martens closed-cup flash tester

2. ASTM standard thermometer (20° to 230°F) for low range temperatures

3. ASTM standard thermometer (50° to 392°F) for medium range temperatures

4. ASTM standard thermometer (200° to 700°F) for high range temperatures.

Reagents and Standards

p-xylene – purchased, store at room temperature and re-evaluate yearly. Use as purchased for LCS.

Calibration

The stir rate must be checked and documented each day the analysis is performed.

Adjust the stir rate to between 90 and 120 rpm (15 to 20 revolutions per 10 seconds).

Thermometers must be calibrated periodically against a NIST-traceable thermometer following *QA-SOP11183*.

Procedure

A. Procedure A - liquid samples

1. Adjust the test flame and the support flame to the size of the bead on the post next to the test flame (4 mm in diameter) and adjust the stir rate to between 90 and 120 rpm (15 to 20 revolutions per 10 seconds).

2. Thoroughly clean and dry all parts of the cup prior to testing a sample. Make sure no cleaning solvent is present.

3. Fill the cup with the sample to be tested to the level indicated by the filling mark, and reassemble the apparatus in the standard operating configuration described in ASTM D93.

    a. For the Laboratory Control Standards (LCS/D), fill the cup to the filling mark with *p*-xylene (as purchased) and refrigerate for a short time prior to analysis. Do not allow the standards to freeze.

    b. Analyze a sample matrix duplicate by performing the analysis on two equal aliquots of the same sample. Only samples that flash above the LOQ, should be considered for use as a batch duplicate.

    c. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a *p*-xylene LCSD must be analyzed to demonstrate method precision.

    d. For samples with more than one layer, analyze the surface layer or oil/water emulsion layer. Document the layer analyzed.

    e. For samples known to flash below 75°F - place in the cup, cover with aluminum foil, and place in a freezer prior to an analysis.

4. Engage the locking device.

5. Insert the thermometer.

6. Heat sample at a rate of 9° to 11°F/min.

NOTE: For samples with high suspensions of solids and for highly viscous materials, see Procedure B. Analyst will need to make technical decision.

7. Stop the stirrer during each test flame application.

8. Apply test flame on every other degree Fahrenheit by lowering the test flame into the vapor space of the cup in ½ second, holding the test flame in place for approximately 1 second, and then quickly releasing the controls.

NOTE: If the approximate flash point of a sample is known, the test flame need not be applied until the temperature is within 30° to 50°F of this point.

9. The observed flash point is the temperature, recorded to the nearest degree Fahrenheit, at the time the test flame application causes a distinct flash inside the test chamber.

Do not confuse the true flash point with the "enhanced" flame (bluish halo surrounding the test flame during applications preceding the one that causes the actual flash).

10. If the flash has not occurred by 220°F, quickly switch to the medium- or high-range thermometer.

11. If the test flame extinguishes due to non-flammable vapors, continue the analysis for at least 20°F to be sure the flame continues to extinguish.

12. Always continue the analysis until at least 150°F.

13. In the Notes column of the Worksheet tab in the LIMS, include either an enhanced temperature for samples that flashed or the temperature at which the test flame first consistently extinguished.

B. Procedure B - viscous samples

For samples with high suspensions of solids and for highly viscous materials, follow Procedure A using the following modifications:

1. Increase stir rate to 250 ± 10 rpm.

2. Decrease heating rate to 2° to 3°F/min.

C. Solid samples

Since EPA does not have an official method for the Flash Point determination of solid samples, analyze solid samples using Procedure A with the following modifications:

1. Do not attempt to stir the sample at any time during the Flash Point analysis, as stirring a solid may damage the Pensky-Martens closed-cup flash tester.

2. Report the results with the following non-conformance memo disclaimer (formerly comment #171):

The Pensky Martens closed cup apparatus is designed to determine the flash point of a liquid sample. The sample submitted could not be mixed well enough to obtain uniform heating. The temperature being measured was that of the material near the top of the cup. The material at the bottom of the cup would have a higher temperature. The temperature reported may not be accurate.

Calculations

Corrected flash point = F + 0.06 (760 - P)

Where:

F = Observed flash point in degrees Fahrenheit

P = Ambient barometric pressure, mm Hg

Statistical Information/Method Performance

The practical limit of quantitation is 50°F.

The acceptable range for the p-xylene LCS is 78.5 to 83.49°F.

Quality Assurance/Quality Control

The barometric pressure must be recorded each day the analysis is performed.

Batch size is limited to 20 samples or less.

A LCS of *p*-xylene must be analyzed with each batch of not more than 20 samples.

When sample volume permits, analyze a sample matrix duplicate that flashes above the LOQ, each day the analysis is performed and with each group of not more than 10 samples. When sample volume does not permit, or samples do not meet the above requirement of flashing above the LOQ, then a *p*-xylene LCSD must be analyzed to demonstrate method precision.

>A second sample matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: a non-program deleted duplicate or an LCSD.

See LIMS for current quality control acceptance limits. Follow guidelines in *T-WC-WI10360* for outlier QC data.

10360 Quality Control Data for Wet Chemistry
11183 Thermometer Use and Calibration
11913 Laboratory Notebooks, Logbooks, and Documentation

End of document

Version history

Version	Approval	Revision information	
10	01.NOV.2018		
11	24.NOV.2020		
12	13.SEP.2021		

eurofins	Always check on-line for validity. **Digestion of Hexavalent Chromium in Solids by SW-846 3060A**	Level: **Work Instruction**
Document number: **T-WC-WI10618**		
Old Reference: **1-P-QM-WI-9011687**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **08-OCT-2021**	Document users: **6_EUUSLA_ Instrumental Water Quality_3060A, 6_EUUSLA_Water Quality_24/48 Hour Analyst, 6_EUUSLA_Water Quality_24/48 Hour Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 19	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Purpose	Unnecessary	Removed section
Personnel Training and Qualifications	Clarification	added criteria
Reagents and Standards 12	EPA 3060A	Added buffer pH criteria

Revision 18	**Effective Date:**	24-MAR-2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Current designation	Added current LIMS IDs
Definitions	Current designation	Changed to current LIMS designations
Safety Precautions and Waste Handling	Addition	Added third sentence
Sample Collection, Preservation and Handling	Update for current LIMS	Replaced old analysis numbers with current LIMS designation
Apparatus and Equipment	Transferred to T-WC-WI-11501	Removed 1-cm cell and Kimwipes

Revision	18	**Effective Date:**	24-MAR-2021
Reagents and Standards	Transferred to T-WC-WI-11501		Removed diphenylcarbazide and acetone
Calibration	Transferred to T-WC-WI-11501		Removed calibration curve and spectrophotometer
Procedure B.	Transferred to T-WC-WI-11501		Removed analysis portion of procedure(B) and put it in T-WC-WI-11501.
Calculations	Transferred to T-WC-WI-11501		Removed all calcs and referenced T-WC-WI-11501
Quality Assurance/Quality Control	Transferred to T-WC-WI-11501		Removed CCV instructions and acceptance criteria for QC

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 7196A, July 1992
2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3060A, December 1996
3. *Chemical Hygiene Plan,* current version

Cross Reference

Document	Document Title
T-WC-WI11501	Hexavalent Chromium in waters and Soils (Colorimetric) by SW-846 7196A
T-WC-WI10352	Spectronic Genesys 2 and 10 Vis Spectrophotometers
T-WC-WI11519	pH Probes and Meters
QA-SOP11880	Balance, Syringe, Pipette Verification
T-WC-WI11518	pH by EPA 9045C, 9045D, or 150.1 and Corrosivity by SW-846 Chap 7 of Solids, Soils and Solvents using Electrometric Methods
T-WC-WI11512	Oxidation-Reduction Potential for Wastewaters and Soils by ASTM D1498, SM 2580 B-2011
T-WC-WI10360	Quality Control Data for Wet Chemistry
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11188	Reagents and Standards

Scope

This method is for the digestion of hexavalent chromium in solid wastes. Following the digestion, the extracts are analyzed by either the colorimetric procedure SW-846 7196A or by the Ion Chromatography procedure performed by the Instrumental Water Quality Group (SW-846 7199).

Basic Principles

The solid sample is digested using a hot 3% sodium carbonate/2% sodium hydroxide solution and filtering through a 0.45-µm filter. The pH of the filtrate must then be carefully adjusted. Failure to meet the pH specifications necessitates redigestion of the sample.

Definitions

1. CCV – Continuing Calibration Verification
2. HSS – High Level Soluble Spike
3. ICV – Initial Calibration Verification
4. IS – Insoluble Matrix Spike (MSI)
5. ISD – Insoluble Spike Duplicate
6. Soluble LCS – Laboratory Control Sample, referred to as LCS (5 mg/kg)

7. LCSD – Laboratory Control Sample Duplicate

8. LCSIS - LCS Insoluble Spike (LCSI)

9. PDS – Post Digestion Matrix Spike

10. SS – Soluble Matrix Spike (MSS)

Interferences

When analyzing a sample for hexavalent chromium, it is appropriate to determine the reducing/oxidizing tendency of each sample matrix. This is accomplished by characterizing each sample with additional parameters, such as pH, ferrous iron, sulfides, and oxidation reduction potential. Other indirect indicators of reducing/oxidizing tendency include total organic carbon, chemical oxygen demand, and biochemical oxygen demand. Analysis of these additional parameters is usually requested by the client to establish the tendency of Cr (VI) to exist in the unspiked samples and to assist in the interpretation of QC data for matrix spike recoveries outside the accepted criteria.

Magnesium chloride, in a phosphate buffer, is added to the alkaline extraction solution to suppress possible oxidation of soluble Cr (III). One of the most insoluble forms of chromate in alkaline solution, barium chromate, requires additional heating time to affect complete dissolution in some soil matrices.

Refer to the quantification protocols for additional information on possible interferences.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Use caution when handling any chemicals, solvents, or reagents. Avoid inhalation and skin contact. Standard safe laboratory procedure must be followed as outlined in the Chemical Hygiene Plan.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC consists of four aliquots spiked at 1-4X the RL that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy with a recovery of 50-150% and standard deviation of less than or equal to 20%.

The DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the LCS %recovery acceptance criteria and standard deviation of less than or equal to 20%.

Sample Collection, Preservation, and Handling

Soils are collected in an unpreserved glass container and stored at 0° to 6°C; not frozen. They must be digested within 30 days of sample collection (Method 3060A). Analysis of the digestate must occur within 168 hours.

Apparatus and Equipment

1. Hot plate with magnetic stirrer

2. Vacuum filter apparatus with 0.45-µm filters – Gelman Sciences membrane 47 mm or equivalent or Whatman glass microfibre filters 42.5 mm or equivalent

3. Spectrophotometer for use at 540 nm

4. Class A glassware and pipettes – 50-, 100-, and 250-mL beakers, 50-mL graduated cylinder, 100-mL volumetric flasks, and assorted pipettes

5. Watch glass covers for 250-mL beakers

6. Thermometer (NIST traceable or equivalent)

7. Calibrated pH meter

8. Calibrated balance

9. Analytical balance capable of weighing to .0001 g

10. pH indicator paper

Reagents and Standards

Alternative weights and volumes are allowed as long as the final concentration remains the same. See *QA-SOP11188* for appropriate labeling and documentation of reagents and standards preparation.

1. NaOH, Na2CO3, K2HPO4, KH2PO4 – Stored at room temperature, re-evaluated yearly.

2. Reagent water is defined as water in which an interferant is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory must meet these criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

3. Digestion solution – In a 2-L glass volumetric, dissolve 60.0 ± 0.05 g Na2CO3 and 40.0 ± 0.05 g NaOH in reagent water and dilute to 2 L. Solution expires 30 days from date of preparation. Store at room temperature. The pH of the digestion solution must be checked before use each day using pH indicator paper. Record the pH of the solution in the Batch Notes section in LIMS. The pH must be 11.5 or greater; if not, discard.

4. 5.0 M nitric acid, analytical reagent grade - Purchased, or dilute 320 mL of concentrated nitric acid with reagent water to 1 L in a volumetric flask. See label for expiration date. Do not use concentrated nitric acid to prepare 5.0 M solution if it has a yellow tinge. Store at 20° to 25°C in the dark. Use a fresh portion from stock each time the analysis is run.

5. Sulfuric acid, 10% (v/v) – Add 10 mL of concentrated sulfuric acid to approximately 70 mL of reagent water. Mix well and let cool. Dilute to 100 mL with reagent water. Solution expires 1 year from date of preparation. Store at room temperature in a glass container.

6. Potassium dichromate stock solution (50 mg/L Cr+6) – In a 1-L glass volumetric, dissolve 0.1414 ± .0001 g K2Cr2O7 (dried for 4 hours at 105° ± 2°C) in reagent water and dilute to 1 L . This standard expires 6 months from date of preparation. Store at room temperature in a glass container.

7. Working chromium solution (5 mg/L Cr+6) – Dilute 10.0 mL of potassium dichromate stock solution to volume in a 100-mL volumetric flask with reagent water. Prepare fresh daily.

NOTE: A separate stock solution must be prepared using a different source for K2Cr2O7. **This second stock solution must be used for preparation of the calibration curve only.**

8. 5.0 mg/kg LCS (Soluble LCS)/ICV/CCV – Pipette 2.5 mL of 5 mg/L hexavalent chromium working standard into approximately 2.5 g glass beads and add 50 mL of digest solution. Prepare fresh daily.

NOTE: For the Soluble LCS use 30 glass beads spiked with 2.5 mL of a 5 mg/L Working Standard solution. The weight assigned for each of these is 2.50 grams. The resulting concentration for the Soluble LCS is 5 mg/kg.

9. Lead chromate, PbCrO4, analytical reagent grade. See label for expiration date. Store at room temperature.

10. LCS Insoluble Spike (LCSIS LCSI) - Add 10 to 20 mg of PbCrO4 to approximately 2.5 g of glass beads

NOTE: Refer to Quality Assurance section for instructions for preparation of other quality control samples (Blank, PDS, MSS, MSI, and HSS)

11. Magnesium chloride, MgCl2 (anhydrous), analytical reagent grade. Store at room temperature. See label for expiration date.

12. Phosphate buffer, 0.5M K2HPO4/0.5M KH2PO4. This buffer is prepared in the Water Quality Dept. (4029)

In a 1-L glass volumetric flask, dissolve 87.09 ± .05 g K2HPO4 and 68.04 ± .05 g KH2PO4 into approximately 700 mL of reagent water. Dilute to volume with reagent water. The pH must be 7.0 +/- 0.5. Record the pH of the phosphate buffer

in LIMS. If the pH of the phosphate buffer is not within range, discard the solution and re-prepare.

Solution expires 6 months from the date of preparation.

Store solution at 0° to 6 °C; not frozen; in a glass or plastic container.

13. Glass beads – purchased; see container for shelf-life and storage information

Calibration

A. Balances must be calibrated each day before use. Refer to *QA-SOP11880*.

B. pH meters must be calibrated each day before use. Refer to *T-WC-WI11519*.

Procedure

A. Sample preparation and digestion

1. Place 2.5 ± 0.10 g of the as-received sample, a stir bar, and 50 mL of digestion solution (using a graduated cylinder) into a 250-mL beaker. Add approximately 400 mg of MgCl2 and 0.5 mL of the phosphate buffer. Cover with a watch glass.

2. Stir the samples continuously (unheated) for at least 5 minutes using an appropriate stirring device. Heat the sample and maintain a temperature range of 90° to 95°C with constant stirring for 60 minutes. Do not allow sample to go to dryness; it is possible for hexavalent chromium to be lost due to side reactions in the sample matrix.

3. The temperature during digestion must be recorded at the 30 minute and 60 minute interval of digestion.

4. After the digest has cooled to room temperature, filter it quantitatively through a 0.45-µm filter. Rinse the filtering apparatus with reagent water and transfer the filtrate and the rinses to a clean 250-mL beaker.

9. **Slowly, and with constant stirring, add 5.0 M nitric acid to the beaker dropwise**. For samples to be analyzed by SW-846 7196A, adjust the pH of the solution to 7.5 ± 0.5 while monitoring the pH with a pH meter.

10. Record the pH in the worksheet in LIMS.

11. If the pH of the solution drops below 7.0, discard the solution and re-digest. If overshooting of the pH 7.5 ± 0.5 occurs repeatedly, prepare a diluted nitric acid solution and repeat the digestion procedure.

12. If a flocculent precipitate forms, the sample must be filtered through a 0.45-µm membrane filter. If the filter becomes clogged using the 0.45-µm filter paper, a larger pore size filter paper (Whatman GFB or GFF) is used to pre-filter the samples.

NOTE: When the digest is to be analyzed by SW-846 7199, adjust the pH of the solution to 9.0 ± 0.5 while monitoring the pH with a pH meter. If the pH of the solution drops below 8.5, discard the solution and redigest. If overshooting of the pH 9.0 ± 0.5 occurs repeatedly, prepare a diluted nitric acid solution and repeat the digestion procedure.

13. Quantitatively transfer the contents of the beaker to a 100-mL volumetric flask and dilute to volume with reagent water. Mix well.

14. The extracts are now ready for analysis by SW-846 7196A or SW-846 7199. Analyze using T-WC-WI-11501.

15. When samples are digested for analysis by SW-846 7196A, enter the digests under Method 7196A / 3060A. When samples are digested for analysis by SW-846 7199, enter the digests under Method 7199_ORGFM / 3060A_IC.

Calculations

Refer to *T-WC-WI11501* for calculations.

Statistical Information/Method Performance

The method detection limit (MDL) is determined annually by following the procedure outlined in *QA-SOP11892*.

The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

See Quality Assurance/Quality control section of *T-WC-WI11501* for acceptance criteria and corrective actions.

All quality control samples are digested under the same conditions as client samples.

A digestion batch contains a maximum of 20 samples.

NOTE: For the Blank use 30 glass beads. For the Soluble LCS use 30 glass beads spiked with 2.5 mL of a 5 mg/L Working Standard solution. The weight assigned for each of these is 2.50 grams. The resulting concentration for the Soluble LCS is 5 mg/kg.

One blank (prepared by adding approximately 2.5 g of glass beads to 50 mL of digest solution – see NOTE above) and two duplicates must be analyzed with every batch.

NOTE: The 5 mg/kg LCS/ICV/CCV and the LCSIS preparation are documented in the reagent and standards section.

Both soluble and insoluble predigestion matrix spikes must be analyzed per batch (not more than 20 samples).

The soluble matrix spike (SS) is spiked with 2.0 mL of stock standard (equivalent to 40 mg/kg Cr+6) or at twice the sample concentration, whichever is greater.
When a high level soluble spike (HSS) is requested, a 400 mg/kg HSS is analyzed.

The insoluble matrix spike (MSI) is prepared by adding 10 to 20 mg of PbCrO4 to a separate sample aliquot. The matrix spike is then carried through the digestion process.

A post-digestion matrix spike (PDS) must be analyzed per batch (not more than 20 samples). This spike must be equivalent to 40 mg/kg or twice the sample concentration, whichever is greater.

NOTE: Do not spike the PDS until after the analysis of the original sample. Use the same sample for the PDS as was used for the pre-spike. If the post-digestion matrix spike is not within quality control limits, the entire batch must be redigested/reanalyzed.

Follow Any Notes in LIMS for any additional unique client requirements.

10352 Genesys 30 Spectrophotometer
10360 Quality Control Data for Wet Chemistry
11188 Reagents and Standards
11501 Hexavalent Chromium in Waters and Soils (Colorimetric) by SW-846 7196A
11512 Oxidation-Reduction Potential for Wastewaters and Soils by ASTM D1498, SM 2580 B-2011
11518 pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometic Methods
11519 pH Probes and Meters
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information	
17	05.SEP.2018		
18	10.MAR.2021		
19	05.OCT.2021		

eurofins	Always check on-line for validity. **Ignitability of Solids by 40 CFR, Part 261.21**	Level: **Work Instruction**
Document number: **T-WC-WI10627**		
Old Reference: **1-P-QM-WI-9012741**		
Version: **9**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **15-FEB-2022**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing, LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision:	9	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure	Updated to reflect current Procedure		Updated for Clarity

Revision:	8	**Effective Date:**	Nov 9,2015
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in EtQ		Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers

Revision:	8	**Effective Date:**	Nov 9,2015
Document Title	Enhancement		Add method: Ignitability of Solids by 40 CFR, Part 261.21
Sample Collection, Preservation and Sampling	Reflects current industry standards		Replaced 4° ± 2°C with 0° to 6°C, not frozen.

Reference

1. *40 CFR, Part 261.21*.

2. *Chemical Hygiene Plan,* current version.

Cross Reference

Document	Document Title
T-WC-WI10437	Flash Point for Liquids and Solids by ASTM D93, EPA 1010A, or EPA 1010B

Scope

This method is applicable to testing solid samples for ignitability. Analyze liquid samples using EPA 1010/1010A/1010B.
The overall test allows clients to classify their solid waste for the RCRA characteristic of ignitability using the definitions listed in the *Code of Federal Regulations* (40 CFR 261.21).

Basic Principles

The CFR defines a solid waste as ignitable if "it is not a liquid and is capable, under conditions of standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard."

Since no official method exists for checking ignitability of solids, this in-house method was developed after consultation with the US EPA and Texas Water Commission.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Analysts are considered proficient when they have successfully demonstrated competency under supervision of a group leader or other trained analyst.

Sample Collection, Preservation, and Handling

Samples for the analysis must be unpreserved, collected in glass containers and refrigerated at 0° to 6°C, not frozen, up to the time of analysis. Analyze at room temperature within 28 days of collection.

Apparatus and Equipment

1. Crucible, aluminum pan, or equivalent

2. 400 grit size sandpaper, or equivalent

3. Pensky-Martens closed cup tester

4. Glass stirring rod, or equivalent

5. Pan balance or equivalent.

6. Bunsen burner (needed for samples that yield a positive flash during the closed-cup portion of the analysis)

Reagents and Standards

Not applicable to this procedure.

Calibration

Balances must be calibrated each day before use. Refer to *QA-SOP11880*.

Procedure

1. Weigh approximately 5 g of sample. Leave the sample in contact with air for a few minutes. If the sample shows any signs of spontaneous combustion upon exposure to air, it is considered spontaneously ignitable.

2. Add approximately 5 mL of reagent water , to approximately 5 g of sample. Observe the sample at all times for signs of combustion. If the sample shows any signs of combustion upon contact with water, it is considered ignitable.

3. Using a glass-stirring rod, rub approximately 1 g of sample against extremely fine sandpaper (400 grit size). Perform this test under a hood. Maintain a safe working distance from the sample. If the sample shows any signs of combustion during the test, it is considered ignitable by friction.

4. Fill the cup of a closed-cup flash point tester half full with sample. Allow the sample to sit in the closed cup for 5 minutes at room temperature, then test the sample for ignitable fumes following Method 1010A, **except do not stir and do not heat the sample.** If the fumes ignite, it is considered ignitable by a closed-flame source. If the fumes do ignite, proceed to Step 5.

5. If the fumes do ignite in Step 4, hold an approximately 5 g portion of the sample over a Bunsen burner to confirm the sample itself is ignitable. Another analyst should observe for safety and to confirm that the sample is ignitable. Remove sample from the flame and carefully document all reactions in LIMS.

Calculations

No calculations are needed for this analysis.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

No quality assurance procedures are available for this analysis.

10437 Flash Point for Liquids and Solids by ASTM D93, EPA 1010A or EPA 1010B
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment

---

End of document

Version history

Version	Approval	Revision information	
8	09.NOV.2015		
9	15.FEB.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **S-SS-WI10697**	**% Moisture Calculation and % Solids Calculation (Gravimetric)**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015065**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **UCSS** Effective Date: **14-MAY-2021**	Document users: **5_EUUSLA_Sample Support_Manager, 6_EUUSLA_ Sample Support_Moisture/Puck Mill**	Responsible: **5_EUUSLA_Sample Support_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Calibration
Procedure
Calculations
Quality Assurance/Quality Control

Revision Log

Revision: 19		**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision log up to previous version
Procedure A	Clarification		Clarified the oven documentation
Reference	Requirement		Removed 2540 G references, added local method
Calibration	Clarification		Changed the balance type used
Sample Collection, Preservation, and Handling	Requirement		Added section on dealing with samples possibly containing explosives

Revision: 18		**Effective Date:**	08 Jun 2020
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision log up to previous version.

Revision: 18	**Effective Date:** 08 Jun 2020	
Scope	Requirement Clarification	Added EPA Region 1 process Removed obsolete account# and added new LIMS method references
Procedure A.	Clarification	Moved %moisture process to section A. Changed process for TALS
Procedure B.	Requirement	Added EPA Region 1 process
Apparatus and Equipment	Clarification	Changed the balance type used

Reference

1. Moisture - Percent Moisture, Local Method. Determination of dry weight correction reporting.

2. *Chemical Hygiene Plan*, current version.

Scope

This method is for the determination of moisture in most solid and semisolid samples. Percent solids are then determined by calculation.

If clients request EPA Region 1 guidance regarding solid and sediment samples, %solids evaluation and centrifuging/decanting is performed as needed following Procedure B. in this SOP.

Basic Principles

A measured amount of sample is placed in an empty tared pan and dried in an oven at 103° to 105°C. The decrease in weight of the sample, after drying, is calculated as the moisture content of the sample.

Reference Modifications

The method has been modified by using purchased aluminum foil pans that are not preconditioned, as this step is unnecessary.

%Moisture- Dry Wt Calculation requires multiple weights to be taken until the change in weight from the previous weight is within 4% or 50 mg (whichever is less). The modification is based on a study that was performed which determined that a constant weight was achieved after the initial drying cycle and therefore multiple weights were not necessary.

Interferences

The determination of moisture in solid and semisolid materials is subject to error due to loss of ammonium carbonate and volatile organic matter during drying.

Non-representative, nonhomogeneous materials, such as stones, are excluded from the analysis if their inclusion is not desired in the final result.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local state laws and regulations.

See Chemical Hygiene Plan for general information regarding employee safety, waste management and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

Initially, each technician performing the analysis must work with an experienced technician for a period of time until they can independently perform the analysis.

Sample Collection, Preservation, and Handling

Samples for moisture analysis must be kept in an unpreserved container and refrigerated at 0 to 6°C, not frozen.

Samples submitted for explosives must have a visual check performed by the analyst looking for any discolorations in the soil or small objects that look like metal. If observed a supervisor must be informed to review the sample before proceeding.

Apparatus and Equipment

1. Disposable aluminum foil pans, or equivalent

2. Oven maintained at 103° to 105°C. Adjust as needed to stay in this range.

3. Top Loading balance

4. Desiccators, or equivalent.

5. 6 X 3/4 Tongue Blades or equivalent

6. 1/10 inch opening pipette

7. TALS is computer program that integrates a PC with a balance to collect data directly from the balance. It also organizes the data, performs calculations and transmits the final results to the central computer system.

Calibration

Refer to routine lab practices for calibration procedures for top loading balances.

Procedure

A. Percent Moisture

1. Verify that the balance calibration check has been performed each day before use.

2. Set up the batch in TALS creating a SRF if requesting the samples. Moisture can be done in conjunction with sample splitting by scanning the samples to a batch as you go.

3. Number (for identification) the purchased disposable aluminum foil pans before use.

4. Place one aluminum foil pan on a zeroed balance. Record the weight

5. With the aluminum foil pan remaining on the balance, place soil in the foil pan and using the print button on the balance send the weight to TALS

NOTE: Most samples allow the use of a tongue blade for sampling but a pipette with a 1/10 inch opening must be used when sampling liquid sludge's or any matrix with significant amounts of liquid. These sample types must be shaken vigorously before sampling. The sample aliquot must be taken from the middle of the sample directly after shaking the sample.

8. Record the date and time on the TALS batch worksheet and then place the pans containing sample into the oven.

   a. Dry at 103° to 105°C for 8 to 48 hours.

   b. Oven temperatures are monitored and logged in the TALS System through the use of a stationary thermometer.

9. Record the date and time on the LLENS batch worksheet, and then remove the pans containing dried sample from the oven.

10. Cool in a desiccator for 1 hour.

NOTE: Check desiccant to verify that the indicator crystals are still blue and not pink.

11. Again, verify that the balance calibration check has been performed each day before use.

12. Use tongs to place the pan containing dried sample on a zeroed balance. Record weight of pan and dried sample.

B. Client Requested EPA Region 1 Guidance

1. Sample with >70% Moisture must be segregated to be decanted

2. Observe the sample to determine if the sample needs to be centrifuged. If centrifugation is required, contact your supervisor.

3. If there is an aqueous layer on the sediment/soil, decant the aqueous layer.

4. Perform Percent Moisture following Procedure A. on the decanted sample.

Calculations

$$\%moisture = \frac{A - B}{C} \times 100$$

Where:

A = Weight of sample and container before drying (in grams)

B = Weight of sample and container after drying (in grams)

C = Weight of sample before drying (in grams)

Percent solids = 100 - %moisture

Quality Assurance/Quality Control

Calibration verification of the balances must be performed each day before use.

End of document

Version history

Version	Approval	Revision information	
17	21.MAR.2019		
18	27.MAY.2020		
19	30.APR.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-GC-WI10879**	**Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices**	**Work Instruction**
Old Reference: **1-P-QM-WI -9012711**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **04-MAY-2021**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_DP 32 Cleanups, 6_EUUSLA_EPH/Misc. GC_All Management/Verifier/Prin, 6_EUUSLA_EPH/Misc. GC_EPH Chemist, 6_EUUSLA_EPH/Misc. GC_TX Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 12	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced references to old LIMS/data recording with new LIMS

Revision: 11	**Effective Date:**	11-MAR-2020
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reference	Reflects current practice	Removed reference to WA EPH as it is no longer offered. Added reference to LA EPH and TN EPH; removed reference 3630C

Revision: 11	**Effective Date:**	11-MAR-2020
Section	**Justification**	**Changes**
Reference Modifications	Reflects current practice	Added reference modification regarding extract concentration technique
Procedure	Reflects current practice	Removed references to WA EPH as it is no longer offered. Updated step 19 to reflect change

Reference

1. TNRCC TX Method 1006, Characterization of nC6 to nC35 Petroleum Hydrocarbons in Environmental Samples, May 2000.

2. Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), Massachusetts Department of Environmental Protection, revision 1.1, May 2004.

3. Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge Matrices (NJDEP EPH 10/08.).

4. MT-DEQ, Montana Risk-Based Corrective Action Guidance for Petroleum Releases, September, 2016.

5. LA Dept. of Environmental Quality; Risk Evaluation/Correction Action Program (RECAP); Table D-1.

6. Method for Determination of Extractable Petroleum Hydrocarbons by GC/FID TN EPH, December 11, 1998.

7. Test Methods for Evaluating Solid Wastes, SW-846 Method 3630C, December 1996.

8. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-GC-WI10883	Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix
T-OE-GC-WI10890	Separatory Funnel Extraction for EPH in Water or Wastewater by Montana Protocol
T-OE-GC-WI10899	Microwave Extraction for EPH in a Solid Matrix by Montana Protocol
T-OE-GC-WI10902	Ultrasonic Extraction for EPH in a Solid Matrix by Tennessee Methodology
T-OE-GC-WI10909	Microwave Extraction, Method 3546, for MA EPH in a Solid Matrix
T-OE-GC-WI10914	Separatory Funnel Extraction for EPH in Waters by Massachusetts, New Jersey, and Louisiana Protocol

Document	Document Title
T-OE-GC-WI11364	Extraction of Total Petroleum Hydrocarbon Organics in Waters by Texas Methodology
T-OE-GC-WI11365	Extraction of Total Petroleum Hydrocarbons in a Solid Matrix by Texas Methodology
T-GC-WI9672	EPH by Massachusetts Protocol (MAEPH) in Waters and Solids Using GC
T-GC-WI9678	Fractionated EPH using LA RECAP Ranges in Waters and Solids by GC-FID
T-GC-WI9685	MA DEP VPH in Waters and Solids using GC/FID/PID
T-GC-WI9792	TX 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Waters and Solids by GC-FID
T-GC-WI9736	New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This procedure applies to both water and solid samples. A silica gel fractionation is performed in order to separate an extract into an aliphatic and an aromatic fraction prior to GC analysis. Both fractions are then analyzed separately.

Basic Principles

A sample extract is placed on a silica gel column. Fractionation surrogate is added to monitor recovery. See Analysis Method for compounds and preparation. The column is then eluted with pentane for TX analyses and hexane for LA EPH, NJ EPH, MT EPH, and MA EPH analyses to pull off the aliphatic compounds followed by a methylene chloride elution to remove the aromatic compounds. The fractions are then individually concentrated to 1.0 mL.

Reference Modifications

Fractions are concentrated using a Microsnyder extraction instead of a Nitrogen blow down technique as specified in the NJ, MA, MT, and TX methods. This procedure has given acceptable results for this analysis and maintains consistency for this type of cleanup.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity of all compounds used in these procedures has not been established. Each compound must be treated as a potential health hazard. Care must be taken when handling the neat analyte standards. Nitrile gloves must be worn and the procedure performed in a hood to avoid skin and respiratory contact. As most of the samples contain unknown compounds, care must be used in their handling. Pentane and Hexane are highly flammable and must be used away from possible ignition sources. Safety data sheets (SDSs) are available from the Safety Officer.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware) is disposed of in the normal solid waste collection containers.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation and Handling

See the appropriate extraction procedure for holding times and storage conditions.

Apparatus and Equipment

1. 15 mL, 3 g disposable silica gel columns, UCT XRSIH13M15 or equivalent
2. 10-mL ampules
3. GC vials
4. Pipettes – Class A, assorted sizes

5. Syringes – Hamilton or equivalent - appropriate sizes

6. Vacuum chamber for eluting multiple silica gel columns

7. Steam bath – VWR/LLI Model #1127 or equivalent

8. Micro Snyder columns

Reagents and Standards

1. Methylene chloride ($MeCl_2$ or CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. Hexane – Pesticide grade or equivalent. Store at room temperature for up to one year.

3. Acetone – Pesticide grade or equivalent. Store at room temperature for up to one year.

4. NJ EPH fractionation surrogate - See analysis method for preparation, storage, and expiration.

5. MA EPH fractionation surrogate – See analysis method for preparation, storage, and expiration.

6. TX1006 Fractionation spike – See analysis method for preparation, storage, and expiration.

7. Pentane – Pesticide grade or equivalent. Store at room temperature for up to one year.

Calibration

Not applicable to this procedure

Procedure

A. **Fractionation procedure for TX samples:**

1. Allow the extracts to reach room temperature if they were stored in the cold.

2. Assemble the vacuum chamber by screwing the drip tips into the manifold.

   a. Place the valves on top of the drip tips and rinse the tips with acetone.

   b. Place a silica gel column for each sample, labeled with the sample number, on top of the valve.

   c. Be sure the valve is open.

3. Remove the rack from the chamber.

a. Remove the bottom adjustable shelf to allow the ampules to fit into the rack and the manifold to fit on the chamber.

b. Replace the manifold onto the chamber without the rack inside.

4. Rinse the column with acetone (the column filled to the top)

a. Do not apply a vacuum, but let gravity pull the solvent through the column.

b. Collect the rinseate in the vacuum chamber.

c. Repeat.

5. Rinse the column with methylene chloride (the column filled to the top).

a. Do not apply a vacuum, but let gravity pull the solvent through the column until it stops dripping.

b. Collect the rinseate in the vacuum chamber.

6. Rinse the column with pentane (the column filled to the top).

a. Do not apply a vacuum, but let gravity pull the solvent through the column.

b. Repeat the Pentane rinse and close the stop cocks immediately after the column stops dripping.

7. Dispose of the rinseate in the chamber.

8. Place labeled ampules in the rack so that they are lined up with the drip tips of the matching cartridges coming through the manifold.

a. Place the rack into the vacuum chamber and replace the manifold so that the drip tips are in the ampules.

b. Be sure the sample number on the ampule matches the number on the column.

9. Pipette or syringe 1.0 mL of extract onto the column.

10. Open the valves and collect the solvent into labeled 10-mL ampules (labeled “aliphatic”).

a. Do not apply a vacuum, but let gravity pull the sample through the column at a drip rate of approximately 2mL/min.

b. After the extract has drained from the cartridge, immediately add exactly 3.0 mL of Pentane using a Class A graduated cylinder.

c. After the 3.0 mL of Pentane has drained from the cartridge and stops dripping, immediately add exactly 3.5 mL of Pentane using a Class A graduated cylinder.

d. The flow through the column must be a slow drip, approximately 2 mL/min. The valves may need adjusted to increase or decrease the flow rate.

e. Allow the cartridge to drain until all the solvent has been collected in the 10ml ampule.

11. Close the stopcock on the column.

a. Remove the manifold and take out the ampules.

b. This is the aliphatic fraction.

c. Place Micro Snyder columns onto the ampules and concentrate the solvent on a steam bath at 80° to 90°C to just below 1.0 mL.

d. Go to step 17 for bottling procedure.

12. Place a labeled clean 10-mL ampule under each column and replace the manifold (be sure this is labeled "aromatic").

13. Using a squirt bottle fill the column with methylene chloride (approximately 6.0 mL)

14. Open the stopcock and collect the solvent in the 10-mL ampules.

a. Do not apply a vacuum, but let gravity pull the sample through the column at flow rate of approximately 2ml/min. The valves may need adjusted to increase or decrease the flow rate.

b. Allow the full volume of methylene chloride to drain through the column until it stops dripping.

c. After the column stops dripping immediately add approximately 2.0 mL of methylene chloride.

d. Do not apply a vacuum, but let gravity pull the sample through the column at flow rate of approximately 2ml/min. The valves may need adjusted to increase or decrease the flow rate. Allow the columns to drip dry.

15. Close the stopcock on the column.

a. Remove the manifold and take out the ampules.

b. This is the aromatic fraction.

16. Place Micro Snyder columns onto the ampules and concentrate the solvent on a steam bath at 80° to 90°C to just below 1.0 mL.

17. Using a disposable Pasteur pipette quantitatively transfer each fraction to final volume 1.0 mL in a class A volumetric. Use the same solvent used to elute the fraction off the column when bringing to final volume (aliphatic fraction use pentane, aromatic fraction use methylene chloride).

a. Transfer the 1.0 mL fractions of solvent into 2 labeled (aliphatic/aromatic) crimp-top GC autosampler vials.

b. Cap the vials and store in the freezer at ≤-10ºC until analysis.

c. Record the final volume in the LIMS.

B. **Fractionation procedure for MA EPH, MT EPH, NJ EPH, and LA EPH**

1. Allow the extracts to reach room temperature if they were stored in the cold. Hold the bottled extracts up to the light and slowly shake the gc vials to check for oily or thick extracts that need diluted to a higher final volume. Samples that do not require dilution go to step 2.

a. The final volume should be raised if the extracts are thick or oily. The final volume should be raised to a volume that dilutes the extract to a point that the extract flows freely through a disposable pipette. Thick oily extracts will clog the cartridges and cause poor fractionation results.

b. After diluting the sample, a 1.0 mL aliquot of the diluted extract is used for the fractionation procedure. The rest of the diluted extract should be saved until the fractionation procedure is complete. After the fractionation procedure is complete the remainder of the diluted extract should be disposed of in a solvent waste carboy.

c. Make any changes to final volumes in the LIMS. Note in the LIMS the reason any final volumes were raised.

2. Assemble the vacuum chamber by screwing the drip tips into the manifold.

a. Place the valves on top of the drip tips and rinse the tips with acetone.

b. Place a silica gel column for each sample, labeled with the sample number, on top of the valve.

c. Be sure the valve is open.

3. Remove the rack from the chamber.

a. Remove the bottom adjustable shelf to allow the ampules to fit into the rack and the manifold to fit on the chamber.

b. Replace the manifold onto the chamber without the rack inside.

4. Rinse the column with acetone (the column filled to the top)

a. Do not apply a vacuum, but let gravity pull the solvent through the column.

b. Collect the rinseate in the vacuum chamber.

c. Repeat and allow the column to go dry.

5. Rinse the column with methylene chloride (the column filled to the top) and allow the column to go dry.

a. Do not apply a vacuum, but let gravity pull the solvent through the column.

b. Collect the rinseate in the vacuum chamber.

6. Rinse the column with Hexane (the column filled to the top).

a. Do not apply a vacuum, but let gravity pull the solvent through the column.

b. Repeat the hexane rinse and close the valve as soon as the column stops dripping.

7. Dispose of the rinseate in the chamber.

8. Place the labeled 10-ml ampules in the rack so that they are lined up with the drip tips of the matching cartridges coming through the manifold.

a. Place the rack into the vacuum chamber and replace the manifold so that the drip tips are in the ampules.

b. Be sure the sample number on the ampule matches the number on the column.

9. Un-crimp the gc vial containing the 1.0 mL of extract and pour the extract into the fractionation column.

a. Add hexane to the empty gc vial to the 0.5 mL line on the vial. Do not fill the vial past the 0.5 mL line or breakthrough of the aromatic fraction into the aliphatic fraction could occur.

b. Pour the 0.5 mL of hexane from the gc vial into the fractionation column.

10. This step is performed only for MA EPH, MT EPH, NJ EPH, and LA EPH samples.

Use a pipette or syringe to add surrogate as follows:

a. If the sample is for MA EPH, MT EPH, or LA EPH add 0.5 mL of MA EPH fractionation surrogate (OP_MAFRAC_SS) onto the column.

b. If the sample is in for NJ EPH, using a pipette or syringe, add 0.5 mL NJEPH fractionation surrogate (OP_NJFRAC_SS).

11. Open the valves and collect the solvent into labeled 10-mL ampules (labeled “aliphatic”).

a. Do not apply a vacuum, but let gravity pull the sample slowly through the column at rate of approximately 2ml/min. The valve may need adjusted to increase or decrease the flow rate.

b. After the extract has drained from the cartridge and stops dripping, immediately add exactly 3.0 mL of hexane using a Class A graduated cylinder. Drain the hexane slowly through the column using gravity at a flow rate of approximately 2mL/min. The valves may need adjusted to increase or decrease the flow rate.

c. After the 3.0 mL of hexane has drained from the cartridge and stops dripping, immediately add exactly 3.5 mL of hexane using a Class A graduated cylinder

d. The hexane should slowly drain through the column at a rate of approximately 2 mL/min. The valves may need adjusted to increase or decrease the flow rate.

e. Allow the cartridge to drain until all the solvent has been collected in the 10-mL ampule.

12. Close the stopcock on the column.

a. Remove the manifold and take out the ampules.

b. This is the aliphatic fraction.

13. Place a labeled clean 10-mL ampule under each column and replace the manifold (be sure this is labeled “aromatic”).

14. Using a squirt bottle fill the column with methylene chloride (approximately 6.0 ml)

15. Open the stopcock and collect the solvent in the 10-mL ampules.

a. Do not apply a vacuum, but let gravity slowly pull the sample through the column. The methylene chloride should slowly drain through the column at flow rate of approximately 2mL/min. The valves may need adjusted to increase or decrease the flow rate.

b. Allow the full volume of methylene chloride to drain through the column until it stops dripping.

16. Immediately add approximately 2.0 mL of methylene chloride to the column.

17. Open the stopcocks and using gravity slowly drain the methylene chloride at a drip rate of approximately 2mL/min. until the column stops dripping. The valves may need adjusted to increase or decrease the flow rate.

18. Close the stopcock on the column.

a. Remove the manifold and take out the ampules.

b. This is the aromatic fraction.

19. Place micro-snyders on the ampules of the fractionated extracts and concentrate the extract on a steam bath to just below 1.0 mL.

a. Concentrate the Aliphatic extracts on a steam bath set to ≤95°C.

b. Concentrate the Aromatic extracts on a steam bath set to ≤90°C until an apparent volume of 2-3 mL is achieved, then use a steam bath set to ≤95°C to microsnyder slightly below 1.0 mL.

20. Using a disposable Pasteur pipette quantitatively transfer each fraction to final volume 1.0 mL in a class A volumetric. Use the same solvent used to elute the fraction off the column when bringing to final volume (aliphatic fraction use hexane, aromatic fraction use methylene chloride).

a. Transfer the 1.0 mL fraction of solvent into two labeled (aliphatic/aromatic) crimp-top GC autosampler vials.

b. Cap the vials and store in the freezer at ≤-10ºC until analysis.

c. Record the final volume in the LIMS.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

See analysis method.

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
10883 Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix
10890 Separatory Funnel Extraction for EPH in Water or Wastewater by Montana Protocol
10899 Microwave Extraction for EPH in a Solid Matrix by Montana Protocol
10902 Ultrasonic Extraction for EPH in a Solid Matrix by Tennessee Methodology
10909 Microwave Extraction, Method 3546, for MA EPH in a Solid Matrix
10914 Separatory Funnel Extraction for EPH in Waters by Massachusetts, New Jersey, and Louisiana Protocol
11364 Extraction of Total Petroleum Hydrocarbon Organics in Waters by Texas Methodology
11365 Extraction of Total Petroleum Hydrocarbons in a Solid Matrix by Texas Methodology
9672 EPH by Massachusetts Protocol (MA EPH), LA RECAP Ranges (LAEPH) and Montana DEQ (MT EPH) in Waters and Solids Using GC
9678 Fractionated EPH using LA RECAP Ranges in Waters and Solids by GC-FID
9685 VPH in Waters and Solids Using GC/FID/PID
9736 New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID
9792 TX 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Waters and Solids by GC-FID

End of document

Version history

Version	Approval	Revision information	
10	07.AUG.2018		
11	26.FEB.2020		
12	04.MAY.2021		

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9012711_9_0497.doc
Errortext: Unable to fetch attachment

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-GC-WI10883**	**Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix**	**Work Instruction**
Old Reference: **1-P-QM-WI -9012864**		
Version: **6**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-DEC-2021**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_TPH Soils, 6_EUUSLA_EPH/Misc. GC_All Management/Verifier/Prin, 6_EUUSLA_EPH/Misc. GC_EPH Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 6		**Effective Date:**	This Version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure 6b1a	Current Process		Added spike used during NJEPH Screen

Revision: 5		**Effective Date:**	November 4, 2020
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout Document	current process		Updated to current LIMS terms
Procedure 13.-23.	current process		replaced rapid-vap with K-D

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, February 2007.

2. Analysis of Extractable Petroleum Hydrocarbon Compounds (EPH) in Aqueous and Soil/Sediment/Sludge Matrices (NJDEP EPH 10/08.)

3. MARS Operation Manual, Revision 2, February 2006.

4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title

Document	Document Title
T-OE-GC-WI10879	Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
T-GC-WI9736	New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope
This procedure is for the extraction of petroleum hydrocarbons from soils or solid wastes by New Jersey protocol (method codes NJEPH and NJEPH_Screen).

Basic Principles
A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is loaded into the instrument and extracted. The organic compounds present in the soil dissolve in the solvent, which is then removed. The sample is concentrated and bottled. A screen may be performed and/or the extract is fractionated.

Reference Modifications
1. The joint of the K-D is not rinsed with fresh solvent when the ampule is removed in the Procedure Step 18. Quad and MDL studies have shown that this step is unnecessary.

2. The silica gel fractionation listed in the method is not followed. Instead, the method listed in *T-OE-GC-WI10879* is followed. This method has given acceptable results for this analysis and maintains consistency for all of this type of cleanup.

Definitions
1. DUP – Duplicate

2. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

3. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

4. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences
Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling
All laboratory waste is accumulated, managed, and disposed in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.
Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0º to 6º C, not frozen, prior to extraction. Samples must be extracted within 14 days of collection and extracts are stored in the freezer at -10º to -15ºC.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during concentration
3. Steam bath, VWR/LLI Model #1127 or equivalent
4. Micro-Snyder columns
5. Beakers – stainless steel, assorted sizes
6. Pipettes – Class A, assorted sizes
7. Pipettes – disposable
8. Balance – capable of weighing to 0.01 g
9. Sodium sulfate columns
10. Teflon™ wash bottles
11. Vials – assorted sizes
12. Teflon™ boiling chips
13. Forceps
14. Scoop

15. Frits – various sizes

16. Funnels – stainless steel or Teflon™

17. Extraction vessels

Reagents and Standards

1. Sodium Sulfate (Na2SO4) – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

2. Methylene chloride (CH2Cl2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

3. Hexane – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

4. Ottawa sand or equivalent

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical SOP *T-GC-WI9736*.

Preparation of Glassware

See *T-OE-GEN-WI10864*

Calibration

Not applicable to this procedure.

Procedure

1. Weigh out 10.0 -10.5 g of sample into a stainless steel beaker.

NOTE: Alternate weights may be required to meet certain limits. If over 30 g is to be used, divide the sample among multiple vessels and combine the extracts.

2. The background, MS, and MSD are performed on three separate aliquots of a field sample.

3. The Blank, LCS, and LCSD (if applicable) are prepared by filling a Teflon™ extraction vessel with 15 g of sodium sulfate.

Record 10.0 g on the extraction log which is the "sample" weight and the additional 5 g represents the sodium sulfate added to each vessel. Skip to Step 5.

4. Add 5 g of sodium sulfate to each sample and mix.

   a. If the sample has high water content or is a clay-like soil, then add an additional 10 g of sodium sulfate.

   b. Mix the sodium sulfate and sample until a free-flowing consistency is reached.

5. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is be used to prevent spillage and loss of sample.

6. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates – 1.0 mL of MA/WA/NJ EPH surrogate (OP_MASS/NJ_SS) is added to all samples, blanks, and spikes.

   b. Spiking solutions – Spiking solutions are added to the laboratory control sample (LCS), LCSD if applicable, matrix spike, and matrix spike duplicate samples.

      (1) Add 1.0 mL New Jersey EPH spike (OP_NJEPH_MS).

a. If this is in for New Jersey EPH Screen prepare with 1.0 mL of New Jersey EPH Screen spike (OP_NJSCREEN)

(2) Spikes are changed to accommodate specific client requirements as appropriate.

(3) See *T-OE-GEN-WI10876* for storage and handling of spikes.

7. Add 30 mL of methylene chloride to each vessel.

8. Cap each vessel according to manufacturer's guidelines.

9. Invert each vessel to ensure mixing of sample and solvent.

10. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

11. Run Program "LL Soils". Verify that the run temperature has reached 100°C and document this on the batch log.

Instrument Conditions	
Power:	1600W
Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

12. Uncap the cooled vessel.

13 Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a K-D assembly containing Teflon™ boiling chips.

14. Rinse the vessel with 10 to 20 mL of methylene chloride from a wash bottle and pour the rinse onto the sodium sulfate column.

15. Place a 3-Ball Snyder column on the K-D set-up, wet the column with methylene chloride, and concentrate over a steam bath at 85° to 99°C.

(This steam bath temperature ensures concentration in a reasonable length of time.)

NOTE: Use the type of ampule normally used for pesticide extractions to allow the sample to concentrate after the hexane exchange.

16. When the apparent volume in the ampule is 3 to 5 mL, use a graduated cylinder to add approximately 50 mL of hexane directly to the KD through the Snyder column.

Do not allow the ampule to go dry to avoid loss of analytes.

17. When the apparent volume in the ampule again reaches 3 to 5 mL remove the sample from the bath and allow to cool for 10 minutes.

18. Remove the ampule and stopper the ampule if fractionation is not to be performed immediately.

19. Microsnyder the sample to just below 1 mL.

20. Bring the samples to a final volume of 1.0 mL in hexane by quantitatively transferring the extract from the rapid vap tubes into a class A 1.0 mL volumetric.

21. Bottle the extracts in one amber gc vial and cap.

22. Samples that do not require fractionation (i.e., there is no 3630C in the method chain) are delivered to the analytical department.

a. Deliver the extracts to the analytical department.

b. After screening (NJEPH_Screen), the analytical group sends notification of which samples on the batch require the 3630C fractionation.

23. Samples that require fractionation (LIMS code 3630C) should be placed in the dept. 36 fridge.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples a blank, LCS, LCSD, MS and MSD must be extracted. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
10879 Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
9736 New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID

End of document

Version history

Version	Approval	Revision information	
4	24.OCT.2019		
5	04.NOV.2020		
6	29.DEC.2021		

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9012864_3_1097911990.doc
Errortext: Unable to fetch attachment

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C, 608, or 608.3 for Pesticides and PCBs in a Wastewater**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10920**		
Old Reference: **1-P-QM-WI -9015079**		
Version: **22**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **15-APR-2022**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Waters, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Preparation of Glassware
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision 22		**Effective Date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced references to old LIMS with the new LIMS
Throughout Document	Update	Removed references to 8141/622 testing
Procedure	Update	Removed references to 1L pesticide prep
Procedure 19a, 22a	Reflects current practice	Changed concentration timer from 10 minutes to 8 minutes

Revision 22		**Effective Date:** This version
Sample Collection, Preservation, and Handling	Update	Updated hold time statement to reflect accurate hold times
Procedure 22b	Clarification	Added that the sample should be brought up to volume with Methylene Chloride
Procedure 24-27	Clarification	Changed references for which prep to the analytical common name instead of the SOP

Revision 21		**Effective Date:** December 02, 2019
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure 7.a.	Reflects current procedure	Changed verbiage from shake to swirl

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev. 3, December 1996.
2. USEPA, 40 CFR Part 136, Appendix A, Method 608.
3. USEPA, 40 CFR Part 136, Appendix A, Method 608.3, December 2016. MUR Effective September 2017.
4. USEPA, 40 CFR Part 136, Appendix A, Method 622.
5. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-PEST-WI9998	Pesticides in Water by Method 8081A and 8081B using GC-ECD
T-PEST-WI9843	CLIENT SPECIFIC - Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD
T-PEST-WI11971	Polychlorinated Biphenyls (PCBs) by Method 608.3 or 8082 in Waters
T-PEST-WI9997	Pesticides in Aqueous Samples by Method 608
T-PEST-WI9238	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD
T-PEST-WI9961	Low Level PCBs in Water by Method 8082/8082A using GC-ECD
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by Method 3640A
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-OE-GEN-FRM23822	Instructions for Checking pH During Extraction Procedures

Purpose

The purpose of this SOP is to provide clear instructions for performing the separatory funnel extraction procedure on samples that are to be analyzed for pesticides and PCBs.

Scope

This procedure is for the extraction of organochlorine and organophosphorous pesticides and PCBs from wastewaters.

Basic Principles

An aliquot of the sample is placed into a separatory funnel. The volume of sample extracted is adjusted (if appropriate) depending on the physical appearance of the sample and the volume sent for analysis.
A surrogate standard is added to the sample to monitor recovery. The sample is then extracted with methylene chloride. The extract is dried, concentrated, and exchanged to hexane. Several cleanup procedures are available to eliminate matrix interferences before the sample is analyzed. They include sulfuric acid treatment, copper treatment, florisil, and Gel-Permeation Cleanup (GPC).

Reference Modifications

1. Surrogate and matrix spiking solutions are not added before the transfer to the extractor. For several reasons:

   a. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

   b. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

   c. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

   d. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

2. In Procedure Step 19 the joint of the KD is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is

maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles with PTFE-lined lids, preserved with sodium thiosulfate, and stored refrigerated at 0 - 6°C, not frozen. The sample hold times are 365 days unless collected from New Jersey or requested as shorter by the client for PCB samples. The sample hold times are 7 days starting from day of collection for Pesticide samples. Extracts are stored frozen at less than or equal to -10°C.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction

3. Water bath – VWR/LLI Model #1127 or equivalent

4. Sodium sulfate column with extra course frit

5. Nitrogen evaporation (N-Evap) with nitrogen supply – Organomation Associates or equivalent

6. pH paper – Wide range

7. Automatic shaker – Glass Col or equivalent, capable of holding 2-L separatory funnels

8. Pipettes – Class A, assorted sizes

9. Graduated cylinders – Class A, assorted sizes

10. Pipettes – Disposable

11. Solvent dispenser – Brinkmann, adjustable or equivalent

12. Balance – Capable of weighing to 0.01 g

13. Centrifuge – Beckman GS-6 or equivalent

14. Micro-Snyder columns

15. Wash bottles – Teflon

16. Vials – Assorted sizes

17. Teflon boiling chips

18. Syringes - Assorted sizes

19. Micro-pipetter

20. Automated Water Extraction Bench – capable of holding separatory funnels for 250 mL extractions.

21. Rapid-Vap Evaporators – for concentration of 250 mL extractions

22. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH2Cl2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

3. Hexane – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

4. 10N Sodium hydroxide (NaOH) – Lab Chem or equivalent. Store at room temperature. Follow manufacturer's expiration date.

5. Sulfuric acid (H2SO4) – ACS grade or equivalent. Store at room temperature. Follow manufacturer's expiration date.

6. Sodium Sulfate (Na2SO4) – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan to remove organic contaminants. Store in a glass jar at room temperature for up to 1 year after baking.

7. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

8. Extraction fluid – Prepared and delivered by the leachate department. Store refrigerated at 0-6°C, not frozen, in a glass container with a PTFE-lined lid.

9. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in *T-PEST-WI9998*, *T-PEST-WI9843*, *T-PEST-WI11971*, *T-PEST-WI9997*, *T-PEST-WI9238*, *T-PEST-WI9961*.

Calibration

Not applicable to this procedure.

Preparation of Glassware

See SOP *T-OE-GEN-WI10864*.

Procedure

1. Determine the volume of sample to be used for each extraction. Typically, this is 1L or 250 mL. For 1311/8081: 50 mL of sample is measured from the sample bottle and diluted to 250 mL in a sep funnel.

1 Liter Analyses: *T-PEST-WI9961*

250 mL Analyses: *T-PEST-WI9998*, *T-PEST-WI9843*, *T-PEST-WI11971*, *T-PEST-WI9997*, *T-PEST-WI9238*

a. If uncertain of the volume to extract for any sample, ask your supervisor.

b. Use one full bottle for all analysis scans (with the exception of 1311/8081) unless the matrix is poor (thick, lots of sediment, extremely foul odor).

(1) If using reduced volume due to matrix, take as much as possible while trying to minimize matrix problems, document why the reduced volume was used.

(2) Reduced volume aliquots due to matrix are typically are 500, 200, or 100 mL (100, 50, or 25 mL for 250 mL extractions).

c. For 1311/8081:

(1) If the sample bottle contains at least 100 mL of sample, measure 50 mL.

(2) If the sample bottle contains <100 mL of sample, use 1/2 of the available volume or 10 mL, whichever is greater.

(3) If a matrix spike (MS) or MS/matrix spike duplicate (MSD) is required for the sample, use 50 mL each.

(4) After adding the 50 ml of sample add approximately 200 mL of Di water to bring the volume in the sep funnel to 250 mL.

d. The background, MS, and MSD are performed on three separate aliquots of a field sample.

2. Prepare the blank, laboratory control sample (LCS), laboratory control sample duplicate (LCSD) (if applicable) with 1 L of reagent water (or 250mL for 250 mL extractions) measured into the separatory funnel.

Exception: For 1311/8081 - The blank, LCS, and LCSD (if applicable) are prepared using 50 mL of extraction fluid measured into the separatory funnel. Add approximately 200 mL of DI water to bring the volume to 250 mL.

3. For samples using 1 entire bottle:

a. Weigh the entire bottle including the cap on a balance and record in gross weight column in the LIMS.

b. Shake the bottle vigorously and then pour the contents into a separatory funnel.

4. For all samples requiring a specified volume:

a. Shake each bottle vigorously.

b. Use a clean graduated cylinder to measure the desired volume.

c. Pour the sample from the graduated cylinder into the sep funnel.

d. Record any comments about the sample appearance or odor. Also record comments if a reduced volume was taken due to sample matrix or insufficient available sample.

e. If <1000 mL (or <250mL for 250mL extractions) of sample is used, use a graduated cylinder to add enough reagent water to bring the volume in the separatory funnel to 1-L (or 250mL for 250mL extractions).

5. Use pipettes to add surrogate standards and spiking solutions to the aqueous sample in the separatory funnel.

a. Be certain the standard drips directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

b. Surrogates – Surrogates are added to all samples, blanks, and spikes.

The type of surrogate is determined by the analysis scan number. Typically they are as follows:

(1) For *T-PEST-WI9961* – 0.1 mL of SW-846 Surrogate.

(2) For *T-PEST-WI11971*, *T-PEST-WI9843*, *T-PEST-WI9997*, *T-PEST-WI9238*, *T-PEST-WI9998* – 0.25 mL of SW-846 Surrogate.

(3) For *T-PEST-WI9998* by 1311/8081- Use 1.0 mL of Mini Sep. SW846 Surrogate

c. Spiking Solutions – Spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD.

(1) The type of spike is determined by an analysis number. Typically they are as follows:

(a) For *T-PEST-WI11971*, *T-PEST-WI9238* – 0.25 mL PCB Spike.

(b) For *T-PEST-WI9998*, *T-PEST-WI9997* – 0.25 mL SW-846 Spike.

(c) For *T-PEST-WI9998* by 1311/8081 – 1.0 mL of Mini TCLP Pesticides Spike regardless of initial volume

(d) For *T-PEST-WI9843* – 1.0 mL Captan/Captafol Spike

(e) For *T-PEST-WI9998* – 0.25 mL Chlordane Spike

(f) For *T-PEST-WI9961* – 0.1 mL of PCB Spike

(2) Spike details can be found in the corresponding analytical SOP(s)

(3) This is changed to accommodate specific-client requirements, if appropriate.

(4) If a sample requires any special compounds in addition to the standard list, an appropriate spike containing those compounds is added at this time.

(5) See SOP *T-OE-GEN-WI10876* for storage and handling of spikes.

6. Measure the pH of the sample using wide-range pH paper. Record the pH of the sample in the initial pH column of the LIMS. See *T-OE-GEN-FRM23822* for instructions to check and adjust pH.

a. If necessary, adjust the pH to between 5 and 9 using 10N NaOH (to bring up the pH) or concentrated H2SO4 (to lower the pH).

b. To adjust the pH, add a few drops of the appropriate solution with a disposable pipette, swirl the separatory funnel and re-check the pH.

c. If the pH now falls between 5 and 9, record the adjusted pH in the 1st pH column of the LIMS.

d. If the pH is still out of range, continue adding small aliquots of base or acid, shaking and checking the pH until it is within the specified range.

e. Record the adjusted pH in the 1st pH column of the LIMS.

NOTE: Any samples from North Carolina require that the volume of acid or base added to the sample to adjust the pH to be recorded in the LIMS.

7. If the original sample bottle is empty:

a. Use a solvent pump to measure 60 mL (15 mL for 250 mL extractions) of methylene chloride. Add the methylene chloride to the sample bottle and swirl the bottle to rinse the interior of the bottle with methylene chloride. Add the solvent to the separatory funnel.

b. Weigh the entire bottle including the cap on a balance and record in the tare weight column in the LIMS.

c. The initial volume automatically calculates in the initial volume of the LIMS.

8. If the sample container is not empty, measure 60 mL (15 mL for 250mL extractions) of methylene chloride to the graduated cylinder used to measure out the sample volume and add it to the separatory funnel.

9. Cap the funnel, invert it, and vent immediately. With the cap on shake the separatory funnel and vent. Continue shaking and venting until the pressure in the funnel has equalized.

10. For 1 Liter Analyses: Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

For 250 mL Analyses: Separatory funnels remain on the Automated Water Extraction Bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

NOTE: Shaker speeds vary greatly between instruments so the proper setting is marked on each.

11. For 1 Liter Analyses: Place the separatory funnel on the rack and allow it to sit undisturbed until the solvent layer (bottom layer) has separated from the water layer (top layer). For 250 mL Analyses: the separatory funnel will sit undisturbed on the Automated Water Extraction Bench.

a. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated.

b. If an emulsion forms and is greater than 1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

12. Removing the Solvent Layer.

a. For 1 Liter analyses: Remove the solvent layer by opening the stopcock and collect the solvent in a metal beaker then pour through approximately 10cm of sodium sulfate into a K-D apparatus containing Teflon boiling chips.

b. For 250 mL analyses: drain the solvent layer directly into the sodium sulfate column containing approximately 5cm of sodium sulfate. This drains into a Rapid-Vap Evaporator Tube.

NOTE: Do not use more than the recommended quantity of sodium sulfate and take care not to transfer water into the column. Excessive sodium sulfate and/or water in the column results in low aldrin recovery.

13. Use a solvent pump to add 60 mL (15mL for 250mL extractions) of methylene chloride to the separatory funnel and repeat Procedure Steps 10 through 13, venting only as necessary.

14. Again, use a solvent pump to add 60 mL (15 mL for 250mL extractions) of methylene chloride to the separatory funnel and repeat Procedure Steps 10 through 13, venting only as necessary.

15. For 1L extractions only, rinse the metal beaker that was used for solvent collection with approximately 20 mL of methylene chloride. Pour into salt column.

16. Rinse salt column with approximately 20 mL (5mL for 250mL extractions) of methylene chloride.

17. Concentrating extracts for 1 Liter analyses

a. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 3 to 5 mL on a steam bath at 85° to 99°C. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 10-20 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood. This steam bath temperature ensures concentration in a reasonable length of time.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

b. Add 50 mL of hexane directly through the Snyder column after the apparent volume in the ampule reaches 3-5 mL. Continue concentrating on the steam bath until an apparent volume of 3-5 ml is reached. Allow the extracts to cool for 10 minutes prior to removing the ampule from the KD.

Note: Do not allow the extracts to reach a point off dryness. Loss of analytes may occur.

c. Bring the extracts to a final volume of 5 mL in the ampule with hexane.

d. Go to Procedure 23 for details on cleanup procedures.

18. Concentrating extracts for 250 mL analyses for samples that do not require GPC.

Note: For samples that require GPC go to Procedure 22

a. Place the Evaporator Tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 8 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

b. Concentrate the extract in the Rapid-Vap Evaporator until a volume of approximately 3 mL is reached.

c. Add 50 mL of hexane to the rapid vap tube. When adding the 50 mL of hexane make sure to rinse down the inside of the rapid vap tubes. This ensures all analytes sticking to the glass are rinsed into the extract.

d. Continue concentrating until the volume in the rapid vap tube is approximately 3 mL.

Exception: All samples for *T-PEST-WI9998* by 1311/8081 should be concentrated to approximately 1 mL.

e. Quantitatively transfer the extract to a class A volumetric using hexane to a final volume of 5.0 mL.

Exception: All samples for *T-PEST-WI9998* by 1311/8081 are brought to a final volume of 2.0 mL in a class A volumetric using hexane.

f. Go to Procedure 23 for details on cleanup procedures.

22. Concentrating samples that require GPC for 250ml analysis

a. Place the Evaporator Tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 8 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

b. Allow samples to concentrate to approximately 7 mL and then bring to final volume of 10.0 mL in a class A volumetric using Methylene Chloride. Make sure to mix the extract thoroughly to ensure the extract is homogenous.

c. Filter the extracts using a Whatman 0.45 µm filter (part number 6875-2504) and 10 mL Fisher disposable syringe (part number 14955459) into 12 mL glass screw top vials. Place the extract into the appropriate GPC queuing area for storage until the cleanup is performed

d. Perform GPC cleanup following SOP *T-OE-PEST-WI11410*

23. Perform cleanup procedures following Steps 24 through 27 as needed.

24. If the extract is scheduled for PCB analysis (8082), treat the extract with sulfuric acid as described in *T-OE-PEST-WI10281*.

25. If the extract is scheduled for Pesticide analysis (8081), florisil the sample 2 mL to 2 mL as described in the Pesticide Florisil section of SOP *T-OE-PEST-WI10281*.

a. Pesticide florisil is also performed for *T-PEST-WI9843* if required due to matrix or client request.

26. If the extract is scheduled for PCB analysis, florisil the extract following the PCB Florisil section of *T-OE-PEST-WI10281*.

27. If the extract has a sulfur odor, perform copper cleanup of the extract as described in *T-OE-PEST-WI10281* for Pest and PCB (8081, 8082, or 608) samples only. Other samples are cleaned up with GPC.

Calculations
See analysis method as listed in the Cross Reference section.

Statistical Information/Method Performance
See analysis method as listed in the Cross Reference section.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted a blank, an LCS, an MS and an MSD must be extracted. For method 608, the laboratory must, on an ongoing basis, spike at least 10% of the samples, if enough sample volume is received, to assess accuracy. If there is limited sample preventing the preparation of the MS/MSD, an LCSD must be prepared instead. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
11410 Pesticide Extract Cleanup Using GPC by Method 3640A
11971 Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters
23822 Instructions for Checking pH During Extraction Procedures
9238 Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD
9843 CLIENT SPECIFIC - Captan and Captafol by Method 8081A in Waters and Solids using GC-ECD
9961 Low Level PCBs in Water by Method 8082/8082A using GC-ECD
9997 Pesticides in Aqueous Samples by Method 608
9998 Pesticides in Water by Method 8081A and 8081B using GC-ECD

End of document

Version history

Version	Approval	Revision information	
20	22.MAR.2019		
21	02.DEC.2019		
22	01.APR.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-PEST-WI10922**	**Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550B and 3550C**	**Work Instruction**
Old Reference: **1-P-QM-WI -9015081**		
Version: **18**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-DEC-2021**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Background Information
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision	18	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Title	Correction		Added 3550B
Apparatus and Equipment 2.	Enhancement		revised wording
Procedure	Current Process		clarified procedure, added LIMS method codes
Procedure 22	Reflects current practice		Bottling instructions

Revision	17	**Effective Date:**	Oct 31 2019
Section	**Justification**		**Changes**

Revision	17	**Effective Date:**	Oct 31 2019
Revision Log	Formatting requirement		Removed revision logs up to the previous version
LIMS ID	Reflects current practice		Added prep 14248, 14316, 14317
Throughout Procedure	Reflects current practice		Clarified weights for each prep
Throughout document	Update		Replaced old references with D4 references and added hyperlinks
LIMS ID, throughout document	Update		Removed prep 11128. This scan was deactivated
Apparatus and Equipment	Reflects current practice		Added baking step to filter paper Added Teflon Buchner funnels, glass vacuum flasks, vacuum tubing, mirror, and Teflon wash bottles
Procedure 1.a. and 4	Clarification		Clarified amount of sodium sulfate added to dry the sample
Procedure 1b and 3	Clarification		Updated weights to use for different prep scans
Procedure 10-11	Clarification		Clarified the filtering process by describing the filtration system more accurately and noted that QC samples are also filtered
Procedure 18	Reflects current practice		Updated bottling requirements

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3550C, February 2007.

2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3550B, December 1996.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-PEST-WI11972	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solid Samples and Wipes
T-OE-GEN-WI7154	Food and Tissue Preparation
T-OE-GEN-WI10860	Ultrasonic Processor Maintenance and Tuning
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by Method 3640A
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Purpose
The purpose of this procedure is to provide clear instructions for performing the sonication extraction procedure on samples that are to be analyzed for PCBs in a solid matrix.

Scope
This procedure is for the extraction of PCBs from soils, solid wastes, tissues, or wipes.

Background Information
Not applicable to this procedure

Basic Principles
A portion of sample is placed in a beaker. Anhydrous sodium sulfate is added to absorb any water present. Surrogate standards are added to each sample to monitor recovery. An aliquot of solvent is then added to the sample. The sample is subjected to sonic disruption to disperse the soil and force solvent contact. The organic compounds present in the soil dissolve in the solvent, which is then removed. The sample is extracted two additional times with fresh solvent. The fractions are then combined, concentrated, and bottled.

Several cleanup procedures are available to eliminate matrix interferences before the sample is analyzed. They include: sulfuric acid treatment, Florisil, copper, and gel-permeation cleanup (GPC).

Reference Modifications
EPA Method Deviation: In the procedure the K-D is not removed from the steam bath and cooled before adding hexane. The Snyder column is not removed for the solvent addition; therefore, the K-D does not have to be cool.

Interferences
Method interferences are caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling
All laboratory waste is accumulated, managed, and disposed in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employee's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored at 0° -6°C, not frozen, prior to extraction. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at ≤-10° C.

Apparatus and Equipment

1. Sonic probe apparatus (with a minimum of 300W output) for extracting organic components from a soil matrix

2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent extract

3. Steam bath – VWR/LLI Model #1127 or equivalent

4. Filter paper – Fisher brand glass fiber filter circles or equivalent. Bake at 400° C for a minimum of 4 hours to remove organic contaminants. Store at room temperature for up to one year.

5. N-Evap with nitrogen supply

6. Beakers – Stainless steel, assorted sizes

7. Pipettes – Class A, assorted sizes

8. Graduated Cylinders – Class A, assorted sizes

9. Solvent Dispenser – Beckman, adjustable

10. Pipettes – Disposable

11. Balance – Capable of weighing to 0.01 g

12. Teflon® Wash Bottles

13. Vials – Assorted sizes

14. Teflon Boiling Chips

15. Forceps

16. Scoop

17. Volumetric Flasks – Class A, various sizes

18. Teflon Buchner funnels

19. Glass vacuum flasks - 500 mL

20. Tygon 2475 flex tubing

21. Wash bottles – Teflon™

22. Mirror

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to one year.

3. Hexane – Pesticide grade or equivalent. Store at room temperature for up to one year.

4. Sodium sulfate (Na2SO4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. 50% Acetone/Hexane- Prepared as needed by mixing equal amounts of acetone and hexane in an amber solvent container. Store at room temperature for up to one year.

6. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical analysis ***T-PEST-WI11972***.

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure.

Procedure

1. Weigh the sample

a. If Sample Registration has pre-weighed the sample into a glass jar, Using a 1 oz. medicine cup, add one full scoop of sodium sulfate (approximately 45 g), mix and proceed.

b. If sample was not pre-weighed:

(1) For preps 3550_PCB: weigh out 30 – 30.5 g of sample into a stainless steel beaker.

(2) For 3550 Wipes : Record "wipe" in the matrix type section of the LIMS batch and enter the amount as 1 Wipe.

(a) Remove wipe from the vial with clean forceps and place in a stainless steel beaker along with any solvent in the vial.

(b) Use a wash bottle to rinse the vial with a few mL of acetone/methylene chloride and add the rinseate to the beaker.

(c) Record any comments about the sample in the extraction log.

(d) Enter the final volume and surrogate/spike volumes in mL in the extractables database.

(3) For prep 3550_PCB_10: weigh out 10.0 - 10.5 g sample into a stainless steel beaker.

(4) For preps 3550_PCB_3: weigh 3.0 - 3.5 g sample into a stainless steel beaker.

c. Record the initial weight and any comments about the sample in LIMS.

d. Use of alternate weights is acceptable if necessary due to client specifications, amount of sample available, or sample matrix.

e. The background, MS (Matrix Spike), and MSD (Matrix Spike Duplicate) are prepared using three separate aliquots of a field sample.

3. The blank, LCS (Laboratory Control Sample), and LCSD (Laboratory Control Spike Duplicate), if applicable, are prepared by using a 1 oz. medicine cup and adding one full scoop of sodium sulfate (approximately 45 g)

(1) For 3550_PCB: Record 30g in LIMS as the weight.

(2) For 3550 Wipes : Record the amount as 1 Wipe.

(3) For prep 3550_PCB_10: Record the amount as 10g.

(4) For preps 3550_PCB_3: Record the amount as 3g.

4. Using a 1 oz. medicine cup, add one full scoop (approximately 45 g) of anhydrous powdered sodium sulfate to each beaker and mix well.

If necessary, continue to add sodium sulfate until a free-flowing mixture is obtained.

5. Use pipettes to add surrogate standards and spiking solutions.

a. Surrogates – 1.0 mL OP_SW_SS surrogate is added to all samples, blanks, and spikes.

b. Spiking solutions

(1) 1.0 mL OP_PCB_MS spiking solution is added to the LCS, LCSD (if applicable), MS, and MSD samples.

(2) These may change to accommodate specific client requirements as appropriate.

(3) See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

6. Use a solvent dispenser to add approximately 100 mL of 50% acetone in methylene chloride.

7. Set up the sonic probe as described in the manual. See ***T-OE-GEN-WI10860*.**

8. Immerse the tip of the sonic probe approximately 1 to 2 cm below the surface of the liquid in the beaker containing the sample and above the sediment layer. The location of the sonic probe in the beaker needs to be observed visually using a mirror.

9. Disrupt the sample using a medium tip at full output of 10 and a process time/timer of 1:30.

This is equivalent to 3 minutes, 50% duty cycle as described in the EPA method.

10. Place a Buchner funnel on top of a vacuum flask, and attach the flask to the vacuum using Tygon flex tubing. Place glass filter paper in the funnel and record the lot number on the batch-log.

11. Remove the sonic probe from the sample and decant the liquid from the beaker through the filter paper using vacuum filtration into the vacuum flask.

a. Turn the vacuum off immediately after solvent is no longer observed dripping from the funnel.

NOTE: The filtering procedure is done for all samples and QC.

12. Use a solvent dispenser to add 100 mL of fresh solvent to the sample and repeat Procedure Steps 8 through 11.

13. Again, use a solvent dispenser to add 100 mL of fresh solvent to the sample and repeat Procedure Steps 8 through 11.

NOTE: Before placing the probe into another sample, wet a paper towel with reagent water and wipe the probe to remove any soil present from the previous sample. Use a wash bottle to rinse the probe with acetone to remove water followed by a methylene chloride rinse.

14. Pour the liquid and solids from the beaker onto the filter paper. Use a wash bottle to rinse the beaker and filter paper with approximately 30 mL of 50% acetone in methylene chloride.

15. Pour the collected extract into a Kuderna-Danish with a 10 mL class A ampule attached containing Teflon boiling chips.

16. Place a 3-ball Snyder column on the set-up, wet the column with methylene chloride, and concentrate the extract to approximately 5-mL on a steam bath at 85° to 99°C. At the proper rate of distillation, the balls of the column will actively chatter, but the chambers will not flood. Adjust the vertical position of the apparatus and the water temperature as needed to complete the concentration in 10 - 20 min.

17. **If the sample requires GPC, skip this step. Proceed to step 18.**

When the apparent volume in the ampule is 3 to 5 mL, use a graduated cylinder to add approximately 50 mL of hexane directly to the K-D through the Snyder column.

Do not allow the ampule to go dry since loss of analytes will result.

18. When the apparent volume reaches 3 to 5 mL, remove the sample from the bath and allow the sample to cool for 10 minutes.

a. Samples that do not require GPC:

(1) Remove the ampule and adjust the final volume to exactly 10.0 mL with hexane in a class A volumetric.

(2) Mix thoroughly with a disposable pipette.

b. Samples that require GPC:

(1) Using a fine-tip methylene chloride wash bottle, adjust the final volume to exactly 10.0 mL in the class A ampule.

(2) N-Evap if there is an excess of 10mL final volume.

(3) Mix thoroughly with a disposable pipette.

(4) Perform GPC cleanup following ***T-OE-PEST-WI11410***

(5) When GPC cleanup is complete, concentrate the extract as described in Procedure Steps 16, 17, and 18.a. However, in Procedure Step 18.a.(1), adjust the final volume to exactly 5.0 mL with hexane instead of 10.0 mL.

19. Treat the 10-mL extract with sulfuric acid as described in ***T-OE-PEST-WI10281***.

20. Florisil the extract following the PCB Florisil section of ***T-OE-PEST-WI10281***.

21. Perform copper cleanup of the extract as described in ***T-OE-PEST-WI10281***.

22. Bottle three times, two clear GC vials with no insert and one clear GC vial with an insert, in appropriately labeled crimp-top autosampler vials.

23. All extracts are stored in the freezer at ≤ -10° C.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, a LCS, MS, and MSD must be extracted. If there is limited sample that prevents the preparation of the MS/MSD, then an LCSD must be prepared instead.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed.

10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10860 Ultrasonic Processor Maintenance and Tuning
10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
11410 Pesticide Extract Cleanup Using GPC by Method 3640A
11972 Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes
7154 Food and Tissue Preparation

End of document

Version history

Version	Approval	Revision information	
16	09.MAY.2016		
17	17.OCT.2019		
18	29.DEC.2021		

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015081_16_081911128.doc
Errortext: Unable to fetch attachment

eurofins	Always check on-line for validity. **Microwave Extraction Method 3546 for Pesticides in a Solid Matrix**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10926**		
Old Reference: **1-P-QM-WI -9015103**		
Version: **11**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **12-APR-2022**	Document users: **5_EUUSLA_Organic Extraction_All, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_OC Pesticide C**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 11	**Effective Date:**	This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Apparatus and Equipment	Reflects current practice	Added 1fl oz. medicine cup
Procedure 1f	Reflects current practice	Identified medicine cup as means of creating QC

Revision: 10	**Effective Date:**	27-MAR-2020
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced references to Parallax with new LIMS
Procedure 3	Reflects current practice	Removed reference to alachlor spike
Procedure 8	Enhancement	Added microwave programs based on type of microwave used. Removed reference to Table I.
Table I	Obsolete	Deleted and replaced with text contained in Procedure step 11

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, Revision 0, February 2007.

2. MARS Operation Manual, Revision 2, February 2006.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-OE-GEN-WI7154	Food and Tissue Preparation
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-PEST-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10871	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
T-OE-PEST-WI10876	Organic Extraction Standards Storage and Handling
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by Method 3640A
T-PEST-WI9232	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD
T-PEST-WI9992	Pesticides by Method 8081A in Solid Samples using GC-ECD

Scope

This procedure is used for the extraction of organochlorine pesticides from soils, tissues, or solid wastes.

Basic Principles

A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the soil dissolve in the solvent, which is then removed. The extract is then concentrated and bottled.

Several cleanup procedures are used as needed to eliminate matrix interferences before the sample is analyzed. They include: florisil, copper, carbon cleanup, and gel-permeation cleanup (GPC).

Reference Modifications

The joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Definitions

1. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. This is used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

2. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

3. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences

Method interferences are caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

The extracts are concentrated on a steam bath. Caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0º to 6ºC, not frozen, prior to extraction. Samples must be extracted within 14 days of collection. Extracts are stored in the freezer at ≤-10°C.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during extraction
3. Steam bath, VWR/LLI Model #1127 or equivalent
4. N-Evap with nitrogen supply
5. Beakers – stainless steel, assorted sizes
6. Pipettes – Class A, assorted sizes
7. Pipettes – disposable
8. Balance – capable of weighing to 0.01 g
9. Teflon®-wash bottles
10. Vials – assorted sizes
11. Teflon®-boiling chips
12. Forceps
13. Scoop
14. TurboVap II concentration workstation w/appropriate concentration tubes – Zymark or equivalent
15. Funnels – stainless steel or Teflon®
16. Extraction vessels
17. Frits – various
18. Sodium Sulfate Columns
19. GPC – J2 Scientific or equivalent
20. 1 fl oz. medicine cup

Reagents and Standards

1. Hexane – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

2. Acetone – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

3. Methylene Chloride (CH_2Cl_2) – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt.

4. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400ºC for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the reagent module in the LIMS. Detailed instructions can be found in the corresponding analytical SOPs *T-PEST-WI9232* and *T-PEST-WI9992*.

Preparation of Glassware

See *T-OE-PEST-WI10864*

Calibration

Not applicable to this procedure.

Procedure

1. Sample aliquot

   a. If Sample Registration has pre-weighed the sample into a glass jar, add approximately 5g of sodium sulfate, mix and proceed.

   b. If the sample is not pre-weighed, weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. (If sample matrix is tissue, weigh 15.0 - 15.5 g.)

      (1) Record the initial weight and any comments about the sample in the LIMS.

      (2) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 is used the sample must be divided among multiple vessels and the extracts combined.

   c. Process all tissues as outlined in *T-OE-GEN-WI7154* prior to extraction.

   d. The background, MS, and MSD are performed on three separate aliquots of a field sample.

   e. Add approximately 5 g of sodium sulfate to each sample and mix until a free-flowing consistency is reached.

      (1) If the sample has a high water content or is a clay-like soil, add additional sodium sulfate until a free-flowing consistency is achieved.

   f. The Blank, LCS, and LCSD (if applicable) are prepared by scooping approximately a full medicine cup of sodium sulfate into an extraction vessel. (If sample matrix is tissue, use 15.0-15.5 g tilapia and add approximately 5 g sodium sulfate. Then mix.)

      (1) For non-tissue samples: Record 30 g in the LIMS.

2. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is used to prevent spillage and loss of sample.

3. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates – 1.0 mL of SW-846 surrogate (OP_SW_SS) is added to all samples, blanks, and spikes.

   b. Spiking solutions – 1.0 mL of SW-846 spike (OP_SW846_MS) is added to the LCS, LCSD (if applicable), MS, and MSD samples.

      (1) These may change to accommodate specific client requirements as appropriate.

      (2) See *T-OE-PEST-WI10876* for storage and handling of spikes.

4. Add 30 mL of 50% acetone in methylene chloride to each vessel.

5. Cap each vessel according to manufacturer's guidelines.

6. Invert each vessel to ensure mixing of sample and solvent.

7. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

8. Run the appropriate method based on the microwave used. Verify that the run reached 100°C and document in the LIMS.

   a. Microwaves are programmed with a 30 minute warm-up to 100ºC, 10 minutes at temperature, followed by a 15 minute cool-down time.

   b. MARS 6 - Press the 'Classic Methods', '100C', and then 'START'

   c. MARS 5 - Press 'Start' from the home screen to run 'LLISOILS'.

9. Uncap the cooled vessel.

10. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of a Kuderna-Danish (K-D) assembly containing Teflon®-boiling chips. Rinse the vessel with approximately 10 mL of methylene chloride from a wash bottle and pour through salt column. Rinse the column with approximately 10 mL of methylene chloride.

11. Place a 3-Ball Snyder column on the K-D set-up and concentrate over a steam bath at 85° to 99°C. This steam bath temperature ensures concentration in a reasonable length of time.

12. **If the sample requires GPC, skip this Step. Proceed to Procedure step 14 b.**

When the apparent volume in the ampule is 3 to 5 mL, use a bottle-top dispenser to add approximately 50 mL of hexane directly to the KD through the Snyder column.

Do not allow the ampule to go dry since loss of analytes will result.

13. When the apparent volume in the ampule again reaches 3 to 5 mL remove the sample from the bath and allow to cool for approximately 10 minutes until the K-D setup reaches ambient temperature.

14. Remove the ampule and use a wash bottle to adjust the final volume.

a. Samples that do not require GPC: Adjust final volume to exactly 10 mL with hexane in a calibrated ampule. Mix thoroughly with a disposable pipette. Proceed to 14. c.

b. Samples that require GPC: Adjust the final volume to exactly 10 mL with methylene chloride. Mix thoroughly with a disposable pipette.

(1) Perform GPC cleanup following *T-OE-PEST-WI11410*.

(2) When GPC cleanup is complete, concentrate the extract to final volume 5 mL using a TurboVap as described in T-OE-GEN-WI10871.

(3) Florisil the sample 2 mL to 2 mL as described in the Pesticide Florisil Cleanup section of *T-OE-PEST-WI10281*.

NOTE: DO NOT florisil samples that have Kepone as a compound of interest.

(4) Bottle twice in appropriately labeled crimp-top autosampler vials.

(5) Place the remaining extract in an appropriately labeled screw-cap vial.

(6) Store all extracts in the freezer at ≤-10ºC.

c. Samples that require carbon cleanup:

(1) Perform carbon cleanup on the sample 2 mL to 2 mL as described in the Carbon Cleanup section of *T-OE-PEST-WI10281*.

(2). Perform copper cleanup to remove sulfur interference from extracts. See *T-OE-PEST-WI10281* for this procedure.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, an LCS, MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10864 Glassware Cleaning for Organic Extractions
10871 Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation
10876 Organic Extraction Standards Storage and Handling
11410 Pesticide Extract Cleanup Using GPC by Method 3640A
7154 Food and Tissue Preparation
9232 Analysis of Pesticides by 8081B in Solid Samples using GC-ECD
9992 Pesticides by Method 8081A in Solid Samples using GC-ECD

End of document

Version history

Version	Approval	Revision information	
9	13.MAR.2020		
10	12.APR.2021		
11	30.MAR.2022		

eurofins	Always check on-line for validity. **Microwave Extraction Method 3546 for PCBs in a Solid Matrix**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10927**		
Old Reference: **1-P-QM-WI -9015104**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **08-NOV-2021**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Pest/PCB Soils, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_PCB Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I

Revision Log

Revision	10	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout Document	New LIMS		Replaced references to old LIMS/data recording with new LIMS
Sample Collection, Preservation, and Handling	Reflects current procedure		Updated hold time from 14 days of collection to 1 year.

Revision	10	**Effective Date:**	This version
Apparatus and Equipment	Reflects current procedure		Removed steam bath, boiling chips, TurboVap concentrators, and frits. Added MARS 6 microwave, tongue depressors, Rapid-Vap and Rapid-Vap tubes.
Procedure 1f	Reflects current procedure		Clarified Blank/LCS/LCSD measurement process
Procedure	Reflects current procedure		Removed steam bath concentration process for Rapid-Vap concentration.

Revision	09	**Effective Date:**	31-OCT-2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
LIMS ID	Reflects current practice		Added preps 13998, 14114, and 14652
Throughout procedure	Reflects current practice		Clarified weights to use for each prep number
Procedure 3	Reflects current practice		Added spiking procedure for prep 14652

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3546, Revision 0, February 2007.

2. *Chemical Hygiene Plan*, current version.

3. MARS Operation Manual, Revision 2, February 2006.

Cross Reference

Document	Document Title
T-PEST-WI11972	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes
T-OE-GEN-WI7154	Food and Tissue Preparation
T-OE-PEST-WI11410	Pesticide Extract Cleanup Using GPC by method 3640A
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-PEST-WI10281	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This procedure is applicable for the extraction of PCBs from soils, tissues, or solid wastes.

Basic Principles

A portion of sample to be analyzed is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the microwave and extracted. The organic compounds present in the sample dissolve in the solvent, which is then removed. The sample is then concentrated and bottled.

Several cleanup procedures may be required to eliminate matrix interferences before the sample can be analyzed. They include: sulfuric acid treatment, florisil, copper, and gel-permeation cleanup (GPC).

Reference Modifications

The KD is not removed from the steam bath and cooled before adding hexane. The Snyder column is not removed for the solvent addition; therefore, the KD does not have to be cool.

Double volumes of surrogates and matrix spiking solutions are not added when a sample requires gel-permeation cleanup. Instead, the extract is concentrated to one-half the normal final volume after GPC to make up for the loss on GPC and maintain the limit of quantitation.

The Joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Definitions

1. GPC – Gel Permeation Cleanup

2. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations. Used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

3. Matrix spike/matrix spike duplicate (MS/MSD) – A sample created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the accuracy of the method in light of the matrix analyzed. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

4. Surrogates – Organic compounds which are similar to the analytes of interest but are not naturally occurring in environmental samples. Surrogates are spiked into all standards and every field and QC sample prior to extraction and analysis to provide information regarding the effects of the sample

Interferences

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.
Since the extracts are concentrated on a steam bath, caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or must be disposed of in the designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in wide-mouth glass jars with PTFE-lined lids and stored under refrigeration at 0º to 6º C, not frozen, prior to extraction. Samples must be extracted within 1 year. Extracts are stored in the freezer at -10° to -15°C.

Apparatus and Equipment

1. MARS Xpress, MARS 6 – CEM Corp. or equivalent

2. Disposable Tongue Depressors or equivalent

3. N-Evap with nitrogen supply

4. Beakers – stainless steel, assorted sizes

5. Pipettes – class A, assorted sizes

6. Pipettes – disposable

7. Balance – capable of weighing to 0.01 g

8. Teflon®- wash bottles

9. Vials – assorted sizes

10. Forceps

11. Scoop

12. Funnels – stainless steel or Teflon®

13. Teflon® extraction vessels

14. Labconco - Rapid-Vap Evaporators

15. Rapid-Vap evaporator tubes - class A

16. Sodium sulfate Columns

17. Glass vial inserts

Reagents and Standards

1. Hexane – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

2. Acetone – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

3. Methylene Chloride (CH_2Cl_2) – Pesticide grade or equivalent. Fisher Optima grade or equivalent, stored in a FisherPak at room temperature for one year after receipt

4. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding SOP *T-PEST-WI11972*.

Preparation of Glassware

See ***T-OE-GEN-WI10864***

Calibration

Not applicable to this procedure

Procedure

1. Sample aliquot

a. If Sample Registration has pre-weighed the sample into a glass jar, add 5g of sodium sulfate, mix and proceed to step 2.

b. If the sample is not pre-weighed:

(1) For preps 3546, 3546_PCB: weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. (If matrix is tissue, weigh 15.0 - 15.5 g)

(2) For prep 3546_PCB_10: weigh 10.0 - 10.5 g of sample into a labeled stainless steel beaker.

(3) For prep 3546_PCB_3: weigh 3.0 - 3.5 g of sample into a labeled stainless steel beaker.

(4) Record the initial weight and any comments about the sample in the extraction log.

(5) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 is used, the sample must be divided among multiple vessels and the extracts combined.

c. If sample is a wipe: record "wipe" in the matrix type section of the extraction log and enter the amount as 1 wipe in both the extraction log and the extractables database.

(1) Remove wipe from the vial with clean forceps and place in a stainless steel beaker along with any solvent in the vial.

(2) Use a wash bottle to rinse the vial with a few mL of acetone/methylene chloride and add the rinsate to the beaker.

(3) Record any comments about the sample in the extractables database.

d. Process all tissues by analysis Homogenize_Tiss prior to extraction.

e. Add approximately 5 g of sodium sulfate to each sample and mix.

(1) If the sample has high water content or is a clay-like soil, add additional sodium sulfate until a free-flowing consistency is reached.

(2) Mix the sodium sulfate and sample with a disposable tongue depressor or equivalent until a free-flowing consistency is reached.

f. The Blank, LCS, and LCSD (if applicable) are prepared by:

(1) For preps 3546, 3546_PCB: filling a Teflon® extraction vessel with one medicine scoop (approximately 30g) of sodium sulfate. Record 30 g on the extraction log. If sample matrix is tissue, use 15.0-15.5 g tilapia and add approximately 5 g sodium sulfate. Then mix.

(2) For prep 3546_PCB_10: filling a Teflon® extraction vessel with 10.0 - 10.5 g sodium sulfate. Record 10 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 15.0 grams to account for the 10 gram "sample" plus the 5 grams of sodium sulfate.)

(3) For prep 3546_PCB_3: filling a Teflon® extraction vessel with 3.0 - 3.5 g sodium sulfate. Record 3 g on the extraction log. (The sodium sulfate used for the QC samples is measured out as 8.0 grams to account for the 3 gram "sample" plus the 5 grams of sodium sulfate.)

2. Carefully place each sample into its clearly marked corresponding extraction vessel. A funnel is used to prevent spillage and loss of sample.

3. Use pipettes to add surrogate standards and spiking solutions. These may change to accommodate specific client requirements.

a. Surrogates – 1.0 mL of OP_SW_SS surrogate is added to all samples (including QC).

b. Spiking solutions:

(1) 1.0 mL of OP_PCB_MS spiking solution is added to the LCS, LCSD if applicable, MS, and MSD.

c. See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

4. Add 30 mL of 50% acetone in methylene chloride to each vessel.

5. Cap each vessel according to manufacturer's guidelines.

6. Invert each vessel to ensure mixing of sample and solvent.

7. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

8. Run the appropriate method based off the microwave used. Verify that the run reached 100°C and document in the LIMS. See Table I for Instrument conditions.

a. Microwaves are programmed with a 30 minute warm-up to 100°C, 10 minutes at temperature, followed by a 15 minute cool-down time.

b. MARS 6 - Press the 'Classic Methods', '100C', and then 'START'

c. MARS Xpress - Press Start from the home screen to run LLISOILS.

9. Uncap the cooled vessel. Pour the extract and sample into a column filled with approximately 10cm of sodium sulfate on top of the Rapid-Vap evaporator tubes with matching sample identification. If more than one extraction vessel was used in the microwave, pour volumes into separate evaporator tubes.

10. Rinse the vessel twice using 10-20 mL of Methylene Chloride from a wash bottle. Add each rinse to appropriate salt column.

11. Rinse the salt columns using two additions of approximately 5-10 mL down the insides of the salt column. These rinses help to improve compound recovery that would otherwise stick to the glassware.

NOTE: Use a methylene chloride rinse bottle to bring sample volumes to visually the same amount in the evaporator tube before placing in Rapid-Vap Evaporator. This will prevent an issue with some of the samples going dry and others needing more concentration.

12. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at approximately 15 PSI (this is adjusted on the regulator attached to the nitrogen line).

Do not allow the evaporator tube go dry since loss of analytes will result.

a. Open the Rapid-Vap Evaporator. Extract volume will be approximately 3-5mL. If not, continue concentrating in 2 minute increments till a volume of 3-5mL is achieved.

(1) **If the sample requires GPC (3640)**, quantitatively transfer the extract to a class A volumetric using MeCl2 and disposable pipettes. Adjust the final volume to 10.0 mL with MeCl2. **Skip to step 14**.

(2) **If a sample was split between two evaporator tubes**, quantitatively transfer to one tube and concentrate to 3-5mL.

(3) For other samples, rinse down the inside of extractor tubes with 50mL of hexane using a solvent pump. This ensures all analytes sticking to the glass are rinsed into the extract.

e. Set a 6 minute timer on the Rapid-Vap and continue concentrating until the volume in the rapid vap tube is approximately 7mL.

f. Quantitatively transfer the extract to a class A volumetric using hexane and disposable pipettes. Adjust the final volume to 10.0mL with hexane.

g. Mix thoroughly with a disposable pipette.

13. Record the final volume in the LIMS. Skip to step 15 if GPC (3640) not required.

14. If the sample requires GPC, perform GPC cleanup following ***T-OE-PEST-WI11410*****.** When GPC cleanup is complete, concentrate the extract as described above including Step 12. However, concentrate the sample to approximately 3mL in step 12d. In step 12e. adjust the final volume to exactly 5 mL with hexane instead of 10mL.

15. Treat the 10 mL extract with sulfuric acid as described in ***T-OE-PEST-WI10281*****.**

16. Perform the copper and florisil cleanup on the extract as described in ***T-OE-PEST-WI10281*****.**

17. Bottle in three appropriately labeled crimp-top autosampler vials (one with an insert), and place the remaining extract in an appropriately labeled screw-cap vial.

18. All extracts are stored in the freezer.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted in any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

For each batch of samples extracted, a blank, LCS, MS, and MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

Table I

Power:	1600W
Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

10281 Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)
10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
11410 Pesticide Extract Cleanup Using GPC by Method 3640A
11972 Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes
7154 Food and Tissue Preparation

End of document

Version history

Version	Approval	Revision information	
8	17.APR.2018		
9	24.OCT.2019		
10	25.OCT.2021		

eurofins	Always check on-line for validity. **Microwave Extraction by Method 3546 for Semivolatiles**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI10928**		
Old Reference: **1-P-QM-WI -9015105**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date **15-APR-2022**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Soils, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Preparation of Glassware
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I

Revision Log

Revision 14		**Effective Date:**	**This version**
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout Document	New LIMS		Update LIMS references to new terminology
Cross Reference	Update		Change document reference to current analysis SOP
Apparatus and Equipment	Update		Removed Frits
Throughout Document	Update		Removed Analysis #10962, 11622
Procedure 6	Update		Compiled spiking amounts in reflection for analysis consolidation
Procedure 20	Reflects current practice		Changed boiling chip to boiling chips
Procedure 1a	Update		Removed wording to allow the process to flow better
Procedure 17	Clarification		Specified solvent used to rinse the evaporator tube
Procedure 24	Clarification		Specified how low to allow sample to concentrate GPC samples for tissue

Revision 14		**Effective Date:**	**This version**
Procedure 25	Clarification		Specified final volumes for solid samples vs tissue samples
Cross Reference	Update		Updated document titles to current document titles

Revision 13		**Effective Date:**	**March 20, 2019**
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
LIMS ID	Update		Removed "DOD"
Throughout procedure	Reflects current practice		Added amounts for tissue samples/QC
Apparatus and Equipment	Reflects current equipment		Added Rapid Vap evaporators and Rapid Vap evaporator tubes.
Procedure 1.b.2	Clarification		Replaced "less than" with "greater than"
Procedure 2, 2.a	Clarification		Added "approximately"
Procedure 13 through 18	Reflects current procedure		Added rapid vap concentration technique to replace steam bath.

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3546, Revision 0, February 2007.

2. *MARS Operation Manual*, Revision 2, February 2006.

3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-SVOA-WI9623	Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
T-OE-GEN-WI7154	Food and Tissue Preparation
T-SVOA-WI9587	Tetraethyl Lead (TEL) in Water and Solids by 8270D/E by GC/MS
T-SVOA-WI9995	Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS
T-SVOA-WI9252	Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-OE-SVOA-WI10554	Semivolatile Extract Cleanup Using GPC by Method 3640A
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This procedure is used to clearly outline the steps taken for the extraction of semivolatile compounds from soils or solid wastes using microwave technology.

Basic Principles

A portion of sample is placed in an extraction vessel. Surrogate standards are added to each sample to monitor recovery. The vessel is then loaded into the instrument and extracted. The organic compounds present in the sample dissolve in the solvent, which is then removed. The extract is concentrated to about 1 mL. At this time, it is determined if the sample requires gel-permeation cleanup (GPC). If needed, the extract is diluted to 10 mL, then cleaned using GPC and concentrated to 0.5 mL. If GPC is not necessary, the extract is brought to 1.0 mL and bottled. The extract is stored in an amber-autosampler vial in the freezer until analysis.

Reference Modifications

Base/Neutral and Acid compounds are added at a concentration of 50 ppm in the matrix spiking and LCS solutions so that the concentrations in the extract are within calibration range.

After Procedure Step 24, the joint of the K-D is not rinsed with fresh solvent when the ampule is removed. Quad and MDL studies have shown that this step is unnecessary.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing can interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria for the LCSs include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation and Handling

Samples are collected in glass wide-mouth jars with PTFE-lined lids and stored under refrigeration at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted within 14 days of sample collection. Extracts are stored in the freezer at ≤-10° C and must be analyzed within 40 days of the date extracted.

Apparatus and Equipment

1. MARS Xpress – CEM Corp. or equivalent
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction
3. Steam bath, VWR/LLI Model #1127 or equivalent
4. Balance – Capable of weighing to 0.01 g
5. Beakers – Stainless steel – Assorted sizes
6. Scoop
7. Pipettes – Class A, assorted sizes
8. Wash bottles – Teflon®
9. Teflon®-boiling chips

10. Micro Snyder columns

11. Disposable pipettes

12. Autosampler vials – Amber, crimp top

13. Funnels – Stainless steel or Teflon®

14. Extraction vessels

15. Sodium sulfate columns

16. Rapid-Vap Evaporators – Labconco model number 7910000 or equivalent.

17. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.

2. Acetone – Pesticide grade or equivalent. Store at room temperature for up to one year.

3. Sodium Sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at 400°C for a minimum of 4 hours in a shallow pan to remove contaminants. Store in a glass jar for up to 1 year after baking.

4. Ottawa sand - Bake at ~ 400° C for a minimum of 4 hours to remove organic contaminants. Store in a glass jar for up to 1 year after baking.

NOTE: All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical analyses for scans *T-SVOA-WI9623*, *T-SVOA-WI9587*, *T-SVOA-WI9995*, *T-SVOA-WI9252*, *T-SVOA-WI9617*

Calibration

Not applicable to this procedure.

Preparation of Glassware

See *T-OE-GEN-WI10864*.

Procedure

1. Sample aliquot

   a. If Sample Registration has pre-weighed the sample into a glass jar, proceed to procedure step 2.

   b. If the sample is not pre-weighed, weigh 30.0 - 30.5 g of sample into a labeled stainless steel beaker. If sample matrix is tissue, use 15.0 - 15.5 g.

      (1) Record the initial weight and any comments about the sample in the LIMS.

      (2) Alternative sample weights may be used to meet certain reporting limits. However, if sample weight greater than 30.5 g is used the sample must be divided among multiple vessels and the extracts combined.

   c. Process all tissues by Analysis *T-OE-GEN-WI7154* prior to extraction.

2. Add approximately 5 g of sodium sulfate to each sample and mix.

   a. If the sample has high water content or is a clay-like soil, add an additional 10 g (approximate) of sodium sulfate.

   b. Mix the sodium sulfate and sample until a free-flowing consistency is reached.

3. Perform the background, matrix spike (MS), and matrix spike duplicate (MSD) on three separate aliquots of a field sample.

4. Prepare the Blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) by filling a Teflon® extraction vessel with 35 g of sodium sulfate. Use 15.0 g tilapia if matrix is tissue.

NOTE: For samples from SC, use Ottawa Sand for the preparation of the Blank, LCS, and LCSD (if applicable).

Record 30.0 g in the LIMS (or 15.0 for tissue samples). (The sodium sulfate used for the QC samples is measured out as 35.0 g to account for the 30 g "sample" plus the 5g of sodium sulfate.)

5. Place each sample into its clearly marked corresponding extraction vessel. Use a funnel to prevent spillage and loss of sample.

6. Add surrogate standards and spiking solutions using pipettes. Add surrogates to all samples, blanks and spiked samples. Add spikes to the LCS, LCSD (if applicable), MS, and MSD samples. Typically they are as follows:

a. Analysis *T-SVOA-WI9623* – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of LCS spike. If required, spike 1.0 mL of Benzenthiol spike in a separate LCS/LCSD. If required, Spike 1.0 mL of AppIX Mix #1 in a separate LCS/LCSD. If required, Spike 1.0 mL of AppIX Mix #2 in a separate LCS/LCSD.

b. Analysis *T-SVOA-WI9995* – Surrogate: 1.0mL of BNA surrogate. Spike: 1.0mL of SIM LCS spike.

c. Analysis *T-SVOA-WI9587* – Surrogate: 1.0mL of BNA Surrogate. Spike: 1.0mL of TEL/TML spike.

d. Analysis *T-SVOA-WI9252* – Surrogate: 1.0 mL of BNA surrogate. Spike: 1.0 mL of "Client Specified" spike. If required, 1.0 mL of DPnB spike.

NOTE: If the sample is being analyzed for Benzoic Acid, a separate LCS/LCSD must be created with 1.0 mL of Appendix IX Mix#1 spike.

See *T-OE-GEN-WI10876* for storage and handling of spikes and *T-SVOA-WI11998* for SVOA spiking and calibration standards.

NOTE: If the sample is being divided among multiple vessels, the spike must be divided among the vessels as well.

7. Add 30 mL of 50% acetone in methylene chloride to each vessel.

8. Cap each vessel according to manufacturer's guidelines.

9. Invert each vessel to ensure mixing of sample and solvent.

10. Place the vessels into the carousel. When all samples are loaded, place the carousel into the microwave.

11. Run Program "LL Soils". See Table I for Instrument conditions. Verify that the run reaches the 100 °C temperature requirement and document in the LIMS.

12. Uncap the cooled vessel.

13. Pour the extract and sample from the vessel into a salt column filled with approximately 10 cm of sodium sulfate on top of an evaporator tube.

14. Rinse the microwave vessel with 10 to 20 mL of methylene chloride from a wash bottle and pour it into the salt column.

15. Allow the salt column to drip dry into the evaporator tube.

16. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 90°C) Rapid-Vap Evaporator. Set the timer for 15 minutes and speed at 75%(the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line).

17. Allow the samples to concentrate to around 5.0 mL and rinse the sides of the evaporator tube down with Methylene Chloride. This ensures that all the analytes sticking to the glassware are rinsed down into the evaporator tube.

Note: Failure to rinse down the sides of the evaporator tube may cause poor recoveries.

18. After rinsing down the sides of the evaporator tubes continue concentrating the extracts to just below 1.0 mL.

19. If GPC is not needed, go to Procedure Step 25.

a. For samples that require GPC bring the final volume to 10.0 mL with methylene chloride in a class A volumetric. Filter extracts into a 100 mm. screw cap tubes using a 10mL Luer-Lok glass syringe and a disposable 0.45-micron filter (Whatman catalog number 6874-2504 or equivalent).

b. Place the extract into the appropriate GPC queuing area for storage until the cleanup is performed. See *T-OE-SVOA-WI10554*.

c. Once the GPC clean up is completed, go to Step 20.

20. Place the extract in a Kuderna-Danish containing Teflon®-boiling chips.

21. Place a 3-ball Snyder column on the set-up, wet the column with methylene chloride.

22. Concentrate over a steam bath at 80° to 90°C until the apparent volume reaches 1 to 2 mL.

23. Allow the sample to cool at least 10 minutes. Approximately 3 mL condenses into the ampule at this time.

24. Attach the ampule of the K-D to a micro-Snyder column, and concentrate the extract to below 0.5 mL (concentrate extract to below 1.0 mL if matrix of sample is tissue). Allow the sample to cool.

25. Bring to a final volume of 1.0 mL (0.5 mL if GPC was performed on standard solid sample matrix; 1.0 mL if GPC was performed on tissue matrix) with methylene chloride in a labeled amber GC vial.

a. The final volume is determined by placing the extract into an amber-autosampler vial and comparing the level in the vial to a reference vial containing the exact targeted final volume.

b. The vials used for bottling must be the same lot number as the reference vial.

c. Methylene chloride is added to the extract using a disposable pipette until exactly the same level is in both vials.

d. If too much solvent is added to the sample vial, remove the extract from the vial and concentrate it by micro-snydering to slightly less than the targeted final volume and rebottle.

e. Cap the vial and store in the freezer until analysis.

f. Record the final volume in the LIMS.

Calculations
See analysis method.

Statistical Information/Method Performance
See analysis method.

Quality Assurance/Quality Control
For each batch of samples extracted, a method blank, an LCS, an unspiked background sample, an MS, and an MSD must be extracted. If insufficient volume of sample is available for MS/MSD, then an LCSD must be prepared instead.

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batching requirements, these must be followed.

Table I

Instrument Conditions

Power:	1600W
Ramp Temperature:	100°C
Ramp Time:	30 minutes
Hold Time:	10 minutes
Cool Down Time:	20 minutes

T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-OE-GEN-WI7154 Food and Tissue Preparation
T-OE-SVOA-WI10554 Semivolatile Extract Cleanup Using GPC by Method 3640A
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI9252 Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
T-SVOA-WI9587 Tetraethyl lead (TEL) in Water and Solids by 8270D/E by GC/MS
T-SVOA-WI9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9623 Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
T-SVOA-WI9995 Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS

End of document

Version history

Version	Approval	Revision information	
12	31.MAY.2017		
13	20.MAR.2019		
14	01.APR.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-SVOA-WI10935**	**Separatory Funnel Extraction (Method 3510C) of Base Neutrals and Acid Extractables in Leachates**	**Work Instruction**
Old Reference: **1-P-QM-WI -9015149**		
Version: **16**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **18-APR-2022**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 16	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Title	Clarification	Removed waste dilution from title
LIMS ID	New LIMS	Added TALS LIMS ID
Throughout Procedure	New LIMS	Changed documentation from 'on the extraction log' to 'in the LIMS' Added TALS reagent names

Revision: 15	**Effective Date:**	24.Feb.2021
Section	**Justification**	**Changes**

Revision: 15	**Effective Date:**	24.Feb.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure 5 and 6	Clarification	Updated to current practice
Procedure 13 and 14	Clarification	Updated to current practice

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3580A, July 1992
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, December 1996.
3. *Federal Register*, Friday, June 29, 1990, pp. 26986-26998.
4. *Chemical Hygiene Plan,*current version.

Cross Reference

Document	Document Title
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-OE-SVOA-WI10936	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix by Method 3580A
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9623	Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC-MS

Scope

This method is suitable for the extraction of semivolatile organic compounds (base neutral and acid extractables) from the toxicity characteristic leachate (TCLP) of liquid, solid, or multi-phase wastes.

Basic Principles

A 50-mL portion of sample to be analyzed is placed into a separatory funnel. Surrogate standards are added to each sample to monitor the extraction process. The pH of the sample is then adjusted to >11 and the sample is serially extracted with methylene chloride. The pH is then adjusted to <2

and the sample is again extracted with methylene chloride. The solvent fractions are combined, and the extract is dried and concentrated to 1.0 mL.

Reference Modifications

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

High levels of organic compounds in the sample lead to interferences with normal detection limits.

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Therefore, each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a rapid-vap; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employee's training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles with PTFE-lined lids and stored at 0° to 6ºC, not frozen, prior to extraction. Samples must be extracted within 7 days of completion of the leachate. The extract is stored in an amber autosampler vial in the freezer at ≤-10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix
2. Graduated Cylinders – Class A, assorted sizes
3. Pipettes – Class A, assorted sizes
4. Pipettes – Disposable
5. Solvent pumps – Beckman or equivalent
6. Balance – Capable of weighing to 0.01g
7. Centrifuge – Beckman GS-6 or equivalent
8. Sodium sulfate columns with extra course frits
9. Wash bottles – Teflon™
10. Vials – assorted sizes
11. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions.

12. Rapid-Vap Evaporators – for concentration of 250-mL extractions

13. Rapid-Vap Evaporator Tubes – Class A

Reagents and Standards

1. Methylene chloride ($MeCl_2$ or CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. 10N Sodium hydroxide (NaOH) – Lab Chem or equivalent. Store at room temperature for up to 1 year.

3. Sulfuric acid (H_2SO_4) – ACS grade or equivalent. Store at room temperature for up to 1 year.

4. Sodium sulfate (Na_2SO_4), reagent grade or equivalent – Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

5. Extraction Fluid – Prepared and delivered by Department 4028. Store refrigerated in an amber glass bottle at 0° to 6ºC, not frozen, for up to seven days.

6. All QC standards added during extraction process are prepared by Department 4036 using instructions generated by the reagents module. Detailed instructions can be found in *T-SVOA-WI11998*.

Preparation of Glassware

See *T-OE-GEN-WI10864*

Calibration

Not applicable to this procedure.

Procedure

NOTE: If a sample is an oil and needs a waste dilution, refer to *T-OE-SVOA-WI10936*.

1. If the sample bottle contains at least 200 mL of sample:

   a. Shake the bottle vigorously.

   b. Use a clean graduated cylinder to measure 50 mL of sample and pour it into a separatory funnel.

   c. Add 200 mL of reagent water.

   d. Rinse the graduated cylinder with methylene chloride and add the rinseate to the separatory funnel.

e. Record the initial sample volume and any comments about the sample in the LIMS.

2. If required, the background (BKG), matrix spike (MS), and matrix spike duplicate (MSD) are performed on three separate aliquots of a field sample.

   a. If an MS or MS/MSD is required for the sample and 200 mL of sample is available, use 50 mL for each.

   b. If an MS or MS/MSD is required for the sample and there is <200 mL of sample, evenly split half of the volume available between the sample and spikes.

      (1) Add enough reagent water to bring the volume in the separatory funnel to 250 mL.

      (2) Rinse the graduated cylinder with methylene chloride and add the rinseate to the separatory funnel.

      (3) Record the initial volume and any comments about the sample in the LIMS.

3. The blank, LCS, and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 50 mL of extraction fluid measured into the separatory funnel. Reagent water is added to the separatory funnel for a total volume of 250mL.

4. Use pipettes to add surrogate and spiking solutions

   a. Ensure the standard drips directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

   b. Surrogates – Add 1.0 mL of BNA surrogate (OP_MINIBNA_SS) to all samples, blanks, and spikes.

   c. Spiking solutions – Add 1.0 mL of mini LCS #1 (OP_MINLCS1_MS) matrix spiking solution to the LCS, LCSD (if applicable), MS, and MSD.

      (1) If the sample requires any compounds in addition to the priority pollutant semivolatile compounds, add 1.0 mL of the appropriate spiking solution(s) at this time.

      (2) See *T-SVOA-WI11998* for spike details.

      (3) See *T-OE-GEN-WI10876* for storage and handling of spikes.

5. Add approximately 4 drops of 10N sodium hydroxide to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.
6. Check the pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained. Record the information in the LIMS

7. Use a solvent pump to measure 15 mL of methylene chloride and add the solvent directly to the separatory funnel.

8. Cap the funnel, invert it, and vent immediately. Handshake and vent frequently until the pressure is stable.

9. Separatory funnels remain on the Automated Water Extraction bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

10. The separatory funnel will sit undisturbed on the Automated Water Extraction Bench. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

    a. If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

11. Drain the solvent layer directly into the sodium sulfate column containing approximately 10 cm of sodium sulfate. This drains into a Rapid-Vap evaporator tube.

12. Use a solvent pump to add 15 mL of methylene chloride to the separatory funnel and repeat Procedure Steps 8 through 11 two more times, venting only as necessary. The acid extract is also added to this Rapid-Vap evaporator tube.

13. Add approximately 10 drops of sulfuric acid to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.
14. Check the pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained. Record the information in the LIMS.

15. Using three 15-mL aliquots of methylene chloride, serially extract the sample as described in Procedure Steps 8 through 11, venting only as necessary, and collect the solvent in a Rapid-Vap evaporator tube.

16. Use a solvent pump to rinse the sodium sulfate column with approximately 5 mL of methylene chloride.

17. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes, and set the speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 PSI (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 0.5 mL.

    NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

18. Rinse the evaporator tube with 5 mL of methylene chloride and repeat step 17.

19. Quantitatively transfer the sample from the Concentrator Tube to an amber autosampler vial.

    a. Determine the final volume (1.0 mL) by placing the extract into an amber-autosampler vial and comparing the level in the vial to a vial containing the targeted final volume.

    b. Add methylene chloride to the extract using a disposable pipette until exactly the same level is in both vials.

c. If too much solvent is added to the sample vial, remove the extract from the vial, concentrate it to slightly less than the targeted final volume, and rebottle.

20. Cap the vial securely and store it in the freezer at ≤-10°C. Record the final volume in the LIMS.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared.

Each extraction batch must contain a method blank, an LCS, and any matrix type spike samples that are specified on the TCLP nonvolatiles batch sheet must be prepared. In addition, one of the matrix spike samples specified on the TCLP nonvolatile batch sheet must be extracted as MS/MSD. If no matrix spike samples are designated on the TCLP nonvolatile batch sheet, an LCSD must be prepared instead.

If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing should be used.

If any client, state, or agency has more stringent QC or batching requirements, these must be followed instead.

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
10936 Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix by Method 3580A
11998 Semivolatile Spiking and Calibration Standards
9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
9623 Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS

End of document

Version history

Version	Approval	Revision information	
14	24.DEC.2019		
15	24.FEB.2021		
16	04.APR.2022		

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015149_12_4731.doc
Errortext: Unable to fetch attachment

eurofins	Always check on-line for validity. **Extraction of Nitroaromatics and Nitroamines by Method 3535A in Water**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10942**		
Old Reference: **1-P-QM-WI -9015171**		
Version: **15**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **25-AUG-2022**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Explosives Waters and, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_Explosive Chem**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Preparation of Glassware
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 15	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Reagents and Standards	Reflects current practice	Removed sulfuric acid and the making of 10% sulfuric acid
Procedure 1	Reflects current practice	Removed sulfuric acid rinsing. All glassware will be rinsed with acetone

Revision: 14	**Effective Date:**	August 01, 2022
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Removed references to Parallax and replaced with TALS and/or D4 references
Reference	Unnecessary	In the previous revision, the method reference was updated from 8330 to 3535A, however the 8330 method references were never removed from this section. These references have now been removed.

Revision: 14	**Effective Date:**	August 01, 2022
Section	**Justification**	**Changes**
Cross Reference	Obsolete	Per document feedback, removed reference to T-PEST-WI9982 as samples are no longer being analyzed under 8330A
Apparatus and Equipment	Reflects vials used	Changed screw cap autosampler vials to clear crimp cap autosampler vials per Procedure 14.a.
Procedure	Reflects current practice	Added spikes to use if additional special compounds are requested

Reference

1. Solid-Phase Extraction (SPE), EPA SW-846 Method 3535A, February 2007.

2. "Analyze Nitroaromatic and Nitroamine Explosives in Groundwater Using Solid Phase Extraction and HPLC," Waters, 1994.

3. *Test Methods for Evaluating Solid Wastes*, EPA SW-846 Method 8330B, Rev. 2, October 2006.

4. *Chemical Hygiene Plan,* current version.

Cross Reference

Document	Document Title
T-PEST-WI9981	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

The method is for the extraction of trace levels of nitroaromatics and nitroamines from explosives in water samples.

Basic Principles

A portion of the sample is passed through a Porapak RDX cartridge. The cartridge is then eluted with acetonitrile and the extract is brought to exactly 5 mL. The extract is diluted to 10 mL using a calcium chloride solution.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be is rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are then transferred to the lab-wide disposable facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Samples suspected of being high in explosives must be handled with extreme care.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in 1-L, unpreserved, amber glass bottles with PTFE-lined lids and stored refrigerated at 0° to 6°C, not frozen, prior to extraction. Samples must be extracted with 7 days of collection. The extract is stored in a clear autosampler vial in a refrigerator at 0° to 6°C, not frozen, for up to 40 days after extraction.

Preparation of Glassware

See *T-OE-GEN-WI10864*.

Apparatus and Equipment

1. Porapak RDX Sep-pak extraction cartridges – Waters
2. SPE vacuum manifold system – Baker or equivalent
3. Disposable pipettes – glass
4. Volumetric pipettes – Class A, assorted sizes
5. Graduated cylinders – Class A, assorted sizes
6. Disposable cartridge membrane filters – 0.2-µm Teflon
7. Clear crimp cap autosampler vials
8. 12-mL screw cap vials
9. Volumetric flask – Class A, assorted sizes
10. Filter paper – Fisher glass fiber or equivalent
11. Buchner funnel

Reagents and Standards

1. Acetonitrile (ACN) – HPLC grade. Store at room temperature for up to 1 year.
2. Calcium Chloride ($CaCl_2$) – Reagent grade.
   a. To prepare solution:
      (1) Add 5.0 g $CaCl_2$ to approximately 800 mL of reagent water.
      (2) Shake until the $CaCl_2$ goes into solution.
      (3) Dilute to 1000 mL with reagent water.
   b. Store at room temperature in a glass bottle. Reagent is stable 1 year.
   c. Preparation of larger volumes is acceptable if equivalent volumes are used.

d. Document all reagent preps in the appropriate logbooks.

4. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the reagent module of the LIMS. Detailed instructions can be found in the corresponding analytical SOP *T-PEST-WI9981*.

Calibration

Not applicable to this procedure.

Procedure

1. Rinse all glassware with acetone using a wash bottle.

2. Measure 500 mL of each sample into 500-mL volumetric flasks.

3. Measure 500 mL reagent water into 500-mL volumetric flasks for the blank, Laboratory Control Sample (LCS), and Laboratory Control Sample Duplicate (LCSD) if applicable.

4. If necessary, filter the samples through a Buchner funnel and filter paper.

If any samples are filtered, the blank, LCS, and LCSD must also be filtered.

5. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates are added to all samples (including all QC).

   b. Spikes are added to the LCS, LCSD (if applicable), Matrix Spike (MS), and Matrix Spike Duplicate (MSD) samples.

   c. The surrogates and spikes are as follows:

      (1) Surrogate: 0.5 mL Explosives Water Surrogate (OP_EXPW_SS)

      (2) Spike: 0.5 mL 8330B Explosives Spike (OP_8330B_MS)

      (3) If 2,4-diamino-6-nitrotoluene or 2,6-diamino-4-nitrotoluene are requested, create an additional LCS/LCSD. Add 0.1 mL of OP_246DIA_STK and OP_264DIA_STK to both.

   d. See *T-PEST-WI9981* for spike details.

   e. See *T-OE-GEN-WI10876* for storage and handling of spikes.

6. Assemble the SPE vacuum manifold with the Porapak RDX cartridges.

7. With the valves closed, use a graduated cylinder to add 15 mL of ACN to each reservoir.

   a. Elute the solvent through the cartridge at 10 mL/min.

   b. Empty the waste in the chamber into the appropriate solvent waste container.

8. Again, with the valves closed, use a graduated cylinder to add 30 mL of reagent water to each reservoir.

Elute the water through the cartridge at 10 mL/min.

9. Pull all samples through the cartridge at 10 mL/min. Empty the chamber as needed so it does not overflow.

10. Place labeled 5-mL volumetric flasks, numbered to match the cartridges, into the tube holder.

    a. Place the tube holder into the vacuum chamber.

    b. Place the top onto the vacuum chamber; the drip tips must go into the top of the volumetric flasks.

11. Use a graduated cylinder to elute the cartridge with 5 mL of ACN.

    a. Disassemble the vacuum chamber.

    b. Bring each sample to exactly 5.0 mL with ACN.

12. Use a disposable pipette to transfer the extract to a 10-mL volumetric flask.

13. Use $CaCl_2$ solution to rinse the 5-mL volumetric flask and add the rinseate to the 10-mL flask.
    a. Add enough $CaCl_2$ solution to the flask to bring the extract to exactly 10.0 mL.
    b. Mix thoroughly.
14. Filter the extract through a 0.2-µm filter into a clear screw cap 12-mL vial.
    a. Bottle a portion of the extract into two clear crimp cap auto sampler vials.
    b. Verify that all vials are labeled with the appropriate sample number.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in any day an additional batch must be prepared.

For each batch of samples extracted a blank, an LCS, an MS and an MSD must be extracted. If there is limited sample preventing the preparation of the MS/MSD, then an LCSD must be prepared instead. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
9981 Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection

---

End of document

Version history

Version	Approval	Revision information	
13	26.FEB.2020		
14	12.APR.2021		
15	11.AUG.2022		

eurofins	Always check on-line for validity. **Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330B in Solids**	Level: **Work Instruction**
Document number: **T-OE-PEST-WI10943**		
Old Reference: **1-P-QM-WI -9015173**		
Version: **18.1**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **30-MAR-2022**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Explosives Waters and, 6_EUUSLA_Pesticide Residue Analysis_All Management, 6_EUUSLA_Pesticide Residue Analysis_Explosive Chem**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 18	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced references to old LIMS/data recording with new LIMS
Procedure	Reflects current practice	Updated all instances of 10.4g to 10.5g
Procedure A.7 and B.7	Reflects current practice	Separated centrifugation step into two parts. First centrifuge at 1000 rpm for 15 minutes. If further centrifugation is required, centrifuge at up to 1500 rpm for 20 minutes.

Revision	17	**Effective Date:**	28-DEC-2020
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Header	Deactivated methods		Removed 8330 and 8330A methods

Revision	17	**Effective Date:**	28-DEC-2020
LIMS ID	Deactivated analyses		Removed 6917 and 11138
Reference	Deactivated methods		Removed references to methods 8330 and 8330A
Cross Reference	Deactivated methods		Removed SOP linked to methods 8330/A
Sample Collection, Preservation, and Handling	Clarification		Added lack of preservation
Reagents and Standards 6	Deactivated analyses		Removed 6916, 6918, 10595, and 10596
Procedure	Deactivated analyses		Removed section A - methods no longer in use
Procedure A.6	Reflects current practice		Changed desired water level in ultrasonic bath

Reference

1. *Test Methods for Evaluating Solid Wastes*, EPA SW-846 Method 8330B, Rev. 2, October 2006.
2. *Chemical Hygiene Plan,* current version.

Cross Reference

Document	Document Title
T-PEST-WI9981	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
S-SS-WI11268	Sample Preparation of Solid Samples Including Sieving and Milling for Extraction and Analysis

Scope

This method is applicable for the extraction of trace levels of nitroaromatics and nitroamines from explosives in solid samples.

Basic Principles

A portion of sample to be analyzed is placed in a vial and dried with sodium sulfate. Acetonitrile (ACN) is added and the sample is vortexed to suspend the soil in the solvent. The sample is then placed into a chilled ultrasonic bath and sonicated for 18 hours. After sonication, it is centrifuged for 15 to 20 minutes and a portion of the ACN is removed from the vial. The volume of the removed aliquot is doubled by adding an equal volume of calcium chloride solution. The extract is then filtered.

Reference Modifications

Drying during homogenization results in loss of the analytes of interest, therefore, the samples are not dried or crushed with a mortar and pestle or passed through a 30-mesh sieve. Sodium sulfate is added to absorb any water that may be present in the sample.

The sample is centrifuged to provide better separation of the soil and solvent.

Filtration through a 0.45-µm filter is sufficient to remove particles from the extract for samples that are not puck milled, since the sample is not ground with a mortar and pestle and passed through a sieve. A 0.1-µm filter is required for samples that are puck milled.

Interferences

Method interferences may be caused by impurities in solvents, reagents, glassware, or other hardware used in sample processing. All glassware is rinsed with solvent before use and a method blank is performed with each batch of sample to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Samples suspected of being high in explosives must be handled carefully. Soil samples must not be dried in an oven and not ground with a mortar and pestle if high concentrations of explosives are suspected. Method 8510 is used to screen for high levels of explosives if suspected. Lumps of material that have a chemical appearance must be suspect and not ground. Explosives are generally a finely ground, grayish-white material.

Prior to performing moisture analysis, all soil samples must be found to contain less than 1% by weight total explosives. If samples are found to contain greater than this level, wet weight results must be reported. If moisture determination is deemed safe, contact client services to add moisture analysis to sample.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or must be disposed of in the designated containers. These will then be transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) may be disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the technicians training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (or alternatively, one blind sample for the DOC) that is carried through all steps of the extraction and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Samples are collected in unpreserved, wide-mouth glass jars with PTFE-lined lids. They must be extracted within 14 days of collection. All samples must be stored refrigerated 0°to 6°C, not frozen.

Apparatus and Equipment

1. Top loader balance – Capable of weighing to 0.01 g
2. Disposable pipettes
3. Pipettes – Class A, assorted sizes
4. Disposable syringes – 20-mL
5. Disposable cartridge membrane filters – 0.45-µm PTFE filters, Whatman brand catalog #6875-2504 or equivalent

6. Volumetric flasks – Class A, assorted sizes
7. Glass vials – 25 mL
8. Vortex mixer
9. Temperature controlled ultrasonic bath
10. Glass bottles
11. Wash bottles
12. Glass jars
13. Syringes – Assorted sizes
14. Graduated cylinders – Class A, assorted sizes
15. Centrifuge – Beckman Allegra or equivalent
16. Disposable cartridge membrane filters - 0.1-µm PTFE filters, Whatman brand catalog #6798-2501 or equivalent
17. Centrifuge tubes- 15 ml disposable centrifuge tubes, Fisher brand catalog #05-539-5 or equivalent

Reagents and Standards

1. Acetonitrile (ACN) – HPLC grade. Store at room temperature for up to one year.
2. Calcium chloride ($CaCl_2$)– Reagent grade.
   a. To prepare solution, add 5.0 g $CaCl_2$ to approximately 800 mL of reagent water in a 1,000-mL volumetric flask. Shake until the $CaCl_2$ goes into solution. Use a wash bottle to dilute to 1,000 mL with reagent water.
   b. Store at room temperature in a glass bottle. Reagent is stable 1 year.
   c. Larger volumes may be prepared as long as equivalent volumes are used.
   d. Document all reagent preparation in the appropriate logbooks or the TALS reagent module.
3. Sodium sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.
4. Sand – Standard Ottawa or equivalent. Bake at approximately 400°C for a minimum of 4 hours prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.
5. Acetone - Pesticide grade or equivalent. Store at room temperature for up to 1 year.
6. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the TALS reagent module. Detailed instructions can be found in the corresponding analytical work instruction *T-PEST-WI9981*.
7. Certified Reference Material (CRM)- To be used for the Laboratory Control Sample Incremental Sampling Method (LCSISM) that is required on each batch of samples that are puck milled.
   a. To create the CRM, a 5 mL custom spike from Phenova is added to 500 grams of a clean solid material, puck milled (see *S-SS-WI11268*), and stored in a glass screw top jar at 0° to 6°C, not frozen. The expiration for the CRM is 7 days from the creation date.
8. Custom 8330B standard - Phenova custom 5 mL spiking solution containing 17 analytes at a final spiked concentration of 2000 ug/kg (with Nitroglycerin and PETN at a final spiked concentration of 10,000 ug/kg) in Acetonitrile, or equivalent. Each standard is provided as a pre-measured 5.00 mL spike flame sealed in a 10 mL

amber ampoule, designed for "snap and spike" use where quantitative transfer of 100% of the 5 mL is applied to 500 g clean solid matrix to create the CRM.

9. Clean soil matrix – Blank soil matrix for 8330B purchased from Phenova or equivalent. The clean soil matrix is used to create the CRM.

Preparation of Glassware

See *T-OE-GEN-WI10864*.

Calibration

Not applicable for this procedure

Procedure

NOTE: All samples must be properly prepared prior to extraction. The preparation could include homogenization, drying, etc. Please ask your group leader if you have any questions.

A. For samples that do not require puck mill

1. Weigh 10.0 to 10.5g of sample into a 40-mL glass vial.

   a. Record the initial weight and any comments about the sample in the LIMS.

   b. The background, MS, and MSD are performed on three separate aliquots of a field sample.

2. The Blank, LCS, and LCSD (if applicable) and Diamino LCS and Diamino LCSD are prepared by weighing 10.0 to 10.5 g of sand into a vial. Record the weight in the LIMS.

3. Add approximately 2 g of sodium sulfate to all vials and mix. More sodium sulfate can be added if samples are wet. Sodium sulfate should be added until a free flowing mixture is observed.

4. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates are added to all samples (including all QC).

   b. Spikes are added to the LCS, LCSD (if applicable), MS, and MSD samples. Diamino Stocks are added to the Diamino LCS and Diamino LCSD.

   c. Typically, the surrogates and spikes are as follows:

      (1) Surrogate: Add 0.5mL Explosive Soil Surrogate (OP_EXPS_SS).

      (2) Spike: Add 0.5 mL 8330B Explosives spike (OP_8330B_MS) into LCS, LCSD, MS and MSD, if applicable.

      (3) Stocks: If 2,4-diamino-6-nitrotoluene or 2,6-diamino-4-nitrotoluene are requested, add 0.18 mL of 2,6-Diamino-4-nitrotoluene (OP_2,4D6N_STK) and 0.18 mL of 2,6-Diamino-6-nitrotoluene (OP_2,6D4N_STK) stocks into Diamino LCS and Diamino LCSD.

   d. See *T-PEST-WI9981* for spike details.

   e. See *T-OE-GEN-WI10876* for storage and handling of spikes.

5. Use a graduated cylinder to add 20.0 mL of ACN and vortex swirl the sample for approximately 1 minute to suspend the soil in the ACN.

6. Place the sample in a cooled (<30°C) ultrasonic bath that contains a level of water equal to the level of sample in the vial and sonicate for 18 hours.

   Document the temperature of the bath when the samples are placed in the bath and the temperature of the bath when the samples are removed in the LIMS.

7. After sonication, centrifuge the sample at 1,000 rpm for 15 minutes. If further centrifuging is required because the sample is not separating, centrifuge at up to 1,500 rpm for 20 minutes.

8. Use a pipette to place 5.0 mL of calcium chloride solution (5 g/L) into a 10-mL volumetric flask that has been rinsed with acetone.

   a. Use a disposable pipette to bring to volume using the solvent layer of the centrifuged sample.

   b. Mix thoroughly.

   c. Allow the mixture to stand 15 minutes.

9. Filter all the samples, including QC samples, through 0.45-µm PTFE filters (Whatman brand catalog # 6874-2504 or equivalent) using a 10-mL disposable syringe.

   a. Discard the first 3 mL.

   b. Filter into two clear GC vials.

   c. Filter the remaining sample into a clear 12 mL vial.

   d. Store in the refrigerator at 0° to 6°C, not frozen, until analysis.

   e. Document the final volume as 40.0 mL in the LIMS.

B. For samples that require puck mill (See *S-SS-WI11268* for puck mill instructions.)

1. Weigh 10.0 to 10.5 g of sample into a 40-mL glass vial.

   a. Record the initial weight and any comments about the sample in the LIMS.

2. Quality control samples:

   a. The background, MS, and MSD are performed on three separate aliquots of a field sample weighed out at 10.0 to 10.5 g.

   b. The Blank, LCS, and LCSD (if applicable) and Diamino LCS and Diamino LCSD are prepared by weighing 10.0 to 10.5 g of sand into a 40-mL glass vial.

   c. An LCSISM is required on each scheduled batch of samples. The LCSISM is prepared by weighing out 10.0 to 10.5 g of CRM into a 40-mL glass vial. See document number *S-SS-WI11268* for details on creating CRM.

   d. One sample is required to be prepared in triplicate on each scheduled batch. The sample to be prepared in triplicate is assigned three unique sample numbers at the time of sample entry. The triplicate samples are weighed out at 10.0 to 10.5 g. The triplicate samples are scheduled on batches through the LIMS. See document number *S-SS-WI11268* for details on creating the triplicate samples.

   e. Puck mill blanks are created each time samples are processed through the puck mill. The puck mill blank is given a unique sample number and is scheduled on batches through the LIMS. The puck mill blanks are weighed out at 10.0 to 10.5 g. See document number *S-SS-WI11268* for details on creating the puck mill blank.

   f. Record the weights of all QC samples in the LIMS.

3. Add approximately 2 g of sodium sulfate to all vials and mix.

4. Use pipettes to add surrogate standards and spiking solutions.

   a. Surrogates are added to all samples (including all QC).

   b. Spikes are added to the LCS, LCSD (if applicable), MS, and MSD samples. Diamino Stocks are added to the Diamino LCS and Diamino LCSD.

   c. Typically, the surrogates and spikes are as follows:

(1) Surrogate: Add 0.5mL Explosive Soil Surrogate (OP_EXPS_SS).

(2) Spike: Add 0.5 mL 8330B Explosives spike (OP_8330B_MS) into LCS, LCSD, MS and MSD, if applicable.

(3) Stocks: If 2,4-diamino-6-nitrotoluene or 2,6-diamino-4-nitrotoluene are requested, add 0.18 mL of 2,6-Diamino-4-nitrotoluene (OP_2,4D6N_STK) and 0.18 mL of 2,6-Diamino-6-nitrotoluene (OP_2,6D4N_STK) stocks into Diamino LCS and Diamino LCSD.

d. See *T-PEST-WI9981* for spike details.

e. See *T-OE-GEN-WI10876* for storage and handling of spikes.

5. Use a graduated cylinder to add 20 mL of ACN and vortex swirl the sample for approximately 1 minute to suspend the soil in the ACN.

6. Place the sample in a cooled (<30°C) ultrasonic bath that contains a level of water equal to the level of solvent in the vial and sonicate for 18 hours.

7. Document the temperature of the bath when the samples are placed in the bath and the temperature of the bath when the samples are removed in the LIMS.

8. After sonication, centrifuge the sample at 1,000 rpm for 15 minutes. If further centrifuging is required because the sample is not separating, centrifuge at up to 1,500 rpm for 20 minutes.

9. Use a pipette to place 5 mL of calcium chloride solution (5 g/L) into a 10-mL volumetric flask that has been rinsed with acetone.

   a. Use a disposable pipette to bring to final volume of 10-mL in the 10-mL volumetric flask containing the 5-mL of calcium chloride solution using the solvent layer of the centrifuged sample.

   b. Mix thoroughly.

   c. Allow the mixture to stand for 15 minutes.

   d. Transfer the 10-ml of extract into a 15ml centrifuge tube (Fisher brand catalog #05-539-5 or equivalent).

   e. Centrifuge the samples between 1,000 and 1,500 rpm for 5 minutes.

10. Filter all samples,, including QC samples, through 0.1-µm PTFE filters (Whatman brand catalog # 6798-2501 or equivalent) using a 10-mL disposable syringe.

    a. Discard the first 3 mL.

    b. Filter into two clear GC vials.

    c. Filter the remaining sample into a clear 12 mL vial.

    d. Store in the refrigerator at 0° to 6°C, not frozen, until analysis.

    e. Document the final volume as 40.0 mL in the LIMS.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day, but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. For each batch of samples extracted, a blank, LCS, MS, and MSD must be extracted. If there is limited sample that prevents the preparation of the MS/MSD, then an LCSD must be prepared instead. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing must be used.

If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
11268 Sample Preparation of Solid Samples Including Sieving and Milling for Extraction and Analysis
9981 Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection

---

End of document

Version history

Version	Approval	Revision information	
17	14.DEC.2020		
18	22.MAR.2021		
18.1	29.MAR.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-GC-WI10944**	**Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater**	**Work Instruction**
Old Reference: **1-P-QM-WI -9015175**		
Version: **24**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **25-APR-2022**	Document users: **5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_DRO Waters, 6_EUUSLA_EPH/Misc. GC_All Management/Verifier/Prin, 6_EUUSLA_EPH/Misc. GC_Chemist DRO Water, 6_EUUSLA_EPH/Misc. GC_Chemist DRO/Dx Mini Water, 6_EUUSLA_EPH/Misc. GC_TPH/Interpretive Chemist**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Preparation of Glassware
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 24	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Quality Assurance/Quality Control	Update/Clarification	Clarified how many duplicates should be prepared per number of samples in a batch
Cross Reference	Update	Updated the document titles
Procedure 13	Reflects current practice	Removed time (10 min) for allowing the sample to sit undisturbed

Revision: 23	**Effective Date:**	March 31, 2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Document	New LIMS	Replaced references to old LIMS/data recording with new LIMS
Apparatus and Equipment	Update	Added pH paper; removed scriber
Throughout Procedure	Combined work instructions	Incorporated steps for 3510C_CA 500 mL extraction
Procedure	Reflects current practice	Spiking is performed prior to pH-ing, steps rearranged accordingly

Revision: 23	**Effective Date:**	March 31, 2021
Section	**Justification**	**Changes**
Procedure 1	Reflects current practice	Removed note regarding use of 1L for samples from South Carolina
Procedure 2	New LIMS	Updated steps to determine sample volume using weight as opposed to measuring volume using a graduated cylinder and scriber
Procedure 7	Reflects current practice	Removed "wide range" for the type of pH paper used
Procedure 13	Reflects current practice	Added statement to document when the sample requires centrifugation

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev. 3, December 1996.
2. *"Method for the Determination of Diesel Range Organics"*, American Petroleum Institute, Revision 4, August 8, 1993.
3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-GC-WI9786	DRO and ORO by 8015B/C/D in Water using GC-FID
T-GC-WI9656	Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID
T-GC-WI9778	TPH and Quantitative Fuel Fingerprinting by Methods 8015B/C/D mod. in Waters and Solids Using GC-FID
T-GC-WI9771	Total Petroleum Hydrocarbons with Ranges by Methods 8015B/8015C/8015D in Waters and Solids by GC-FID
T-GC-WI9772	Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID
T-OE-GC-WI10278	10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
T-OE-GC-WI10949	3 g Silica Gel Column Cleanup for DRO by Method 3630C
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling

Scope

This procedure is for the extraction of diesel range organics (DRO) from waters and wastewaters. This extraction procedure is an acceptable substitute for the state-specific methods for Iowa, Missouri, and Wyoming.

Basic Principles

An aliquot of the sample is placed into a separatory funnel. The volume of sample extracted may be adjusted depending on the physical appearance of the sample. A surrogate standard is added to the sample to monitor

recovery. The sample is then serially extracted with methylene chloride. The extract is dried and concentrated.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a quad study is performed and on file.

Reference Modifications

EPA Method Deviation: Surrogate and matrix spiking solutions are not added before the transfer of the sample to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.
2. Many sample bottles have no headspace and there is no room to add surrogate to the bottle.
3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.
4. To maintain consistency with all extractions, no samples will be spiked in the bottle or graduated cylinders.

Interferences

Impurities in solvents, reagents, glassware, or other hardware used in sample processing interfere with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath; caution must be exercised while working around this apparatus.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility.

Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employee's training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of

Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in amber glass bottles with PTFE-lined lids and stored at 0° to 6°C, not frozen, until the time of extraction. Samples do not require preservation but samples submitted preserved to a pH <2 with HCl can be analyzed for this analysis. The extraction must be performed within 7 days of sample collection. The extract is stored in the freezer at less than or equal to -10 °C.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction
3. Steam bath – VWR/LLI Model #1127 or equivalent
4. Sodium sulfate column with extra course frit
5. Graduated cylinders – Class A, assorted sizes
6. Pipettes – Class A, assorted sizes
7. Automatic shaker – Glass Col or equivalent
8. Pipettes – Disposable
9. Reagent pumps – Brinkmann, adjustable or equivalent
10. Centrifuge – Beckman GS-6 or equivalent
11. Micro-snyder columns
12. Wash bottles – Teflon
13. Vials – assorted sizes
14. Teflon boiling chips
15. Balance – Capable of weighing to 0.1 g
16. Teflon separatory funnel
17. 1-mL and 2-mL Class A volumetrics
18. Automated Water Extraction Bench – Capable of holding separatory funnels for 250-mL extractions
19. Rapid-Vap Evaporators – for concentration of 250-mL extractions
20. Rapid-Vap Evaporator Tubes – Class A
21. pH paper capable of indicating a pH of <2

Reagents and Standards

1. Methylene chloride (CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to 1 year.

2. Hydrochloric acid (HCl) – ACS grade or equivalent. To prepare 1:1 solution, add equal amount concentrated acid to reagent water. **Never add water to acid**. Store in a glass bottle for up to 1 year.

3. Sodium sulfate (Na_2SO_4) – Reagent grade or equivalent. Bake at ~ 400°C for a minimum of 4 hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1 year.

4. Silica gel, 60 - 200 mesh – Baked at 120° to 130°C for 12 hours. Store in the desiccant cabinet for 6 months before re-baking. Alternatively store in an oven at 100° to 105°C.

5. Reagent water – water in which an interferent is not observed at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

6. All QC standards added during extraction process are prepared by Organic Extractions using instructions generated by the standards database. Detailed instructions can be found in the corresponding analytical SOPs.

Preparation of Glassware

See *T-OE-GEN-WI10864*

Calibration

Not applicable to this procedure.

Procedure

1. Determine the volume of sample to be used for each extraction. Ideally, one full bottle is used (Typically this is 1L for routine 3510C extraction, 500mL for 3510C_CA extraction, or 250mL for 3510C_LVI extraction).

2. If using one full bottle:

   a. Place the full sample bottle, with cap, on the scale.

   b. Record this weight in the LIMS as the gross weight.

   c. Shake the bottle vigorously.

   d. Pour the sample into a separatory funnel

   e. Record any comments about the sample in the LIMS.

3. Reduced volumes of sample are only used with prior approval by the client or if the matrix of the sample prohibits the use of the full volume (thick, approximately 1/3 or more sediment, distinct fuel layer on the water, extremely foul odor).

   a. If using reduced volume of sample due to matrix problems, take as much sample as possible while trying to avoid matrix problems.

   b. Reduced volume aliquots are 500, 200, 100 mL, or less if the matrix is extremely difficult.

c. Use a clean graduated cylinder to measure out the desired volume of sample to be used and add enough reagent water to bring the volume up to 1L (250 mL for 3510C_LVI extraction, 500 mL for 3510C_CA extraction).

d. Pour sample into a separatory funnel.

e. Rinse the graduated cylinder with methylene chloride, and add the rinseate to the separatory funnel.

f. Record the original sample volume used and comment why the reduced volume was used in the LIMS.

g. If uncertain of the volume to extract for any sample, consult your supervisor.

4. The blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) are prepared using 1 L of reagent water (250 mL for 3510C_LVI extraction, 500 mL for 3510C_CA extraction) measured into the separatory funnel and preserved with 5 mL of 1:1 HCl in water solution (1 mL of 1:1 HCL in water solution for 3510C_LVI extractions).

5. The background, MS, and MSD (if applicable) are performed on three separate aliquots of a field sample.

6. Use a pipette to add surrogate standards and spiking solutions to the aqueous sample in the separatory funnel.

a. Be certain the standard drips directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

b. Surrogates

(1) Analyses starting with 8015(B, C, or D)_DRO paired with a 1L prep – 1.0 mL of 2-µL DRO Water Surrogate (OP_DROW#2_SS) is added to all samples (including all QC).

(2) Analyses starting with 8015(B, C, or D)_TPH - 1.0 mL of DRO Water Surrogate (OP_DROW#1_SS) is added to all samples (including all QC).

(3) Prep methods 3510C_LVI or 3510C_LVI_14d - 1.0 mL of Mini DRO Water Surrogate (OP_MINIDRO_SS) is added to all samples (including QC).

(4) Prep method 3510C_CA - 1.0 mL low vol CA surrogate (OP_LOWCA_SS) is added to all samples (including QC).

c. Spiking solutions

(1) Analyses starting with 8015(B, C, or D)_DRO paired with a 1L prep - 1.0 mL of 2-µL DRO Water Spike solution (OP_DROW#2_MS) is added to the LCS, LCSD, and if applicable, MS and MSD samples.

(2) Analyses starting with 8015(B, C, or D)_TPH - 1.0 mL of DRO Water Spike (OP_DROW#1_MS) is added to the LCS, LCSD, and if applicable, MS and MSD samples.

(3) Prep methods 3510C_LVI or 3510C_LVI_14d - 1.0 mL of Mini DRO Water Spike (OP_MINIDRO_MS) is added to the LCS, LCSD and if applicable MS and MSD samples.

(4) Prep method 3510C_CA – 1.0 mL of low vol CA spike (OP_LOWCA_MS) is added to the LCS, LCSD and if applicable MS and MSD samples.

d. If a sample requires any special compounds in addition to the standard list, an appropriate spike containing the compounds is also added at this time.

e. Spikes are changed to accommodate specific client requirements if appropriate.

f. See ***T-OE-GEN-WI10876*** for storage and handling of spikes.

7. If using 500 mL or less of sample or if the original sample bottle was not preserved with HCl:

a. Use a reagent pump to add 5 mL of 1:1 HCl in water solution to the sample (1 mL of 1:1 HCL in water solution for 250mL extractions).

b. Mix samples with added 1:1 HCl by swirling the separatory funnel in a circular motion.

c. Use pH paper to check all samples to confirm a pH of <2, and record the results in the LIMS. If the pH isn't <2, add 1:1 HCL in increments of approximately 1mL and check the pH after each addition until the sample reaches a pH of <2.

8. If the original sample bottle is empty:

a. Use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250mL extraction). Add the solvent to the sample bottle and swirl the bottle to rinse the interior with methylene chloride. Add the solvent to the separatory funnel.

b. Place the rinsed, empty sample bottle, with cap, on the scale. Record this weight in the LIMS as the tare weight.

c. The initial amount is calculated in the LIMS by subtracting the tare weight from the gross weight.

9. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250mL extraction) and add the solvent directly to the separatory funnel.

10. Cap the funnel, invert it, and vent immediately.

11. Handshake and vent frequently until the pressure is stable.

12. For 1-Liter and 500-mL extractions: Place the sample on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.

For 250-mL extraction: Separatory funnels remain on the Automated Water Extraction bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.

NOTE: Shaker speeds vary greatly between instruments so the proper setting is marked on each.

13. For 1-Liter and 500-mL extractions: Place the separatory funnel on the rack and allow it to sit undisturbed. For 250-mL extraction: the separatory funnel will sit undisturbed on the Automated Water Extraction bench.

a. The time required for extracts to set undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusual high density (i.e. high salt content).

b. If an emulsion forms and is greater than 1/3 of the volume of the solvent layer, mechanical techniques such as pouring the emulsion into a Teflon separatory funnel and centrifuging (2500 rpm for 2 minutes) must be employed to complete the separation. Document that centrifuging was required in the sample comments of the LIMS.

14. For 1 Liter and 500-mL extractions: Drain the solvent layer into a metal beaker and pour it through approximately 10cm (~4 in) of sodium sulfate into a K-D apparatus containing Teflon boiling chips. For 250-mL extraction: drain the solvent layer directly into the sodium sulfate column containing approximately 5cm (~2 in) of sodium sulfate. This drains directly into a Rapid-Vap Evaporator Tube.

15. For 1 Liter and 500-mL extractions: Rinse the beaker with approximately 20 mL of methylene chloride and add to the salt column. (For 250-mL extractions, rinse salt column with approximately 5 mL of methylene chloride).

16. Add 60 mL of methylene chloride (15 mL for 250-mL extraction) to the separatory funnel and repeat Procedure Steps 12 through 14, venting only as necessary.

17. Again, add 60 mL of methylene chloride (15 mL for 250-mL extraction) to the separatory funnel and again repeat Procedure Steps 12 through 14, venting only as necessary.

18. Perform a final rinse of the beaker with approximately 20 mL of methylene chloride and add to the salt column. Then, using a wash bottle, rinse the sodium sulfate column with approximately 20 mL of methylene chloride (5 mL for 250-mL extraction).

19. For 250-mL extractions (3510C_LVI, 3510C_LVI_14d):

a. Place the Evaporator Tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 15 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). Confirm that the nitrogen is set at 15 psi (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 1 mL. Bring to final volume 2 mL in the Class A Evaporator Tube by rinsing with Methylene Chloride.

NOTE: the temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices.

b. Mix the sample thoroughly in the Evaporator Tube .

c. If the sample is not scheduled for split and does not require cleanup, bottle the extract into two clear, labeled, crimp-top auto sampler GC vials.

d. Deliver both vials of extract to the instrument laboratory and store in the freezer at less than or equal to -10ºC.

e. If the sample is scheduled for both "with" and "without" silica gel column cleanup:

(1) Remove exactly 1.0 mL from the volumetric and bottle in a clear GC vial. Deliver the extract to the instrument laboratory and store in their freezer at less than or equal to -10ºC.

(2) Place the remaining 1.0 mL of extract in a GC vial. Store the vial in the GPC freezer for 3g silica gel column cleanup (3630C_LVI).

20. For 1-Liter and 500-mL extractions:

a. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 3 to 5 mL on a steam bath at 80° to 90°C. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 10-20 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood. This steam bath temperature ensures concentration in a reasonable length of time.

To avoid loss of analytes do not allow the ampule to go dry

b. Allow the sample to cool for 10 minutes.

FOLLOW THE STEPS BELOW BASED ON THE METHODS REQUESTED

21. For analyses starting with 8015_DRO:

a. Concentrate the sample to slightly below 2 mL using a microsnyder.

b. Bring the sample to a final volume of 2.0 mL with methylene chloride using a Class A 2-mL volumetric.

c. Mix the sample in a volumetric with a disposable pipette.

d. If the sample is not scheduled for split and does not require cleanup, bottle the extract into two clear, labeled, crimp-top auto sampler GC vials. Deliver both vials of extract to the instrument laboratory and store in the freezer at less than or equal to -10ºC.

e. If the sample is scheduled for both "with" and "without" silica gel column cleanup:

(1) Remove exactly 1.0 mL from the volumetric and bottle in a clear GC vial. Deliver the extract to the instrument laboratory and store in their freezer at less than or equal to -10ºC.

(2) Place the remaining 1.0 mL of extract in a GC vial. Store the vial in the GPC freezer for silica gel column cleanup (3630C_Mod_10).

22. For analyses starting with 8015_TPH:

a. Concentrate the sample to slightly below 1 mL using a microsnyder.

b. Bring the sample to final volume of 1 mL with methylene chloride using a Class A 1-mL volumetric.

c. If the sample is not scheduled for split and does not require cleanup, bottle the extract into two clear, labeled, crimp-top auto sampler GC vials. Deliver both vials of extract to the instrument laboratory and store in their freezer at less than or equal to -10ºC.

d. If the sample is scheduled for both "with" and "without" 10g silica gel column cleanup:

(1) Remove exactly 0.2 mL from the volumetric and bottle in a clear GC vial with insert. Deliver the extract to the instrument laboratory and store in their freezer at less than or equal to -10ºC.

(2) Place the remaining 0.8 mL of extract in a GC vial. Store the vial in the GPC freezer for 10g silica gel column cleanup (3630C_Mod_10).

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A. MO/IA/Methods

1. Each day samples are extracted, a blank, a LCS and an LCSD must be extracted. In addition, an MS is prepared if sufficient sample volume is available.

2. The preparation of an MS is not necessary for samples from Iowa or Missouri.

B. 8015 Methods

1. Each day samples are extracted, a blank, LCS, MS and a duplicate sample must be prepared if sufficient sample volume is available. If sufficient sample volume is not available to extract the MS and DUP, an LCSD must be extracted instead.

2. If it is known that a group of samples is clean, an MSD may be substituted for the duplicate sample.

C. A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples.

If more than 20 samples are prepared in a day, an additional batch must be prepared.

D. If any client, agency, or state has more stringent QC or batch requirements, these must be followed instead.

E. See the GC analysis method for specifics on compounds in the spiking solution.

10278 10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices
10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
10949 3 g Silica Gel Column Cleanup for DRO by Method 3630C
9656 Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID
9669 DRO/ORO by 8015B/C/D and TPH by NWTPH-Dx (Modified) in Water using Mini-Extraction and GC-FID
9771 Total Petroleum Hydrocarbons with Ranges by Methods 8015B/8015C/8015D in Waters and Solids by GC-FID
9772 Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID
9778 TPH and Quantitative Fuel Fingerprinting by Methods 8015B/C/D mod. in Waters and Solids Using GC-FID
9786 DRO and ORO by 8015B/C/D in Water using GC-FID
9790 TPH-DRO by 8015C South Carolina Methodology Using GC-FID

End of document

Version history

Version	Approval	Revision information	
22	20.MAR.2019		
23	31.MAR.2021		
24	11.APR.2022		

An error has happened on file: /D4Doc/formularer/2016/09/Quality Document # 1-P-QM-WI -9015175_20_7000310304.doc
Errortext: Unable to fetch attachment

eurofins	Always check on-line for validity. **Preparation of Vials for Field Preservation of Soils for Volatile Analysis**	Level: **Work Instruction**
Document number: **T-VOA-WI11242**		
Old Reference: **1-P-QM-WI-9015073**		
Version: **18**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **20-JAN-2022**	Document users: **6_EUUSLA_GC/MS Volatiles_VOA Prep**	Responsible: **5_EUUSLA_GC/MS Volatiles_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Purpose
Scope
Basic Principles
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision	18	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Basic Principles	LIMS update		Updated LIMS program
Definitions	LIMS update		Removed old program reference
Procedure	LIMS update		Updated LIMS program
Procedure	Updated reporting		Method for reporting issues to PM updated

Revision	17	**Effective Date:**	3/22/2018
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout document	Applicable to the procedure		Updated frozen temp to = -10°C

Reference

1. USEPA, 40 CFR Part 60, Appendix A, Method 25D
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 5035, December 1996.
3. Test Methods for Evaluating Solid Wastes, SW-846, Method 5035A, July 2002.
4. *Method for the Field Extraction/Preservation of Soil Samples with Methanol for Volatile Organic Compounds*, New Jersey DEP, February 1997.
5. Method AK101 for the Determination of Gasoline Range Organics, April 8, 2002.
6. USEPA, 40 CFR Part 60, Appendix A, Method 25D
7. WI PVOC PUBL-SW-140 09/95, *Wisconsin DNR Modified GRO*.
8. *Chemical Hygiene Plan*, current version.

Purpose

The purpose of this SOP is to provide detailed instructions for the preparation of vials used for field-preservation of soil samples to be analyzed for volatiles.

Scope

This procedure applies to analysts who prepare pre-preserved containers used in the field for soil sampling of volatile analyses.

Basic Principles

An aliquot of preservative is placed in a volatile-free container and weighed. The weight of the container and preservative is then captured using the Analyst Desktop program in LIMS. When requested, the container is sent to the client for use in field preservation of a solid sample. When the container and the soil sample are returned to the lab, it is re-weighed and the actual sample weight is calculated. Samples are then spiked with the appropriate surrogate as determined by the analysis being performed.

Definitions

Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) – A sample of known composition analyzed with each batch of samples to demonstrate laboratory accuracy. The samples either naturally contain the analytes of interest or are clean samples fortified with known concentrations used to demonstrate laboratory accuracy. A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test.

Interferences

Sample contamination can occur if the vial preparation is not performed in a volatile-free environment; therefore, this process must be performed in one of the designated volatile-free laboratories. Samples also become contaminated if volatiles diffuse through the sample vial septum. A trip blank carried through sampling, storage and handling acts as a check of such contamination.

Safety Precautions and Waste Handling

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

Methanol is flammable. Containers of this solvent must be kept away from any sources of open flames or sparks. Due to the potentially toxic nature of samples received from clients for analysis, safety precautions must be observed when handling samples. Safety glasses, lab coats, and gloves are required. Weighing out of the samples must always take place in a hood.

The solvents utilized in this procedure are disposed of in a solvent waste container which is transferred to the lab-wide disposal facility. Expired standards in methanol are disposed of as hazardous waste. Bulk sample containers and methanolic sample preparations are returned to the sample storage area for future disposal. Other wastes generated by Lancaster Labs are disposed of via incineration at EPA licensed facilities.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP.

The initial training consists of observing the procedure being carried out by an experienced analyst/technician. Next, the trainee performs the procedure while the experienced person watches, answers questions, and gives feedback. Following the initial training, experienced individuals are available as a resource until no longer required. Analysts are considered proficient when they are able to perform the procedure independently.

Sample Collection, Preservation, and Handling

Sample containers must be refrigerated at 0° to 6°C, not frozen, after preparation. Containers containing surrogates are not kept for more than 2 weeks before being discarded or sent into the field for use in sample collection. Packaging of sample containers must follow all DOT regulations. When returned, samples must be preserved and refrigerated unfrozen at 0° to 6°C or frozen in reagent water at = -10° within 48 hours of collection. See individual technical area SOPs for method specific hold times.

Apparatus and Equipment

1. 40-mL vials with Teflon™-lined septa and screw caps

2. 40-mL vials with stir bars, Teflon™-lined septa, and screw caps

3. 125-mL amber glass wide mouth jar with Teflon™-lined septa and screw caps

4. Pipette capable of dispensing up to 25 ± 0.25 mL.

5. 50-µL syringe

6. 1000-mL volumetric flask, class A

7. Analytical balance capable of weighing ±0.01 g.
8. Label printer/labels

9. LIMS VOA prep application and Reagent, Solution, and Balance Applications which integrates a PC with an analytical balance to collect data directly from the balance. It organizes the data, performs calculations, and stores final results in the Laboratory Information Management System (LIMS).

Reagents and Standards

NOTE: A rinse using reagent water followed by methanol must be performed on the pipette dispensers before adding a new lot of solution or standards.

1. Methanol – Purge and trap grade.

   a. Store at room temperature and re-analyze yearly.

   b. Use methanol that has been previously tested and approved for use by the labs.

2. 8260A/B Surrogate Mix, Restek Catalog #30340 (2500 µg/mL) or equivalent.

   a. Store at = -10°C for up to 1 year.

   b. Use standard as is, or diluted in methanol to a final concentration of 2.5 µg/mL. Diluted standard must be stored at = -10°C for up to 6 months.

   c. This standard is used for the GC/MS analyses.

3. Custom a,a,a-trifluorotoluene (TFT), Restek Catalog #54357 (15,000 µg/mL) or equivalent.

   a. Dilute standard in methanol to a final concentration of 750 µg/L for the working solution. A prep dilution of 0.5 mL of TFT to 10 mL of methanol is used when spiking returned field preserved containers.

   b. Store at = -10°C for up to 30 days.

   c. This standard is used for the GC analyses.

4. Sodium hydrogen sulfate anhydrous powder, Fluka, Catalog #2316657 or equivalent.

   a. Store at room temperature and re-analyze yearly.

   b. If compounds are detected above the method detection limit (MDL), prepare another vial and repeat the analysis. If compounds are still detected above the MDL, a new container must be tested and used.

5. Sodium Bisulfate Solution –

   a. Prepare by diluting 200 ±0.5 g of the Sodium hydrogen sulfate anhydrous into 1000 mL of reagent water in 1000-mL volumetric flask. Cap and invert at least 10 times to mix.

   b. Store at room temperature and re-analyze every 6 months if supply remains.

   c. If compounds are detected above the method detection limit (MDL), repeat the analysis. If compounds are still detected above the MDL, remake the solution and test before using.

6. Reagent water – water in which target analytes are not detected at or above the reporting limit for parameters of interest. In general, the deionized water supplied at the taps in the laboratory meets criteria. If the reagent water does not meet the requirements, see your supervisor for further instructions.

7. Polyethylene glycol (PEG) – Average molecular weight 400 amu, EM Science preferred.

   a. Any lot/vendor must meet a cleanliness level of <50 mg/kg volatile content.

   b. Store at room temperature and re-analyze each year if supply remains.

Calibration

Not applicable to this procedure.

Procedure

A. Prepare preservative containers

NOTE: Pre-purchased vials can be used for selected preps. Vials containing 5 mL of DI Water, vials containing 5 mL of Sodium Bisulfate and vials containing 5, 10 and 15 mL of methanol are available for field preserved analyses. The vials contain the initial tare weight, vial lot number, and the preservative lot number.

1. Check to make sure the pipette calibration has been performed.

2. Use the pipette to add the appropriate amount of preservative to a clean container. A 40-mL vial is used unless otherwise indicated on T-VOA-FRM10681.

   a. For AK101 and 10mL DE Vials for 8260 the appropriately diluted surrogate solution must be added at this time using a pipette.

   b. For NJ 25mL vials for 8260 use a syringe to add the ampulated 8260A/B surrogate standard plus methanol into a 40-mL vial. Use 1 µL of 8260A/B surrogate for every 1 mL of methanol in the vial.

3. Seal the container with a screw cap and septum seal.

4. Label the container with the tracking number.

5. Check to make sure the balance has been calibrated each day before use.

6. Place the container on a zeroed balance and capture the weight electronically to the nearest 0.01 g using Analyst Desktop.

7. Store the prepared containers in the designated area in the Volatile Prep room. Vials containing surrogates must be stored in the freezer, vials containing just methanol are stored at room temperature or refrigerated.

8. Pull vials as requested via e-mail from client services and place on the designated shelf in the bottles room storage area. The containers are now ready to be sent into the field for sample collection.

9. Send a reply e-mail to the client service representative to notify them that the order has been completed.

B. Re-weigh preservative containers after return from the field

1. Using Analyst Desktop application, scan the tracking number on the container. This brings up the information documented from the preparation step described above.

NOTE: If using purchased pre-tarred vials insert the vial ID, preservative, and tare weight information on the Pre-Tarred tab within the Volatile Prep Application.

2. Check to make sure the balance has been calibrated each day before use. Place the container on a zeroed balance and capture the second weight electronically using the VOA Prep application.

3. Analyst Desktop calculates the net weight. (weight of vial, solution, and soil minus the weight of the vial and solution).

4. If there are any holding-time issues or if weights are outside of the Action Requirement, an NCM should be generated and the PM contacted.

5. Record any unusual observations about the sample in the comment section.

C. Sample spiking

NOTE: Wipe samples do not require a surrogate to be spiked into the methanol.

A 1:1 ratio of µL to mL is required when spiking surrogate into methanol, except for analysis 0388 MA-VPH samples which require 30 µL to the 15 mL of methanol.

1. Determine the amount of methanol in the sample. This is determined by the analysis number and the mL of methanol printed on the tracking number.

2. Fill the syringe with the appropriate surrogate slightly past the amount of µL needed.

   a. Add the appropriate surrogate based on the bottle code entered and the department receiving the sample.

   b. GC requires a TFT surrogate mix to be used, bottle code 64.

   c. GC/MS requires an 8260A/B surrogate mix to be used, bottle codes 14 and 66.

3. Dispense the surrogate from the syringe until the required level of µL is reached. This assures no air bubbles are present and the syringe contains surrogate.

   a. Tilt the vial so the methanol comes toward the top of the vial, spike through the septa, submerging the tip of the syringe into the methanol.

   b. Shake the vial to disperse the surrogate throughout the sample.

   c. Put an “S” on the vial label to indicate surrogate has been added.

   d. Clean the syringe before proceeding to the next sample.

D. Deliver samples to the labs

Once the sample containers have been re-weighed, they must be transported to the laboratory for analysis. Each department has a designated refrigerated drop-off spot. All trip blanks and field blanks submitted must follow the sample containing the same preservative. Blanks submitted as waters are to be stored in the designated volatile refrigerator.

NOTE: Any sample designated for prescreen must be taken to the appropriate refrigerator and placed in a box sorted in numerical order in groups of 21 or 42 when applicable. If a methanol sample is designated for prescreen and a corresponding methanol trip blank or field blank is submitted the blanks must follow the associated samples through the entire process including sample prescreen.

Calculations

Calculation of sample weight : Wn = Ws - Wf

Where:

Wf = weight of container + solution (first weight)

Ws = weight of container + solution + soil (second weight)

Wn = net weight of soil sample

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

The number of containers requested from Client Services includes the appropriate amount of extra bottles to serve as matrix quality control (QC) for volatile analyses requested. The matrix QC spiking for this process is noted in Procedure C. All other QC samples such as the LCS, LCSD, and method blanks are prepared as outlined in the individual technical area's SOPs.

End of document

Version history

Version	Approval	Revision information	
16	30.SEP.2016		
17	08.MAR.2018		
18	06.JAN.2022		

eurofins	Always check on-line for validity. **Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater**	Level: **Work Instruction**
Document number: **T-OE-SVOA-WI11432**		
Old Reference: **1-P-QM-WI-9015076**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date **29-JUL-2022**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
Table II

Revision Log

Revision: 19	**Effective Date:**	This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Cross Reference	Correction	Updated WI9252 to current name
Procedure 3 and 8	Current Procedure	Updated to reflect current practice
Procedure	Clarification	Updated throughout to say LIMS in place of logbook
Reagents and Standards	Addition	Added reagents used in esterification with Diazald
Procedure 24c	Addition	Added notes and process for esterification with Diazald

Revision: 18	**Effective Date:**	25.FEB.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Procedure	New LIMS	Changed record information 'on the extraction log' to record information 'in the LIMS'
Reagents and Standards	Reflects current process	Added acetone
Procedure 1.	Reflects current process	Added extra rinse steps for the Dinoseb_ATP prep
Procedure 6.a.	Reflects current process	Updated spike amount for Dinoseb surrogate
Procedure 7.f.	Reflects current process	Updated spike name and amount for RV SIM LCS/D MS/D

Revision: 18	**Effective Date:**	25.FEB.2021
Section	**Justification**	**Changes**
Procedure 8.b.	Reflects current process	Clarified that Dinoseb_ATP is only extracted with acid adjustment
Quality Assurance/Quality Control	Clarification	Changed statistical limit evaluation from every 6 months to as frequently as defined in the analytical method
TablesI/II	Reflects current standards	Updated reagent analyte lists, as spike compositions have changed

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev 3, December 1996.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8151A, December 1996
3. Chemical Hygiene Plan, current version.

Cross Reference

Document	Document Title
T-OE-GEN-FRM23822	Instructions for Checking pH During Extraction Procedures
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-SVOA-WI13634	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D/E
T-SVOA-WI9252	Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
T-SVOA-WI9623	Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9995	Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS
T-SVOA-WI34848	Client Specific Dinoseb by 8270C in Water Using GC/MS
T-SVOA-WI31758	Client Specific Methylphenols by Method 8270D in Water Using GC/MS

Scope

This method is for the extraction of semivolatile organic compounds at low ppb to low ppm levels in aqueous samples that are not prone to emulsions. High levels of organic compounds and/or extreme alkalinity or acidity in the sample often interfere with normal detection limits.

Basic Principles

A sample is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is adjusted to >11 and the sample is serially extracted with methylene chloride. The pH is then adjusted to <2 and the sample is again serially extracted with methylene chloride. The solvent fractions are combined, and the extract is concentrated to 1.0 mL.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a demonstration of capability study is performed and on file.

Reference Modifications

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.
2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.
3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.
4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

High levels of organic compounds in the sample lead to interferences with normal detection limits.

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants. See *T-OE-GEN-WI10864* for glassware cleaning instructions.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath or rapid vap; caution must be exercised while working around these apparatuses.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples must be collected in amber glass bottles with PTFE-lined lids and stored under refrigeration at 0º to 6ºC, not frozen, prior to extraction. Samples must be extracted within 7 days of collection. The extract is stored in an amber autosampler vial in the freezer at ≤-10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction
3. Water bath – VWR/LLI Model #1127 or equivalent
4. Graduated cylinders – Class A, assorted sizes
5. Pipettes – Class A, assorted sizes
6. Pipettes – Disposable
7. Solvent pumps – Beckman, adjustable
8. Balance – Capable of weighing to 0.01 g
9. Automatic shaker – Capable of holding 2L separatory funnels
10. Centrifuge – Beckman GS-6 or equivalent
11. Sodium sulfate columns with extra course frits
12. Micro-snyder columns
13. Wash bottles – Teflon™
14. Amber autosampler vials with crimp caps
15. Teflon™ boiling chips
16. Teflon™ separatory funnel

17. pH paper - wide range or Hydrion (or equivalent) 10 to 12 range and 1 to 2.5 range.
18. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions.
19. Rapid-Vap Evaporators – for concentration of 250-mL extractions
20. Rapid-Vap Evaporator Tubes – Class A
21. N-evap nitrogen evaporator with nitrogen supply
22. Erlenmeyer flasks - 250mL

Reagents and Standards

Unless otherwise noted, use ACS grade reagents or equivalent. See *T-OE-GEN-WI10876* for storage and handling of spikes.

1. Methylene chloride ($MeCl_2$ or CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.
2. Methanol (MeOH) - pesticide grade or equivalent. Store at room temperature for up to 1 year.
3. Hexane - Pesticide grade or equivalent. Store at room temperature for up to 1 year.
4. Acetone - Pesticide grade or equivalent. Store at room temperature for up to 1 year.
5. 10N Sodium hydroxide (NaOH) – Lab chem or equivalent. Store at room temperature for up to one year.
6. Sulfuric acid(H_2SO_4) – ACS grade or equivalent, concentrated. Store at room temperature for up to one year.
7. Sodium sulfate – Anhydrous reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1year.
8. Tap water - In general the laboratory tap water has been shown not to contribute interferences at or above the reporting limits for parameters of interest.
9. Reagent water – Deionized water (DIH_2O) in which interferences are not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the DIH_2O taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.
10. Trimethylsilyldiazomethane (TMSD) - Follow manufacturer's storage and expiration information
11. Silicic Acid - Follow manufacturer's storage and expiration information
12. Diazald (N-methyl-N-nitroso-*p*-toluenesulfonamide) - Follow manufacturer’s storage and expiration information
13. Potassium Hydroxide (KOH) – ACS Certified, Fisher Chemical or equivalent. Store at room temperature for up to 5 years
14. Reagent Alcohol GR. Store at room temperature for up to 1 year

All QC standards added during extraction process are prepared by the organic extraction department using the Reagent module in TALS as a guide. Detailed instructions can be found in *T-SVOA-WI11998*.

Calibration

Not applicable to this procedure

Procedure

1. Prepare the glassware to be used as outlined in *T-OE-GEN-WI10864*. If the sample is entered for analytical method Dinoseb_ATP, perform a thorough acid rinse of the separatory funnel through the stopcock, followed by a thorough water rinse and finally, a thorough solvent rinse using 1:1 Acetone/Hexane prior to extraction.
2. Determine the volume of sample to be used for each extraction. Ideally, one full bottle is used. (Typically, this is 1 L for routine extraction or 250 mL for mini-extractions).
   a. Samples being extracted using 1 L are entered for 3510C.
   b. Samples being extracted using 250 mL are entered for 3510C_LVI.
3. If using one full bottle:
   a. Place the full sample bottle with the cap on the scale. Record this weight in the LIMS as the gross weight.
   b. Shake the bottle vigorously.
   c. Pour the sample into a separatory funnel.

d. Record any comments about the sample in the LIMS.

NOTE: Reduced volumes of sample are only used with prior approval by the client or if the matrix of the sample does not allow the extraction to proceed using the full volume. The sample must then be diluted with reagent water to 1 L or 250 mL depending on the extraction.

4. The method blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 1 L (or 250 mL for mini-extractions) of tap water (except for isotope dilution (ID) analytical methods 8270C_SIM_MS_ID, 8270D_SIM_ID_D5, 8270D_SIM_ID_DK, 8270D_SIM_MS_ID which are prepared with reagent water) measured into the separatory funnel.

5. The background, MS, and MSD are prepared on three separate aliquots of a field sample.

6. Surrogates

Unless noted otherwise, surrogate spike is added to all samples, blanks, LCS, LCSD (if applicable), MS, and MSD (if applicable). See *T-SVOA-WI11998* for preparation of spikes. See *T-OE-GEN-WI10876* for storage and handling of spikes.

a. For samples entered for any of the 8270 methods referenced in the cross reference section of this SOP paired with extraction method 3510C (1 L) - Add 1.0 mL BNA surrogate (OP_BNA_SS). Exception: Any samples entered for analytical method Dinoseb_ATP - Add 0.2 mL Mini BNA surrogate.

b. For samples entered for any of the 8270 methods referenced in the cross reference section of this SOP paired with extraction method 3510C_LVI (250 mL) – Add 1.0 mL of Mini BNA surrogate (OP_MINIBNA_SS). Exception: for isotope dilution methods listed in step 4 - Add 0.25 mL of Mini 1,4- Dioxane-d8 Surrogate (OP_14DX-d8_SS).

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

7. Spiking solutions

Unless noted otherwise, spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD (if applicable).

a. For methods 8270C, 8270D, 8270D_DKQP, 8270D_DOD5, 8270DEL, 8270E, 8270MCP, 8270RCP paired with extraction method 3510C, add 1.0 mL of LCS Spike Mix #1 (OP_LCS1_MS). The analytes contained in this mix can be found in Table I. The following additional spikes may also be added as indicated below dependent upon the requested analyte list.

i. Add 1.0 mL of LCS Spike Mix #2 (OP_LCS 2_MS) if benzaldehyde, atrazine, or caprolactam are requested analytes.

ii. Add 1.0 mL of Benzenethiol Spike (OP_BENTHIO_MS) if phenylmercaptan is requested. This will be spiked into a separate LCS/D.

iii. Add 1.0 mL of APPIX Mix #1 (OP_APPIX1_MS) if any analytes contained in Table II are requested. This will be spiked into a separate LCS/D.

iv. Add 1.0 mL of APPIX Mix #2 (OP_APPIX2_MS) if p-Phenylenediamine is requested. This will be spiked into the same LCS/D as APPIX Mix #1. Note: APPIX Mix #2 will not be requested without APPIX Mix #1.

b. For methods 8270C, 8270D, 8270D_DKQP, 8270D_DOD5, 8270D_MPhenols, 8270DEL, 8270E, 8270MCP, 8270RCP paired with extraction method 3510C_LVI, add 1.0 mL of Mini LCS Spike Mix #1 (OP_MINLCS1_MS). The analytes contained in this mix can be found in Table I. The following additional spikes may also be added as indicated below dependent upon the requested analyte list.

i. Add 1.0 mL of Mini LCS Spike Mix #2 (OP_MINLCS2_MS) if benzaldehyde, atrazine, or caprolactam are requested analytes.

ii. Add 0.25 mL of Benzenethiol Spike (OP_BENTHIO_MS) if phenylmercaptan is requested. This will be spiked into a separate LCS/D. Note: A spiking solution is not prepared at a lower concentration for reduced volume analysis.

iii. Add 1.0 mL of Mini APPIX Mix #1 (OP_MINAPP1_MS) if any analytes contained in Table II are requested. This will be spiked into a separate LCS/D.

iv. Add 0.25 mL of APPIX Mix #2 (OP_APPIX2_MS) if p-Phenylene diamine is requested. This will be spiked into the same LCS/D as APPIX Mix #1. Notes: APPIX Mix #2 will not be requested without APPIX Mix #1. A spiking solution is not prepared at a lower concentration for reduced volume analysis.

c. For the isotope dilution methods listed in Step 4, add 0.25 mL of 1,4-Dioxane LCS Spike (OP_1,4-D_MS).

d. For Dinoseb_ATP add 0.08 mL Mini APPIX #1 Spike (OP_MINAPP1_MS).

e. For methods 8270_SIMMCP, 8270_SIMRCP, 8270C_SIM, 8270D_SIM, 8270D_SIM_DKQP, 8270D_SIM_DOD5, 8270E_SIM paired with extraction method 3510C, add 1.0 mL of SIM spiking solution (OP_SIMLCS_MS).

f. For methods 8270_SIMMCP, 8270_SIMRCP, 8270C_SIM, 8270D_SIM, 8270D_SIM_DKQP, 8270D_SIM_DOD5, 8270E_SIM paired with extraction method 3510C_LVI, add 0.25 mL of SIM spiking solution (OP_SIMLCS_MS).

g. For methods 8270C_SIM_Alkyl, 8270D_SIM_Alkyl, 8270D_SM_Alk_D5 paired with extraction method 3510C, add 1.0 mL of Alkyl PAH spike (OP_ALK_PAH_MS).

h. If the sample requires analytes in addition to those found in the above mixes and in Tables I and II, add 1.0 mL (or 0.25 mL for 250-mL extractions) of the appropriate spiking solution.

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

8. Adjusting the pH of samples

   a. See *T-OE-GEN-FRM23822* for instructions on checking the pH of samples.

   b. For samples entered for analytical method Dinoseb_ATP, only the acid fraction is extracted. If samples are entered with a LabNote requesting 'reverse pH prep', or if the sample is acid-preserved, the acid fraction is extracted first, followed by the base-neutral fraction.

   c. For all other analytical methods, the base-neutral fraction is extracted first.

9. Adjusting the pH of samples to >11 for 1 L extractions:

   a. Add approximately 12 drops of 10 N sodium hydroxide to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.

   b. Check the pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

   c. If a pH of >11 is not observed, add approximately 6 to 7 drops of 10 N sodium hydroxide using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 10 to 12 range pH paper or equivalent. See a supervisor if a pH of >11 is not achieved after repeating the 10 N sodium hydroxide addition five times. Note any issues in the LIMS batch for any samples that are difficult to pH adjust.

10. Adjusting the pH of samples to >11 for 250 mL extractions:

    a. Add approximately 4 drops of 10 N sodium hydroxide to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.

    b. Check the pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

    c. If a pH of >11 is not observed, add approximately 2 to 3 drops of 10N sodium hydroxide using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 10 to 12 range pH paper or equivalent. See a supervisor if a pH of >11 is not achieved after repeating the 10 N sodium hydroxide addition five times. Note any issues in the LIMS batch for samples that are difficult to pH adjust.

11. If the original sample bottle is empty:

    a. Use a solvent pump to measure 60 mL of methylene chloride for 1 L extractions (15 mL for 250-mL extractions).

    b. Rinse the sample bottle by adding the methylene chloride to the bottle. Swirl the bottle to rinse the interior of the bottle with methylene chloride.

    c. Transfer the solvent to the separatory funnel.

    d. Place the empty sample bottle, with the cap, on the scale.

    e. Record this weight in the LIMS as the tare weight. The initial weight is automatically calculated.

    f. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250 mL extractions) and add the solvent to the graduated cylinder or directly to the separatory funnel.

12. Cap the funnel, invert it, and vent immediately.

13. Handshake and vent frequently until the pressure is stable.

14. For 1 L extractions - Place the funnel on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.
    For 250 mL extractions – Separatory funnels remain on the Automated Water Extraction bench. Press the green “start” button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.
    NOTE: Shaker speeds vary greatly between instruments; the proper setting is marked on each.

15. For 1 L extractions - Place the separatory funnel on the rack and allow it to sit undisturbed until the methylene chloride layer (bottom layer) has separated from the water.
    For 250 mL extractions - the separatory funnel will sit undisturbed on the Automated Water Extraction Bench.
    The time required for extracts to sit undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusually high density (i.e. high salt content).
    If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

16. For 1L extractions, drain the solvent layer into a metal beaker and pour it through approximately 10 cm (~4 inches) of sodium sulfate into a K-D apparatus containing Teflon™-boiling chips.
    For 250 mL extractions, drain the solvent layer directly into the sodium sulfate column containing approximately 5 cm of sodium sulfate (~2 inches). This drains into a Rapid-Vap evaporator tube.

17. Use a solvent pump to add 60 mL of methylene chloride (15 mL for 250 mL extractions) to the separatory funnel and repeat Procedure 14 through 16, venting only as necessary.

18. Use a solvent pump to add another 60 mL of methylene chloride (15 mL for 250 mL extractions) to the separatory funnel and repeat Procedure 14 through 16, venting only as necessary, a second time for the third of three methylene chloride extractions.

    NOTE: The acid extract is also added to this K-D (or evaporator tube for 250 mL extractions).

19. Adjusting the pH of samples to <2 for 1 L extractions:

a. Add approximately 1 mL (1/2 full disposable Pasteur pipette) of concentrated sulfuric acid to all batch QC and samples using a disposable glass pipette. Swirl to mix.

b. Check the pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

c. If a pH of <2 is not observed, add approximately 10 to 11 drops of concentrated sulfuric acid using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 1 to 2.5 range pH paper or equivalent. See a supervisor if a pH of <2 is not achieved after repeating the concentrated sulfuric acid addition six times. Note any issues in the LIMS for samples that are difficult to pH adjust.

20. Adjusting the pH of samples to <2 for 250 mL extractions:

a. Add approximately 12 drops of concentrated sulfuric acid to all batch QC and samples using a disposable glass pipette. Swirl to mix.

b. Check the pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

c. If a pH of <2 is not observed add approximately 3 to 4 drops of concentrated sulfuric acid using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 1 to 2.5 range pH paper or equivalent. See a supervisor if a pH of <2 is not achieved after repeating the concentrated sulfuric addition six times. Note any issues in the LIMS for samples that are difficult to pH adjust.

21. After a pH of <2 has been attained: Using three 60-mL aliquots of methylene chloride (15 mL for 250 mL extractions), serially extract the sample as described in Procedure 14 through 16, venting only as necessary.

22. Collect the solvent in a K-D setup (or evaporator tube for the 250 mL extractions). For 1 L extractions, rinse the metal beaker with approximately 20 mL of methylene chloride and pour into the sodium sulfate column.

23. Use a wash bottle to rinse the sodium sulfate column with approximately 20 mL of methylene chloride (approximately 5 mL for 250 mL extractions).

24. For 1 L extractions:

a. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 2-mL on a steam bath at 80° to 90°C. At the proper rate of distillation, the balls of the column will actively chatter, but the chambers will not flood. Adjust the vertical position of the apparatus and the water temperature as needed to complete the concentration in 10 - 20 min. Allow the extracts to cool for approximately 10 minutes.

NOTE: This steam bath temperature ensures concentration in a reasonable length of time. Do not allow the ampule to go dry.

b. If extracting samples entered for client-requested analytical method Dinoseb_ATP, the extracts are methylated at this time. For all other extractions, proceed to step 24d. The methylation steps outlined below must be followed utilizing a hood containing no electrical appliances or steam baths. Additional heat and electrical hazards must be avoided. **Note:** In the case of limited availability of TMSD, the use of Diazomethane for esterification can be used. If using Diazomethane, skip step 24b and go to step 24c.

i. After allowing the 2-3 mL of extract to cool for 10 minutes, add 1 mL TMSD.

ii. Add 0.5 mL MeOH, mix with a Pasteur pipette, and let sit for 10 minutes.

iii. Quench with approximately 10 mg of silicic acid.

iv. Quantitatively transfer to a new ampule to remove the extract from the silicic acid.

v. Concentrate on N-evap nitrogen evaporator to bring the extract below 1 mL.

vi. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 2 mL amber autosampler vial using hexane. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of hexane.

vii. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the ampule. Concentrate on N-evap nitrogen evaporator to bring the extract below 1 mL. The previous step is then repeated to bring the extract to 1 mL.

viii. Cap the vial securely and store in the freezer at ≤-10°C.

ix. Record the final volume in the LIMS.

NOTE: TMSD is flammable and acutely toxic. Only open the container in a drawn hood. If the solution is spilled, leave the area immediately and contact safety. Wear gloves at all times during this procedure. Additional protection such as a safety shield is also recommended. All glassware used in this procedure must be taken directly to wash room personnel. Do not place it on a cart with other dirty glassware.

c. Set up diazomethane generator and esterify the extract as described below:

Safety precautions

i. Diazald is a carcinogen. **Wear gloves at all times during this procedure**.
ii. Perform esterification in a hood with the sash down. Additional protection, such as a safety shield, is recommended. **Avoid inhalation of diazomethane.**
iii. Avoid using etched or scratched glassware, ground glass joints, and glass stirrers - **EXPLOSION may result**.
iv. **To avoid explosion do not heat over 90°C.**
v. All glassware used in this procedure must be taken directly to wash room personnel, not placed on cart of dirty glassware.
vi. The generator must be set up in a hood containing no electrical appliances or steam baths. Additional heat and electrical hazard must be avoided.

Diazomethane Generator Procedure

i. Prepare the KOH solution.

Reagents must be mixed in the following order:

(a) Place 5 g of KOH in a 125-mL Erlenmeyer flask.
(b) Use a graduated cylinder to add 8 mL of reagent water and swirl to dissolve the KOH.
(c) **Allow the solution to cool.**
(d) Use a graduated cylinder to add 25 mL of reagent alcohol.
(e) Use a graduated cylinder to add 25 mL of ethyl ether.
(f) The amount of KOH solution needed depends on the number of samples extracted. One solution can be used for eight to ten samples. If more than ten samples are to be extracted, prepare a second solution for use during esterification.

ii. Fill 40-mL vials with ethyl ether for rinsing the generator between samples. Use 1 vial per 3 samples.

iii. Prepare the diazomethane solution under a hood and just prior to starting the procedure:

(a) Add approximately 3 g of diazald powder to each KOH solution.
NOTE: Add the diazald powder immediately before use.
(b) Clamp the Erlenmeyer in place.

iv. Fill a plastic beaker with warm water from the steam bath (not to exceed 80º to 85ºC for safety concerns using diazomethane) and hold under the Erlenmeyer containing the diazomethane solution. At the same time, hold a rinse vial of ethyl ether at the end of the generator.

v. When the rinse vial begins to turn yellow, remove the vial and begin placing samples at the end of the generator.

(a) Use a rinse vial to rinse the generator between samples.
(b) Be sure each sample turns bright yellow before going on to the next sample. This ensures that esterification is complete.
(c) If the yellow color does not persist in all of the samples after methylation is complete, remethylate the samples that are no longer yellow.

vi. After esterification, N-Evap the samples below 1 mL.

vii. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 1 mL amber autosampler vial using hexane. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of hexane.

viii. Cap the vial securely and store in the freezer at≤-10ºC.

ix. Record the final volume in the LIMS.

d. Attach a microsnyder to the ampule and concentrate on a steam bath to slightly below 1 mL.

e. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 2 mL amber autosampler vial using methylene chloride. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of methylene chloride.

f. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the ampule. A microsnyder is then attached to the ampule and the extract is concentrated on a steam bath to around 0.5 mL. The previous step is then repeated to bring the extract to 1 mL.

g. Cap the vial securely and store in the freezer at ≤-10°C.

h. Record the final volume in the LIMS.

25. For 250-mL extractions:

a. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). After 10 minutes, rinse the tube with approximately 5-7 mL methylene chloride and set the timer for 10 more minutes. Confirm that the nitrogen is set at approximately 15 PSI (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 0.5 mL.

NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

b. The extract is quantitatively transferred from the evaporator tube using a Pasteur pipette to a 2 mL amber autosampler vial using methylene chloride. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of methylene chloride.

c. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the evaporator tube and concentrated on the rapid vap down to around 0.5 mL. The previous step should then be repeated to bring the extract to 1 mL.

d. Cap the vial securely and store in the freezer at ≤-10°C.

e. Record the final volume in the LIMS.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batch requirements, these must be followed instead.

Each extraction batch (up to 20 samples) must contain a method blank, a LCS, and an unspiked background sample, MS, and MSD. An LCSD is required if insufficient sample volume is submitted for a background/MS/MSD. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing should be used.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated as frequently as defined in the analytical method and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

Table I

LCS Mix #1 Reagent Analyte List

1,1'-Biphenyl
1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3-Dichlorobenzene
1,3-Dinitrobenzene
1,4-Dichlorobenzene
1,4-Dioxane
1-Methylnaphthalene
1-Methylphenanthrene
2,3,4,6-Tetrachlorophenol
2,2'-oxybis[1-chloropropane]
2,3-Dichlorobenzeneamine
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dichlorophenol
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroaniline
2-Nitrophenol
3,3'-Dichlorobenzidine
3-Methylphenol
3-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl phenyl ether
4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Acetophenone
Alpha Methyl Styrene
Alpha-Terpineol
Aniline
Anthracene
Benzidine
Benzo[a]anthracene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[g,h,i]perylene
Benzo[k]fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Carbazole
Chrysene
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Dimethylformamide
Di-n-butyl phthalate
Di-n-octyl phthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexadecane
icosane
Indene
Indeno[1,2,3-cd]pyrene
Isophorone
Naphthalene
n-Decane
n-Docosane
Nitrobenzene
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
n-Octadecane
n-Tetradecane
Octachlorostyrene
Pentachlorophenol
Phenanthrene
Phenol
Phenyl ether
Pyrene
Pyridine

Table II

APPIX Mix #1 Reagent Analyte List

1,3,5-Trinitrobenzene
1,4-Dinitrobenzene
1,4-Naphthoquinone
1-Chloronaphthalene
1-Naphthylamine
2,3,5,6-Tetrachlorophenol
2-Acetylaminofluorene
2-Naphthylamine
2-Picoline
Famphur
Hexachloropropene
Isodrin
Isosafrole
Kepone
Methapyrilene
Methyl methanesulfonate
Methyl parathion
N-Nitro-o-toluidine

2-Toluidine
3,3'-Dimethylbenzidine
3-Methylcholanthrene
4,4'-Methylene bis(2-chloroaniline)
4-Aminobiphenyl
4-Nitroquinoline-1-oxide
6-Methylchrysene
7,12-Dimethylbenz(a)anthracene
alpha,alpha-Dimethyl phenethylamine
Aramite, Total
Chlorobenzilate
Diallate
Dibenz[a,h]acridine
Dibenz[a,j]acridine
Dimethoate
Dinoseb
Disulfoton
Ethyl methanesulfonate
Ethyl Parathion
N-Nitrosodiethylamine
N-Nitroso-di-n-butylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
o,o',o''-Triethylphosphorothioate
p-Dimethylamino azobenzene
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Phenacetin
Phorate
p-Phenylene diamine
Pronamide
Quinoline
Safrole, Total
Sulfotepp
Thionazin

T-OE-GEN-FRM23822 Instructions for Checking pH During Extraction Procedures
T-OE-GEN-WI10864 Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876 Organic Extraction Standards Storage and Handling
T-SVOA-WI11998 Semivolatile Spiking and Calibration Standards
T-SVOA-WI13634 The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D/E
T-SVOA-WI31758 Client Specific Methylphenols by Method 8270D in Water Using GC/MS
T-SVOA-WI34848 Client Specific Dinoseb by 8270C in Water Using GC/MS
T-SVOA-WI9252 Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
T-SVOA-WI9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
T-SVOA-WI9623 Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
T-SVOA-WI9995 Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS

End of document

Version history

Version	Approval	Revision information	
17	30.OCT.2020		
18	25.FEB.2021		
19	22.JUL.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-OE-SVOA-WI11432**	**Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015076**		
Version: **19**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **29-JUL-2022**	Document users: **5_EUUSLA_GC/MS Semivolatiles_Manager, 5_EUUSLA_Organic Extraction_Manager, 6_EUUSLA_ Organic Extraction_Semivolatile Waters, 6_EUUSLA_GC/MS Semivolatiles_Analysts**	Responsible: **5_EUUSLA_Organic Extraction_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
Table II

Revision Log

Revision: 19	**Effective Date:**	This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Cross Reference	Correction	Updated WI9252 to current name
Procedure 3 and 8	Current Procedure	Updated to reflect current practice
Procedure	Clarification	Updated throughout to say LIMS in place of logbook
Reagents and Standards	Addition	Added reagents used in esterification with Diazald
Procedure 24c	Addition	Added notes and process for esterification with Diazald

Revision: 18	**Effective Date:**	25.FEB.2021

Revision: 18	Effective Date: 25-FEB-2021	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout Procedure	New LIMS	Changed record information 'on the extraction log' to record information 'in the LIMS'
Reagents and Standards	Reflects current process	Added acetone
Procedure 1.	Reflects current process	Added extra rinse steps for the Dinoseb_ATP prep
Procedure 6.a.	Reflects current process	Updated spike amount for Dinoseb surrogate
Procedure 7.f.	Reflects current process	Updated spike name and amount for RV SIM LCS/D MS/D
Procedure 8.b.	Reflects current process	Clarified that Dinoseb_ATP is only extracted with acid adjustment
Quality Assurance/Quality Control	Clarification	Changed statistical limit evaluation from every 6 months to as frequently as defined in the analytical method
TablesI/II	Reflects current standards	Updated reagent analyte lists, as spike compositions have changed

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3510C, Rev 3, December 1996.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 8151A, December 1996
3. Chemical Hygiene Plan, current version.

Cross Reference

Document	Document Title
T-OE-GEN-FRM23822	Instructions for Checking pH During Extraction Procedures
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards
T-SVOA-WI13634	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D/E
T-SVOA-WI9252	Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
T-SVOA-WI9623	Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS

Document	Document Title
T-SVOA-WI9995	Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS
T-SVOA-WI34848	Client Specific Dinoseb by 8270C in Water Using GC/MS
T-SVOA-WI31758	Client Specific Methylphenols by Method 8270D in Water Using GC/MS

Scope

This method is for the extraction of semivolatile organic compounds at low ppb to low ppm levels in aqueous samples that are not prone to emulsions. High levels of organic compounds and/or extreme alkalinity or acidity in the sample often interfere with normal detection limits.

Basic Principles

A sample is placed into a separatory funnel. Surrogate standards are added to each sample to monitor recovery. The pH of the sample is adjusted to >11 and the sample is serially extracted with methylene chloride. The pH is then adjusted to <2 and the sample is again serially extracted with methylene chloride. The solvent fractions are combined, and the extract is concentrated to 1.0 mL.

Procedural changes to use a reduced sample aliquot while maintaining the default reporting limits are permitted as long as the reagent aliquots are reduced proportionally and a demonstration of capability study is performed and on file.

Reference Modifications

Surrogate and matrix spiking solutions are not added before the transfer to the separatory funnel for several reasons:

1. Samples must be poured from the amber bottles to determine the matrix and volume of sample to use for each extraction.

2. Many sample bottles have no headspace and there is no room to add surrogate to the sample in the bottle.

3. Due to the volume of samples extracted, a separate graduated cylinder for each sample is unrealistic.

4. To maintain consistency with all extractions, no samples are spiked in the bottle or graduated cylinders.

Interferences

High levels of organic compounds in the sample lead to interferences with normal detection limits.

Impurities in solvents, reagents, glassware, or other hardware used in sample processing lead to interferences with the method. All glassware must be rinsed with solvent before use. A method blank is performed with each batch of samples to demonstrate that the extraction system is free of contaminants. See *T-OE-GEN-WI10864* for glassware cleaning instructions.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical compound must be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, such as fume hoods, lab coats, safety glasses, and gloves.

Extracts are concentrated on a steam bath or rapid vap; caution must be exercised while working around these apparatuses.

All solvent waste generated from this preparation must be collected for recycling (if applicable) or disposed of in the designated containers. These are transferred to the lab-wide disposal facility. Any solid waste material (disposable pipettes, broken glassware, pH paper) is disposed of in the normal solid waste collection containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the employees training records.

Initially, each technician performing the extraction must work with an experienced employee for a period of time until they can independently perform the extraction. Proficiency is measured through a documented Initial Demonstration of Capability (IDOC).

The IDOC consists of four laboratory control samples that are carried through all steps of the extraction and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four laboratory control samples, or one blind sample.

Sample Collection, Preservation, and Handling

Samples must be collected in amber glass bottles with PTFE-lined lids and stored under refrigeration at 0º to 6ºC, not frozen, prior to extraction. Samples must be extracted within 7 days of collection. The extract is stored in an amber autosampler vial in the freezer at ≤-10 °C for up to 40 days prior to analysis.

Apparatus and Equipment

1. Separatory funnel for extracting organic components from an aqueous matrix
2. Kuderna-Danish (K-D) assembly with appropriate ampule for concentrating the solvent used during the extraction
3. Water bath – VWR/LLI Model #1127 or equivalent
4. Graduated cylinders – Class A, assorted sizes
5. Pipettes – Class A, assorted sizes
6. Pipettes – Disposable

7. Solvent pumps – Beckman, adjustable
8. Balance – Capable of weighing to 0.01 g
9. Automatic shaker – Capable of holding 2L separatory funnels
10. Centrifuge – Beckman GS-6 or equivalent
11. Sodium sulfate columns with extra course frits
12. Micro-snyder columns
13. Wash bottles – Teflon™
14. Amber autosampler vials with crimp caps
15. Teflon™ boiling chips
16. Teflon™ separatory funnel
17. pH paper - wide range or Hydrion (or equivalent) 10 to 12 range and 1 to 2.5 range.
18. Automated Water Extraction Bench – capable of holding separatory funnels for 250-mL extractions.
19. Rapid-Vap Evaporators – for concentration of 250-mL extractions
20. Rapid-Vap Evaporator Tubes – Class A
21. N-evap nitrogen evaporator with nitrogen supply
22. Erlenmeyer flasks - 250mL

Reagents and Standards

Unless otherwise noted, use ACS grade reagents or equivalent. See *T-OE-GEN-WI10876* for storage and handling of spikes.

1. Methylene chloride ($MeCl_2$ or CH_2Cl_2) – Pesticide grade or equivalent. Store at room temperature for up to one year.
2. Methanol (MeOH) - pesticide grade or equivalent. Store at room temperature for up to 1 year.
3. Hexane - Pesticide grade or equivalent. Store at room temperature for up to 1 year.
4. Acetone - Pesticide grade or equivalent. Store at room temperature for up to 1 year.
5. 10N Sodium hydroxide (NaOH) – Lab chem or equivalent. Store at room temperature for up to one year.
6. Sulfuric acid(H_2SO_4) – ACS grade or equivalent, concentrated. Store at room temperature for up to one year.
7. Sodium sulfate – Anhydrous reagent grade or equivalent. Bake at approximately 400°C for a minimum of 4hours in a shallow pan prior to use to remove organic contaminants. After baking, store in a glass jar at room temperature for up to 1year.

8. Tap water - In general the laboratory tap water has been shown not to contribute interferences at or above the reporting limits for parameters of interest.

9. Reagent water – Deionized water (DIH_2O) in which interferences are not observed at or above the reporting limit for parameters of interest. In general, the reagent water supplied at the DIH_2O taps in the laboratory meets this criterion. If the reagent water does not meet the requirements, see your supervisor for further instructions.

10. Trimethylsilyldiazomethane (TMSD) - Follow manufacturer's storage and expiration information

11. Silicic Acid - Follow manufacturer's storage and expiration information

12. Diazald (N-methyl-N-nitroso-*p*-toluenesulfonamide) - Follow manufacturer's storage and expiration information

13. Potassium Hydroxide (KOH) – ACS Certified, Fisher Chemical or equivalent. Store at room temperature for up to 5 years

14. Reagent Alcohol GR. Store at room temperature for up to 1 year

All QC standards added during extraction process are prepared by the organic extraction department using the Reagent module in TALS as a guide. Detailed instructions can be found in *T-SVOA-WI11998*.

Calibration

Not applicable to this procedure

Procedure

1. Prepare the glassware to be used as outlined in *T-OE-GEN-WI10864*. If the sample is entered for analytical method Dinoseb_ATP, perform a thorough acid rinse of the separatory funnel through the stopcock, followed by a thorough water rinse and finally, a thorough solvent rinse using 1:1 Acetone/Hexane prior to extraction.

2. Determine the volume of sample to be used for each extraction. Ideally, one full bottle is used. (Typically, this is 1 L for routine extraction or 250 mL for mini-extractions).

   a. Samples being extracted using 1 L are entered for 3510C.

   b. Samples being extracted using 250 mL are entered for 3510C_LVI.

3. If using one full bottle:

   a. Place the full sample bottle with the cap on the scale. Record this weight in the LIMS as the gross weight.

   b. Shake the bottle vigorously.

   c. Pour the sample into a separatory funnel.

   d. Record any comments about the sample in the LIMS.

   NOTE: Reduced volumes of sample are only used with prior approval by the client or if the matrix of the sample does not allow the extraction to proceed using the full volume. The sample must then be diluted

with reagent water to 1 L or 250 mL depending on the extraction.

4. The method blank, laboratory control sample (LCS), and laboratory control sample duplicate (LCSD) (if applicable) are prepared using 1 L (or 250 mL for mini-extractions) of tap water (except for isotope dilution (ID) analytical methods 8270C_SIM_MS_ID, 8270D_SIM_ID_D5, 8270D_SIM_ID_DK, 8270D_SIM_MS_ID which are prepared with reagent water) measured into the separatory funnel.

5. The background, MS, and MSD are prepared on three separate aliquots of a field sample.

6. Surrogates

Unless noted otherwise, surrogate spike is added to all samples, blanks, LCS, LCSD (if applicable), MS, and MSD (if applicable). See *T-SVOA-WI11998* for preparation of spikes. See *T-OE-GEN-WI10876* for storage and handling of spikes.

a. For samples entered for any of the 8270 methods referenced in the cross reference section of this SOP paired with extraction method 3510C (1 L) - Add 1.0 mL BNA surrogate (OP_BNA_SS). Exception: Any samples entered for analytical method Dinoseb_ATP - Add 0.2 mL Mini BNA surrogate.

b. For samples entered for any of the 8270 methods referenced in the cross reference section of this SOP paired with extraction method 3510C_LVI (250 mL) – Add 1.0 mL of Mini BNA surrogate (OP_MINIBNA_SS). Exception: for isotope dilution methods listed in step 4 - Add 0.25 mL of Mini 1,4-Dioxane-d8 Surrogate (OP_14DX-d8_SS).

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

7. Spiking solutions

Unless noted otherwise, spiking solutions are added to the LCS, LCSD (if applicable), MS, and MSD (if applicable).

a. For methods 8270C, 8270D, 8270D_DKQP, 8270D_DOD5, 8270DEL, 8270E, 8270MCP, 8270RCP paired with extraction method 3510C, add 1.0 mL of LCS Spike Mix #1 (OP_LCS1_MS). The analytes contained in this mix can be found in Table I. The following additional spikes may also be added as indicated below dependent upon the requested analyte list.

i. Add 1.0 mL of LCS Spike Mix #2 (OP_LCS 2_MS) if benzaldehyde, atrazine, or caprolactam are requested analytes.

ii. Add 1.0 mL of Benzenethiol Spike (OP_BENTHIO_MS) if phenylmercaptan is requested. This will be spiked into a separate LCS/D.

iii. Add 1.0 mL of APPIX Mix #1 (OP_APPIX1_MS) if any analytes contained in Table II are requested. This will be spiked into a separate LCS/D.

iv. Add 1.0 mL of APPIX Mix #2 (OP_APPIX2_MS) if p-Phenylenediamine is requested. This will be spiked into the same LCS/D as APPIX Mix #1. Note: APPIX Mix #2 will not be requested without APPIX Mix #1.

b. For methods 8270C, 8270D, 8270D_DKQP, 8270D_DOD5, 8270D_MPhenols, 8270DEL, 8270E, 8270MCP, 8270RCP paired with extraction method 3510C_LVI, add 1.0 mL of Mini LCS Spike Mix #1 (OP_MINLCS1_MS). The analytes contained in this mix can be found in Table I. The following additional spikes may also be added as indicated below dependent upon the requested analyte list.

i. Add 1.0 mL of Mini LCS Spike Mix #2 (OP_MINLCS2_MS) if benzaldehyde, atrazine, or caprolactam are requested analytes.

ii. Add 0.25 mL of Benzenethiol Spike (OP_BENTHIO_MS) if phenylmercaptan is requested. This will be spiked into a separate LCS/D. Note: A spiking solution is not prepared at a lower concentration for reduced volume analysis.

iii. Add 1.0 mL of Mini APPIX Mix #1 (OP_MINAPP1_MS) if any analytes contained in Table II are requested. This will be spiked into a separate LCS/D.

iv. Add 0.25 mL of APPIX Mix #2 (OP_APPIX2_MS) if p-Phenylene diamine is requested. This will be spiked into the same LCS/D as APPIX Mix #1. Notes: APPIX Mix #2 will not be requested without APPIX Mix #1. A spiking solution is not prepared at a lower concentration for reduced volume analysis.

c. For the isotope dilution methods listed in Step 4, add 0.25 mL of 1,4-Dioxane LCS Spike (OP_1,4-D_MS).

d. For Dinoseb_ATP add 0.08 mL Mini APPIX #1 Spike (OP_MINAPP1_MS).

e. For methods 8270_SIMMCP, 8270_SIMRCP, 8270C_SIM, 8270D_SIM, 8270D_SIM_DKQP, 8270D_SIM_DOD5, 8270E_SIM paired with extraction method 3510C, add 1.0 mL of SIM spiking solution (OP_SIMLCS_MS).

f. For methods 8270_SIMMCP, 8270_SIMRCP, 8270C_SIM, 8270D_SIM, 8270D_SIM_DKQP, 8270D_SIM_DOD5, 8270E_SIM paired with extraction method 3510C_LVI, add 0.25 mL of SIM spiking solution (OP_SIMLCS_MS).

g. For methods 8270C_SIM_Alkyl, 8270D_SIM_Alkyl, 8270D_SM_Alk_D5 paired with extraction method 3510C, add 1.0 mL of Alkyl PAH spike (OP_ALK_PAH_MS).

h. If the sample requires analytes in addition to those found in the above mixes and in Tables I and II, add 1.0 mL (or 0.25 mL for 250-mL extractions) of the appropriate spiking solution.

NOTE: The standard must drip directly into the aqueous sample without touching the glass side of the separatory funnel to avoid poor recoveries.

8. Adjusting the pH of samples

a. See *T-OE-GEN-FRM23822* for instructions on checking the pH of samples.

b. For samples entered for analytical method Dinoseb_ATP, only the acid fraction is extracted. If samples are entered with a LabNote requesting 'reverse pH prep', or if the sample is acid-preserved, the acid fraction is extracted first, followed by the base-neutral fraction.

c. For all other analytical methods, the base-neutral fraction is extracted first.

9. Adjusting the pH of samples to >11 for 1 L extractions:

a. Add approximately 12 drops of 10 N sodium hydroxide to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.

b. Check the pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

c. If a pH of >11 is not observed, add approximately 6 to 7 drops of 10 N sodium hydroxide using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 10 to 12 range pH paper or equivalent. See a supervisor if a pH of >11 is not achieved after repeating the 10 N sodium hydroxide addition five times. Note any issues in the LIMS batch for any samples that are difficult to pH adjust.

10. Adjusting the pH of samples to >11 for 250 mL extractions:

    a. Add approximately 4 drops of 10 N sodium hydroxide to all batch QC and samples using a disposable Pasteur pipette. Swirl to mix.

    b. Check the pH of samples using Hydrion 10 to 12 range pH paper or equivalent to check if pH of >11 has been attained.

    c. If a pH of >11 is not observed, add approximately 2 to 3 drops of 10N sodium hydroxide using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 10 to 12 range pH paper or equivalent. See a supervisor if a pH of >11 is not achieved after repeating the 10 N sodium hydroxide addition five times. Note any issues in the LIMS batch for samples that are difficult to pH adjust.

11. If the original sample bottle is empty:

    a. Use a solvent pump to measure 60 mL of methylene chloride for 1 L extractions (15 mL for 250-mL extractions).

    b. Rinse the sample bottle by adding the methylene chloride to the bottle. Swirl the bottle to rinse the interior of the bottle with methylene chloride.

    c. Transfer the solvent to the separatory funnel.

    d. Place the empty sample bottle, with the cap, on the scale.

    e. Record this weight in the LIMS as the tare weight. The initial weight is automatically calculated.

    f. If the sample container is not empty, use a solvent pump to measure 60 mL of methylene chloride (15 mL for 250 mL extractions) and add the solvent to the graduated cylinder or directly to the separatory funnel.

12. Cap the funnel, invert it, and vent immediately.

13. Handshake and vent frequently until the pressure is stable.

14. For 1 L extractions - Place the funnel on the automatic shaker and shake at the designated speed for 2 minutes with the stopcocks closed.
    For 250 mL extractions – Separatory funnels remain on the Automated Water Extraction bench. Press the green "start" button to lower the hood and activate the Automated Water Extraction Bench. The bench will tumble for 2 minutes. The sash will rise after the samples have tumbled.
    NOTE: Shaker speeds vary greatly between instruments; the proper setting is marked on each.

15. For 1 L extractions - Place the separatory funnel on the rack and allow it to sit undisturbed until the methylene chloride layer (bottom layer) has separated from the water.
    For 250 mL extractions - the separatory funnel will sit undisturbed on the Automated Water Extraction Bench.
    The time required for extracts to sit undisturbed is based upon visual confirmation that the layers are adequately separated. Additional time may be necessary for samples with unusually high density (i.e. high salt content).
    If an emulsion forms and is >1/3 of the volume of the solvent layer, mechanical techniques such as stirring and centrifugation must be employed to complete the separation.

16. For 1L extractions, drain the solvent layer into a metal beaker and pour it through approximately 10 cm (~4 inches) of sodium sulfate into a K-D apparatus containing Teflon™-boiling chips.
    For 250 mL extractions, drain the solvent layer directly into the sodium sulfate column containing approximately 5 cm of sodium sulfate (~2 inches). This drains into a Rapid-Vap evaporator tube.

17. Use a solvent pump to add 60 mL of methylene chloride (15 mL for 250 mL extractions) to the separatory funnel and repeat Procedure 14 through 16, venting only as necessary.

18. Use a solvent pump to add another 60 mL of methylene chloride (15 mL for 250 mL extractions) to the separatory funnel and repeat Procedure 14 through 16, venting only as necessary, a second time for the third of three methylene chloride extractions.

NOTE: The acid extract is also added to this K-D (or evaporator tube for 250 mL extractions).

19. Adjusting the pH of samples to <2 for 1 L extractions:

    a. Add approximately 1 mL (1/2 full disposable Pasteur pipette) of concentrated sulfuric acid to all batch QC and samples using a disposable glass pipette. Swirl to mix.

    b. Check the pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

    c. If a pH of <2 is not observed, add approximately 10 to 11 drops of concentrated sulfuric acid using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 1 to 2.5 range pH paper or equivalent. See a supervisor if a pH of <2 is not achieved after repeating the concentrated sulfuric acid addition six times. Note any issues in the LIMS for samples that are difficult to pH adjust.

20. Adjusting the pH of samples to <2 for 250 mL extractions:

    a. Add approximately 12 drops of concentrated sulfuric acid to all batch QC and samples using a disposable glass pipette. Swirl to mix.

    b. Check the pH of samples using Hydrion 1 to 2.5 range pH paper or equivalent to check if pH of <2 has been attained.

    c. If a pH of <2 is not observed add approximately 3 to 4 drops of concentrated sulfuric acid using a disposable Pasteur pipette. Swirl and re-check the pH with Hydrion 1 to 2.5 range pH paper or equivalent. See a supervisor if a pH of <2 is not achieved after repeating the concentrated sulfuric addition six times. Note any issues in the LIMS for samples that are difficult to pH adjust.

21. After a pH of <2 has been attained: Using three 60-mL aliquots of methylene chloride (15 mL for 250 mL extractions), serially extract the sample as described in Procedure 14 through 16, venting only as necessary.

22. Collect the solvent in a K-D setup (or evaporator tube for the 250 mL extractions). For 1 L extractions, rinse the metal beaker with approximately 20 mL of methylene chloride and pour into the sodium sulfate column.

23. Use a wash bottle to rinse the sodium sulfate column with approximately 20 mL of methylene chloride (approximately 5 mL for 250 mL extractions).

24. For 1 L extractions:

    a. Attach a 3-ball Snyder column to the K-D, wet with solvent, and concentrate the extract to approximately 2-mL on a steam bath at 80° to 90°C. At the proper rate of distillation, the balls of the column will actively chatter, but the chambers will not flood. Adjust the vertical position of the apparatus and the water temperature as needed to complete the concentration in 10 - 20 min. Allow the extracts to cool for approximately 10 minutes.

    NOTE: This steam bath temperature ensures concentration in a reasonable length of time. Do not allow the ampule to go dry.

b. If extracting samples entered for client-requested analytical method Dinoseb_ATP, the extracts are methylated at this time. For all other extractions, proceed to step 24d. The methylation steps outlined below must be followed utilizing a hood containing no electrical appliances or steam baths. Additional heat and electrical hazards must be avoided. **Note:** In the case of limited availability of TMSD, the use of Diazomethane for esterification can be used. If using Diazomethane, skip step 24b and go to step 24c.

i. After allowing the 2-3 mL of extract to cool for 10 minutes, add 1 mL TMSD.

ii. Add 0.5 mL MeOH, mix with a Pasteur pipette, and let sit for 10 minutes.

iii. Quench with approximately 10 mg of silicic acid.

iv. Quantitatively transfer to a new ampule to remove the extract from the silicic acid.

v. Concentrate on N-evap nitrogen evaporator to bring the extract below 1 mL.

vi. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 2 mL amber autosampler vial using hexane. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of hexane.

vii. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the ampule. Concentrate on N-evap nitrogen evaporator to bring the extract below 1 mL. The previous step is then repeated to bring the extract to 1 mL.

viii. Cap the vial securely and store in the freezer at ≤-10°C.

ix. Record the final volume in the LIMS.

NOTE: TMSD is flammable and acutely toxic. Only open the container in a drawn hood. If the solution is spilled, leave the area immediately and contact safety. Wear gloves at all times during this procedure. Additional protection such as a safety shield is also recommended. All glassware used in this procedure must be taken directly to wash room personnel. Do not place it on a cart with other dirty glassware.

c. Set up diazomethane generator and esterify the extract as described below:

Safety precautions

i. Diazald is a carcinogen. **Wear gloves at all times during this procedure**.
ii. Perform esterification in a hood with the sash down. Additional protection, such as a safety shield, is recommended. **Avoid inhalation of diazomethane.**
iii. Avoid using etched or scratched glassware, ground glass joints, and glass stirrers - **EXPLOSION may result**.
iv. **To avoid explosion do not heat over 90°C.**
v. All glassware used in this procedure must be taken directly to wash room personnel, not placed on cart of dirty glassware.
vi. The generator must be set up in a hood containing no electrical appliances or steam baths. Additional heat and electrical hazard must be avoided.

Diazomethane Generator Procedure

i. Prepare the KOH solution.

Reagents must be mixed in the following order:

(a) Place 5 g of KOH in a 125-mL Erlenmeyer flask.

(b) Use a graduated cylinder to add 8 mL of reagent water and swirl to dissolve the KOH.
(c) **Allow the solution to cool.**
(d) Use a graduated cylinder to add 25 mL of reagent alcohol.
(e) Use a graduated cylinder to add 25 mL of ethyl ether.
(f) The amount of KOH solution needed depends on the number of samples extracted. One solution can be used for eight to ten samples. If more than ten samples are to be extracted, prepare a second solution for use during esterification.

ii. Fill 40-mL vials with ethyl ether for rinsing the generator between samples. Use 1 vial per 3 samples.

iii. Prepare the diazomethane solution under a hood and just prior to starting the procedure:

(a) Add approximately 3 g of diazald powder to each KOH solution.
NOTE: Add the diazald powder immediately before use.
(b) Clamp the Erlenmeyer in place.

iv. Fill a plastic beaker with warm water from the steam bath (not to exceed 80º to 85ºC for safety concerns using diazomethane) and hold under the Erlenmeyer containing the diazomethane solution. At the same time, hold a rinse vial of ethyl ether at the end of the generator.

v. When the rinse vial begins to turn yellow, remove the vial and begin placing samples at the end of the generator.

(a) Use a rinse vial to rinse the generator between samples.
(b) Be sure each sample turns bright yellow before going on to the next sample. This ensures that esterification is complete.
(c) If the yellow color does not persist in all of the samples after methylation is complete, remethylate the samples that are no longer yellow.

vi. After esterification, N-Evap the samples below 1 mL.

vii. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 1 mL amber autosampler vial using hexane. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of hexane.

viii. Cap the vial securely and store in the freezer at≤-10ºC.

ix. Record the final volume in the LIMS.

d. Attach a microsnyder to the ampule and concentrate on a steam bath to slightly below 1 mL.

e. The extract is quantitatively transferred from the ampule using a Pasteur pipette to a 2 mL amber autosampler vial using methylene chloride. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of methylene chloride.

f. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the ampule. A microsnyder is then attached to the ampule and the extract is concentrated on a steam bath to around 0.5 mL. The previous step is then repeated to bring the extract to 1 mL.

g. Cap the vial securely and store in the freezer at ≤-10°C.

h. Record the final volume in the LIMS.

25. For 250-mL extractions:

a. Place the evaporator tube containing the solvent extract into the pre-heated (approximately 80°C) Rapid-Vap Evaporator. Set the timer for 10 minutes and speed at 75% (the speed is the rotation within the unit while the sample is evaporating). After 10 minutes, rinse the tube with approximately 5-7 mL methylene chloride and set the timer for 10 more minutes. Confirm that the nitrogen is set at approximately 15 PSI (this is adjusted on the regulator attached to the nitrogen line). Allow samples to concentrate to around 0.5 mL.

   NOTE: The temperature, timer, and speed settings can be adjusted as necessary to accommodate difficult sample matrices, etc.

b. The extract is quantitatively transferred from the evaporator tube using a Pasteur pipette to a 2 mL amber autosampler vial using methylene chloride. The final volume of 1 mL is quantified by comparing the extract auto sampler vial to a reference auto sampler vial containing exactly 1 mL of methylene chloride.

c. If too much solvent is added to the sample vial, the extract from the vial should be transferred back into the evaporator tube and concentrated on the rapid vap down to around 0.5 mL. The previous step should then be repeated to bring the extract to 1 mL.

d. Cap the vial securely and store in the freezer at ≤-10°C.

e. Record the final volume in the LIMS.

Calculations

See analysis method.

Statistical Information/Method Performance

See analysis method.

Quality Assurance/Quality Control

A batch is defined as the samples to be extracted on any given day but not to exceed 20 field samples. If more than 20 samples are prepared in a day, an additional batch must be prepared. If any client, state, or agency has more stringent QC or batch requirements, these must be followed instead.

Each extraction batch (up to 20 samples) must contain a method blank, a LCS, and an unspiked background sample, MS, and MSD. An LCSD is required if insufficient sample volume is submitted for a background/MS/MSD. If the batch contains only field or equipment blank samples, the LCS/LCSD QC pairing should be used.

QC limits for surrogates, LCS/LCSD, and MS/MSD are established through statistical analysis of historical data. The limits are evaluated as frequently as defined in the analytical method and updated as needed. The limits are maintained in the LIMS for the relevant analysis numbers.

Table I

LCS Mix #1 Reagent Analyte List

1,1'-Biphenyl	4-Chloro-3-methylphenol	Di-n-octyl phthalate

1,2,4,5-Tetrachlorobenzene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Diphenylhydrazine
1,3-Dichlorobenzene
1,3-Dinitrobenzene
1,4-Dichlorobenzene
1,4-Dioxane
1-Methylnaphthalene
1-Methylphenanthrene
2,3,4,6-Tetrachlorophenol
2,2'-oxybis[1-chloropropane]
2,3-Dichlorobenzeneamine
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dichlorophenol
2,6-Dinitrotoluene
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroaniline
2-Nitrophenol
3,3'-Dichlorobenzidine
3-Methylphenol
3-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl phenyl ether
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol
Acenaphthene
Acenaphthylene
Acetophenone
Alpha Methyl Styrene
Alpha-Terpineol
Aniline
Anthracene
Benzidine
Benzo[a]anthracene
Benzo[a]pyrene
Benzo[b]fluoranthene
Benzo[g,h,i]perylene
Benzo[k]fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Carbazole
Chrysene
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Dimethylformamide
Di-n-butyl phthalate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexadecane
icosane
Indene
Indeno[1,2,3-cd]pyrene
Isophorone
Naphthalene
n-Decane
n-Docosane
Nitrobenzene
N-Nitrosodimethylamine
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
n-Octadecane
n-Tetradecane
Octachlorostyrene
Pentachlorophenol
Phenanthrene
Phenol
Phenyl ether
Pyrene
Pyridine

Table II

APPIX Mix #1 Reagent Analyte List

1,3,5-Trinitrobenzene
1,4-Dinitrobenzene
1,4-Naphthoquinone
1-Chloronaphthalene
1-Naphthylamine
2,3,5,6-Tetrachlorophenol
2-Acetylaminofluorene
2-Naphthylamine
2-Picoline
2-Toluidine
3,3’-Dimethylbenzidine
3-Methylcholanthrene
4,4'-Methylene bis(2-chloroaniline)
4-Aminobiphenyl
4-Nitroquinoline-1-oxide
6-Methylchrysene
7,12-Dimethylbenz(a)anthracene
Famphur
Hexachloropropene
Isodrin
Isosafrole
Kepone
Methapyrilene
Methyl methanesulfonate
Methyl parathion
N-Nitro-o-toluidine
N-Nitrosodiethylamine
N-Nitroso-di-n-butylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
o,o',o''-Triethylphosphorothioate
p-Dimethylamino azobenzene

alpha,alpha-Dimethyl phenethylamine
Aramite, Total
Chlorobenzilate
Diallate
Dibenz[a,h]acridine
Dibenz[a,j]acridine
Dimethoate
Dinoseb
Disulfoton
Ethyl methanesulfonate
Ethyl Parathion
Pentachlorobenzene
Pentachloroethane
Pentachloronitrobenzene
Phenacetin
Phorate
p-Phenylene diamine
Pronamide
Quinoline
Safrole, Total
Sulfotepp
Thionazin

10864 Glassware Cleaning for Organic Extractions
10876 Organic Extraction Standards Storage and Handling
11998 Semivolatile Spiking and Calibration Standards
13634 The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D/E
23822 Instructions for Checking pH During Extraction Procedures
31758 Client Specific Methylphenols by Method 8270D in Water Using GC/MS
34848 Client Specific Dinoseb by 8270C in Water Using GC/MS
9252 Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS
9617 Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS
9623 Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS
9995 Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS

End of document

Version history

Version	Approval	Revision information	
17	30.OCT.2020		
18	25.FEB.2021		
19	22.JUL.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-WC-WI11475**	**Multi-Parameters in Solids and Waters by ManTech Multi-Parameter System**	**Work Instruction**
Old Reference: **1-P-QM-WI-9013112**		
Version: **16.1**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **08-OCT-2021**	Document users: **6_EUUSLA_Water Quality_24/48 Hour Analyst, 6_EUUSLA_Water Quality_24/48 Hour Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I

Revision Log

	Revision: 16.1	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Personnel Training and Qualifications	Clarification	Added laboratory IDOC criteria
Table I	TNI2016	Removed additional CCV concentrations

	Revision: 16	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Scope	Method reactivation	Added acidity prep analysis
Reagents and Standards A.20.	Current Process	Removed lab preparation of EDTA
Apparatus and Equipment 3.	Method reactivation	Added step 3.

	Revision: 16	**Effective date:** This version
Section	**Justification**	**Changes**
Calibration B. Calibration E.	Current process TNI2016	removed calibration process for 2340C Added percent error requirement and acceptance criteria
Procedure I.B.	Method reactivation	Added acidity prep analysis
Calculation	Correction	Replaced 'mLs EDTA used' with 'A' and 'EDTA constant' with 'B.' Defined A and B. Clarified stoichiometry.
Quality Assurance / Quality Control	Clarification	Clarified that CCVs must be at or below the mid-point

Revision	15	**Effective Date:**	22.APR.2021
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout document	Current process		Update to new LIMS
Cross-Reference	Higher level documents are not required to be referenced		Removed QA-SOP-11880, *QA-SOP11188*, *QA-SOP11913*
Scope / Reference	Deactivated analysis		Removed SM2340A, 13414(total acidity prep)
Apparatus and Equipment 3.	Deactivated analysis		Deleted step 3.
Calibration C, D, E	Current process		Added instructions to attach calibration data to the analytical batches
Procedure I.B	Deactivated analysis		Removed total acidity prep instructions
Calculation G.	Deactivated analysis		Deleted non-carbonate hardness calculation. Moved Un-ionized ammonia to G, correcting for the 2 H. calculations

Reference

1. Standard Methods for the Examination of Water and Wastewater, Method 2310 B-2011.
2. Standard Methods for the Examination of Water and Wastewater, Method 2310 B-1997.
3. Standard Methods for the Examination of Water and Wastewater, Method 2320 B-2011.
4. Standard Methods for the Examination of Water and Wastewater, Method 2320 B-1997.
5. Standard Methods for the Examination of Water and Wastewater, Method 2340 C-2011.
6. Standard Methods for the Examination of Water and Wastewater, Method 2340 C-1997.

7. Standard Methods for the Examination of Water and Wastewater, Method 2510 B-2011.
8. Standard Methods for the Examination of Water and Wastewater, Method 2510 B-1997.
9. Standard Methods for the Examination of Water and Wastewater, Method 2550 B-2010.
10. Standard Methods for the Examination of Water and Wastewater, Method 4500-CO2 D-2011.
11. Standard Methods for the Examination of Water and Wastewater, Method 4500-F B-2011.
12. Standard Methods for the Examination of Water and Wastewater, Method 4500-F C-2011.
13. Standard Methods for the Examination of Water and Wastewater, Method 4500-F C-1997.
14. Standard Methods for the Examination of Water and Wastewater, Method 4500 H+ B-2011.
15. Standard Methods for the Examination of Water and Wastewater, Method 4500-H+ B-2000.
16. Standard Methods for the Examination of Water and Wastewater, Method 4500 NH3 B-2011.
17. Standard Methods for the Examination of Water and Wastewater, Method 4500 NH3 D-2011.
18. Standard Methods for the Examination of Water and Wastewater, Method 4500 NH3 D-1997.
19. Standard Methods for the Examination of Water and Wastewater, 8010 F-2015 (Table 8010:VI.)
20. Method 120.1, Methods for Chemical Analysis of Water and Wastes USEPA 600, rev 1982
21. Method 130.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.
22. Method 150.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
23. Method 170.1 Methods for Chemical Analysis of Water and Wastes USEPA 600 rev 1974
24. Method 305.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.
25. Method 305.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.
26. Method 310.1, Methods for Chemical Analysis of Water and Wastes USEPA 600, rev 1974
27. Method 340.2, Methods for Chemical Analysis of Water and Wastes USEPA 600.
28. Method 350.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.
29. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040B.
30. Test Methods for Evaluating Solid Wastes, SW-846 Method 9040C.
31. Test Methods for Evaluating Solid Wastes, SW-846 Method 9050A, December 1996.
32. Test Methods for Evaluating Solid Wastes, SW-846 Method 9214.
33. ManTech Associates, Inc. PC-Titration Plus Instruction and Operation manual, January 25 2000.

34. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI10425	Bellack Distillation for Fluoride in Waters and Solids by SM 4500-F B–1997 or EPA 340.1 Procedure 6.1
T-WC-WI11519	pH Probes and Meters
T-WC-WI10348	Fixed Volume Hand-Held Pipettes
T-WC-WI9897	Adjustable Volume Handheld Pipettes
T-WC-WI11585	Standardization of 0.02 Normal Sodium Hydroxide
T-WC-WI10362	Standardization of 0.02 and 0.1 Normal Sulfuric Acid
T-WC-WI10360	Quality Control Data for Wet Chemistry
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits

Scope

This SOP uses the ManTech Multi-Parameter System for sample analyses. The ManTech Multi-Parameter System is an instrument used for the determination of the following analytes (see table below) in drinking waters, surface waters, and wastewater samples.
The table below lists the name and LIMS ID number of the analyses that are included in this SOP and the method references associated with each.

Table of Analyses and Reference Methods

Analysis Name	LIMS ID	Analysis Method
Acidity to pH 3.7 and pH 8.3 (titrimetric)	305.2	EPA 305.2
Fluoride	340.2 4500_F_C	SM 4500-F C-2011 SM 4500-F C-1997 EPA 340.2
Fluoride (distilled)	340.2_Dist 4500_F_B	SM 4500-F C-2011 SM 4500-F C-1997 EPA 340.2 SW-846 9214
Total Acidity	SM2310B 305.1	SM 2310 B-2011 SM 2310 B-199 EPA 305.1
Specific Conductance	2510B 120.1 9050A	SM 2510 B-2011 SM 2510 B-1997 EPA 120.1 SW-846 9050A

Total Hardness	2340C 130.2	SM 2340C-2011 SM 2340C-1997 EPA 130.2
Carbonate Alkalinity	2320B	SM 2320B-2011 SM 2320B-1997
Bicarbonate Alkalinity	2320B	SM 2320B-2011 SM 2320B-1997
Total Alkalinity	2320B 310.1	SM 2320B-2011 SM 2320B-1997 EPA 310.1
Temperature of pH	170.1 SM2550B	EPA 170.1, SM 2550B-2010
pH	SM4500_H+ 9040C 9040B	SM 4500-H+ B-2011 SM 4500-H+ B-2000 SW-846 9040B SW-846 9040C
pH	150.1	EPA 150.1
Ammonia-Nitrogen	SM4500NH3_D 350.3	SM 4500-NH3D-2011 SM 4500-NH3 D-1997 EPA 350.3
Ammonia-Nitrogen Distilled	SM4500NH3_D 350.3	SM 4500-NH3 D-2011 SM 4500-NH3 D-1997 EPA 350.3
Phenolphthalein Alkalinity	2320B 310.1	SM 2320B-2011 SM2320B-1997 EPA 310.1
Preparation /Calculations		**Method**
Free Carbon Dioxide	SM4500_CO2_D	SM 4500-CO2 D-2011
Hydroxide Alkalinity	2320B	SM 2320 B-2011, SM 2320 B-1997
Fluoride distillation	4500_F_B 340.2_Dist	SM 4500-F B-2011, SM 4500-F B-1997 EPA 340.1
Unionized Ammonia	SM8010F_NH4	SM 8010 F-2011 (Table 8010:VI)
Ammonia Distillation	SM4500NH3_B	SM 4500-NH3 B-2011 EPA 350.3
Total Acidity	SM2310B_Prep	SM 2310 B-2011 SM 2310 B-1997 EPA 305.1

Basic Principles

Samples are analyzed using the ManTech Multi-Parameter System, which has been designed to test for specific analytes. The system is able to be configured in different ways to optimize sample volumes required, and analysis times. The ManTech system is able to analyze for one parameter or multi-parameters at the same time.

Reference Modifications

The following analyses have reference modifications:

1. Method 2340C - Total Hardness:

   a. The procedures listed in SM 2340C and Method 130.2 are modified by using potassium cyanide (KCN) as the inhibitor instead of sodium cyanide (NaCN).

   b. SM2340C and EPA 130.2 state to dilute 25 mL of sample to 50 mL with reagent water prior to titration. This procedure uses 50 mL sample.

2. Method 4500_F_C, 340.2 – Fluoride and Distilled Fluoride
SM 4500-F-C states that the electrodes are inserted before stirring the sample. For EPA 340.2 begin stirring the sample before the electrodes are inserted.
3. Method SM4500NH#_D, 350.3 – Ammonia-Nitrogen and Distilled Ammonia-Nitrogen
Instead of using NaOH in order to pH adjust the samples during the ammonia analysis, this procedure uses alkaline reagent. Alkaline reagent is a purchased reagent containing NaOH that is currently recommended by the manufacturer of the ammonia electrode.

Interferences

Sample matrix is likely to be the largest cause of interference for each analysis.

Samples containing oily layers, soaps, suspended solids, or precipitates may impede the electrode response. The electrode must be cleaned according to the manufacturer's instructions.

Total Hardness – excessive amounts of heavy metals can interfere, causing a faded or indistinct endpoint by the stoichiometric consumption of EDTA. If this interference is not resolved after multiple dilutions on the ManTech automated procedure, then the sample must be analyzed using the manual procedure. See SM 2340C for more discussion on interferences and how to treat them.

Ammonia Nitrogen – volatile amines are a positive interference. Mercury and Silver also interfere with this procedure. Electrode responds slowly at levels <1 mg NH3-N/L; use longer electrode immersion times.

Fluoride – several polyvalent cations, notably aluminum, iron and silicon interfere by forming complexes with fluoride. Adding TISABIII provides a uniform ionic strength background, adjusts pH and breaks up complexes so that the fluoride ion activity can be measured. Fluoborates are widely used in industrial processes. At concentrated levels, as in electroplating wastes, fluoborates do not hydrolyze to release fluoride without using the Bellack distillation (Analysis 01448) prior to analyzing the sample distillate by ISE. SM 4500 F C-2011 1.b requires to distill fluoride if the Total Dissolved Solids concentration is greater than 10,000 mg/L.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC consists of four aliquots spiked at 1-4X the RL that are carried through all steps of the procedure. The criteria include the calculation of mean accuracy of 50 - 150% and standard deviation of less than 20%.

The DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the LCS acceptance criteria and standard deviation of less than 20%.

Sample Collection, Preservation, and Handling

Samples for pH and Temperature of pH are to be collected in unpreserved glass or plastic containers and analyzed as soon as possible upon receipt at the laboratory. Avoid sample agitation and prolonged exposure to air.

Samples for Total Alkalinity, Total Acidity, and Acidity to pH 3.7 and pH 8.3 are to be collected with minimum aeration and analyzed within 14 days of collection.

Samples for Specific Conductance and Fluoride are to be collected in unpreserved glass or plastic containers and analyzed within 28 days of collection.

Samples for Ammonia must be collected in a glass container, preserved with concentrated sulfuric acid to a pH < 2. Analyze within 28 days of collection.

Samples for Total Hardness must be collected in a glass or plastic container, preserved with nitric acid to a pH < 2. Analyze within 6 months of collection.

All samples must be stored at 0° to 6°C, not frozen. Prior to analysis, samples must be brought to room temperature.

Apparatus and Equipment

1. ManTech Multi-Parameter System instrument:

The instrument is equipped and programmed to analyze for pH, temperature of pH, alkalinity, acidity, conductivity, fluoride, ammonia and total hardness.

Each test can be performed individually or in tandem with others. The analyst will determine the combination of analyses for each run.

a. pH Electrode

b. Fluoride ion selective electrode

c. Interface

d. Burivar I/2 (25 mL burette)

e. TitraRinse pump

f. TitraRinse slow speed reagent addition pump

g. Reversible Peri-Max pump

h. ManTech photometric detector with a 620nm filter

i. Conductivity/TDS Meter, Model 4510

j Ammonia electrode

k. Autosampler - MEGA, 197 sample locations

2. Ammonia Distillation LIMS ID SM4500NH3_B

a. Kjeldahl distillation rack

b. Refrigerated recirculator (Coolflow) with a recirculating pressure set at 20 psi and the temperature adjustment set at 10°C, or equivalent.

c. Glass distillation apparatus with connector and 800 mL Kjeldahl flask

d. pH indicator strips, purchased

e. Porous boiling chips, purchased

f. 500 mL class A graduate

g. 400 mL (approx.) distillation collection cups

h. 800 mL (approx.) sample collection cups

i. Kjeldahl flasks

j. 5 mL class A pipette

3. Total Acidity Preparation LIMS ID SM2310B_Prep

a. pH meter with pH electrode and automated temperature compensator (ATC) probe that reads to 0.05 pH units

b. Magnetic stir bar and stir plate

c. Hot plate

d. 150-mL glass beakers and plastic cups

Reagents and Standards

Alternative weights and volumes are acceptable as long as final concentrations remain the same.

A. Reagents and Standards needed for ManTech Analyses

1. Standardized Sulfuric acid, 0.02 N

   a. Dilute 0.6 mL of concentrated sulfuric acid to 1000 mL with reagent water.

   b. Store at room temperature in glass or plastic container and re-evaluate yearly.

   c. Standardize according to *T-WC-WI10362*.

   d. Re-standardize titrant before use if more than 30 days have passed since the last standardization date.

2. Sodium hydroxide, 10 N - Purchased; see container for shelf life information. Or prepare:

   a. Dissolve 400 ± 0.5 g NaOH pellets in 1000 mL volumetric flask containing approximately 800 mL reagent water. Solution becomes very warm.

   b. Cool to room temperature and dilute to 1000 mL with reagent water.

   c. Store at room temperature in plastic or glass container and re-evaluate yearly.

3. Sodium hydroxide, 1.0 N

   a. In a 1-L glass volumetric flask containing approximately 500 mL reagent water, dissolve 40.00 ± 0.05 g NaOH.

   b. Cool and dilute to volume.

   c. Store at room temperature in plastic or glass container and re-evaluate yearly.

4. Standardized Sodium Hydroxide, 0.02 N

   a. In a 1-L glass volumetric flask, add approximately 500 mL reagent water.

   b. Add 20 mL of 1 N NaOH to the flask and dilute to volume with reagent water.

   c. Store at room temperature in glass or plastic container and re-evaluate yearly.

   d. Standardize using instructions as per *T-WC-WI11585*.

   e. Re-standardize titrant before use if more than 30 days have passed since the last standardization date.

5. Total alkalinity standard (9400 mg/L as $CaCO_3$)

   a. Dry sodium carbonate (Na_2CO_3) for at least 4 hours at approximately 250°C.

   b. Desiccate approximately 2 hours.

   c. Dissolve 9.954g ± 0.002g Na_2CO_3 in reagent water and dilute to 1000 mL in a volumetric flask.

d. Solution expires 3 months from the date of preparation.

e. Store in a glass container at 0º to 6ºC, not frozen.

f. Dilute for other concentrations.

6. pH 4, 7, and 10 buffer solutions- purchased; see container for shelf life information.

NOTE: A second source 7.00 pH buffer solution that is from ISO 17025 approved vendor must be purchased; see container for shelf life information. This is to be used for Methods SM4500_H+, 9040C, 9040B Laboratory Control Standard (LCS). It is also to be used for Methods SM4500_H+, 9040C, 9040B, 2320B and 310.1 Continuing Calibration Verification Standards (CCVs)

7. 1413 µhoms/cm cell constant; purchased. See container for shelf life information

8. 0.1 M KCl (12,900 µhoms/cm) [Solution I]

a. In a 1 L glass volumetric flask, dissolve 7.4555 ± .0001 g predried KCl (2 hours at 105° ± 2°C) in approximately 500 mL reagent water.

b. Dilute to volume with reagent water.

c. Solution expires 3 months from the date of preparation.

d. Store at room temperature in a glass or plastic

9. 0.01 M KCL (1413 µhoms/cm) [Solution II

a. In a 1-L volumetric flask, dissolve 0.7456 ± 0.0001 g predried KCl (2 hours at 105° ± 2°C) in approximately 500 mL reagent water.

b. Dilute to volume with reagent water.

c. Solution expires 3 months from the date of preparation.

c. Store at room temperature in a glass or plastic container.

10. 5 umhos/cm low-level check standard

a. In a 1 L glass volumetric flask, containing approximately 500 mL reagent water, dissolve 0.0025 g of NaCl.

b. Prepare fresh before use.

11. Fluoride standard stock solution (100 mg/L)

a. Dissolve 0.2210 ± .0005 g of anhydrous sodium fluoride (NaF) in reagent water and dilute to 1000 mL in a volumetric flask.

b. Stable for 6 months.

c. Store in a plastic container at room temperature.

d. Dilute for other concentrations.

NOTE: A separate standard fluoride stock solution must be prepared using a **different source of NaF** when preparing a calibration curve.

12. TISAB III, purchased. See container for storage conditions.

13. Ammonia nitrogen standard (100 m/L NH_3-N)

a. Dry ammonium chloride (NH4Cl) at 103°C to 105°C for approximately 2 hours.

b. Desiccate approximately 1 hour.

c. Dissolve 0.3819 ± 0.0002 g NH_4Cl in approximately 800 mL reagent water.

d. Once dissolved, preserve the solution with concentrated sulfuric acid to a pH < 2. Dilute to 1000 mL in a volumetric flask.

e. Stable for 6 months.

f. Store at 0º - 6º C, not frozen in a glass or plastic container.

g. Dilute as needed for other concentrations.

NOTE: The Ammonia nitrogen standard used to prepare the calibration curve must be prepared using a **different source** of NH4Cl.

14. Ammonia electrode storage solution- purchased. See container for shelf life information.

15. Standard EDTA titrant (0.02N) - Purchased; see container for shelf life information.

16. pH 10 hardness buffer solution – purchased; see container for shelf life information. Or prepare:

a. Dissolve 16.9 g ammonia chloride (NH_4Cl) in 143 mL of concentrated ammonium hydroxide (NH_4OH).

b. Separately, dissolve 1.179 ± 0.0005 g of disodium EDTA and 0.78 ± 0.005 g of ($MgSO_4 \cdot 7$ H2O) in 50 mL of reagent water (this solution becomes turbid).

c. Combine the above two solutions and dilute to 250 mL with reagent water in a volumetric flask.

d. Solution is stable 30 days.

e. Store at room temperature in plastic container.

17. Calmagite indicator solution (0.1 % w/v) – Purchased; Store at room temperature. See manufacturer's label for expiration date.

18. Calcium reference standard (1000 mg/L Ca = 2497 mg/L $CaCO_3$) – Purchased; store at room temperature. See manufacturer's label for expiration date.

19. 1000 mg/L $CaCO_3$ intermediate calcium standard

    a. Pipette 20.0 mL of purchased reference standard into 50 mL volumetric flask and dilute to volume with reagent water.

    b. Stable for 6 months.

    c. Store at room temperature in glass or plastic container.

20. 15% w/v Sodium Acetate Solution – Add 85 mL of reagent water to a 150 mL beaker. Dissolve 15.0 g ± 0.01 g of sodium acetate anhydrous into the reagent water. Prepare fresh before use.

21. Total acidity standard (5000 mg/L as $CaCO_3$)

    a. In a 1-L glass volumetric flask containing approximately 500 mL of reagent water; add 20.4000 ± 0.0005 g potassium hydrogen phthalate, dried at 120 degrees C for 2 hours. Cool in desiccator for approximately 1 hour.

    b. Allow to dissolve and dilute solution to volume.

    c. Store at 0°to 6°C, not frozen, in a glass container.

    d. Solution expires 6 months from the date of preparation.

22. Hydrogen peroxide (H_2O_2, 30% solution) – purchased. Store at room temperature. See label for expiration date.

23. pH 8.00 buffer Solution; purchased. Store at room temperature. See container for shelf life information.

B. **Reagents needed for LIMS ID SM4500NH3_B – Ammonia distillation:**

1. Borate buffer solution – Dissolve 19.0 ± 0.1 g sodium borate, 10-hydrate ($Na_2B_4O_7 \cdot 10\ H_2O$) in approximately 1000 mL of reagent water. Add 176 mL of 0.1N NaOH to the solution and dilute to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a glass container. Solution stable for 6 months.

2. 0.1N H_2SO_4 – Dilute 3.0 mL of concentrated sulfuric acid to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a glass or plastic container and re-evaluate yearly.

3. 4% H_2SO_4 Solution – Dilute 380 mL of 0.1N H_2SO_4 to 1000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly.

4. Antifoam B; purchased. Store at room temperature. See manufacturer's label for expiration date.

5. Sodium hydroxide, 5N – Dissolve 200 ± 0.5 g sodium hydroxide (NaOH) pellets in approximately 800 mL of reagent water. Solution becomes very warm. Cool to room temperature and dilute to 1000 mL with reagent water in a volumetric flask. Store at room temperature in plastic container and re-evaluate yearly. (This is used to pH adjust samples.)

6. Sodium hydroxide, 0.1N – Dilute 40 mL of 5N NaOH solution to 2000 mL with reagent water in a volumetric flask. Store at room temperature in a plastic container and re-evaluate yearly. (This is used in borate buffer solution.)

7. Dilute Hydrochloric (HCl) acid – Add 50 mL of concentrated HCl to approximately 3.5 liters of reagent water. Slowly invert. Store at room temperature in a plastic container. (This is used to rinse tubing prior to steam cleaning the distillation apparatus.)

8. Ammonia-nitrogen standard, 500 mg/L NH_3-N – In a 1 L volumetric flask containing approximately 500 mL reagent water, dissolve 1.9095 ± .0002 g NH_4Cl (which has been dried at 105° ± 2°C for at least 2 hours). Dilute to 1 L using reagent water. Preserve the solution with concentrated sulfuric acid to a pH <2. Store the standard at 0º to 6ºC, not frozen in a glass or plastic container. Standard expires 6 months from the date of preparation.

C. Standards Preparation Needed for Linearity Check for LIMS ID 2510B, 120.1 and 9050A

1. Prepare Solution I (12,900 µhoms/cm) and II (1413 µhoms/cm) as indicated above under the reagents and standards section.

2. Prepare the following 8 standards in 100-mL volumetric flasks using Solutions I or II as indicated in the table below. Bring to volume with reagent water. Prepare fresh before use.

Solution to use	Standard	mL of Solution	umhos/cm
Solution II	0.0001 M	1	14.94
Solution II	0.0005 M	5	73.9
Solution II	0.001 M	10	147
Solution II	0.005 M	50	717.8
Solution II	0.01 M	100	1,413
Solution I	0.02 M	20	2,767
Solution I	0.05 M	50	6,668
Solution I	0.1 M	100	12,900

Calibration

Calibration is performed daily. It is only necessary to calibrate for analyses that will be performed on that day.

Balances must be calibrated each day before use.

NOTE: For all calibrations, 50 mL of standard is poured into a sample tube. For each analysis, a predetermined and programmed sample volume is used (to be taken from the 50 mL in the sample tube).

NOTE: Recalibration is necessary for each analysis if acceptance criteria is not met.

A. LIMS ID 2510B,120.1, 9050A Conductivity Calibration

1. Determine cell constant daily:

   a. Place 1413 µhoms/cm calibration standard into autosampler rack.

b. The ManTech instrument then rinses the conductivity cell with reagent water, followed by the calibration standard. The instrument reading stabilizes for 25 seconds.

c. The meter prompts the analyst to press calibration key twice.

d. The cell constant is displayed. Record cell constant in maintenance logbook.

2. Conductivity Meter Linearity Check:

a. Linearity check of the conductivity meter must be performed on the instrument at least once per year using the following concentrations below. Refer to Reagents and Standards section A for preparation instructions.

0 .0001M, 0.0005M, 0.001M, 0.005M, 0.01M, 0.02M, 0.05M, 0.1M

b. Fill tubes with standards in accending order by concentration and schedule the Mantech instrument to perform conductivity on all the standards.

c. Print out data from standards and keep in designated calibration folder for Conductivity.

d. Correlation Coefficient must be = 0.995. If this acceptance criteria is not met, the linearity check must be repeated.

B. pH Calibration - Analyses that require pH calibration: LIMS ID# 305.2, SM2310B, 305.1, SM4500_H+, 9040C, 9040B, 2320B, 310.1

1. Place pH 4, 7, and 10 buffers into autosampler rack and run a schedule to calibrate pH electrode.

2. Sampler moves to rinse station where the sample transfer line and Titrasip vessel are rinsed with reagent water.

3. Sampler moves to pH 4 buffer position and sample transfer line is primed with pH 4 buffer solution.

4. 10 mL of buffer solution is pumped into Titrasip cell and stirrer is turned on.

5. pH of buffer solution is measured and recorded.

6. Steps b. to e. are repeated for pH buffers 7 and 10.

7. Acceptance criteria: Slope of pH calibration must be within the range of -54.0 to -60.0.mV for pH performed on the ManTech.

8. Record pH electrode ID, instrument ID, Employee ID, and date on calibration print out. Export and attach the calibration to the analytical batch in LIMS. Store in designated calibration folder for pH calibration sheets.

9. Immediately after calibration, analyze one of the pH buffers again. The result must be within ±0.1 pH units of the true value of the buffer.

C. LIMS ID 340.2, 4500_F_C Fluoride Calibration:

1. Curve:

a. Using the fluoride concentrations listed below, analyze a new calibration curve daily.

NOTE: When analyzing samples from the state of North Carolina, each analyst performing the analytical procedure must produce a standard curve (Ref 15A NCAC 2H .0805 (a) (7) (l)).

Concentration (mg/L)	mL Stock Standard (100 mg/L)	Final Volume (mL)
0.10	1	1000
0.50	5	1000
1.0	10	1000
1.5	15	1000
2.0	20	1000

NOTE: Before analyzing distillate batches from LIMS ID 4500_F_B or 340.2_dist, add 1 mL of 15% Sodium Acetate to all curve standards.

b. Place calibration standards 0.10, 0.50, 1.0, 1.5, 2.0 mg/L, into autosampler rack in ascending order and run a schedule to calibrate fluoride probe.

1.) Fluoride curves for distillate batches (from LIMS ID 4500_F_B or 340.2_dist), must have 1 mL of 15% of Sodium Acetate added to all curve standards.

c. Sampler moves to rinse station where sample transfer line and Titrasip vessel are rinsed with reagent water.

d. Sampler moves to first standard position.

e. Sample transfer line is primed with standard solution.

f. 30 mL of standard and 3 mL of TISAB is pumped into the Titrasip vessel, and stirrer is turned on.

g. Fluoride concentration is measured and recorded.

h. Steps c. – g. are repeated for remaining standards.

i. Acceptance criteria: The slope of the curve must be between -54.0 to -60.0 mV.

j. Record pH electrode ID, instrument ID, TISAB III lot number, calibration standards documentation, Employee ID and date on calibration print out. Store in designated calibration folder.

k. Export and attach the curve to the analytical batch in LIMS.

D. LIMS ID SM4500NH3_D, 350.3 Ammonia Calibration

1. Curve: Prepare a calibration curve daily using the concentrations listed below.

The curve must be analyst specific.

Conc. (mg/L NH3-N)	mL 100 mg/L ® 100 mL
0.1	0.1
0.5	0.5

2.5	2.5
5.0	5.0
10.0	10.0

a. Ensure electrode is filled to line with appropriate fill solution (NH4Cl).

b. Dilute stock standard to obtain the following concentrations: 0.1, 0.5, 2.5, 5.0, 10.0 mg/L and place calibration standards into the sampler rack in ascending order, and pH 4 buffer into dip rinse (second rinse) position.

c. Sampler moves to flowing rinse station where electrode is rinsed with reagent water.

d. Sampler moves to dip station and electrode remains immersed in pH 4 buffer for 15 seconds.

e. Sampler moves to flowing rinse station where electrode is rinsed again with reagent water.

f. Sampler moves to first calibration standard position and stirrer is turned on.

g. 0.45 mL of ISA (10 N NaOH) is added to sample to adjust pH to 11 or greater, ensuring all NH4 is converted to NH3.

h. Ammonia electrode is allowed to stabilize and reading is recorded.

i. Steps c. - h. are repeated for remaining calibration standards.

j. Acceptance criteria: The slope of the curve must be between -54.0 to -60.0 mV

k. Record pH electrode ID, instrument ID, Employee ID, and date on calibration print out. Store in designated calibration folder.

l. Export and attach the curve to the analytical batch in LIMS.

E. When linear fits are used, the % error is measured between the calculated and expected amounts to determine the calibration function acceptability. The % error must be ≤50% for the low calibration point and ≤30% for the mid-point of the calibration curve. This calculation is kept on file with the raw calibration data.

Procedure

I. Preparation Procedures: Ammonia Distillation

A. LIMS ID SM4500NH3_B - Ammonia Distillation (for use with LIMS ID SM4500NH3_D)

1. Before each distillation, rinse tubes with dilute HCl. Add approximately 500 mL of reagent water to an 800-mL Kjeldahl flask to steam clean the distillation apparatus.

2. Connect Kjeldahl flask to glass adapter and hose. Turn on the Coolflow. Turn on the temperature control and distill until approximately 150 mL of water is collected in the beaker at

the bottom of the setup. Remove distillate from delivery tube immediately after turning off heat source to avoid back wash during the cool-down phase.

3. Measure 500 mL of sample (or an aliquot diluted to 500 mL with reagent water) using a Class A graduated cylinder. Pour into a beaker and adjust the pH of the sample to 9.5 with 5N NaOH. Check pH of adjusted sample with purchased pH strips to ensure the pH is 9.5, and then add 25 mL of borate buffer solution.

4. Transfer the solution to an 800-mL Kjeldahl flask. Add a pinch of boiling chips and approximately 5 mL of antifoam B to the solution. Connect flask to glass adapter and hose. Turn on the Coolflow.

5. Measure 50 mL of 4% H2SO4 solution into a 400-mL beaker. Make sure the delivery tube is below the level of the 4% H2SO4 solution (receiving solution).

6. Begin heating. Collect approximately 220 mL of distillate. Distill at a rate of 6 - 10mL/min. Turn off heat and immediately remove the distillate beakers from the delivery tube. Turn off the Coolflow.

7. Pour the distillate into a 500-mL Class A graduated cylinder and dilute to final volume of 500 mL with reagent water. Store distillate at 0°C - 6°C; not frozen, prior to analyzing

8. Analyze distillate for NH3-N according to Method SM4500NH3_D procedure.

B. LIMS ID SM2310B_Prep - Total Acidity Preparation (for use with LIMS ID SM2310B)

1. Calibrate the pH electrode prior to use. Refer to *T-WC-WI11519* for instructions on calibration.
2. Pour 100 mL of the sample into a 150-mL beaker. Read the initial pH of the sample and record the result.

3. If the pH is above 4.0, add standard sulfuric acid in 5 mL increments to lower the pH to 4.0 or less. If the initial pH is less than 4.0, addition of sulfuric acid is not required.

4. Add 5 drops of 30% H_2O_2 .

5. Heat the sample to boiling and boil for 3 minutes.

6. Cool the sample to room temperature. Analyze for Total Acidity, LIMS ID SM2310B.

II. ManTech Procedure:

NOTE: Before operating the analyst must ensure that all required reagents and reagent water containers needed for each test are in adequate supply and are not expired.

A. To operate the instrument, open the PC-titrate software menu from the computer desktop.

Each day before any analysis is performed; the daily calibration associated with each analysis must be completed and evaluated to ensure that the acceptance criteria are met. (See the calibration section for the required concentrations and acceptance criteria for each calibration). Daily calibration schedules are created and saved. If a specific analysis is not being performed that day, the calibration can be removed from the schedule for that day.

B. Performing daily calibration:

Open the daily start up tab and load the standards according to the schedule for each calibration. Click on the start button and the instrument will proceed with the calibration. Once the calibration is complete the calibration data is automatically sent to the assign printer and is printed. Ensure the calibration data meets requirements before proceeding. See the calibration section for the required concentrations and acceptance criteria for each calibration. Store calibration sheets in designated ManTech folders.

C. Analyzing samples:

NOTE: Before analyzing distilled fluoride samples (requiring Method 4500_F_C with 4500_F_B), add 1 mL of 15% of Sodium Acetate to all standards (including the curve), samples, and Blank.

NOTE: For Fluoride, the LCS must be at or below the Maximum Contaminant Level (MCL) when analyzing regulatory drinking waters.

NOTE: When referencing EPA 150.1, perform additional measurements on successive volumes of sample until the values differ by **less than** 0.1 pH units (two or three measurements are usually sufficient).

To analyze samples, select "Run titration" from the PC-titrate menu. A blank schedule will appear.

1. Click on the add row buttons to add the required number of rows for that run.

2. Double click on the blank space under the schedule header. The menu of analyses will appear. Select the analyses to be performed and click ok.

3. When completing the schedule, each analysis must be bracketed by its own Continuing Calibration Verification standard (CCV) of alternating concentrations and a Continuing Calibration Blank (CCB). The CCV's and CCB's ID's are pre–programmed and are to be scanned in from the charts provided at each instrument. Barcodes are provided for each CCV and CCB. See Table I.

4. The Laboratory Control Standard (LCS) for each analysis is pre-programmed and is to be scanned in from the charts provided at each instrument. See Table I.

5. Scan the sample numbers directly from the label of the container. Sample numbers and QC identifiers can be typed. Use a "^" to designate the dilution factor. 410-12345-A-6^10 indicates a 10 times dilution.

6. Fill the sample tubes with Method Blank, LCS, each CCV, CCB and samples. Ensure the sample tubes are loaded according to the order on the schedule.

7. Click on the auto-generate order number to add the order number to the schedule.

8. Once the schedule is completed, click start and the instrument will proceed with the analysis until the entire schedule of samples is complete.

9. Save the data and send to the PC –Titrate export file before importing to the LIMS system.

10. Create PDFs of all calibrations and raw data associated with the batch. Attach the PDFs to the "Docs" tab in the batch in the LIMS.

D. Routine Maintenance of ManTech multi-parameter system

1. Calibration of Titrasip Pumps: Flow Rate Check:

a. Manual Control of Autosampler

(1) From the PC-Titrate main menu, click on Titrator, then on Manual Control (autosampler tab)

(2) Next, click on Load Tray From Folder button and then double click on Automax 197 Tube Sampler file

(3) Then, under Zone select tubes. Under Tubes select tube position and place a tube in that position on the autosampler tray.

(4) Click on Home Sampler

(5) Click on Go To This Location XYZ button. The autosampler will then move to the tube position.

(6) Click OK button in order to get back to the PC-Titrate main menu

b. Flow Rate Check:

(1) From the PC-Titrate menu select the pump to be calibrated (Click on Pump Cal button) and follow the prompts.

(2) Calibration must be performed monthly and documented in the maintenance logbook.

NOTE: When completed, Home sampler (follow instructions under II. ManTech Procedure D1a. steps 1-4)

2. Calibration of Zero and Span for the Hardness detector and monthly buffer volume check for Hardness Detector

NOTE: Turn on Hardness Detector in order for the detector to warm up before calibration.

NOTE: Ensure reagent water is in titration vessel cup containing the photo cell

a. Accessing Zero and Span Check screen and set-up:

(1) From the PC-Titrate main menu, click on Titrator, then on Manual Control

(2) Click on Analog

(3) Click on Scan Analog, making sure the continuous button is checked

(4) The Hardness Detector is on Monitor Electrode # 4

b. Zero Check/Calibration:

(1) Unscrew the Zero (careful not to look directly into the bright light). The Zero must be as close as possible to 0 mV.

(2) If not, adjust the screw for Zero on the hardness detector until reading is as close as possible to 0 mV.

(3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

c. Span Check/Calibration:

(1) The Span reading must be -400 mV ± 25 mV.

(2) If not, adjust the screw for Span on the hardness detector until reading is within range.

(3) Check/Calibration must be performed monthly and documented in the maintenance logbook.

d. Monthly buffer volume check on Hardness Detector:

**Perform two trials:

(1) Place buffer dispenser titrant line into a 10 mL graduated cylinder.

(2) From the PC-titrate main menu, click on run titration.

(3) Following steps outlined in procedure section C above, schedule a vial of reagent water to be analyzed for Hardness and click on START.

(4) Once the buffer has been dispensed into the graduated cylinder, click on STOP on the computer screen.

(5) Record the amount of buffer solution collected in the graduated cylinder in the maintenance logbook for the instrument. Repeat steps 1-5 once more.

(6) Average two trials and record average result in maintenance logbook

(7) Acceptance criteria is 2.0 mL +/- 0.1 mL.

(8) If averaged amount falls outside the acceptance range, then repeat the buffer volume check. If the check fails again then seek guidance from supervisor.

3. Changing and Entering Acid Normalities on ManTech:

a. Changing Titrant –Purging titrant: Titrant must be changed each time a new stock of titrant is prepared.

NOTE: Disconnect acid titrant bottle from dispenser line

(1) Click on PC-Titrate, Titrator, Manual Control, Serial Devices

(2) Click on Burivar II TIS1 tab; Titrasip pump#1/Burette #1

(3) Purge Buret one time (empty cup-use manual button on side of pump #1 at the top of cup)

(4) Fill titrant bottle with new standardized 0.02N H2SO4 titrant and connect dispenser line to bottle

(5) Purge system two more times

(6) Click OK

b. Entering Acid Normalities: Acid Normalities must be updated in ManTech software each time the acid is standardized and the standardization yields a new normality.

(1) Click on PC-Titrate, Set-up, Titration Method, Load

(2) Click Alkalinity

(3) Under Titrant Information-Concentration, change Normality to current value.

(4) Click Save

(5) Click Alkalinity-Low and follow steps (3) and (4) above

E. Maintenance of all other systems:

1. Maintenance of the Ammonia Ion-Selective Electrode – See manufactures instruction manual for maintenance and operation of electrode

2. Maintenance of pH electrodes- refer to *T-WC-WI11519* for maintenance of pH electrodes

3. Perform Maintenance on all other systems as needed.

F. Retrieving Historical Raw Data on ManTech:

1. Find run number of sample in question.

2. Open PC-titrate software menu from computer desktop

3. Click on Titrator, Replay Titration, Load, Sort by order and sample name

4. Click on sample (go by time), Select, Print, Equation Result Report (rplyeqn.srw), Print.

Calculations

A. Fluoride, pH, Temperature of pH, Conductivity, and Ammonia are measured directly and therefore no calculations are needed.

B. Alkalinity: (LIMS ID 2320B, 310.1)

To pH of 8.3:

Alkalinity, mg/L CaCO3 = (mL of titrant pH 8.3) x Normality x 50,000) / mL of sample

To pH of 4.5:

Alkalinity, mg/L CaCO3 = (Total mL of titrant x Normality x 50,000) / mL of sample

C. Low Alkalinity (< 20 mg/L CaCO3):

[(2 X B - C) X N X 50,000] / mL of sample

where:
B = mL titrant to first pH
C = Total mL titrant to pH 0.3 units lower
N = Normality of 0.02 N H2SO4

D. Carbonate, Bicarbonate, and Hydroxide Alkalinity are calculated from the total alkalinity result and the phenolphthalein alkalinity value (LIMS ID 2320B)

Phenolphthalein Alkalinity Value	Bicarbonate Alkalinity Calculation	Carbonate Alkalinity Calculation	Hydroxide Alkalinity Calculation
< MDL	Total Alkalinity	< MDL	< MDL
< 1/2 x Total Alkalinity	Total Alkalinity - (2 x Phenolphthalein Alkalinity)	2 x Phenolphthalein Alkalinity	< MDL
= 1/2 x Total Alkalinity	< MDL	2 x Phenolphthalein Alkalinity	< MDL
> 1/2 x Total Alkalinity	< MDL	2 x (Total Alkalinity - Phenolphthalein Alkalinity)	(2 x Phenolphthalein Alkalinity) - Total Alkalinity
= Total Alkalinity	< MDL	< MDL	Total Alkalinity

E. Free Carbon Dioxide Calculation (LIMS ID SM4500_CO2_D)

The calculation assumes that the total alkalinity of the sample is due almost entirely to hydroxides, carbonates or bicarbonates.

The total dissolved solids of the sample may not be greater than 500 mg/L for this calculation.

mg/L CO2 = 2.0 x B x 10^(6-pH)

Where:
B = bicarbonate alkalinity (from LIMS ID 2320B)

NOTE: Total carbon dioxide can be calculated, if requested, according to the calculations found in SM 4500 CO2 D-2011

F. Total Hardness (LIMS ID 2340C, 130.2):

Hardness (EDTA) as mg $CaCO_{3/L}$ =

A x B x 1000 / mL of sample

where:
A = mL titration for sample
B = mg CaCO3 equivalent to 1.00 ml of 0.01 M EDTA titrant (B = 1.00088)

B is calculated as follows:

$$B = \left(\frac{0.01\ \text{mol}}{\text{L}}\right) \times \left(\frac{0.001\ \text{L}}{1}\right) \times \left(\frac{100.088\ \text{g}}{\text{mol}}\right)\left(\frac{1000\ \text{mg}}{\text{g}}\right)$$

B = (Molarity of titrant) x (1 mL of titrant) x (molecular weight of CaCO3)

G. Un-ionized Ammonia (LIMS ID SM8010F_NH4):

mg un-ionized ammonia/L = (ammonia nitrogen raw result mg/L) x (% un-ionized ammonia at a given pH and temperature)

Refer to table below for % un-ionized ammonia:

Table 8010: VI.
Percentage of Ammonia Un-ionized in Distilled Water*

Temp °C	Percentage Un-ionized at a given pH*								
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
5	0.01	0.04	0.11	0.40	1.1	3.6	10	27	54
10	0.02	0.06	0.18	0.57	1.8	5.4	15	36	64
15	0.03	0.08	0.26	0.83	2.6	7.7	21	45	72
20	0.04	0.12	0.37	1.2	3.7	11.7	28	55	80
25	0.05	0.17	0.51	1.7	5.1	14	35	63	84
30	0.07	0.23	0.70	2.3	7.0	19	43	70	88

*Prepared from data given in Sillen and Martell.

H. Total Acidity (LIMS ID SM2310B, 305.1)

$$\text{Acidity as mg / mL } CaCO_3 \quad \frac{[(A \times B) - (C \times D)] \times 50{,}000}{\text{mL of sample}}$$

Where:
A = Vol. of std. NaOH used in titration
B = Normality of std. NaOH
C = Vol. of std. H2SO4 used to reduce pH to less than 4
D = Normality of std. H2SO4

I. Acidity to pH 3.7 and pH 8.3 (LIMS ID 305.2)

mg/L as CaCO3 = (Normality)(50,000)(mL of titrant) / (mL of sample volume)

Statistical Information/Method Performance

The method detection limit (MDL) is determined annually by following the procedure outlined in *QA-SOP11892*.

The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

The batch size is limited to 20 samples or less. For analyses with more than 10 samples on a batch, two duplicates are needed (excluding ammonia and fluoride – only one duplicate is needed per batch 20 samples –unless a batch contains an NPDES sample(s) from South Carolina and the batch contains more than 10 samples, then two duplicates are needed).
A Laboratory Control Standard (LCS) must be analyzed for each analysis per batch. See Table I for each analysis LCS concentration.

For alkalinity, Total Acidity and total hardness one matrix spike (MS) must be analyzed per batch of 20 samples or less.

For ammonia, fluoride and Acidity to pH 3.7 and 8.3 (total acidity spikes only), a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed per batch of 20 samples or less.

When sample volume does not permit the analysis of either a sample matrix duplicate or an MS and MSD, then a LCSD must be analyzed to demonstrate method precision.

For Fluoride, pH, Ammonia by ISE, and specific conductance a Certified Reference Material (CRM) must be analyzed annually. The acceptance range for the CRM is 90% to 110% of the true value.

Total Acidity samples with results > 600 mg/L as CaCO3 must be diluted and reanalyzed.

Samples from West Virginia require a usable precision measurement for each batch.

Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

For Specific Conductance, if the batch contains samples from the state of North Carolina a low-level check standard of 5 umhos/cm NaCl must be analyzed.

For Total Hardness, samples that are designated NPDES require digestion. Confirm whether this analysis is appropriate for samples designated NPDES.

For Fluoride, the LCS must be at or below the MCL when analyzing regulatory drinking waters.

For each analysis, a continuing calibration verification (CCV) standard must be analyzed at the beginning of each batch, after every 10 samples and at the end of each batch. The concentration of the CCV must at or below the mid-point of the calibration. All CCVs must have an acceptance criteria of 90% to 110%. If any CCV's are outside this range, then the samples bracketed by the out of specification CCV must be repeated. Refer to Table I for CCV concentrations for each analysis.

A continuing calibration verification blank (CCB – a reagent water blank) must be analyzed after each CCV standard on the batch. The CCB must be less than the LOQ for the analysis.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in *T-WC-WI10360* for outlier QC data.

Table I

Analysis Name and Number	CCV Barcodes/Concentrations	Frequency	Acceptance Criteria
(2320B, 310.1) Total Alkalinity	CCVPH2 = 7.00 pH buffer (ISO 17025 approved) LCSAK = 188 mg/L	CCV/CCB - beginning/end of	CCVs ±10% of true value

Carbonate Bicarbonate	LCSPH = 7.00 pH buffer (ISO 17025 approved) PBW = Method Blank CCB = reagent water blank	batch, after every 10 samples	PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
SM2310B, 305.1 Total Acidity	CCVPH8 = 8.00 pH buffer LCSHACD = 250 mg/L PBW = Method Blank CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
305.2 Acidity to pH 3.7 and pH 8.3	CCVPH8 = 8.00 pH buffer LCSACD = 250 mg/L PBW = Method Blank CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
SM4500_H+, 9040C, 9040B, 150.1 pH Temperature of pH SM2550B, 170.1	CCVPH2 = 7.00 pH buffer (ISO 17025 approved) LCSPH = 7.00 pH buffer (ISO 17025 approved) CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
2510B, 120.1, 9050A Specific Conductance	CCVSC2 = 1413 umhos/cm LCSSC = 147 umhos/cm PBW = Method Blank CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
4500_F_C, 340.2 Fluoride	CCVFL2 = 1.0 mg/L LCSFL = 1.0 mg/L PBW = Method Blank CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
SM4500NH3_D 350.3 Ammonia Distilled Ammonia	CCVNH2 = 2.5 mg/L LCSNH = 5 mg/L PBWNH = Method Blank (12679-distilled) PBW = Method Blank (12677) CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC acceptance windows
2340C, 130.2 Total Hardness	CCVTH2 = 40 mg/L LCSTH = 40 mg/L PBWTH = Method Blank CCB = reagent water blank	CCV/CCB - beginning/end of batch, after every 10 samples	CCVs ±10% of true value PBW/CCBs <LOQ LCS - see LIMS for current QC

			acceptance windows

10348 Fixed Volume Hand-Held Pipettes
10360 Quality Control Data for Wet Chemistry
10362 Standardization of 0.02 and 0.1 Normal Sulfuric Acid
10425 Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B-2011, EPA 340.1 Procedure 6.1 or SM 4500 F B-1997
11188 Reagents and Standards
11519 pH Probes and Meters
11585 Standardization of 0.02 Normal Sodium Hydroxide
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits
11913 Laboratory Notebooks, Logbooks, and Documentation
9862 Accumet Model AB30 pH/Ion/Conductivity Meter
9897 Adjustable Volume Handheld Pipettes
9898 Calibration of Hach 2100AN Turbidimeter

End of document

Version history

Version	Approval	Revision information	
15	22.APR.2021		
16	04.OCT.2021		
16.1	06.OCT.2021		

eurofins	Always check on-line for validity. **Hexavalent Chromium in Waters and Soils (Colorimetric) by SW-846 7196A**	Level: **Work Instruction**
Document number: **T-WC-WI11501**		
Old Reference: **1-P-QM-WI-9011652**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **31-MAR-2022**	Document users: **6_EUUSLA_Water Quality_24/48 Hour Analyst, 6_EUUSLA_Water Quality_24/48 Hour Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing, LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 14		**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Apparatus and Equipment	Samples must be pH adjusted to 1.5-2.5 SU	Added pH paper as alternative to pH meter
Calibration A4.	Enhancement	Expanded step 4 to include use of pH indicator paper
Calibration D.	pH meters must be calibrated prior to use	Added pH meters

Revision: 14		**Effective date:** This version
Section	**Justification**	**Changes**
Procedure C.	Correction Enhancement	Corrected second step 4 to 5 and renumbered. Expanded step 5 to include use of pH indicator paper
Quality Control / Quality Assurance	Clarification	Clarified CCVs must be at or below the midpoint

Revision: 13		**Effective date:** 08-Oct-2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Personnel Training and Qualifications	Laboratory Criteria	Added concentration and criteria
Reagents and Standards 7.	CCVs must be at or below midpoint of calibration curve	Removed 7. 1.0 mg/L CCV
Calibration	Enhancement	Added percent error requirement with acceptance criteria. Added ICV after calibration.
Procedure B.	Clarification	Added run order to clarify CCV/CCB brackets
Quality Control / Quality Assurance	Clarification	Clarified CCVs must be at or below the midpoint

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7196A, July 1992.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7196, 1986.

3. *Department of Defense Quality Systems Manual*, version 5.3, 2019.

4. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 3060A, December 1996.

5. *1983 Annual Book of ASTM Standards*, Volume 11.01, 1983, p. 57.

6. *Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup, WSC-CAM-VI B*, revision 1, July 1 2010.

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI10352	Genesys 30 Spectrophotometer
T-WC-WI11519	pH Probes and Meters
T-WC-WI10360	Quality Control Data for Wet Chemistry
T-WC-WI10618	Digestion of Hexavalent Chromium in Solids by SW-846 3060A

Document	Document Title
QA-SOP11880	Balance, Syringe, Pipettes, Weights, and Labware Verification
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11188	Reagents and Standards

Scope
This method is suitable for the determination of hexavalent chromium concentrations in potable waters, wastewaters, leachates, and soils. Applicable concentration range and reporting limit are found in the LIMS.

Basic Principles
In an acidified matrix, hexavalent chromium reacts with excess 1,5-diphenylcarbohydrazide to produce a strong, red-violet color. The color intensity is read on a spectrophotometer at 540 nm and concentrations are calculated by comparison to a standard curve.

Interferences
Hexavalent molybdenum and mercury salts interfere by forming color with the diphenylcarbohydrazide. With proper pH adjusting, concentrations as high as 200 mg/L can be tolerated. Vanadium interferes more strongly but concentrations 10× that of chromium can be tolerated. Iron interferes strongly by producing a yellow color.

Safety Precautions and Waste Handling
All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications
All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC consists aliquots spiked at 1-4X the RL that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. The mean recovery must be 50-150% and the standard deviation must be less than 20%.

The DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and the mean recovery must meet the LCS acceptance criteria, and the standard deviation must be less than 20%.

Sample Collection, Preservation, and Handling
Waters for this analysis are collected in unpreserved glass or plastic containers and stored at 0° to 6°C, not frozen, until time of analysis. Samples must be analyzed within 24 hours of sample collection.

Soils are collected in an unpreserved glass container and stored at 0° to 6°C; not frozen. They must be digested within 30 days of sample collection (Method 3060A). Analysis of the digestate must occur within 168 hours.

Apparatus and Equipment

1. Spectrophotometer, for use at 540 nm

2. Vacuum filter apparatus with 0.45-micron filters

3. Class A glassware and pipettes - 100-mL and 50-mL glass beakers, 50-mL graduated cylinder, 50-mL and 100-mL volumetric flasks, and assorted pipettes.

4. 1-cm cell

5. Filter paper (0.45 µm and 0.1 µm) – Gelman Sciences membrane, 47 mm and Whatman glass microfibre filters, 42.5 mm or equivalent

6. Calibrated pH meter that uses a glass electrode and reads to 0.05 pH units

7. pH indicator paper, narrow range

Reagents and Standards

Alternative weights and volumes may be used as long as final concentrations remain the same. Refer to *QA-SOP11188* for appropriate labeling and documentation of reagent and standard preparation.

1. Sulfuric acid, 10% (v/v)

   a. In a 100-mL volumetric flask, containing approximately 50 mL reagent water, add 10 mL of distilled analytical reagent grade or spectrograde quality sulfuric acid, H2SO4, using a graduated cylinder.

   b. Dilute to 100 mL with reagent water.

   c. Store at room temperature in a glass container.

   d. Solution expires 1 year from date of preparation.

2. Diphenylcarbohydrazide solution (DPC)

   a. In a 100-mL volumetric flask, add 0.500 ±.010 g 1,5-diphenylcarbohydrazide.

   b. Bring to a final volume of 100 mL with Acetone.

   c. Store at 0°to 6°C, not frozen, in an amber glass bottle

   d. Solution expires 7 days from the date of preparation. If the solution becomes discolored before the expiration date, discard and prepare new.

3. WC_HX_50ppm: Stock chromium solution (50 mg/L Cr+6)

   a. In a 1-L volumetric flask, dissolve 0.1414 g K2Cr2O7 (dried for 4 hours at 105° ± 2°C and dessicated for 1 hour) in reagent water and dilute to 1 L.

   b. Store at room temperature in a glass bottle.

   c. This standard expires 6 months from the date of preparation.

NOTE: A separate stock solution must be prepared using a different source for K2Cr2O7, WC_HEX_CURstd. This second stock solution must be used for preparation of the calibration curve only.

4. WC_HX_5ppm: Working chromium solution (5.0 mg/L Cr+6)

   a. Pipette 10.0 mL stock chromium solution into a 100-mL volumetric flask.

b. Bring to volume with reagent water.

c. Prepare fresh daily.

5. 0.2 mg/L LCS/CCV (for waters)

a. Pipette 0.4 mL of 50 mg/L WC_HX_50ppm into a 100-mL volumetric flask and bring to final volume with reagent water.

b. Proceed to procedure section for analysis information.

6. 0.6 mg/L CCV

a. Pipette 1.2 mL of 5.0 mg/L WC_HX_50ppminto a 100-mL volumetric flask and bring to final volume with reagent water.

b. Proceed to procedure section for analysis information.

7. Check Standard – Purchased; NIST Standard Reference Material (SRM) 2701; See container for shelf-life information and control limits. For Method 7196A_DKQP

Calibration

A. Preparation of Calibration Curve

1. Prepare a standard curve of seven standards and a reagent blank. Place volumes of 5.0-mg/L standard in 100-mL volumetric flasks and dilute to volume with reagent water. Use a separate source than from the LCS/LCSD.

#	Conc. (mg/L Cr+6)	mL spiked into 100mL final volume
1 - Blank	Reagent Blank	-
2 - CAL1	0.01	0.02 mL WC_HEX_CURstd
3 - CAL2	0.05	0.1 mL WC_HEX_CURstd
4 - CAL3	0.10	0.2 mL WC_HEX_CURstd
5 - CAL4	0.20	0.4 mL WC_HEX_CURstd
6 - CAL5	0.50	1.0 mL WC_HEX_CURstd
7 - CAL6	1.00	2.0 mL WC_HEX_CURstd
8 - CAL7	1.25	2.5 mL WC_HEX_CURstd
9 - ICV	0.20	0.4 mL WC_HX_50ppm

2. Using a graduated cylinder, transfer 45 mL of the standard to be tested to a 100-mL beaker.

3. Pipette 1.0 mL of diphenylcarbohydrazide solution (DPC), add to the standard and mix well.

4. pH Adjustment

a. Add 10% sulfuric acid to each standard while stirring to adjust the pH to a range of 1.50 to 2.50. Monitor the pH reading using a calibrated pH meter.

b. When the effervescence has ceased, confirm the final pH of each standard with narrow range pH indicator paper.

c. Record the final pH.

d. A calibrated pH meter may be used for the final pH check if the meter has been calibrated with a 1.5 standard (refer to *T-WC-WI11519* for instructions on pH meter calibrations)

5. Add pH adjusted standard to a 50-mL volumetric flask and dilute using reagent water, mix well. Let stand for 5 to 10 minutes for full color development.

6. Read the absorbances of the standards with a 1-cm cell at 540 nm, using reagent water to zero the spectrophotometer.

The concentrations of the samples are calculated from the eight points in this curve. This curve must be performed quarterly. The curve must have a correlation coefficient not less than 0.995. If the correlation coefficient is <0.995, a new calibration curve must be analyzed. The calibration curve calculator application in LIMS determines the correlation coefficient. The %Relative Error must be calculated on the low point and mid point standard and be <20%.

NOTE: 7196A_DOD5 and 7196A_DKQP require a calibration curve on each day of analysis.

7. An Initial Calibration Verification standard (ICV) of 0.2 mg/L must be performed after completion of a calibration curve. The acceptance criteria for the ICV is 90% to 110%.

B. Balances must be calibrated each day before use. Refer to *QA-SOP11880*.

C. Spectrophotometer must be verified on a monthly basis. Refer to *T-WC-WI10352*.

D. pH meters must be calibrated each day before use. Refer to *T-WC-WI11519*

Procedure

A. Batch QC and Spikes

1. Samples digested by 3060A already have a Method Blank, DUP, insoluble/soluble MS/MSD, and soluble/insoluble LCS. A post-digestion matrix spike (PDS) must be analyzed per batch (not more than 20 samples). This spike must be equivalent to 40 mg/kg or twice the sample concentration, whichever is greater.

NOTE: Do not spike the PDS until after the analysis of the original sample. Use the same sample for the PDS as was used for the pre-spike. If the post-digestion matrix spike is not within quality control limits, the entire batch must be redigested/reanalyzed.

2. For water and undigested samples, prepare the batch QC as follows:

a. The MB is 100 mL filtered reagent water.

b. Prepare a 0.2 mg/L LCS by pipetting 4 mL of 5 mg/L Working chromium solution WC_HX_5ppm into a 100-mL volumetric flask and bring to final volume with reagent water and filter.

c. Prepare a Matrix Spike (MS) and Matrix Spike Duplicate(MSD) by pipetting 4 mL of 5mg/L working chromium solution WC_HX_5ppm into 100 mL of sample, allow to stir and then filter.

1.) For every sample matrix analyzed (i.e., groundwater, potable water, wastewater, etc.) verification is required to ensure that neither a reducing condition nor chemical interference is affecting color development. This must be accomplished by analyzing a second aliquot of the pH-adjusted filtrate that has been spiked with Cr(VI). The amount of spike added should double the concentration found in the original aliquot. Under no circumstances is the increase less than .03 mg/L Cr(VI). To verify the absence of an interference, the spike recovery must be between 75% and 125%.

2.) If the result of verification indicates a suppressive interference (matrix spike not recovering within the acceptable window of 75% to 125%), the sample must be reanalyzed for confirmation. If the sample concentration is > 4 times spike level, then dilute the sample accordingly.

3.) Acidic samples that yield spike recoveries of less than 75% must be retested to determine if the low spike recovery is due to the presence of a residual reducing agent. This determination is performed

by first making an aliquot of the sample alkaline (pH 8.0 to 8.5) using 1 N sodium hydroxide and then respiking and analyzing. If a spike recovery of 75% to 125% is obtained, then the method has been verified.

d. Prepare a Matrix Duplicate (DUP) by preparing a second aliquot of sample for analysis.

e. For DKQP samples:
On each batch a NIST Standard Reference Material (SRM) 2701 Check Standard must be analyzed. The check standard must be within the control limits. If not, reanalyze. If still outside control limits, redigest and reanalyze all samples in the batch. If the reanalysis is outside control limits, then data must be qualified with a comment.

NOTE: If pregnant, the NIST SRM must not be handled! See supervisor for further direction.

B. Analytical Run Order

1. Prepare analytical batch as follows:

CCV
CCB
[Batch QC - MB, LCS, LCSI]
[up to 10 samples/spiked samples]
CCV
CCB
[up to 10 samples/spiked samples]
CCV
CCB

C. Color development and measurement

1. Vacuum filter samples through a 0.45-micron filter. Slow-filtering samples are prefiltered by placing a glass-microfibre filter on top of the 0.45-micron filter. Record the Filter ID in LIMS.

2. Using a graduated cylinder, transfer 45 mL of the filtered sample to a 100-mL beaker.

3. All samples require a sample blank. Take approximately 10 mL of the original sample aside that will be processed at the same time, without diphenylcarbohydrazide added.

4. Pipette 1.0 mL of diphenylcarbohydrazide solution (DPC), add to the original sample and mix well. **Do not add DPC to the sample blank.**

5. pH Adjustment

a. Add 10% sulfuric acid to each sample while stirring to adjust the pH to a range of 1.50 to 2.50. Monitor the pH reading using a calibrated pH meter.

b. When the effervescence has ceased, confirm the final pH of each sample with narrow range pH indicator paper.

c. Record the final pH.

d. A calibrated pH meter may be used for the final pH check if the meter has been calibrated with a 1.5 standard (refer to *T-WC-WI11519* for instructions on pH meter calibrations)

6. Add pH adjusted sample to a 50-mL volumetric flask and dilute using reagent water, mix well. Let stand for 5 to 10 minutes for full color development.

7. Read the absorbances of the samples with a 1-cm cell at 540 nm, using reagent water to zero the spectrophotometer.

Calculations

A. Waters

In the LIMS, enter the net absorbance (sample absorbance - sample blank absorbance). The result calculated in LIMS is the mg/L Cr+6 from curve. Results are calculated as follows:

(Dilution factor) (mg/ LCr+6from curve)=mg /LCr+6

B. Digestates

$$mg/kg\,Cr^{+6} = \left(\frac{CV}{W}\right) \times DF$$

Where:

C = mg/L Cr+6 in digestate

V = Volume of digestate in milliliters

W = Sample weight digested in grams

DF = Dilution factor

C. Relative Percent Difference:

$$RPD = (S - D)/[(S + D)/2] \times 100$$

Where:

S = Initial sample result

D = Duplicate sample result

D. Spike added:

Insoluble/Insoluble spike duplicate added = (mg of PbCrO4x0.1608)/Kg of sample

Where:

0.1608 is the fraction of Cr in PbCrO4: (51.996g/323.4g) = 0.1608

Spike recovery:

Percent Recovery = [(SSR-SR)/SA] x 100

Where:

SSR = Spike sample result

SR = Sample (unspiked) result

SA = Spike added

When clients request results on a dry-weight basis, the samples are analyzed for moisture content and a dry-weight report is generated

Statistical Information/Method Performance

The method detection limit (MDL) is determined annually by following the procedure outlined in *QA-SOP11892*.

The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

Waters batches:

For every batch of ten samples or less, a blank, a LCS (0.2 mg/L) a matrix spike (MS), a matrix spike duplicate (MSD), and one duplicate are to be analyzed.

When there is not enough sample to perform a matrix spike and matrix spike duplicate, an LCSD (0.2 mg/L) must be performed.

Every ten samples analyzed must be bracketed by CCVs (Continuing Calibration Verification standards) of varying concentrations covering the low, mid-point, and high concentration ranges of the calibration curve.

Digestion batches:

For every batch of twenty samples or less, a blank, a LCS (5.0 mg/L), an LCSI (900 mg/kg, LCS insoluble spike), a soluble matrix spike (MSS), an insoluble matrix spike (MSI), a (PDS)and one duplicate are analyzed. A high level soluble spike (HSS, 400 mg/kg) is analyzed only when requested. The acceptance range is 75% to 125%.

When there is not enough sample to perform a matrix spike and matrix spike duplicate, an LCSD (5.0 mg/kg) must be performed.

Every ten samples analyzed must be bracketed by CCVs (Continuing Calibration Verification standards) at or below the midpoint of the calibration curve.

The acceptance range for the PDS is 85% to 115% recovery.

This table lists the frequency and criteria of QC: note that certain regulatory programs have specific limits that are controlled in LIMS (i.e. DOD, DKQP, MCP, RCP methods):

QC	Frequency	Acceptance Criteria	Corrective Action
Calibration	Quarterly DOD and DKQP - Daily	Correlation Coefficient < 0.995 %RE <20	Recalibrate
ICV	After each calibration	90-110%	Recalibrate
CCV	Every 10 samples at 0.6 mg/L	90-110%	Immediately reanalyze twice. If the CCV fails again, every sample bracketed must be reanalyzed or qualified.

MB	Every batch of up to 20 samples	< RL DOD - < 1/2 RL	Re-analyze samples in the batch. If samples are <MDL or >10x the detection in the blank, samples may be reported with qualification.
Waters: LCS/LCSD Soils: LCSIS/LCSID Soils: LCSS/LCSSD	Every batch of up to 20 samples. LCSDs are analyzed per regulatory or client requirement.	Waters - 90-110% DOD Waters - 90-111% Solid - 80 - 120% Precision <20% RPD if applicable	Re-analyze samples in the batch. If samples are ND and the LCS is out high, samples may be reported with qualification.
Waters: MS/MSD Soils: MSS/MSSD Soils: MSI/MSID	Every 10 samples	Waters - 85 - 115% DOD Waters - 90-111% Solid - 75-125% Precision <20% RPD	Re-analyze the sample at a dilution to confirm matrix interference. Report with qualification if still out of specification.
DUP	Every 10 samples	<20% RPD	Samples are qualified
PDS - Soils only	Every batch of up to 20 samples	85 -115%	The entire batch must be redigested and reanalyzed

See LIMS for current quality control acceptance criteria.

Regulatory program specific requirements:

For DKQP samples:

1. On each batch a NIST Standard Reference Material (SRM) 2701 Check Standard must be analyzed. The check standard must be within the control limits. If not, reanalyze. If still out, redigest and reanalyze all samples in the batch. If out again, then data must be qualified with a comment.

NOTE: If pregnant, the NIST SRM must not be handled! See supervisor for further direction.

2. When a Field duplicate (FD) sample is submitted and the results are ≥ 5 times the Reporting Limit, then the RPD ≤ 30%.

For MCP samples:

The ICV, LCS and CCV concentration must be 0.6 mg/L. The ICV must be of a different source than that of the calibration curve. CCVs must be of the same source as that used for the calibration curve. CCBs must follow ICV/CCVs.

If the MS is outside the acceptance range then:

1. Reanalyze MS at a 10X dilution. If acceptable, then no further action is required.
2. After reanalysis, if MS recovery is 30% to 74% or >125% and the LCS is within specification, no corrective action is required.
3. If MS recovery is <30%, report results and comment.

For RCP samples:

The ICV must be 0.6 mg/L. The LCS and CCV concentration must be 0.2 mg/L. The ICV must be of a different source than that of the calibration curve. CCBs must follow ICV/CCVs.

Refer to *T-WC-WI10360* if any of the QC and CCV's do not meet required specifications.

10352 Genesys 30 Spectrophotometer
10360 Quality Control Data for Wet Chemistry
10618 Digestion of Hexavalent Chromium in Solids by SW-846 3060A
11188 Reagents and Standards
11519 pH Probes and Meters
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information	
12	26.FEB.2021		
13	07.OCT.2021		
14	17.MAR.2022		

eurofins	Always check on-line for validity. **Paint Filter Liquids Test (Free Liquids Test) in Waste by SW-846 9095B**	Level: **Work Instruction**
Document number: **T-WC-WI11513**		
Old Reference: **1-P-QM-WI-9013402**		
Version: **10**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **04-NOV-2021**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 10	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Lims ID	Software change	Update from Parallax to TALS
Quality Assurance / Quality Control	Clarification	Specified QC blank media & amount
Procedure	Clarification	Removed comment wording and replaced with "Add an NCM"

Revision:	9	**Effective Date:**	July 9, 2019

Revision:	9	**Effective Date:**	July 9, 2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
Cross-reference	Higher level documents not required to be referenced.		Removed 1-P-QM-QMA-9015389 and 1-P-QM-QMA-9021767
Apparatus and Equipment	Not required to be listed		Removed balance and re-numbered
Procedure 2.	Method requirement		Added step 2 for samples with less than 100g.
Quality Assurance/Quality Control	Method requirement		Duplicates are performed on batches when sufficient sample is provided.

Reference

1. *Test Methods for Evaluating Solid Waste*, SW-846 9095A, December 1996.

2. *Test Methods for Evaluating Solid Wastes,* SW-846 Method 9095B, November 2004.

3. *Chemical Hygiene Plan,* Current version.

Cross Reference

Not applicable

Scope

This method is used to determine the presence of free liquids in a sample of waste.

Basic Principles

A measured amount of sample is placed in a paint filter. If any liquid portion of the sample passes through and drops from the filter within the 5-minute test period, the sample is considered to contain free liquids for the purposes of 40 CFR 264.314 and 265.314.

Interferences

It is possible for alkaline materials to cause the separation of the filter media from the filter cone.

It is possible for temperature to affect the results if the analysis is performed below the freezing point of any liquid in the sample. In order to avoid this possibility, the analysis is performed at room temperature.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See the *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention. Standard safe laboratory procedure must be followed as outlined in the *Chemical Hygiene Plan*.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP.

Analysts are considered proficient when they have successfully demonstrated competency under supervision of a supervisor or other trained analyst. Documentation of this training is in each analyst's training records.

Sample Collection, Preservation, and Handling

Samples for this analysis must be unpreserved and collected in a glass or plastic container. Samples are stored at 0° to 6°C, not frozen. There is no holding time for this analysis.

Apparatus and Equipment

1. Conical paint filter – Mesh number 60 ± 5% (fine meshed size), purchased

2. Glass funnel (optional) – Needed if the paint filter, with the sample, cannot support its weight on the ring stand

3. Ring stand and ring or equivalent

4. Graduated cylinder – 100 mL or equivalent

5. Stopwatch or timer or equivalent

Reagents and Standards

Not applicable to this procedure.

Calibration

Not applicable to this procedure.

Procedure

Record data in a raw data logbook.

1. Assemble test apparatus as shown in Figure 1.

2. 100 g is required to perform this analysis. If less than 100 grams is used due to the sample matrix, then add an NCM.

3. Mix sample well.

4. Place a 100 gram representative sample in the paint filter. (For the sake of uniformity, samples which do not conform to the shape of the paint filter are allowed to be reduced in size if the integrity of the sample is maintained).

5. Allow the sample to drain for **5 minutes** into the graduated cylinder.

6. If any liquid portion of the sample collects in the graduated cylinder in the 5-minute period, the material is considered to contain free liquids for purposes of 40 CFR 264.314 and 265.314. Determine the amount of any free liquid (in grams).

7. If the sample does contain free liquids, enter the amount (grams of free liquid) into LIMS for a positive result. If the sample does not contain free liquid, enter zero into LIMS for a negative result.

Calculations

No calculations are needed for this analysis.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

Analyze one blank (10g glass beads) on each batch. Analyze one duplicate if sufficient sample is available.

A batch is limited to 20 samples or less.

No other quality assurance procedures are available for this analysis.

Attachment:
Figure 1 (.doc)

End of document

Version history

Version	Approval	Revision information	
8	08.JUN.2015		
9	25.JUN.2019		
10	04.NOV.2021		

eurofins	Always check on-line for validity. **pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometic Methods**	Level: **Work Instruction**
Document number: **T-WC-WI11518**		
Old Reference: **1-P-QM-WI-9011685**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **30-APR-2021**	Document users: **6_EUUSLA_Water Quality_24/48 Hour Analyst, 6_EUUSLA_Water Quality_24/48 Hour Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision	14	**Effective Date:**	This version
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Throughout Document	Current process		Update to new LIMS
Cross Reference	Higher level documents are not required to be referenced		Removed *QA-SOP11880*
Procedure 10.	Current process		Added step 10 - to read the 2 and 12 standards when analyzing samples for corrosivity
Procedure	Current Process		Removed previous step 11. Units are reported as S.U.

Revision	14	**Effective Date:**	This version
Quality Assurance/ Quality Control	Clarification Current process		Added acceptance range for CCVs. Removed requirement to analyze the 2 and 12 standards before any samples Removed step to read pH 3 times for corrosivity

Revision	13	**Effective Date:**	08-JUL-2019
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Procedure 11	Clarification		Added how solid pH is reported (soil pH measured in water at recorded temp at time of analysis)

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045C, January 1995.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 9045D, November 2004.

3. Test Methods for Evaluating Solid Wastes, SW-846 Chapter 7.

4. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI11519	pH Probes and Meters
T-WC-WI10360	Quality Control Data for Wet Chemistry

Scope

This SOP provides the guidelines for analysts performing pH on solid, soil, and solvent samples. This procedure is applicable to solid/soil/solvent samples.

The sensitivity limit for this technique is 0.01 pH units.

Basic Principles

A 1:1 slurry is prepared and the activity of hydrogen ions in the supernatant is measured using a combination pH electrode.

Determination of corrosivity is based on the pH value of the sample.

Reference Modifications

Method 9045C/D has been modified for the analysis of solid, soil, and solvent samples in the following ways:

1. An Automatic Temperature Compensator is used for all samples instead of manually performing calculations to correct measured pH values if the sample and buffer solution temperatures differ by more than 2°C.

2. 25 g of soil to 25 g reagent water is used instead of the 20 g: 20 mL ratio.

3. The samples are tumbled for approximately 30 minutes instead of being stirred with a stir bar for 5 minutes.

These modifications are performed in order to allow for adequate agitation and to provide sufficient supernatant to immerse the pH electrode during analysis.

Interferences

Interferences occur when oily or particulate matter adheres to the electrodes and reduces the response. Gentle wiping or rinsing with reagent water usually corrects this problem. Temperature effects are compensated for by calibrating the pH meter at the temperature of the sample or using a pH meter equipped with temperature compensators. There are no means of controlling temperature effects caused by shifts in ionic equilibria of the sample.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention. Standard safe laboratory procedure must be followed as outlined in the Chemical Hygiene Plan.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four pH readings of the 7.00 pH buffer (which is used as the laboratory control standard) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Sample must be collected in an unpreserved container and stored at 0° to 6°C; not frozen, until the time of analysis. There is no published holding time for pH analysis on soil; analysis is performed as soon as possible after sample is received in the laboratory.

Apparatus and Equipment

1. Analytical balance capable of weighing 0.0001 g

2. pH meter equipped with an ATC probe (Automatic Temperature Compensator)

3. Combination electrode or equivalent

4. Stir bar and stir plate

Reagents and Standards

1. 7.00 pH Buffer (ISO 17025 approved vendor) – purchased; see container for shelf life information.

2. Appropriate pH electrode filling solution for electrode, purchased. Store at room temperature. See label for expiration date.

Calibration

Balances must be calibrated each day before use.

Calibrate pH meter as described in *T-WC-WI11519*.

Procedure

1. Make sure the pH meter has been calibrated within the last 24 hours.

2. Weigh 25 ± 0.5 g of sample into a clean specimen cup and add 25 ± 0.5 mL of reagent water (makes a 1:1 slurry).

If the sample absorbs the water, add an additional 25 ± 0.5 mL of reagent water (makes a 1:2 slurry). If a 1:2 slurry does not provide sufficient supernatant to immerse the pH electrode, use less sample and add reagent water in proportion to the weight selected. Enter a comment in LIMS indicating the dilution.

3. Tightly place the screw-cap lid on the sample and mix the slurry in the tumbler for approximately 30 minutes.

4. Remove the sample from the tumbler and allow the sample to settle for about 1 hour.

5. Rinse and shake off any water on the electrodes.

6. Dip the electrodes into the supernatant (aqueous layer) of the sample and allow to equilibrate. If necessary, decant or pipette this layer into another container.

7. Using the calibrated, pH meter note the pH value of the sample after the meter equilibrates, and enter the value in the LIMS.

NOTE: If pH reading is < 4.00 or >10.00, then the pH result will be reported with a qualifying flag.

8. Note the temperature of the sample and record the value in LIMS.

9. Rinse and clean the electrodes before proceeding to the next sample.

10. If corrosivity is to be reported, read the pH 2 and 12 standards and record the pH value.

11. Corrosivity is determined from the sample's pH reading. A "Yes" or "No" response is entered for the corrosivity result, depending on the pH value. A sample is considered corrosive if the pH is <2 or >12, warranting a "Yes" result. A sample with a pH value from 2 to 12 has a corrosivity result of "No".

Calculations

Not applicable.

Statistical Information/Method Performance

Not applicable to this procedure

Quality Assurance/Quality Control

One batch consists of no more than 20 samples.

A Laboratory Control Standard (LCS; 7.00 pH Solution) must be analyzed at the beginning of each batch.

A CCV (7.00 pH Solution) must be analyzed after every ten samples and at the end of the batch. The acceptance range for the CCV is 90 - 110%.

Two matrix duplicates must be analyzed per batch of 20 samples. If 10 or less samples are on a batch then only one matrix duplicate is needed.

When analyzing for Corrosivity, a pH check using buffers 2 and 12 must be analyzed.

If the meter must be re-calibrated during the analysis, a LCS must be analyzed after the calibration is performed.

See LIMS for current quality control acceptance windows.

Refer to *T-WC-WI10360* if any of the QC samples do not meet required specifications.

10360 Quality Control Data for Wet Chemistry
11519 pH Probes and Meters
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment

---

End of document

Version history

Version	Approval	Revision information	
12	27.JUL.2018		
13	27.JUN.2019		
14	22.APR.2021	Annual review completed on 4/28/2022, no changes needed.	

eurofins	Always check on-line for validity. **Reactive Sulfide (titration) by SW-846 9034 (1996) Prepared by Chapter 7.3.4 (1996) in Waste**	Level: **Work Instruction**
Document number: **T-WC-WI11572**		
Old Reference: **1-P-QM-WI-9013032**		
Version: **12**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **09-NOV-2021**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision:	11	**Effective Date:**	This version
Section		**Justification**	**Changes**
Revision Log		Formatting requirement	Removed revision logs up to the previous version
Throughout Document		7.3.3 is the cyanide prep	Removed references to 7.3.3
Personnel Training and Qualifications		Clarification	Added specific criteria
Calculation		Correction	Removed 16030, replaced with 32.06g/2eq.

Revision:	10	**Effective Date:**	30-NOV-2020
Section		**Justification**	**Changes**
Revision Log		Formatting requirement	Removed revision logs up to the previous version
Throughout document		Updated LIMS	Revised analysis numbers to reflect new LIMS
Cross-Reference		Higher level documents are not required to be referenced	Removed LOM-SOP-ES-208, LOM-SOP-ES-225, LOM-SOP-ES-220
Scope		Enhancement	Added matrix, applicable concentration range
Reference Modifications		Not active method references	Removed references to SW-846 9030

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846, Chapter 7.3, 1996.

2. *Test Methods for Evaluating Solid Wastes*, SW-846 9034, 1996.

2. *Chemical Hygiene Plan*, Lancaster Laboratories, current version.

Cross Reference

Document	Document Title
T-WC-WI11574	Reactivity of Waste
T-WC-WI10360	Quality Control Data for Wet Chemistry

Scope

This method is applicable to the measurement of sulfide in solid or liquid wastes following prep method 7.3.4.

This method is not applicable to wastes that form explosive mixtures when combined with acids.

Chapter 7.3 states the total releasable sulfide is 500 mg H2S/kg waste.

Basic Principles

Sulfide is extracted from a sample using prep method 7.3.4 and is trapped in a sodium hydroxide scrubber solution. Excess iodine is added to a portion of the scrubber solution. Under acidic conditions, the iodine oxidizes the sulfide in the scrubber solution to sulfur. The excess iodine is then backtitrated with sodium thiosulfate to determine the concentration of sulfide in the scrubber solution.

Reference Modifications

Not applicable.

Interferences

The iodometric method suffers interference from reducing substances that react with iodine including thiosulfate, sulfite, and various organic compounds.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC consists of four aliquots spiked at 1-4X the RL that are carried through all steps of the procedure. The criteria include the calculation of mean accuracy of 50 - 150% and standard deviation of less than 20%.

The DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the LCS acceptance criteria and standard deviation of less than 20%.

Sample Collection, Preservation, and Handling

Analyze scrubber solution obtained from prep method 7.3.4 as soon as possible after extraction is completed.

If not analyzing immediately, seal the scrubber bottle and store at 0 to 6°C, not frozen.

Apparatus and Equipment

1. Analytical balance.

2. Class A burette with burette stand, or equivalent

3. 500-mL Erlenmeyer flasks or equivalent

4. pH indicator strips

Reagents and Standards

Alternate weights and volumes are acceptable as long as final concentrations remain the same.

1. Hydrochloric acid (1 + 1) – Mix equal portions of concentrated hydrochloric acid (HCI) and deionized water. Store in a glass container at room temperature and re-evaluate yearly.

2. Starch indicator – Purchased. Store at room temperature. See manufacturer’s label for expiration date.

3. Potassium iodide (KI) crystals – Purchased. Store at room temperature and re-evaluate yearly.

4. 0.025 N potassium bi-iodate – Dry KH (IO3)2 for at least 2 hours at 103° to 105°C and cool approximately one hour in a desiccator. Dissolve 0.8124 ± 0.0002 g KH (IO3)2 in deionized water and dilute to 1000 mL in a volumetric flask. Store in amber glass bottle at room temperature. Stable 1 year.

5. 0.1 N sodium thiosulfate – Purchased. Store at room temperature. See manufacturer’s label for expiration date.

6. 0.025 N sodium thiosulfate ($Na_2S_2O_3$) – Dilute 250 mL of 0.1 N $Na_2S_2O_3$ (purchased) to 1000 mL with deionized water. Hold time is determined by manufacturer's expiration date for 0.1 N sodium thiosulfate. Store at room temperature. **Standardize weekly** against 0.025 N potassium bi-iodate.

7. 0.025 N iodine solution – Dissolve 20 to 25 g KI in approximately 800 mL of deionized water and add 3.20 ± 0.05 g iodine. Allow plenty of time to dissolve and then dilute to 1000 mL with deionized water in a volumetric flask. Hold time is 1 year. Store in amber glass bottle at room temperature. **Standardize weekly** against 0.025 N sodium thiosulfate.

Calibration

A. Standardization**:**

Record all standardization in department's solution standardization logbook.

1. 0.025N Sodium thiosulfate

   a. Dissolve approximately 2.0 g KI in an Erlenmeyer flask with approximately 150 mL deionized water. Add a few drops of concentrated H_2SO_4. Swirl.

   b. Add by pipette, 20 mL of 0.025 N potassium bi-iodate.

   c. Dilute to approximately 200 mL with deionized water. Immediately titrate the liberated iodine with 0.025 N $Na_2S_2O_3$ titrant to a pale yellow color.

   d. Add enough starch indicator to turn the solution blue, then titrate to the first colorless endpoint.

   e. Perform duplicate trials and average the results.

$$Na_2S_2O_3N = \frac{(20mL\,KH(IO_3)_2) \times (0.025N\,KH(IO_3)_2)}{mL\ of\ sodium\ thiosulfate\ titrated}$$

2. Iodine

   a. Pipette 10 mL of 0.025 N iodine solution into an Erlenmeyer flask.

   b. Add approximately 90 mL of deionized water.

   c. Titrate immediately with the $Na_2S_2O_3$ (previously standardized) to a pale yellow color.

   d. Add a few drops of starch solution and titrate to the first colorless endpoint.

   e. Perform duplicate trials and average the results.

$$IodineN = \frac{(mL\ of\ Na_2S_2O_3\ titrated)\ (standardized\ normality\ of\ Na_2S_2O_3)}{10.0\ mL\ iodine\ solution}$$

B. A balance calibration check and level check must be performed each day before use.

Procedure

Add reagents to the Erlenmeyer flask in the exact order stated in this procedure to ensure no sulfide gas is liberated before the titration is performed.

1. Pipette 10 mL of the standardized iodine solution into a 500-mL Erlenmeyer flask.

2. Bring the volume up to approximately 20 mL with deionized water.

3. Add approximately 10 mL of 1 + 1 HCl.

4. Pipette 200 mL of the scrubber solution into the flask, discharging the scrubber solution under the iodine solution surface.

5. Swirl gently.

If the iodine color disappears, add more iodine until the color remains. Record the total amount of iodine solution used. Titrate as usual. Then perform a second trial, adding enough iodine before adding the scrubber solution to maintain the yellow color after the scrubber solution addition.

6. Titrate immediately with standardized $Na_2S_2O_3$ solution to a pale yellow.

7. Add enough starch indicator to turn the solution blue and then titrate to a colorless endpoint.

8. Record the amount of titrant and iodine used.

9. Check the pH of the titrated solution. If the 10 ml of 1 + 1 HCl does not bring the pH down to at least 2, then repeat the titration using enough 1 + 1 HCl to bring the pH down to 2.

10. Document the pH check in LIMS.

Calculations

mg/kg sulfide = [[(A x B) - (C x D)] x (32.06 g/2 eq.) x [(1000mg/g)] / E]x PF

Where:

A = mL of iodine solution
B = Normality of iodine solution
C = mL of Na2S2O3 solution
D = Normality of Na2S2O3 solution
E = mL of sample titrated (200mL)
PF = prep factor (10 g initial to 500mL final volume = 50)

Statistical Information/Method Performance

The method detection limit (MDL) is determined annually by following the procedure outlined in QA-SOP11892.

The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

One method blank and a 570 mg/kg sulfide LCS (See method 7.3.4) must be analyzed with each batch. A batch is limited to 20 samples or less.

When sample volume permits, a matrix spike (MS) and a matrix spike duplicate (MSD) must be analyzed with each batch. See method 7.3.4 for the spike preparation instructions.

When sample volume does not permit the analysis of the MS and MSD, then a 570 mg/kg sulfide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD or an LCSD.

A sample matrix duplicate is not required unless a batch contains an NPDES sample(s) from South Carolina.

See LIMS for current quality control (QC) acceptance windows. Follow guidelines in *T-WC-WI10360* for outlier QC data.

10360 Quality Control Data for Wet Chemistry
11574 Reactivity of Waste
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information	
10	26.FEB.2019		
11	24.NOV.2020		
12	09.NOV.2021		

eurofins	Always check on-line for validity. **Reactivity of Waste**	Level: **Work Instruction**
Document number: **T-WC-WI11574**		
Old Reference: **1-P-QM-WI-9013027**		
Version: **15**		Organisation level: **4-Laboratory Site**
Approved by: **X6TJ** Effective Date: **30-NOV-2020**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Definitions
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision: 15	**Effective Date:** This version	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in D4 and methods in LIMS	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with D4 Replaced all prior analysis numbers with new LIMS methods

Revision: 15	**Effective Date:** This version	
Cross Reference	Higher level documents are not required to be referenced	Removed 1-P-QM-QMA-9017328, 1-P-QM-QMA-9015389, 1--P-QM-QMA-9021767
Personnel Training and Qualifications	Required format	Updated required wording
Sample Collection, Preservation and Handling	No longer applies	Removed bottle code reference
Reagents and Standards 1 and 2.	Reflects current practice	Doubled the amounts and volumes.
Quality Assurance/Quality Control	Clarification	Added a sentence to ensure a separate MS/MSD is prepared for both cyanide and sulfide.

Revision: 14	**Effective Date:** 07-Aug-2014	
Section	**Justification**	**Changes**
Title	Formatting requirement	Change title to *Reactivity of Waste*
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version
Throughout Document	Reflects re-identification of documents in EtQ No longer in use	Replaced all prior Level 1, 2, 3, and 4 document numbers (analyses excluded) with EDR numbers Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389
Reference	Additional documentation is appilcable	Added 40 CFR 261.23
Cross Reference	Reflects applicable documents	Replaced LOM-SOP-LAB-208 with 1-P-QM-QMA-9015389
Sample Collection, Preservation and Handling	Compliance	Changed 4° ± 2°C to 0° to 6°C, not frozen

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Chapter 7.3, December 1996.
2. U.S. Government (1999), *Characteristic of reactivity*, 40 CFR 261.23, Appendix C.
3. *Chemical Hygiene Plan, current version.*

Cross Reference

Document	Document Title
T-WC-WI11629	Total, Amenable and Weak Acid Dissociable Cyanide in Waters and Soils, Free Cyanide in Water, Reactive Cyanide of Solids, by SW-846 Method 9012A/B, EPA 335.4/3, and SM 4500-CN G/E-1999/2011
T-WC-WI11572	Reactive Sulfide (titration) by SW-846 9034 (1996) Solid or Liquid Waste

Scope

This method is applicable to all wastes except those that form explosive mixtures when acidified. This method measures only the hydrocyanic acid and hydrogen sulfide evolved under these test conditions.

It is not intended to measure other forms of cyanide or sulfide. This method is applicable for all concentration ranges.

Basic Principles

A measured amount of sample is treated with diluted acid in a closed system. This may convert the cyanide and the sulfide in the sample to gas. The gas is carried by a nitrogen stream into a gas-scrubbing bottle containing sodium hydroxide solution. The base traps the cyanide and sulfide. The sulfide is quantitated using Method 9034_Reactive and the cyanide is quantitated using the method described in T-WC-WI11629.

Definitions

The regulation in 40 CFR 261.23 defines reactive wastes to include wastes that have any of the following properties:

1. Readily undergo violent chemical change.
2. React violently or form potentially explosive mixtures with water.
3. Generate toxic fumes when mixed with water.
4. Explode when subjected to a strong initiating force.
5. Explode at normal temperatures and pressures.
6. Fit within the Department of Transportation's forbidden explosives.

A definition of reactivity for this method is as follows: A cyanide or sulfide bearing waste is considered reactive if it, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or to the environment.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Use special precautions when handling KCN and $Na_2S{\bullet}9H_2O$ as they are extremely toxic. Perform analysis in a hood or well-ventilated area to avoid inhalation.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Proficiency is measured through an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control spikes (or alternatively, one blind sample for the DOC) that are carried through all steps of the procedure and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling
Collect samples in glass containers with no headspace.

Refrigerate at 0° to 6°C, not frozen, until analysis.

Do not homogenize samples before analysis to prevent unwanted aeration.

The holding time is not regulated.

Apparatus and Equipment
1. Each analytical setup requires the following:

   a. Stirring apparatus – To achieve approximately 30 rpm

   b. Round-bottom distillation flask – 500 mL, bi or tri-neck, with 24/40 ground glass joints or equivalent

   c. Addition funnel with pressure equalizing tube and 24/40 ground-glass joints or equivalent

   d. 24/40 ground-glass stopper and keck clips or equivalent

   e. Gas washing bottle (sufficient size to accommodate 500 mL of sodium hydroxide as the scrubbing solution) with scrubber assembly or equivalent

   f. Flexible tubing

   (**Assembly of this apparatus is shown in Figure 1.**)

2. Flowmeter or equivalent

3. Balance capable of weighing to 0.001 gram. Refer to 1-P-QM-QMA-9015389.

Reagents and Standards
Alternate weights and volumes are acceptable as long as final concentrations remain the same.

1. Sulfuric acid (0.05M)

   a. Pipette 5.6 mL concentrated H_2SO_4 into reagent water and dilute to 2000 mL.

   b. Stable one year.

   c. Store in plastic container at room temperature.

2. Sodium hydroxide solution (1.25 N)

   a. Dissolve 100 ± 1 g of NaOH in reagent water and dilute to 2000 mL.

   b. Stable one year.

   c. Store in plastic container at room temperature.

3. Sulfide reference solution

   a. Dissolve 2.01 ± 0.01 g $Na_2S \cdot 9H_2O$ in reagent water and dilute to 500 mL in a volumetric flask.

   b. **Prepare fresh daily**. (This solution is approximately 570 mg/L hydrogen sulfide). Use for LCS and spiking solution.

NOTE: The cyanide reference solution is provided by the department that performs the 9012_ReactiveCN method. The preparation of the cyanide reference solution is not covered in this SOP.

Calibration

Check the flow rate every 6 months using an NIST traceable flow meter. Record the NIST reading for each flow meter in the flow meter logbook. The acceptance range of the flow rate is ±10% of the flow meter setting.

Balances must be calibrated each day before use. .

Procedure

1. Place 100 mL of 1.25 N NaOH and 400 mL of reagent water into the gas-washing bottle.

2. Weigh 10.0 ± 0.5 g of sample (solid or liquid) directly into the distillation flask and record the amount.

Blank, LCS, and MS/MSD Preparation

   a. For the blank and LCS, weigh 10 ± 0.5 g sea sand or glass beads.

b. Before closing the system add 10mL of the standard reference solution to the LCS, MS and MSD flasks.

3. Add a magnetic stirring bar into the flask.

4. In a hood, assemble the glassware apparatus as shown in Figure 1.

5. Place 25 mL of 0.05M H_2SO_4 and 225 mL reagent water into the addition funnel with the stopcock closed.

6. Check all the clips and securely close the system.

7. Begin purging the system with nitrogen gas. Adjust the flow rate to 60 mL/min.

8. With the nitrogen gas flowing, open the addition funnel stopcock to add the diluted H_2SO_4 directly into the flask.

9. Begin magnetically stirring the sample as the acid is entering the tri-neck flask and continue to stir at a constant rate throughout the test.

NOTE: Avoid creating a vortex while stirring.

10. After 30 minutes, turn off the nitrogen gas flow and disconnect the scrubber assembly.

11. Analyze the contents of the scrubber solution for reactive sulfide using the 9034_Reactive method.

12. Subsample a small portion of the scrubber solution into a vial to be analyzed for cyanide using 9012_ReactiveCN.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control
A batch is limited to 20 samples or less.

One method blank, a 570 mg/kg sulfide LCS, and a 1000 mg/kg cyanide LCS must be analyzed with each batch.

A matrix spike (MS) and a matrix spike duplicate (MSD) for reactive sulfide must be analyzed with each batch.

A matrix spike (MS) and a matrix spike duplicate (MSD) for reactive cyanide must be analyzed with each batch.

When sample volume does not permit the analysis of an MS and MSD, then a 570 mg/kg sulfide LCSD and a 1000 mg/kg cyanide LCSD must be analyzed to demonstrate method precision.

Samples from West Virginia require a usable precision measurement for each batch. Analyzing one of the following on a batch containing a West Virginia sample fulfills this requirement: an MS/MSD, a non-program deleted duplicate, or an LCSD.

A sample matrix duplicate is not required unless a batch contains a NPDES sample(s) from South Carolina.

Attachment:
Figure 1 (.doc)

End of document

Version history

Version	Approval	Revision information	
14	07.AUG.2014		
15	23.NOV.2020		

eurofins	Always check on-line for validity. **TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A, Lloyd Kahn**	Level: **Work Instruction**
Document number: **T-WC-WI11627**		
Old Reference: **1-P-QM-WI-9013418**		
Version: **17.1**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **06-JUL-2021**	Document users: **6_EUUSLA_ Instrumental Water Quality _TOC Analyst, 6_EUUSLA_ Instrumental Water Quality _TOC Verifier**	Responsible: **5_EUUSLA_Instrumental Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Sample Cup Preparation
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

Revision:	18	**Effective Date:**	This version
Section		**Justification**	**Changes**
Revision Log		Formatting requirement	Removed revision logs up to the previous version
Reference		MUR	Added method reference to comply with MUR
Throughout Document		LIMs update	Corrected IDs to match current LIMs

Revision:	17	**Effective Date:**	July 09, 2019
Section		**Justification**	**Changes**
Revision Log		Formatting requirement	Removed revision logs up to the previous version.
Scope		Current Process	Removed LIMS analyses 6623 and 11763

Revision:	17	**Effective Date:**	July 09, 2019
Reference Modifications	Method Requirement		Removed 10% dup instead of a quadruplicate per batch
Procedure 8.	Current Process		Removed the process of analyzing three blanks prior to calibration.
Procedure 10.	Current Process		Removed the concentration of the CCV, this changes dependent on the CRM provided by the manufacturer
QA/QC	Method Requirement		One quadruplicate per batch for Lloyd Kahn

Reference

1. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 5310B-2011,

2. Standard Methods for the Examination of Water and Wastewater, Method 5310B-2014.

3. *Method 415.1, Methods for Chemical Analysis of Water and Wastes USEPA 600.*

4. *Test Methods for Evaluating Solid Wastes, SW-846 Method 9060, September 1986.*

5. Test Methods for Evaluating Solid Wastes, SW-846 Method 9060A, November 2004

6. *The Primacs SNC-100 Analyzer Manual*, Skalar..

7. *Determination of Total Organic Carbon in Sediment, U. S. EPA, Region II, July 27, 1988. ("Lloyd Kahn Method.").*

8. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11188	Reagents and Standards

Scope

This method is applicable for the determination of total organic carbon (TOC) in soils and other samples not easily analyzed by the TOC waters method. The limit of quantitation (LOQ) for this method can be found in the analysis information file. Quantitative TOC results up to 1,000,000 mg/kg may be obtained by this method.

Basic Principles

TOC is determined by acidifying a sample and heating it to remove the TIC. An aliquot of sample (1 mg to 1 g) is weighed into a sample cup. The sample is then heated to 900°C for combustion of the remaining TOC. The resulting carbon dioxide from the TOC is detected by a nondispersive infrared (NDIR) detector that has been calibrated to directly display the mass of carbon dioxide detected. The mass is proportional to the mass of TOC in the sample. Samples analyzed by this method include solids such as soils or sediments, slurries, sludges, brines, and corrosives.

The TC measurement is identical to the TOC measurement, with the exception that there is not an acidification and heating step to remove the TIC.

TIC is the calculation subtracting the TOC soil result from the result obtained when analyzing the TC.

Reference Modifications

There is no referenced method for the determination of Total Carbon in solids the analysis references a modified TOC method. The calibration standards, QC standards, and LCS employed for this analysis are composed of only organic sources of carbon (Sucrose for the calibration and QC standards, and a purchased standard for the LCS solid). Therefore, the Total Organic Carbon content is equal to the Total Carbon content in these standards.

Interferences

Carbon is ubiquitous in nature. Therefore, extra care must be taken to avoid contamination of reagents, glassware, and any other materials that come in contact with the sample. Samples which are light in weight may need to be analyzed at smaller aliquots to fit within a sample cup. These samples are reported with an elevated LOQ.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

1. Normal laboratory practices for safety must be followed.

2. Extreme caution must be used when handling sample cups after they have been analyzed.

3. Discard acid waste in acid waste containers.

4. See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability.
Analysts are considered proficient when they have successfully completed a Demonstration of Capability for the analysis. A Demonstration of Capability consists of four laboratory control standards that are carried through all steps of the analysis and that meet the acceptance criteria for the LCS and LCSD. Documentation for these studies are in each individual’s training records.

Demonstration of Capability is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples must be collected and stored in glass containers unpreserved. Samples must be stored under refrigeration at 0° to 6°C, not frozen.

Because very small amounts (1 mg to 1 g) of sample are used for the analysis, the sample must be as homogeneous as possible.

The holding time for analysis by SM 5310 B, EPA 415.1 and SW-846 9060/9060A is 28 days. The holding time for analysis by the Lloyd Kahn method is 14 days.

Apparatus and Equipment

1. Skalar-Primacs SC100

2. PC and SNAccess software

3. 2-stage gas regulator (two required)

4. Sample cups

5. Fiber quartz wool

6. Analytical balance, capable of accurately weighing to 1. mg

7. Glassware – General laboratory glassware as needed for preparing reagents and standards

8. Microliter syringe, various volumes

Reagents and Standards

NOTE: All chemical used must be ACS reagent grade unless otherwise noted.
Different volumes or weights may be used provided the ratios remain equivalent.
See *QA-SOP11188*, for the appropriate labeling and documentation of reagent and standard preparation.

1. Ultra pure nitrogen gas (60 psi)

2. Ultra pure oxygen gas (60 psi)

3. Hydrochloric acid, concentrated (HCI) – Purchased. Store at room temperature.

4. 1+1 Phosphoric acid (WC_TOC_1:1PA)

Phosphoric acid (H3PO4)	50 mL
Reagent water	50 mL

Take 50 mL of H3PO4 and add slowly while swirling to a 100-mL volumetric flask containing 50 mL reagent water. Store at room temperature. Prepare fresh every 6 months.

5. TOC stock calibration standard (sucrose containing 30% carbon) (WC_TOC_30%SUC), purchased. See label for expiration date. Store at room temperature.

6. TOC LCS standard, purchased (WC_TOC_SLCSCC). See label for expiration date, and the certified concentration. Store at room temperature.

Sample Cup Preparation

Sample cups must be conditioned prior to analysis. This is achieved by heating the cups to 750°C for a period of 2 to 5 minutes.

Calibration

1. Working standards for calibration

Pipette a volume of the TOC stock calibration standard into the sample cups as follows:

Working Std. (mg C)	Vol. Stock TOC (µL)
0.30	1.0
0.90	3.0
3.0	10.0
6.0	20.0

Prepare fresh daily. Store at room temperature.

2. Continuing calibration verification standard (CCV)

This is a purchased standard, and the acceptable range is specified by the manufacturer.

Procedure

1. Turn on nitrogen to 60 psig.

2. Turn on oxygen to 60 psig.

3. Add water and a drop of HCI to the scrubber.

4. Measure the carrier gas (oxygen) flow rate and adjust to 200 mL/min.

5. Measure the dryer gas (nitrogen) flow rate and adjust to 160 to 300 mL/min.

6. Power up instrument.

7. Program in a sequence file.

8. Run the calibration sequence as follows: 0.30, 0.90, 3.0, and 6.0 mg C (Performed monthly).

9. The instrument automatically calculates the R and list the calibration data.

10. Samples are analyzed along with the appropriate laboratory control standard and preparation blank. A check standard (CCV) and a continuing calibration blank (CCB) must be run at the beginning of each run and after every ten samples.

11. Add sufficient glass wool to each cup to cover the bottom surface.

12. Weigh samples into sample cups (up to 1000 mg). Add 1+1 H3PO4 drop wise until effervescence stops. Heat at 75°C for 15 minutes. Record the oven ID, time and temperature of this step in the log book.

NOTE: This procedure will convert inorganic carbonates and bicarbonates to carbon dioxide and eliminate it from the sample. The addition of H3PO4 and the heating to 75°C is not performed for analysis 10065.

13. Analyze the residue according to the instrument manufacturer's instructions for the remaining TOC result.

Calculations

1. To determine mg/kg TOC or TC

   mg/kg = (Raw result in mg C) x (1000/weight in mg) x (1000)

2. To determine LOQ/MDL factors

$$Factor = \frac{Maximum\ sample\ aliquot\ weight\ (1000.mg)}{weight\ of\ sample\ (mg)}$$

3. To determine Total Inorganic Carbon (TIC)

   TIC = Total Carbon (TC) - Total Organic Carbon (TOC)

Statistical Information/Method Performance

1. The method detection limit (MDL) is determined annually by following the procedure outlined in *QA-SOP11892*.

2. The quality control acceptance windows are generated annually by following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

1. A calibration must be performed every 30 days. The acceptable range for the calibration is R = 0.995 or greater. If this criteria is not met, the instrument must be recalibrated.

2. A batch must contain no more than 20 field samples.

3. A batch blank (MB) must be analyzed every batch or each day samples are prepared (not to exceed 20 samples). An acceptable result is < the limit of quantitation. If the PBS does not meet this criterion, it must be rerun twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be repeated.

4. A laboratory control standard (LCSS) must be analyzed every batch or each day samples are analyzed (not to exceed 20 field samples). For TOC this is a purchased standard and the acceptable range is specified by the manufacturer. The LCSS should undergo the same steps as the samples. If the LCSS does not meet the acceptable criterion, it must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples in the batch must be reanalyzed.

5. Based upon client requirements, a laboratory control standard duplicate (LCSD) may need prepared and analyzed under the same conditions as the LCS. The acceptance criterion for the LCSD is the same as that of the LCS. The relative percent difference between the LCS and the LCSD is calculated statistically.

6. 9060 - a duplicate is analyzed every 10 samples. Lloyd Kahn - one sample is analyzed in quadruplicate every batch. The acceptable relative percent difference is statistically determined. The duplicate relative percent differences must be tracked to continually monitor method performance.

7. 9060, 5310B - A spike must be analyzed for every 10 samples. The sample is spiked with 3 ul of the purchased TOC stock calibration standard. The acceptance range is determined statistically. The spike recoveries must be tracked to continually monitor method performance.

8. Based upon client requirements, a matrix spike duplicate (MSD) may need prepared and analyzed under the same conditions as the MS. The acceptance criterion for the MSD is the same as that of the MS. The relative percent difference between the MS and the MSD is calculated statistically.

9. A check standard (CCV) and blank (CCB) must be run after every ten injections (including blanks and standards). The acceptable range for the CCV determined by the manufacturer. An acceptable CCB result is < the limit of quantitation. If either, or both, of these injections do not meet the acceptance criterion, the unacceptable original must be repeated twice. If either of the two additional trials do not meet the acceptance criterion, all samples since the last compliant CCV/CCB must be reanalyzed.

10. A CCV and CCB shall be analyzed at the beginning and the end of each run. At any time when the instrument has been idle for a period of 4 hours or more, a CCV and CCB must be analyzed. If either of these parameters cannot meet specifications, the instrument must be recalibrated.

11188 Reagents and Standards
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information	
16	17.OCT.2018		
17	03.JUL.2019		
17.1	22.JUN.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **T-WC-WI11629**	**Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by Methods SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011**	**Work Instruction**
Old Reference: **1-P-QM-WI-9011646**		
Version: **20.1**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **22-AUG-2022**	Document users: **6_EUUSLA_ Instrumental Water Quality _OI Analyst, 6_EUUSLA_ Instrumental Water Quality_Alpkem Analys, 6_EUUSLA_ Instrumental Water Quality_Alpkem Verifi**	Responsible: **5_EUUSLA_Instrumental Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Weekly Standardization of Cyanide Stock Standards
Calibration
Quality Control Standards
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table I
Table II

Revision Log

Revision:	20.1	**Effective Date:**	This Version
Section	**Justification**		**Changes**
Header	Company Name		Updated Company name

Revision:	20	**Effective Date:**	03/11/2021
Section	**Justification**		**Changes**
Revision Log	Formatting requirement		Removed revision logs up to the previous version
Title	Enhancement		Shortened
LIMS ID	Current LIMS		Updated method codes
Throughout	Current LIMS		Removed old analysis scan numbers and removed reference to free cyanide.
QAQC	Current LIMS		QC is not reported for Amenable CN calculations. Removed the Amenable CN column in the QAQC table.

Revision:	19	**Effective Date:**	11/27/2018
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
Throughout Document	Alpkem instrument no longer in use		removed
Apparatus and Equipment	New instrumentation		Added OI 3700
Procedure	Removed unnecessary verbiage		Cleaned up section.
Reference	Updated Methods		Added SM 2011 versions

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012A, December 1996.

2. Method 335.4, Methods for Chemical Analysis of Water and Wastes, USEPA 600, Revision 1.0, 1993.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 9012B, August 2002.

4. Method 335.3, Methods for Chemical Analysis of Water and Wastes USEPA 600.

5. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500-CN G-1999.

6. Test Methods for Evaluating Solid Wastes, SW-846 Chapter 7.3, December 1996.

7. Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005, Method 4500-CN E-1999.

8. Standard Methods for the Examination of Water and Wastewater, Method 4500-CN G-2011

9. Standard Methods for the Examination of Water and Wastewater, Method 4500-CN E-2011.

10. *Flow Diagram for Cyanide Analysis*, Astoria-Pacific International, 1996.

11. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-WC-WI10085	Total and Amenable Cyanide Distillation (As Preparation for Analysis on the Automatic Flow Analyzer)
S-SS-FRM10670	Bottles and Analyses for Preservation Check and Subsampling
T-WC-WI11652	Quality Control for Analyses Performed in Instrumental Water Quality
S-BOT-WI10642	Packing Bottle Orders
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
QA-SOP11188	Reagents and Standards

Scope

This method is applicable to the determination of various forms of cyanide in potable water, groundwater, and wastewater. The amenable cyanide method applies to any water or wastewater where the dissociable cyanide content is to be determined. All samples for total or amenable cyanide must be manually distilled. The samples for free cyanide (Analysis 00241) are analyzed without preparation on the flow analyzer. Analyses 0957 and 0959 are used for solid and water samples referencing CT RCP or MA MCP requirements.

Analysis Name	Matrix	Method
Total CN	Water	EPA 335.3 EPA 335.4
Total CN	Water	SW-846 9012A SW-846 9012B
Total CN	Soil	SW-846 9012A SW-846 9012B
Amenable CN	Water	SM 4500-CN G-2011 SM 4500-CN G-1999 SW-846 9012A SW-846 9012B EPA 335.4
Amenable CN	Soil	SW-846 9012A SW-846 9012B
Reactive CN	Soil	SM 4500-CN G-2011
Free CN	Water	SM 4500-CN G-2011
WAD CN	Water	SM 4500-CN I-2011
WAD CN	Soil	SM 4500-CN I-2011

Basic Principles

Cyanide exists in aqueous solutions either as the simple CN- ion or coordinated with various metal ions to form metallic complexes. Iron, cobalt, zinc, and copper commonly complex with CN (e.g., Fe (CN)6-3, Co (CN)6-3, Zn (CN)4-2, Cu (CN)4-2). Other species also occupy coordination sites in conjunction with cyanide making a myriad of compounds possible.

Cyanide is released from cyanide complexes by distillation only. The liberated hydrogen cyanide and simple cyanides are converted to cyanogen chloride by reaction with Chloramine T. The cyanogen chloride then reacts with the pyridine-barbituric reagent to form a red-colored complex. The complex is measured at 570 nm.

Samples analyzed for free cyanide show the cyanide released without preliminary distillation of the sample. (Free cyanide does not determine or quantify cyanide from tight complexes). For the amenable cyanide determination, the sample is pretreated with chlorine to release the dissociable cyanide. Both a treated and untreated aliquot of sample is analyzed, and the difference between the two results is the cyanide amenable to chlorination.

Weak Acid Dissociable cyanide measures the cyanide liberated from a slightly acidified sample. This method does not recover cyanides from tight complexes.

Reference Modifications

SW846 9012A specifies the pyridine-barbituric acid reagent be brought to a final volume of 250 mL with reagent water. This method utilizes pyridine-barbituric acid reagent that is brought to a final volume of 1000 mL with reagent water. This modification is performance based and meets all requirements set forth in method SW846 9012A, Section 8.0, Quality Control.SW-846 9012B states that the samples are to be analyzed in increasing order. In this instance the modification of the calibration curve is allowed provided all of the QC standard requirements are met.

This method utilizes the flow diagram from the manufacturer of the cyanide block. This modification is performance based and meets all of the requirements set forth in EPA 335.4, Section 9.0, Quality Control.
There are no procedural differences in the determinative step between EPA 335.3 and EPA 335.4.

There are no procedural differences between amenable cyanide by EPA 335.3, or 4 and SM4500-CN G-1999.

For samples dominated by iron-cyanide complexes, there is a potential for the current Weak Acid Dissociable Cyanide procedure to destabilize the iron-cyanide precipitate formed during the process and recover this strong cyanide complex as Weak Acid Dissociable Cyanide. Samples analyzed for this method will be analyzed using LL analysis 11069.

Interferences

The method is prone to numerous interferences. These are cited below.

1. Sulfides adversely affect the colorimetric procedures. The samples are checked in the Sample Support area and treated for sulfide. If the samples are treated for sulfide, the distilled standard and blank, and calibration curve standards must also be treated in the same manner. (Use *S-SS-FRM10670*) These treated standards are then run with the corresponding treated samples.

2. Aldehydes convert cyanide to cyanohydrin, which forms nitrite under the distillation conditions causing poor recoveries. Formaldehyde interference is noticeable in concentrations exceeding 0.5 mg/L.

3. Glucose and other sugars, especially at alkaline pH, lead to the formation of cyanohydrin by reaction of cyanide with aldose.

4. Fatty acids and oils interfere with the distillation and color development if they form soaps under the alkaline conditions.

5. Prior to distillation, samples are checked for residual chlorine and treated with ascorbic acid to prevent destruction of cyanides during storage and the course of the analysis.

6. Samples high in NO3 or NO2 cause high readings in certain types of industrial waste. This is eliminated by pretreatment with sulfamic acid.

7. For samples dominated by iron-cyanide complexes, there is a potential for the current Weak Acid Dissociable Cyanide procedure to destabilize the iron-cyanide precipitate formed during the process and recover this strong cyanide complex as Weak Acid Dissociable Cyanide.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Normal laboratory safety practices must be followed. Because of the toxicity of CN, special care must be taken in handling standards and samples. Breathing pyridine vapors also presents a risk. Be sure to prepare the pyridine reagent in a hood. Inspect the glassware before use; discard or send for repair any glassware that is chipped, flawed, or broken. Discard cyanide waste samples in appropriate cyanide waste containers.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Proficiency is measured through an Initial Demonstration of Capability (IDOC) that consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCS's or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in either glass or plastic containers. They must be preserved with NaOH to pH >12 and refrigerated at 0°to 6°C not frozen. Analysis must be performed within 14 days of sample collection for all types of cyanide except reactive cyanide, which must be analyzed as soon as possible after sample collection.

Apparatus and Equipment

An automated flow analyzer is required for this method. The flow analyzer consists of the following parts:

A. OI automatic sampler (Model 3090) or equivalent

B. OI multichannel dispenser (Model ISM938E) or equivalent

C. Astoria-Pacific glass Cyanide block (with pump tubing)

D. OI spectrophotometry detector (Model FS3700)

E. PC with OI Analytical Flow View TM software

Reagents and Standards
All chemicals used must be ACS reagent grade unless otherwise noted.

Different volumes or weights are acceptable in the preparation of reagents or standards as long as the ratios remain equivalent.

See *QA-SOP11188* for the appropriate labeling and documentation of reagent and standard preparation.

1. WC_FL_25NAOH: Dilution water and receptacle wash (0.25 N NaOH)

Sodium hydroxide (NaOH)	20.0 ±.2 g

a. Carefully dissolve 20 ±.2 g of sodium hydroxide into approximately 1800 mL reagent water in a 2-L volumetric flask.

b. Dilute to volume with reagent water.

c. Stable for 3 months at room temperature.

2. WC_FL_PHOSBUF: Phosphate buffer

Sodium phosphate, monobasic (NaH2PO4•H2O)	138 ±1 g
Brij-35	1.0 mL

a. Dissolve 138 ±1 g of NaH2PO4•H2O in reagent water and dilute to 1 L in a volumetric flask.

b. Add 1.0 mL of Brij-35. Store at 0°to 6°C not frozen in a plastic container.

c. Prepare every 30 days.

NOTE: The amount of Brij-35 added is an estimated amount. Adjust as needed.

3. WC_FL_CHLORAM: Chloramine T reagent

Chloramine T (C7H7ClNO2SNa•3H20)	1.0 ±.05 g

a. Dissolve 1.0 ±.05 g of chloramine T in 200 mL of reagent water and dilute to 250 mL in a volumetric flask.

b. Make fresh each day.

4. WC_FL_PYRBARB: Pyridine barbituric acid reagent

Barbituric acid (C4H4N2O3)	15 ±.2 g
Pyridine (C5H5N)	75 mL
Hydrochloric acid (HCl)	15 mL

a. Place 15 ±.2 g barbituric acid in a 1000-mL volumetric flask and add about 100 mL reagent water to wash the sides of the flask and wet down the barbituric acid.

b. Add 75 mL of pyridine and mix.

c. Add 15 mL of concentrated hydrochloric acid and mix.

d. Dilute to about 800 mL with reagent water and mix until all the barbituric acid has dissolved.

e. Dilute to volume with reagent water.

f. This solution must be made in a hood due to the use of pyridine.

g. Store in an amber glass bottle at 0°to 6°C not frozen for no longer than 2 weeks.

5. Sodium hydroxide 5 N

Sodium Hydroxide (NaOH)	200 ±2 g

a. Dissolve 200 ±2 g of NaOH in reagent water and dilute to 1 L in a volumetric flask.

b. Store at room temperature in a glass volumetric.

c. Prepare every 6 months.

6. WC_FL_CAL10CN: Stock standard for calibration (1000 mg/L CN-)

Potassium cyanide (KCN)	1.255 ±0.005 g
Potassium hydroxide (KOH)	1 ±.05 g

a. Dissolve 1.255 ±0.005 g of potassium cyanide in 400 mL reagent water containing 1 ±.05 g of potassium hydroxide.

b. Dilute to 500 mL with reagent water in a volumetric flask (1.00 mg CN-/mL).

c. Prepare every 30 days.

d. Keep refrigerated at 0°to 6°C not frozen in an amber glass bottle.

e. Standardize weekly.

7. Stock standard for quality control (1000 mg/L CN-)

a. Same procedure as for the stock solution for calibration standards using potassium cyanide from a different source.

b. Standardize weekly.

8. Standard silver nitrate solution, 0.0192 N

Purchased – This reagent is standardized by the manufacturer against potassium chloride. A certificate of analysis is supplied with each bottle that confirms the standardized value to be 0.0192 ±0.0001 N. Store at room temperature. See label for expiration date.

9. Rhodanine indicator

p-methyl-aminobenzalrhodanine	0.020 ±0.001 g
Acetone	100 mL

a. Dissolve 0.020 ±0.001-g p-methyl-aminobenzalrhodanine in 100 mL of acetone in a volumetric flask.

b. Prepare every 6 months.

c. Store at room temperature.

Weekly Standardization of Cyanide Stock Standards

NOTE: This is only required for lab-prepared stock standards

1. Prepare two blanks by diluting 12.5 mL 5 N sodium hydroxide solution to 250 mL with reagent water and pouring each 250-mL aliquot into a separate 500-mL Erlenmeyer flask.

2. Add 20 to 25 drops of rhodanine indicator to each flask.

3. Titrate each solution with standard silver nitrate to the first change in color from yellow to brownish-pink.

4. Average the titration volumes used.

5. Measure 4 mL of the stock solution into two 500-mL Erlenmeyer flasks containing 12.5 mL 5 N sodium hydroxide and 237.5 mL reagent water.

6. Titrate each solution with standard silver nitrate to the first change in color from yellow to brownish-pink.

7. Average the titration volumes used.

8. Calculate the true value of the cyanide stock standard

$$\frac{(A - B) \times 1000\ mg/L}{mL\ standard\ used} = CN\_\ mg/L$$

Where:

A = Volume of $AgNO_3$ from titration of standard
B = Volume of $AgNO_3$ from titration of blank

Calibration

1. WC_FL_CAL10CN: Working Standard A, 10 mg/L

a. Pipette a volume of the calibration standard derived from the standardization procedure to equal 10 mg/L of cyanide (see calculation below) into a 50 mL volumetric flask containing approximately 40 mL of cyanide wash solution.

b. Dilute to 50 mL with wash solution.

c. Prepare daily.

NOTE: Calculate the volume of stock standard required to achieve a final concentration of 10 mg/L using this formula:

$$\text{Volume required (mL)} = \frac{500}{\text{standardized value of 1000 mg / L stock}}$$

2. Using the WC_FL_CAL10CN Working Standard A, prepare the following calibration standards in volumetric flasks. Dilute to volume with wash solution. Prepare daily.

Standard Name	mL Working Standard A	Final Volume (mL)	mg/L CN-
S6	1.75	50	0.350
S5	1.0	50	0.200
S4	0.5	50	0.100
S3	0.25	50	0.050
S2	0.1	50	0.020
S1	0.05	50	0.010

Quality Control Standards

1. WC_FL_Q_10 CN: Working Standard B, 10 mg/L

a. Pipette a volume of the calibration standard derived from the standardization procedure to equal 10 mg/L of cyanide (see calculation below) into a 50-mL volumetric flask containing approximately 40 mL of cyanide wash solution.

b. Dilute to 50 mL with wash solution.

c. Prepare daily.

NOTE: Calculate the volume of stock standard required to achieve a final concentration of 10 mg/L using this formula:

$$\text{Volume required (mL)} = \frac{500}{\text{standardized value of 1000 mg / L stock}}$$

2. WC_FL_CCVCN: Using the Working Standard B, prepare the following quality control standard in a 100-mL volumetric flask containing approximately 40 mL of wash solution. Dilute to volume with wash solution. Prepare daily.

Standard	Working Standard B (mL)	mg/L CN-
WC_FL_CCVCN	1.5	0.15

Procedure

A. Sample Preparation

1. Refer to document *T-WC-WI10085* and/or T-WC-WI10105 for the sample preparation process.

B. Analysis

1. An instrument calibration for automated continuous flow is performed at the beginning of each analytical run.

2. The instrument calibration analyzes six standards of known concentration and a zero concentration point (see table IV for concentration of the calibration standards). An Initial Calibration Check (ICV) and an Initial Calibration Blank (ICB) is analyzed with each calibration.

3. When the calibration standards have been analyzed, check the linearity of the calibration. The coefficient must be >0.995 for the curve to be acceptable.

4. If the calibration and calibration check standards pass all criteria continue to analyze samples with the appropriate laboratory control standard (LCS) and preparation blank (PB). Analyze a calibration verification standard (CCV) and calibration blank (W) between every ten injections.

5. Any sample that falls above the highest standard of the full-scale calibration must be diluted with 0.25 NaOH and reanalyzed. The raw result of the diluted sample must have a value of at least 10% of the highest calibration standard. Samples which have been digested at a reduced weight or volume and fall below 10% of the full-scale calibration must be digested at a higher volume or weight unless there is a sample matrix or volume issue that prevents this form occurring.

6. Filter any sample that has a high amount of suspended matter.

NOTE: Any sample that must be filtered also needs the PBW and LCSW filtered for that batch.

7. End the run with a calibration verification standard and calibration blank.

Calculations

The data system automatically prepares a standard curve by plotting peak heights of standards against their concentration values and computes the concentrations of the samples (the raw result) by comparing sample peak heights with the standard curve. The blank is not used as a point on the calibration curve.

If the sample was not distilled, apply any dilution factors used to the raw result to determine the final result (calculated automatically by the software):

Final result = raw result x dilution factor

If the sample was distilled for total or weak and dissociable cyanide, the calculation as performed by the software is as follows:

1. Waters

$$\text{Final result} = \frac{\text{raw result x dil. factor x 50 mL}}{\text{mL of sample distilled}}$$

2. Soils

$$\text{Final result} = \frac{\text{raw result x dil. factor x 0.05 L}}{\text{g of sample distilled}} \text{ x 1000}$$

3. Cyanide amenable to chlorination (manual calculation)

Final result = untreated result - treated result

4. Reactive cyanide (manual calculations)

   a. Samples and blank

$$\text{Final result (mg/kg)} = \frac{\text{raw result x DF x .5}}{\text{wt (g)}} \text{ x 1000}$$

   b. Reactivity standards (LCS)

$$\text{Final result (\% Rec)} = \frac{\text{Reac std}}{\text{result (mg/L) x DF x .5}} + \frac{\text{Reac flask}}{\text{(mg/L) x DF x .26}} \text{ x } 100$$

Statistical Information/Method Performance

1. The method detection limit (MDL) is determined following the procedure outlined in *QA-SOP11892*.

2. The quality control acceptance windows are generated annually for EPA method references and every 6 months for SW846 method references following the procedure outlined in *QA-SOP11896*.

Quality Assurance/Quality Control

NOTE: If the below criteria is not met, see *T-WC-WI11652* for handling outliers and the corrective action that must be taken unless otherwise directed below.

A. Calibration QC Requirements

1. A calibration curve of six standards and a blank are analyzed at the beginning of every run. The correlation coefficient of the curve must be >0.995. If this is not met, the curve is invalid and must be rerun. The blank intercept of the W must not be greater than the MDL.

2. An initial calibration verification standard (ICV) must be run immediately after every calibration. The acceptable range is ±10% of the true value (0.150 mg/L).

NOTE: Per client request, the ICV is distilled.

3. An initial calibration blank (W) must be run after the ICV. The acceptable result is

4. A continuing calibration verification standard (CCV) and a continuing calibration blank (W) must be run every ten injections. The acceptable range for the CCV is ±10% of the true value. An acceptable calibration blank result is

5. The linearity of the calibration must be determined every 6 months by analyzing a blank and three standards. If any verification data exceeds the initial values by ±10%, linearity must be reestablished. The values of the three standards are taken from the calculated values of the standards used for the calibration curve.

B. Batch QC Requirements

1. A batch must contain no more than 20 samples.

2. Table: Batch QC Requirements

		Acceptance Criteria by Analysis and LIMS ID		
Batch QC	Frequency per Batch	Total CN 335.4 9012	Reactive CN 9012_ReactiveCN	WAD CN 4500_CN_I
LCS	1 or each day samples are prepared	Recovery: 90 - 110%	Statistical windows(1)	Recovery: 80 - 120%
LCSD	By Client Requirement	Recovery: 90 - 110% RPD: Statistical	Statistical windows(1)	Recovery: 80 - 120% RPD: Statistical windows(1)
PB	1 each batch or day samples are prepared or analyzed	< MDL	< MDL	< MDL
DUP	Every 10 samples	Statistical windows(1)	Analyzed by client requirement – Statistical windows(1)	Statistical windows(1)
MS	Every 10 samples	See QAQC B.5. below	Statistical windows(1)	75 - 125% Recovery
MSD	Every 20 samples		Statistical windows(1)	

(1) See LIMS for current acceptance criteria
(2) DOD and Reactive CN Analyses only require one DUP for each set of 20 samples.
(3) DOD and Reactive CN only require one MS for each set of 20 samples.
(4) If the RPD is outside of the control limit, consult your group leader or manager to determine if reanalysis is necessary.

3. For samples of the solid matrix, LCS recoveries must be within the criteria for the concentration of the spike added.

4. If the RPD of an LCSD or MSD exceeds the acceptance criteria, consult your group leader or manager to determine if reanalysis is necessary.

5. For Total Cyanide, an acceptable result is 90% to 110% recovery for samples referencing EPA 335.4. For all other total cyanide methods, see LIMS for current QC acceptance limits.

a. If the MS recovery is outside the acceptance criteria and the sample concentration is less than four times the spike concentration, a post-distillation spike (PDS) must be performed.

b. If a PDS is outside the acceptance criteria and samples are analyzed by SW-846 9012A or SW-846 9012B, a standard additions analysis of the data must be performed. No further action is required for other references.

Table I

Table Name: CN

Cup #	Sample ID	Dil	Wt	Cup #	Sample ID	Dil	Wt
1	SYNC	1	1			1	1
2	Rinse	1	1	3	W	1	1
4	S6	1	1	5	S5	1	1

6	S4	1	1	7	S3	1	1
8	S2	1	1	9	S1	1	1
10	Rinse	1	1	11	W	1	1
12	ICV	1	1	13	W	1	1

Table II

Standards Table

	Units: mg/L
S1	0.01
S2	0.02
S3	0.05
S4	0.10
S5	0.20
S6	0.35

Attachment:
Attachment I (.doc)
Figure 1 (.doc)

10085 Cyanide (Total and Amenable) Distillation in Waters and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011
10642 Packing Bottle Orders
10670 Preservation Check and Treating Samples
11188 Reagents and Standards
11652 Quality Control for Analyses Performed in Instrumental Water Quality
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits

End of document

Version history

Version	Approval	Revision information	
19	13.NOV.2018		
20	25.FEB.2021		
20.1	22.AUG.2022		

eurofins	Always check on-line for validity. **Digestion of Aqueous Samples by SW-846 Method 7470A**	Level: **Work Instruction**
Document number: **T-MET-WI11924**		
Old Reference: **1-P-QM-WI-9015082**		
Version: **23**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **20-MAY-2022**	Document users: **6_EUUSLA_Metals_Hg Prep, 6_EUUSLA_Metals_Hg Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
11924) Procedure

Revision Log

Revision: 23	**Effective Date:**	This Version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Header	Name Change	Changed to current company name
Cross Reference	Current SOP	Updated to reflect current Prep Solution and Standards SOP

	Revision: 22	**Effective date:** Nov 5, 2020
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Updated to reflect current practice	Added TALS methods

	Revision: 22	**Effective date:** Nov 5, 2020
Section	**Justification**	**Changes**
Basic Principles	Updated to reflect current practice	Removed DEENAs
Apparatus and Equipment	Updated to reflect current practice	Removed LLENS
Procedure	Updated to reflect current practice	Updated to current LIMS
Quality Assurance/Quality Control	Updated to reflect current practice	Updated to reflect current terminology

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7470A, September 1994
2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA

Scope

This procedure is used for automated and manual digestion of samples and standards for Mercury analysis in aqueous samples by SW-846 Method 7470A.

Basic Principles

The samples are digested with nitric acid, sulfuric acid, potassium permanganate, and potassium persulfate to oxidize mercury compounds to mercuric ions. Mercuric ions are reduced to mercury metal using stannous chloride. Mercury measurement is performed using the mercury cold vapor technique.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes, or use the designated dispensing equipment.

Sulfuric acid (H_2SO_4) – This acid is a strong oxidizing agent and can cause severe burns. Sulfuric acid spills are extremely slippery, adding to the danger. Always use in a fume hood, or use the desinated dispensing equipment. Never mix with concentrated HCl or concentrated $KMNO_4$ to avoid a violent reaction (explosive splattering and extreme heat).

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood, or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing the digestion must work with an experienced employee for a period of time until they can independently perform digestions. Proficiency is measured through documented audits of the tasks listed as well as an Initial Demonstration of Capability (IDOC).

The IDOC and the DOC consists of four laboratory control samples (LCS's) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Aqueous samples are collected in plastic or glass containers (drinking water sample volume is 1-L). Samples are preserved to a pH of <2 with nitric acid at collection and the pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the laboratory must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Representative is notified for further direction. Samples are stored at 0 to 6°C, not frozen, prior to digestion. Samples must be analyzed within 28 days of collection.

Dissolved Mercury: Samples are to be filtered within 15 minutes of collection by the client. Clients may submit unpreserved bottles to the lab for dissolved mercury analysis. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved to a pH of <2 with HNO_3.

Digested samples are stored in plastic bottles at room temperature. Store samples, standards, and digested samples separately.

Apparatus and Equipment

1. 50-mL polypropylene containers and covers (digestion vessels for block digestion) – certified clean and Class A equivalent

2. Environmental Express HotBlock (block digester) – adjustable and capable of maintaining a sample temperature of 95°C.

Reagents and Standards

1. For standards preparation, shelf life, and storage conditions, see T-MET-WI9082. This form also has instructions for the initial preparation of Method Blanks, LCSs, Matrix Spikes and General Solutions.
2. Store all standards and reagents at room temperature. Label the container with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.
3. Standard/spiking concentration and reagent vendors are subject to change without notification.
4. Nitric acid, 70.0% to 71.0% HNO_3, J.T Baker ACS Grade, or equivalent. Follow manufacturer's expiration date.
5. Sulfuric acid, 95.0% to 98.0%, H_2SO_4, 36 N, J.T Baker, ACS Grade, or equivalent. Follow manufacturer's expiration date.
6. Potassium permanganate, $KMnO_4$, Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.
7. Potassium persulfate, $K_2S_2O_8$ Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.
8. Sodium chloride, NaCl, J.T. Baker, Certified ACS, or equivalent. Follow manufacturer's expiration date.
9. Hydroxylamine hydrochloride, $NH_2OH{\cdot}HCl$, J.T. Baker, Certified ACS, or equivalent. Follow manufacturer's expiration date.
10. Stannous chloride, $SnCl_2$, Baker Analyzed reagent, ACS, or equivalent. Follow manufacturer's expiration date.
11. Hydrochloric acid, HCl, 36.5% to 38.0%, J.T Baker ACS Grade, or equivalent. Follow manufacturer's expiration date.

Calibration

Not applicable to this procedure.

Calculations

Not applicable

Statistical Information/Method Performance

Not applicable

Quality Assurance/Quality Control

1. Each digestion batch is up to 20 samples.

2. Each digestion batch must contain a MB, LCS, BKG, DUP, MS and/or MSD when applicable. If insufficient sample for a duplicate or per client requirement, an LCSD/MSD is added to the batch.

   a. MB – Method Blank also equivalent to a Preparation Blank.

   b. LCS/LCSD – Laboratory Control Sample/Laboratory Control Sample Duplicate

c. BKG – unspiked background sample

d. DUP – duplicate

e. MS – Matrix Spike

f. MSD – Matrix spike duplicate

11924) Procedure

A. Manual hot block digestion

1. Turn block digester on and allow block to reach the Control Point setting that provides 95° ± 1°C sample temperature.

2. Before digestion, check the temperature with a calibrated thermometer and record in the logbook.

3. If the sample to be digested is not in split bin location:

   a. Scan parent bottle into LIMS prep batch.

   b. Shake sample well.

   c. Transfer 20 mL of well-mixed sample (or an aliquot diluted to 20 mL) into the polypropylene container. If a different final volume is necessary, adjust reagent volumes accordingly.

4. Scan split samples from bin into the LIMS prep batch.

5. Prepare batch QC and calibration standards. See T-MET-WI9082 for preparation instructions and concentrations. See the Quality Assurance/Quality Control section for the required batch QC.

   NOTE: Exception - For leachate batches containing leachate spiked QA samples, use one of the leachate spiked QA samples as the batch QC matrix spike and matrix spike duplicate, and proceed with the spiking procedures for the LCS according to T-MET-WI9082.

6. Add 1 mL of H_2SO_4 and mix.

7. Add 0.5 mL of HNO_3 and mix.

8. Add 3 mL of 5% $KMnO_4$ solution and mix.

9. Allow the sample to stand for 15 minutes and then check sample for purple color.

   a. purple color does not persist for at least 15 minutes, perform a dilution on the sample beginning with a DF5.

   b. Continue diluting in increments of 5 or 10 until the purple color persists for at least 15 minutes.

10. Add 1.6 mL of 5% $K_2S_2O_8$ solution and mix.

11. Place containers in block digester.

12. Place a calibrated thermometer in a container with reagent water.

13. Put a polypropylene cover on each container. Remove after the samples reach 95° ± 1°C.

14. Heat for 2 hours in the block digester at 95° ± 1°C. The temperature is checked with a calibrated thermometer and recorded in the logbook.

15. Remove samples from block digester and cool.

16. Add 1.2 mL of 12% sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate (color change is from purple to colorless). If the solution is not colorless, add reductant in 1-mL increments until

$KMnO_4$ is completely reduced.

17. Screw on cap and shake sample

18. Adjust the volume to 20 mL with reagent water and mix. Reserve for analysis.

NOTE: The block temperature is different than the temperature of the liquid being digested.

B. Block Digester Instructions:

1. Turn block digester on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

7965 Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA
9082 Working Instructions for Prep Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
21	29.JUL.2019		
22	05.NOV.2020		
23	26.APR.2022		

eurofins	Always check on-line for validity. **Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)**	Level: **Work Instruction**
Document number: **T-MET-WI11931**		
Old Reference: **1-P-QM-WI-9018442**		
Version: **15**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **09-MAY-2022**	Document users: **6_EUUSLA_Metals_ICP Analysis, 6_EUUSLA_Metals_ICP Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Routine Methods
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Instrument Operations
Routine Maintenance for the ICAP™ 6000 Duo Analyzer
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Appendix I

Revision Log

Revision: 15	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout	Update to current LIMS terms	Updated to reflect current LIMS limits
Reference	Total Hardness reference	Added 2340B reference
Safety Precautions and Waste Handling	Clarification	Reference to contact ERT in case of spills
Reagents and Standards	Clarification	Changes to reflect current standard names
Procedure	Reflects current practice	Changes throughout to reflect current procedure

Revision: 14	**Effective Date:**	30-Nov-2020

Revision: 14	**Effective Date:** 30-Nov-2020	
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Quality Assurance/Quality Control	Current Practice	Updated EPA batch size to 20 samples
Reference	Current Practice	Added new verification SOP
Routine Methods	Current Practice	Removed Analysis numbers from previous system
Apparatus and Equipment	Current Practice	Removed products not being used anymore
Reagents and Standards	Current Practice	Updated to current Definitions
Throughout Document	Current Practice	Updated SOPs to D4 document numbers
Procedure	Current Practice	Updated procedure to new LIMs operation
Instrument Operations	Current Practice	Updated to new LIMs operation
Routine Maintenance for ICAP	Current Practice	Updated to better practice and more detail
Calculations	Clarification	added units to Water sample and added LIMs ID to calculations

Reference

1. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010B, December 1996.

2. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010C, February 2007.

3. *Test Methods for Evaluating Solid Wastes*, SW-846 Method 6010D, Rev.4, July 2014.

4. Method 200.7 (rev. 4.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry, USEPA 600/R-94/111 May 1994.

5. ICAP™ 6000 Series ICP-OES Spectrometer Operator Manual, 2005/2006.

6. *Hardness Calculation SM 2340 B-1997, 20th edition.*

7. *Hardness Calculation SM 2340 B-2011.*

8. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10695.	Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
T-MET-WI12063	ICP Solutions and Standards Preparations
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation
QA-SOP11896	Establishing Control Limits
T-MET-WI35797	Metals Data Verification Process

Scope

This procedure applies to analyses performed in the Metals department using Inductively Coupled Plasma (ICP) Atomic Emissions Spectroscopy for identification and quantitation of metallic constituents by Methods 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous).

The Reporting Limits (RLs) are based on annual statistical evaluation of laboratory data and are subject to change without notification. The current method detection limits (MDLs) and RLs are maintained in the laboratory

information management system (LIMS).

This SOP also outlines the proper operation and maintenance of the ICP instrumentation and provides consistent guidelines for the evaluation of ICP data.

Routine Methods

Elements routinely analyzed on the Thermo Scientific iCAP 6000 and 7000 Series Analyzers:

Element	Wavelength (nm)
Ag	328.06
Al	308.21
As	189.04
B	249.67
Ba	455.4
Be	313.04
Ca	317.93
Cd	226.5
Co	228.62
Cr	267.72
Cu	327.4
Fe	261.19
K	766.49
Li	670.78
Mg	285.21
Mn	257.61
Mo	202.03
Na	589.59
Ni	231.6
P	177.49
Pb	220.35
S	182.03
Sb	206.83
Se	196.09
Si	251.6
Sn	189.99
Sr	421.55
Th	401.913
Ti	334.94
Tl	190.86
V	292.4
W	207.911
Zn	213.86
Zr	339.19

Basic Principles

If required, samples are digested with acids and heated to solubilize metals. Samples are received from the prep area in digestion vials.
After the analytical batch is prepared it is loaded onto the autosampler for trace metals analysis.

Samples are transported to a nebulizer via an autosampler and peristaltic pump. The nebulizer introduces an aerosol into a spray chamber; the resulting mist is then transported to an argon plasma torch where excitation of atoms occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency (R.F.) inductively coupled plasma. The spectra are dispersed by a diffraction grating and the intensities of the light at each wavelength are

monitored by a photosensitive device. The signals from the photosensitive device are processed by a computer. A background correction technique is required to compensate for variable background contribution to the spectra of trace elements.

Interferences

Spectral interferences are caused by background emission, stray light from high concentration elements or overlap from a spectral line from another element. Spectral interferences are compensated for by the use of background points, alternate wavelengths and interelement corrections.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for by using internal standardization.

Memory interference, or carryover, is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time of the autosampler tubing overcomes any memory interference.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO3) – This acid can cause skin burns. Add nitric acid to samples in a hood to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCI with concentrated H2SO4 to avoid a violent reaction. Always use in a fume hood.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Fill reagent bottles in an operating fume hood using caution to avoid spills.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

In case of spills contact the Emergency Response Team.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter data into the LIMS. Proficiency is measured through documented audits of the tasks listed and over checking of data as well as an IDOC (Initial Demonstration of Capability).

The IDOC consists of aliquots spiked at 1-4X the RL that are carried through all steps of the prep and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy of 50 - 150% and standard deviation of </= 20%.

Various options are available for a DOC and can include four laboratory control samples (LCS) or one blind sample. The mean recovery of four LCSs must meet the accuracy criteria of an LCS, and the standard deviation must be </= 20%.

Sample Collection, Preservation, and Handling

A. Preservation and Holding time

1. All samples are typically shipped and stored at 0°to 6°C, not frozen, but room temperature is acceptable. Samples are analyzed within 6 months of collection.

2. Aqueous samples are collected in plastic or glass containers and are preserved to pH <2 with nitric acid. If samples are received > pH 2, they are preserved at the lab and held at least 24 hours until digestion. See *S-SS-WI10695*.

3. Drinking water samples are digested if the turbidity is > 1 NTU. See *S-SS-WI10695*.

4. Dissolved metals must be filtered within 15 minutes of sampling. If this is not done, the lab filters the samples of unpreserved bottles within 5 days of submission to the laboratory. Lab-filtered samples are preserved to pH <2 with nitric acid after filtration.

5. Solid samples are collected in glass containers with no chemical preservation.

6. Sample digestates are stored in plastic bottles at room temperature.

B. Sample Discard - The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and verified in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment

The following is a list of the hardware and apparatus necessary for ICP analysis. More detailed hardware information is located in the *Operator's Manuals*.

1. 15-mL graduated polypropylene test tubes with caps (certified ±1%)

2. 10-mL sterile disposable syringes

3. syringe filters, PTFE, 0.45-µm

4. 30-mL polypropylene medicine cups

5. Calibrated hand-held pipettes and tips (10 – 5000 µL) - FisherBrand or equivalent.

6. Spectrometer - The Thermo Scientific iCAP™ 6000, 6500, and 7000 series Trace Analyzer utilizes a high performance solid state Charge Injection Device (CID) camera system to deliver high contrast/low noise imaging and quantification of all wavelengths in the analytical range. With the entire spectrometer and foreoptics purged with either Argon or Nitrogen, it features a 52.91 grooves/mm grating and dual-view detector.

7. Auto-sampler – The ESI SC-14 auto-sampler and integrated "FAST" system offer increased capacity and reduce sample introduction times. The parameters for each automated run are entered into the auto-sampler table in the iTEVA™ software as described in Instrument Operation, Section A of this SOP.

8. Coolflow –The ThermoFlex™ 900 cooling device for the iCAP™ 6000 series Trace Analyzer operates at 17°C.

9. Personal computer – The iCAP™ 6000 series Trace Analyzer is controlled by PCs.

Reagents and Standards

Reagent and standard information and the preparation of the following standard and solutions are located in *T-MET-WI12063*:

Initial Calibration (ICAL)
Blank (ICIS) and Calibration Standard (STD1)
Initial Calibration Verification (ICV) standard
Continuing Calibration Verification (CCV) standard
Rinse/Carrier and Profile Solutions
Interference Check Solutions (ICSA and ICSAB)
Low Level Check (CRI) standards
Post Digestion Spike (PDS)

Serial Dilution (SD)
Linear Range Standards (LRC)
Initial Calibration Blank (ICB)
Continuing Calibration Blank (CCB)
Internal Standard Solution
Instrument Detection Limit (IDL) and MDL Solutions

Calibration

See T-MET-WI35797 for the frequency, acceptance criteria and corrective action of the ICAL, ICV, ICB, CRI, ICSA/ICSAB.

Procedure

A. Setting up an ICP run sequence file

1. Determine the batches to be analyzed and determine any special requirements by viewing Batch notes and/or Comments that are with the batch paperwork delivered from the metals prep area.

2. Complete necessary pouring for the prep batch following Section B

   a. Batches with only field blanks or equipment blanks do not need a post-digest spike or a serial dilution.

   b. "As Received" samples must be run with a blank and LCS, LCSD (prepared and documented in the LIMs system by the analyst).

3. Open run template following Instrument Operations Section 2

4. Scan samples by digestate bottle into program

5. When setting up a run, Batch QC must be placed in the same block of ten or fewer samples. If there are two LCSs, they must be placed one after the other. [The order of the batch QC is typically MB, LCS, (LCSD), BKG, PDS, DUP, MS, (MSD) and SD.]

   a. ICV/ICB must be analyzed immediately after the calibration curve.

   b. CRI, ICSA, ICSAB, CCV, CCB must immediately follow the ICV/ICB.

   c. 6010D requires analysis of LRCs prior to beginning the analytical run

   c. CCV/CCB must be analyzed after every ten analytical samples.

   d. Additional QC are added per client requirements at the end of the run: CRI, ICSA, ICSAB.

   e. Any deviations from protocol must be noted in the LIMs system

6. Edit dilution factors (DF) and auto-sampler locations as needed.

7. Remove all unnecessary QC standards by selecting individual lines and clicking on the remove samples icon at the top of the screen.

8. Save the sequence file

B. Pouring ICP samples and QC samples

It is important to minimize any chance of contamination, both of yourself and the samples. Keep your hands and the work area clean at all times. Do not re-use any pipette tips.

Run QC standards are prepared separately, and kept in separate auto-sampler racks to be obtained at the time of analysis.

1. Use the prep paperwork to document the following information when pouring samples: initials, employee number, PDS lot number, test tube lot number, filter lot number(if applicable) and the date.

2. Carefully examine the batch to ensure there are no discrepancies between the Batch Preparation Sheet and the physical placement of samples in the batch.

3. Obtain and label all required test tubes, and place them in test tube racks.

4. Prepare and label the PDS required for each new batch (sample volume permitting).

   a. A PDS is prepared using 0.2 mL of a custom-ordered PDS solution into 9.8 mL of background sample.

      i. If sample volume is limited, reduce volumes but keep ratios equivalent (i.e. 0.1 mL PDS solution into 4.9 mL background sample.)

      ii. If the background sample must be diluted, add a reduced volume of background sample and bring to volume with the appropriate matrix.

5. Prepare a DF5 serial dilution(SD) of the background sample by pipetting 2 mL of background sample into 8 mL of the matrix solution.

   a. If the background sample chosen for serial dilution has been diluted due to matrix interference or to bring the concentration into the linear range of the instrument, the serial dilution must also be diluted by 5 times the dilution factor of the background (i.e., if Bkg = DF5, S.D. must = DF25).

6. If samples need to be filtered due to cloudiness or contain particulate, then the corresponding method blank (MB) and laboratory control sample (LCS) must be filtered.

   a. Filter using a 10-mL sterile disposable syringe fitted with a 0.45 µm PTFE syringe filter.

   b. Document lot of filters on the preparation batch sheet and mark each sample lid with an "F" to indicate that it was filtered.

7. Perform any additional spiking or dilutions and document on the preparation batch sheet

8. Cover the samples with lids or with plastic wrap to prevent contamination.

9. Place the poured batch on the bench top to await analysis, or return samples to their ICP sample storage location.

10. Take **NOTE** of the following:

   a. A PDS and a serial dilution (SD) must be performed on one sample in each digestion batch unless the batch contains only field blanks or equipment blanks.

   b. Analysis information, including standard lot numbers, run number, method, analyst and date of analysis, are captured in the LIMs system

   c. Documentation is of utmost importance. Double check all entries.

   d. Dilute samples when necessary to yield a response that falls within the calibration range. When there are multiple analytes over range, only run a maximum of three tubes, the DF 1 if needed, the highest dilution required for the highest analyte, and a dilution in between.
   Exception: If analytes are over range at a DF1, and the next dilution they are ND, take the data

   e. If a batch requires re-analysis, it is acceptable to re-use dilutions and/or spiked samples that were prepared for the previous analysis. A "P" on the preparation batch sheet is used to indicate that a previously poured test tube is being re-used.

Instrument Operations

A. iTEVA™ software: The Thermo Scientific iCAP instrument is operated through iTEVA™ software. From the Start menu, select "iTEVA™ Control Center" to start the software.

1. Plasma ignition

   a. Open the plasma status window by clicking on the icon at the bottom of the screen.

   b. Verify that all parameters are within acceptable range for ignition as indicated by a green light.

   c. Ensure that the drain tubing for the spray chamber is properly connected to the peristaltic pump and positioned to drain into a waste carboy.

   d. Select "Ignite plasma". After the plasma has ignited, the instrument automatically performs optimization of the nebulizer gas pressure, and then starts the on-board peristaltic pump.

   e. If the plasma does not light, repeat steps b-d.

   f. Once the plasma operating parameters have engaged, exit the Plasma status window by clicking on Close.

   g. If the plasma has been off for more than 15 minutes let the instrument warm up for 30 minutes. If the plasma has been off less than 15 minutes, let the instrument warm up 5 to 10 minutes.

2. Automated analysis using the iTEVA™ software

   a. Open the Analyst window from the Control Center by clicking on the Analyst icon. When prompted, select the appropriate method.

   b. In the Analyst window, click on the Sequence tab at the bottom of the screen.

   c. From the Auto-session menu, select New Autosampler.

   d. The "New automation-session" window opens.

   e. Click on "New" to add a sequence and the "New sequence" window appears.

   f. Click on the "Import from delimited text file" option and choose an appropriate template or previously prepared run sequence from the drop-down menu for the run to be entered.

   g. Change the sequence name to reflect the run number, but do not change the method revision number in the parentheses.

   h.Click OK at the bottom of the New Automation session window to continue.

   i. The sequence template is loaded. When prompted in the import warning window, click OK to choose the populate the auto-sampler.

   j. Right-click on the most recent auto-sampler session and select "Auto-locate All" to have autosampler positions automatically assigned.

   k. Click on the "list view" icon and scan calibration information into the table using barcodes provided.

   l. Scan client samples into table from digestate bottle to include sample number and hand enter the dilution factor if greater than a DF1.

   m. Additional samples and QC are added using the "Add sample" and "Add QC" icons, respectively, at the top of the screen. Unused rows are removed by selecting the entire row(s) and using the "remove sample" icon at the top of the screen.

   n. Click on the printer icon and choose to print page 1 only. This printout is staples to the batch paperwork. Document on the print out the prep batch and analytical batch number.

   o. Verify that the sample list begins and ends at the correct tube numbers, and check all entries for errors.

p. Carefully examine the batch to ensure there are no discrepancies between the preparation batch sheet, auto-sampler sequence table and the physical placement of samples in the batch. Sign off on the sequence table sheet to indicate these items have been checked.

q. Click on the "Run auto-session" icon to start the run sequence. If a run sequence is to be started at a sample or standard other than the initial calibration, open auto session run using the plus sign. Open the run and use the plus sign to open the required sample or standards. Right-click on the appropriate sample or standard and choose "Start Auto-Session Run at this Sample". Deselect the reslope (or Calibration option if running Multi Point Method) and QC, then click OK.

3. Running an AutoPeak in iTEVA™

a. In an open autosampler session (autosampler must be initialized), right-click on the location of the AutoPeak solution, and choose "Go to..."

b. Click on the Analysis tab to open the Analysis window.

c. From the Instrument menu, select Perform AutoPeak.

d. Click on All elements, then OK.

e. When prompted to aspirate the high standard (STD1,ICV or CCV), click OK. The AutoPeak is now performed.

f. When the AutoPeak has finished, click on Done.

4. Manual analysis in iTEVA™

a. In an open autosampler session (autosampler must be initialized), add sample(s) to be analyzed to a new or existing sequence as detailed in section A.2 of this section.

b. To start analysis, right-click on the appropriate sample and choose "Start Auto-Session Run at this Sample" and elect not to run the "start actions."

c. When analysis is complete, results can be printed from the Analysis tab by right-clicking on the sample name and selecting "Print Sample…"

5. Performing an interelement correction (IEC) in iTEVA™

a. Prepare a solution of the interfering element at the linear range of the instrument. Perform manual analysis according to section A.4 of this section.

b. Note results of elements with a known interference that are greater than the limit of quantitation.

c. Divide the result of each interfered element by that of the interfering element. These values represent the amount the current IECs need to be adjusted.

d. In the Method window, click on Elements to expand the list of elements in the method.

e. Click on the targeted element to view the settings for that element.

f. Click on the IECs tab to view the current IECs for that element.

g. Add each calculated result to the correction factors currently in the first column corresponding to each pair of elements.

h. Enter the new correction factors in the table.

i. Repeat steps d-f as needed.

j. Click on the Save method icon to save the method.

k. For routine IECs that are completed every six months, an experienced analyst updates the LIMs database with the information provided by a calculated analytical run. For non-routine IECs the analyst must document changes in the instrument log book with updated information.

B. Import Analytical and Raw data into LIMs System

1. Right click on Run Number and select Export All Samples

2. Enter the run number, copy the run number, and hit OK.

NOTE: You will need to export the calibration file with each run number for each analytical batch

3. Go into the IDAT-Sequence folder and copy file to TALs Import folder

4. Go into TALs and find the analytical batch and obtain the designated analytical run number determined by the LIMs system

5. Go into the IDAT-Sequence folder and print text file as PDF and name PDF the same as the analytical batch

6. Sign into ShareFile

7. Go to the Personal Folders and hit the + button to add file and choose UPLOAD

8. Browse files

9. Find the analytical batch file in the IDAT Sequence folder and select Open

10. Upload file. This will now be in analyst personal Share File

11. Open TALs and open the analytical batch that is currently being processed

12. Select DOCs button on the top of the analytical batch

13. Right click in the box that pops up and choose Add New Document

14. Find your Citrix Files on the left hand side to access the Personal Folder

15. Double click on the Personal Folder to open it up to access the raw data file and choose Open

16. Click on the file and hit Select and then hit OK

17. Raw data is now attached

NOTE: For DOD samples these steps must be taken

a. Right click on run number and select edit report options.

b. Select output mode to intensity ratio for unknowns as well as QC standards.

c. Right click on run number after and post process samples.

d. Export with same name used in step 2 with "RAW" at the end of the file

e. Do this for both the Calibration file and the Sample file.

Routine Maintenance for the ICAP™ 6000 Duo Analyzer

A. Sample introduction system removal and cleaning: Remove and clean the sample introduction system when instrument performance declines (See **Figure 1**). Any adjustment to an instrument (replacement of parts, etc.) must be documented in the appropriate instrument logbook.

1. Turn plasma off and let instrument cool for approximately 5 to 10 minutes.

2. Remove spray chamber and nebulizer.

a. Unclamp spray chamber from spray chamber adapter by gently squeezing clamp with one hand while supporting the spray chamber with the other hand.

b. Gently remove the nebulizer from the spray chamber by pulling it out.

c. Disconnect the argon and sample tubing from the nebulizer by pinching the Luer lock and pulling the tubing off the nebulizer.

d. Remove the drain tubing from the spray chamber.

3. Prepare ultrasonic bath. Make sure the bath is at least ½ full with clean reagent water.

4. Clean radial cup
   a. remove gently from box by wiggling back and forth

   b. place radial cup in medicine cup and fill inside radial cup and medicine cup with matrix rinse or 1:1 HCL

   c. allow it to soak for approximately 10 minutes and then rinse off with reagent water

   d. dry radial cup and place back in torch box prior to reconnecting the torch

5. Clean torch, injector tip, and nebulizer.

   a. Invert the torch with tip assembly in a 250-mL vacuum flask of 50% HCl and place in the sonicator for approximatley 10 minutes. After sonication, rinse the torch with reagent water. (Be careful not to get a lot of water down into the base of the torch.) Carefully dry the torch with a paper towel.

   b. For a plastic nebulizer, use a syringe to force the 50% HCl solution through the nebulizer to clean and/or remove any clogs.

   c. Clean the spray chamber by filling with 50% HCL letting sit for approximately 5 minutes and then rinsing with reagent water.

6. Removal and disassemble the torch and tip if dirty or damaged (cracked,melted,ect)

   a. Gently pull the spray chamber adapter out of the torch assembly.

   b. Unlock the torch assembly by turning it clockwise and remove it from the instrument.

   c. Turn the injector tip assembly counter clockwise to separate it from the torch housing.

   d. Gently pull the center tube out of housing to clean.

Note: If the torch and tip is disassembled a torch alignment must be performed before an ICAL is ran

B. Reassemble the sample introduction system: (See **Figure 1**)

1. Torch.

   a. Inspect The o-rings on the metal torch mount and replaced if any wear or damage is visible.

   b. Push on the quartz torch to ensure that it is firmly seated in the housing assembly

   c. The circular "target" design on the torch **MUST** align with the circular notch on the torch mount.

   d. Make sure the tip is fully inserted into the center tube holder.

   e. Mount the torch assembly back into the instrument by inserting it straight through the torch hole and coil, being careful not to disturb the quartz bonnet above the radial view lens.

   f. Turn the assembly counter-clockwise to lock it into position.

   g. Gently push the spray chamber adapter into the back of the center tube assembly.

2. Reassemble the spray chamber and nebulizer.

   a. Reattach the drain tube to the spray chamber.

b. With a twisting motion, insert the nebulizer into the spray chamber so that the collar is a tight fit.

c. Attach the sample and nebulizer gas tubing to the nebulizer.

d. Clamp the spray chamber to the spray chamber adapter.

3. Ignite the plasma.

C. Changing the pump tubing: Change pump tubing on the peristaltic pump when routine maintenance is performed or when the tubing shows wear. Inspect all tubing to insure that it is secure and in good condition.

D. Documentation for instrument/analysis tag out and return to service.

NOTE: The following information is taken from QA-SOP11901: In the event of an equipment failure, the following must be performed:

1. Document the nature of the failure in the maintenance logbook

2. Document how and when the defect was discovered

3. Notification of supervisor or responsible person who can decide on appropriate action to take

4. The instrument must be clearly tagged as *Out of Service*. The tag must contain the following information:

a. Date taken out of service

b. Employee who took the instrument out of service

c. Reason for tagout

Form Q-EQA-FRM6871is used for "tagging out".

5. The date taken out of service and the date returned to service must be documented in the maintenance logbook.

6. Document any corrective action that was taken to bring the equipment back into service.

7. Results of the corrective action (i.e., system calibration within specifications, etc.)

8. Supervisory personnel must perform a documented evaluation and review of instrumentation/equipment where a major or uncommon failure has occurred to assess the potential impact the failure could have on the calibration and/or qualification of the instrument. This is done on a case-by-case basis.

9. After repair, document whether the function has been fixed. Then determine if calibration or verification activities need to be performed before the instrumentation is put back into service.

Calculations

1. Final Result

a. Water sample (mg/L)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\%\ Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Total Hardness Calculation (SM2340B), Standard Methods 2340B-2011. The calcium result (mg/l) is multiplied by a factor of 2.497, the magnesium result is multiplied by a factor of 4.118, and the two values are added together for the hardness result.

7. Trivalent Chromium (7199_CR3) water and soils. Calculation is performed by subtracting hexavalent chromium from total chromium.

8. Ferric Iron (3500_F+3_B_Calc) is calculated by subtracting ferrous iron from the total iron.

Statistical Information/Method Performance

Generate MDLs and RLs according to *QA-SOP11892*. Perform an MDL study on each instrument used for the analysis. Determine the MDL by taking seven spiked replicates through the entire digestion and analysis procedure. Compare and pool results to determine the final reporting MDL. The department supervisor maintains annual study data. The department supervisor requests that a Quality Assurance Specialist update to the LIMS as needed. Update the department database via a download from the LIMS.

QC acceptance limits (MS, MSD, LCS and LCSD) are established as statistical limits (see *QA-SOP11896* for guidance). Limits are evaluated every 6 months by the department and updated in LIMS by QA as directed by the department supervisor.

Quality Assurance/Quality Control

A. For 6010B, 6010C, and 6010D each digestion batch (up to 20 samples) must contain a method blank (MB), LCS, unspiked sample (BKG), Duplicate (DUP), MS, and MSD. If there is not sufficient sample or per client requirement and LCSD is included.

B. For 200.7, each digestion batch (up to 10 samples) must contain a MB, LCS, BKG, DUP, and MS. If there is not sufficient sample or per client requirement and LCSD is included.

C. Batch Quality Control - For the preparation and concentrations see *T-MET-WI12063* and for the frequency, acceptance criteria and corrective action see SOP T-MET-WI35797.

D. Data Quality Checks

1) For SPLP and TCLP samples, an MSA (method of standard additions, EPA 1311 section 8.4.2, EPA 1312 section 8.4.2) is required if:

a. The sample concentration falls between 80% to 100% of the regulatory limits, AND

b. The SPLP or TCLP Matrix Spike (QA) recovers < 50%.

2) For all EW samples (samples from public drinking water sources); check the results against the MCL (maximum contaminant level). If an analyte **exceeds** the MCL, notify a verifier at once. An automated email is sent to the Client Service Representative and the state for the analytes listed in QA-SOP11886. Suppliers must be notified within 24 hours.

F. When raw data checks are complete, check the following:

1. All samples requiring reread/redigestion are listed on the reread/redigestion schedule forms. Any dilutions required have been calculated correctly and added to the reread/redigestion form. Specific instrument has been noted for client requirements if necessary.

2. Data for samples following Good Laboratory Practices (GLP) must be retained as permanent storage.

G. Instrument detection limits are performed when an instruments detector is changed or a new instrument is added to the lab. Method detection limits (MDLs) follow guidelines in SOP ***QA-SOP11892***. Inter-Element Correction factors (IECs) are checked routinely every 6 months for each analytical instrument. Linear ranges are verified semi-annually.

H. For data review reference SOP T-MET-WI35797

Appendix I

Definitions and explanations of the codes and symbols used on the raw data

A. Sample table information

1. The run number.

2. The page number.

3. The tube number.

4. The sample number.

5. The first and second of four asterisks denote whether the sample is a background (U*), duplicate (D*), spike (R*), MSD (M*), post-digestion spike (UP), serial dilution (UL), or not a QC sample (**).

6. The weight to volume or volume to volume digestion ratio, consisting of the initial quantity of sample used and the final digest volume.

7. The dilution factor – Indicating if the digest solution was diluted prior to analysis. An undiluted sample is labeled DF1.

8. Digestion batch number – Assigned when designated samples are scheduled for preparation, this number is used to track samples and QC prepared together.

9. The protocol by which the data is reviewed (SW-846, EPA-600).

10. Date and time of the sample injection into the instrument.

11. The ICAP identification number.

B. The ICP scans all of the method elements simultaneously during the analysis. The QC review lists all the samples on the run. The QC review lists elements verified, good phantom, and elements/phantom that are bad (need to be reread for run or batch QC). The reviewer or verifier documents on the QC review if any element(s)/sample(s) were selected/deselected.

C. The following are error codes in the iTEVA™ software.

1. S = Saturation – The concentration of the element is more than the detector can quantify.

2. K = The Elements Affected by a Saturated Element – The concentration listed is not accurate, and a more accurate result can be obtained by running the sample at a dilution.

D. Along with the average concentration (in ppm), the average intensity, %RSD and all three replicates are shown for each analyte. Internal standard values are intensities (cts/s).

Attachment:
Figure 1 (.doc)

10695 Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits
12063 ICP Solutions and Standards Preparation
35797 Metals Data Verification Process
9082 Working Instructions for Prep Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
13	12.JUL.2019		
14	23.NOV.2020		
15	09.MAY.2022		

eurofins	Always check on-line for validity. **Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)**	Level: **Work Instruction**
Document number: **T-MET-WI11933**		
Old Reference: **1-P-QM-WI-9018443**		
Version: **13**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **27-JUL-2022**	Document users: **6_EUUSLA_Metals_ICP-MS Analysis, 6_EUUSLA_Metals_ICP-MS Analysis Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment testing, LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Routine Methods
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Figure I - Daily Performance Acceptance Criteria and Tuning Solution Concentrations

Revision Log

Revision: 13	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout	Combined SOPs	Removed cross references to T-MET-WI11939.
Procedure E.2.	Enhancement	Added note to reference Internal Standard Attachment.
QAQC 11.	Enhancement	Added note to reference Internal Standard Attachment. Added reference to Verification SOP.
Attachment	Enhancement	Attachment references internal standards used for analysis

Revision: 12	**Effective Date:**	This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Throughout	Update to current LIMS	Updated method references to current LIMS
Throughout	Combined SOPs	Combined with T-MET-WI18027 and T-MET-215089
Cross Reference	Updated document list	Updated document list to reference combined 7700 and 7900 maintenance procedures into T-MET-21590, and combined operations procedures into this procedure

Revision: 12	**Effective Date:**	This version
Section	**Justification**	**Changes**
Cross Reference	Formatting requirement per G-DC-FRM7674	Added prep procedure cross references associated with this analysis and removed higher level references that are not required.
Scope	Added Clarification	Added RL is same as LOQ
Sample Collection, Preservation, and Handling	Reflects current protocol	Updated to reference water digestion and prep SOPs, and updated temperature for stored aqueous samples.

Reference

1. Method 200.8 (rev 5.4), Determination of Metals and Trace Metals in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry, USEPA 600/R-94/111 May 1994.

2. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020, September 1994.

3. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020A, February 2007.

4. Test Methods for Evaluating Solid Wastes, SW-846 Method 6020B, Rev. 2, July 2014.

5. ESI SC Manual.

6. Agilent 7700 and 7900 Series ICP-MS MassHunter Workstation Guide and Hardware Maintenance Manual.

7. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI12065	Working Instructions for Preparation of ICP-MS Solutions and Standards
S-SS-WI10695	Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
T-MET-WI21590	Instrument Maintenance for Agilent 7700 and 7900
T-MET-WI35797	Metals Data Verification Process
T-MET-WI11925	Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples
T-MET-WI11938	Digestion of Waters by EPA 200.7/200.8 for the Analysis of Metals in Water by ICP or ICPMS
T-MET-WI11941	Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS)
T-MET-WI8636	Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS
T-MET-WI8639	Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS
T-MET-WI8732	Lab and Field Filtered Waters and <1NTU Drinking Water Preparation for ICP (EPA 200.7, 6010B/C/D) or ICP-MS (EPA 200.8, 6020/A/B)

Scope

This procedure applies to analyses performed at Eurofins Lancaster Laboratories Environmental (ELLE) using ICP-MS for identification and quantitation of metallic constituents.

Aqueous undigested samples and digestates (aqueous and solid matrices) are analyzed via this SOP.

Limits of Quantitation (LOQs/RLs), Method Detection Limits (MDLs) and linear ranges are maintained in the LIMS. These are subject to change without notification.

This procedure is used for analysis and instrument operation for the Agilent 7700 and 7900 series ICPMS instruments.

Routine Methods

Analyte	Mass
Be	9
B	11
Na	23
Mg	24
Al	27
K	39
Ca	44
Ti	47
V	51
Cr	52

Mn	55
Fe	57
Co	59
Ni	60
Cu	63
Zn	66
As	75
Se*	78
Se**	82
Sr	88
Mo	98
Ag	107
Cd	111
Sn	120
Sb	121
Ba	137
Tl	203
Pb 206	206
Pb 207	207
Pb 208***	208
U	238
*Se 78 is the mass reported from collision cell ICPMS only **Se 82 is the mass reported from non-collision cell ICPMS only ***For Pb masses 206, 207 and 208 are summed for calibration and analysis	

Basic Principles

ICP-MS is an analytical instrument that uses the energy of inductively coupled plasma to generate ions to be analyzed in the mass spectrometer.

The instruments use a discrete sampling system that first loads the sample into a Teflon sample loop. The sample is then pushed by a carrier solution using a computer controlled peristaltic pump that delivers the sample from the loop into the nebulizer attached to a cooled Scott double pass spray chamber.

The Agilent 7700 (E05) and 7900 (E07/E08/E09) can analyze samples in 3 different modes of operation, although typically analysis is done in 3 mode or No Gas mode only:

1. Mode 1 – no gas. This mode does not use a collision or reaction gas. Elements with a low atomic mass or that have no interferences can be analyzed using the "no gas" mode.

2. Mode 2 – Hydrogen (H_2) mode. This mode uses H_2 as a reaction gas, since it reacts quickly and efficiently with the Argon-based interfering species, but reacts slowly or not at all with the analyte(s) of interest. In this mode, interferences can be reduced to the level of baseline noise, allowing lower detection limits to be achieved for some difficult elements.

3. Mode 3 – Helium (He) mode. This mode uses He as a collision gas for reliable, predictable removal of unknown matrix interferences. No new interferences are formed in the cell, and no analytes are lost by a reaction.

Interferences

ICP-MS interferences include isobaric elemental interferences and polyatomic ion interferences derived from the plasma gas, reagents, and/or sample matrix. The Agilent 7900 utilize helium as an inert collision gas to reduce or eliminate many types of polyatomic ion interferences.

Physical interferences caused by the change in sample matrix affecting sample transport and/or nebulization must be compensated for using internal standardization.

Memory interference is the contribution of analyte signal from a previous sample onto the next sample analysis. Adequate rinse time with an appropriate rinse solution of the sample introduction system overcomes any memory interference.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state and local laws and regulations.
See the *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Hydrochloric acid (HCl) – This acid can cause skin burns. Only mix with approved solutions. Always use this chemical in a fume hood.

Hydrofluoric acid (HF) – This acid is very toxic and absorbs through the skin without pain. This acid is found at trace levels in standard solutions.
Hydrogen Peroxide 30% (H2O2) **-** This oxidizer can cause skin burns. Always use in a fume hood.

Nitric acid (HNO3) – This acid can cause skin burns and burning of the respiratory tract. Add nitric acid to samples in a fume hood to avoid exposure to toxic fumes.

When diluting strong acids, never add water to acid; always add acid to water.
Store concentrated acids in the prep room acid cabinets. Only acids are to be stored in these cabinets. Flammable solvents are stored in flammable liquid storage cabinets. Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Large spills are cleaned by HSE. For large spills of concentrated acid, immediately evacuate the area and dial 1-1-1. HSE will use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.)

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each analyst performing the instrumental analysis must work with an experienced analyst for a period of time until they can independently calibrate the instrument, use the sequence editor to set up the run, perform calculations, interpret raw data, and enter/transfer data into the LIMS. Proficiency is measured through documented audits of the tasks listed, and checking of data as well as an IDOC (Initial Demonstration of Capability) and continued DOCs (Demonstration of Capability) as defined in *QA-SOP11178*.

The IDOC consists of four laboratory control samples (LCS) that are carried through all steps of the prep and analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation.

Sample Collection, Preservation, and Handling

Aqueous undigested samples, aqueous digestates, and solid digestates are analyzed via this SOP. Samples must be analyzed within 6 months of collection for all methods in this SOP.

Aqueous samples are collected in plastic or glass containers. Drinking Water samples are collected in 1-L plastic or glass containers. Aqueous samples are preserved with nitric acid with a pH of < 2 and stored at 0° to 6°C, not frozen, or at room temperature.

Aqueous digestates are digested per the method in *T-MET-WI11938* (aqueous samples 200.8), *T-MET-WI8639* (aqueous samples 3005A). Aqueous non-digested samples are prepared per the method in SOP *T-MET-WI8732* (lab and field filtered waters and <1NTU Drinking water). Aqueous samples are stored in 50 ml plastic vials at room temperature.

Solid samples are collected in glass containers and stored at 0° to 6°C, not frozen. Digestates are digested per the method in SOP *T-MET-WI8636*. Solid samples are stored in 100 ml plastic vials at room temperature.

Store standards and digestates separately.

The general practice in the metals group is to discard the digestions after all the required metals from a batch of samples have been analyzed and lab completed in the LIMS. Samples which require the digestate to be held for long term storage are periodically evaluated for discard.

Apparatus and Equipment

A. The following is a list of the hardware used in the Agilent 7700 and 7900 ICP-MS systems.

1. Inductively Coupled Plasma Mass Spectrometers (ICP-MS)

   a. The Agilent 7700 and 7900 - The sample introduction system consists of an ESI FAST discrete sampling system, Teflon nebulizer and cooled spray chamber attached to a concentric quartz tube plasma torch.

2. Autosampler

   a. The Agilent 7700 and 7900 (E08) systems use an ESI SC-8 FAST autosampler. The Agilent 7900 (E07 & E09) systems use an ESI SC-14 FAST autosampler. The autosampler parameters for each automated run are entered into the Sample List in MassHunter software.

3. Coolflow

   a. The Agilent 7700 and 7900 G3292A Recirculating Chillers are set up to deliver cooling liquid to the ICP-MS at a regulated pressure of ~40 psi.

4. Computer

   a.The Agilent 7700 and 7900 are controlled by a Windows-based IBM compatible PC with MassHunter software installed.

5. Vacuum Pumps

   a. The Agilent 7700 and 7900 both have a 2-stage vacuum system. A rotary pump evacuates the interface chamber; a turbo molecular pump evacuates the ion lens chamber and the analyzer chamber.

B. The following is a list of the apparatus necessary for the setup of an ICP-MS run for analysis:

1. ICP-MS prep batch sheets.
2. Test tube racks
3. Graduated 15-mL polypropylene tubes and caps
4. 50-mL polypropylene screw cap tubes
5. FilterMate 2 µm filters and plungers
6. 10-mL sterile disposable syringes
7. 25-mm syringe filters, PTFE, 0.45µm
8. 30-mL polypropylene medicine cups
9. Fixed volume hand-held pipettes (25 – 2000 µL) - Eppendorf or equivalent.

NOTE: For routine operation, calibration, and maintenance of fixed-volume, hand-held pipettes, see *QA-SOP11880*.

Reagents and Standards

Refer to Form *T-MET-WI12065* for reagent and standard information and the preparation of the following standards and solutions

1. ICP-MS Calibration Standards and ICP-MS LOQ Check Standard Solution (CRI)
2. ICP-MS Initial and Continuing Calibration Verification Standards
3. Interference Check Solutions

4. Rinse/Carrier, Tuning, and Calibration Solutions
5. Internal Standard Solution
6. PDS Solutions
7. General Acids and Chemicals

Calibration

Before calibration is performed, allow the instrument to warm up for the recommended time, usually at least 15 minutes, if the plasma has been off for 15 minutes or less, or at least 30 minutes if the plasma has been off for more than 15 minutes. Daily tuning requirements must be performed prior to calibration of the instrument and after warm up occurs. Full Tuning and Optimization is done as needed, or when required by the Group Leader or Manager.

Calibration is performed daily. Calibrations consist of a blank and one to three standards, followed by analysis of an ICV, ICB, CCV, CRI, ICSA/ICSAB, LRC, CCV, and CCB.

A single point calibration, consisting of a blank and one standard, is used for all analysis, except Non-TNI samples requiring a multi-point calibration (either MA MCP or CT RCP protocol or a lab note indicating a multi-point calibration is needed). For samples requiring a multi-point calibration the calibration consists of a blank, "S1", "S2", and "S3" standards. The concentrations of the calibration standards are defined in *T-MET-WI12065*.

For data review, acceptance criteria, and corrective action, see *T-MET-WI35797*.

Procedure

A. Instrument Start Up

This procedure is the same for the Agilent 7700 (E05) and the 7900 (E07/E08/E09) instruments.

1. Power on the ESI autosampler and start the ESI software.

2. Make sure the instrument is powered on before starting the ICP-MS software – the light on the front of the instrument will be red (shutdown mode), orange (standby mode) or green (analysis mode).

3. If the instrument is powered down: flip the main power switch on the back of the instrument to the on position, and then make sure the Foreline Pump (red switch) is also in the on position.

4. Make sure the recirculating chiller power switch is in the on position. If the orange light on the front of the chiller is on, you will need to turn off the chiller and add coolant before turning the chiller back on.

5. Verify that the program is in Online mode – the Hardware tab will have a green check mark if it is online.

6. If the Hardware tab has a red x instead of the green check, click on the arrow down in the Hardware tab and select Communication. Select Online and click OK.

7.Check the Instrument Status pane. The instrument should be in one of three modes: Shutdown (plasma and vacuum off, red light on the front of instrument); Standby (plasma off but vacuum on, orange light on the front of instrument); Analysis (plasma and vacuum on, green light on the front of instrument).

8. If in Shutdown mode click on the Hardware tab arrow down and select Vacuum On – the Foreline pump will start and the instrument will transition to Standby mode.

9. Once Standby mode has been reached select Plasma On from the Plasma tab arrow down.

10. When asked if you want to "Run 'Startup' after plasma ignition?", select No.

11. The plasma will ignite and the instrument will transition to Analysis mode.

12. Once Analysis mode is achieved you must allow the instrument to warm up for at least 20 minutes before running the EPA Daily Tune check sample.

B. Running the Daily Tune Check

1. To run the EPA Daily Tune check place both probes into the EPA Tune Solution and allow sufficient time for the solution to flush through both lines.

2. Make sure the FAST valve is in the LOAD position.

3. Once the EPA Tune Solution is aspirating into the spray chamber take the following steps to start the EPA Daily Tune check.

4. Click on the arrow down for the Batch tab.

5.Open the batch "~ICPMS.b" by clicking on the file in the drop down menu or the pop up menu if necessary.

6. In the Batch pane select the Acq Method tab then the Tune tab.

7. Right click in the Signal Monitor grid and select Report, then Generate Tune Report.

8. In the window that appears verify that the Report Template selected is as follows:

C:\Agilent\ICPMH\Report Templates\en\Letter\Tune Report\TuneCheckReport.xltx

9. Click Generate. The software will acquire the tune check data from the instrument and a report will be printed.

10. If the EPA Daily Tune fails any of the criteria rerun the tune a second time. If it fails a second time take corrective action before running the EPA Daily Tune check again (maintenance or optimization of tuning parameters).

C. Sample analysis

1. Once the EPA Daily Tune passes all criteria, place the internal standard probe in the internal standard solution and place the carrier probe into the carrier solution.

2. Once the carrier and internal standard solution have flushed through the tubing and are

aspirating into the spray chamber, sample analysis can begin.

3. In MassHunter open the method batch file used for analysis. Use ~ICPMS.b for non-potable waters and solids analyses, and ~ICPMS_nogas.b for drinking water analysis.

4. Save the batch with a new name:

YYMDDR## where:

YY is the two digit year
M is the letter of the alphabet corresponding to the month (A for January, B for February, etc.)
DD is the two digit day of the month
R is the letter of the alphabet that changes for each attempted run sequence

Example: For the first run started on March 19 in the year 2012 the batch folder would be named 12C19A01.b

5. Enter the calibration standards and lot numbers in the order of:

ICV/ICB/CRI/ICSA/ICSAB/LRC(s)/Rinse(s)/CCV/CCB

6. Scan all samples into the sample list and add PDS/SD and/or dilutions as needed.

7. Add a CCV/CCB block after every 10 samples (or ending the run) as well as an ending CRI/ICSA/ICSAB as needed per method or project note.

8. Enter the locations of the samples to match the rack in which they will loaded onto the auto-sampler. Ensure that the order of the samples on the batch paperwork/re-read sheet match the order in which they are loaded.

9. Right click on the sample list and print a copy.

10. Use the print out to confirm the sample ID(s) and locations of the samples on the auto-sampler.

11. Load the auto-sampler based off of the printed out sample list. Sign off on the sample list with your initials, employee number and the date.

12. Keep the sample list with the batch(es) paperwork until the batch is imported into the LIMS. Note the analytical and prep batch(es) numbers on the sample list and give to the Group Leader.

D. Pouring an ICP-MS run (Waters only in 50 mL digestion tubes):

It is important to minimize any chance of contamination, to both yourself and the samples. Keep your hands and the work area clean at all times. Wear appropriate PPE at all times to prevent exposure to chemicals and samples including lab coat, gloves, and safety glasses, and additional PPE as required by project or health and safety.

NOTE: See Form *T-MET-WI12065* for standards and solutions used during the analytical run.

1. Choose the appropriate prep batch sheet.

NOTE: When retrieving the batch from the shelf for the first time, record the batch location on the cap of the prep blank in black sharpie. This saves time when returning the batch to the proper location after analysis and shows that the batch has been poured before and verified to be in the correct order. To prevent more than one batch from being assigned to the same location, the digestion trays all have the location written on the foam holder.

2. Verify that each digestion tube is in the correct order according to the prep sheet. If anything is missing, correct the prep sheet and notify PREP or the Group Leader to correct the LIMS and put the sample back in for digestion. If the order is incorrect, reorder the sample digestion tubes to match the paperwork.

3. For batches prepared in hot blocks in 50-mL digestion tubes or prepared by the MTL_ND method:

a. The only tubes that typically need to be poured for the initial run are the post digestion spike (PDS) and serial dilution (SD)samples. These are prepared using the background sample (BKG) or the duplicate background sample (DUP) when limited sample volume is available.

b. All other samples remain in the 50-mL digestion tubes for analysis.

4. Samples that need to be poured into test tubes:

a. Obtain the appropriate number of tubes.

b. Write the last four digits of the sample number and the dilution factor if greater than 1 on each tube. If the MB or LCS must be in tubes, write MB/LCS and the prep batch number/location on the tubes.

c. Place tubes in test tube racks in the same order as the samples on the prep batch cover sheet and/or re-read.

d. The analyst must ensure that tubes are labeled correctly, that dilutions are performed accurately, and that the dilutions are recorded on the prep cover sheet and/or re-read.

5. Post-digest spike (PDS):

a. A PDS is required for each batch (sample volume permitting).

b. A PDS is prepared by pipetting 0.2 mL of the appropriate PDS solution into a 15-mL graduated test tube, and bringing it to a volume of 10 mL with the background sample, "BKG". If the PDS must be diluted, pipette 0.2 mL of the PDS solution into a 14 mL graduated test tube, add the appropriate amount of background sample, "BKG", and dilute to 10 mL using matrix rinse. If there is limited volume for the background sample, "BKG", then the "DUP" may be used for dilutions of the PDS or SD. If the duplicate is used for PDS or SD, make an internal NCM on the analytical batch after analysis.

c. Record the lot number of the PDS solution used on the prep batch cover sheet and/or re-read.

6. Serial dilution (SD)

a. Prepare the SD by diluting the background sample at a dilution that is equal to 5× the dilution factor of the PDS sample (i.e.if PDS= DF1, SD must = DF5; if PDS=DF5, SD must=DF25).

7. Filtering samples

a. Samples that are cloudy or have particulate suspended in solution must be filtered prior to analysis to prevent clogging of the sample introduction system, which causes run failures and instrument down time to correct the problem.

b. Samples that are in the 50-mL digestion tubes may be filtered using the FilterMate filtration devices and plunger or a syringe and syringe filter.

c. Attach a filtration device to the plunger and very carefully insert the filter into the digestion tube until the filter reaches the bottom of the digestion tube.

d. Remove and discard the plunger.

e. An alternative for samples in any type of vessel is to filter using a 10-mL sterile disposable syringe fitted with a 0.45µm PTFE syringe filter.

f. If any samples are filtered, the MB and LCS must also be filtered. If any QC sample is filtered (BKG, DUP, MS, or MSD), then all QC including the MB and LCS must be filtered.

g. Document all filtrations on the prep batch cover sheet.

NOTE: It is not necessary to filter all samples (in 50 mL digestion tubes only) that contain particulate, as long as all of the particulate is settled to the bottom of the tube below the 5-mL mark in 50-mL digestion vessels. The sampling depth of the autosampler probe is set such that the tip of the probe is approximately 100 mm above the bottom of the digestion tube. It is necessary to filter all solid samples and to dilute to DF2 prior to analysis.

8. Verify that all samples in the hotblock tray are in the correct position and/or pour each sample (or sample filtrate) into the appropriate tube. Usually, the order of the batch QC is MB, LCS, (LCSD), Bkg, PDS, DUP, MS, (MSD), and SD. Most importantly, the actual positions of the samples in the tray must match the autosampler table used for analysis.

NOTE: Immediately prior to beginning analysis, the analyst must visually verify that each sample is in the position indicated in the autosampler table used for the run.

9. If not being analyzed immediately, cap any poured tubes to prevent contamination of the samples (digestion tubes and dilutions prepared in graduated test tubes must be capped tightly except during pouring and/or analysis).

10. Return samples to sample storage, being sure to place the batch back into the location recorded on the prep batch sheet.

11. Record the following on the prep batch cover sheet: initials, employee number, and the date, and lot numbers for PDS, filters, test tubes, as used).

12. NOTES:

a. A PDS and a SD are performed on one sample in each digestion batch. Typically, the background sample is chosen. If the batch QC is split between two samples, the PDS is performed on the background sample accompanied by a matrix spike; the SD is performed on the background sample accompanied by a matrix duplicate. If sample volume is limited, it is acceptable to use the duplicate for the PDS and SD.

b. Batches with only field blanks or equipment blanks do not need a PDS or a SD.

c. Air filter batches need only a SD on one sample in the batch (a PDS is not required).

d. “As Received” samples are analyzed with a blank and LCS, LCSD (prepared by the analyst).

e. Documentation is of utmost importance. Verify all entries.

E. Data analysis and Import

1. Once the sample run is complete you will switch to or open the Offline ICP-MS Data Analysis program to make any changes to internal standard selection and generate the file for import into LIMS. Note, the Attachment Internal Standard Reference includes the appropriate internal standards to reference for each metal.

2. Once in the Offline ICP-MS Data Analysis program open the batch that contains the run data you are going to process by clicking Open Analysis File (open folder icon or from the File drop down menu).

3. Evaluate appropriate internal standard selection based on the Quality Control section of this SOP and method requirements for the samples analyzed.

4. If it is appropriate to change internal standard selection from the defaults in the method used click the DA Method Editor button (skip to step e. if alternate internal standard selection is not needed).

a. Under Method Development Tasks (in the left pane of the DA Method Editor window) select “FullQuant” under item number 4 (Set up Analysis Parameters).

b. Under the analyte list that appears in the right hand pane of the DA Method Editor you will see a list of the analytes.

c. Change internal standards for any analytes where alternate internal standard selection is both necessary and appropriate.

d. Then click “Return to Batch-at-a-Glance” in the left hand pane.

e. When prompted to “Update Analysis Method?” select “Yes”.

f. Click the “Process Batch” button to recalculate all concentration values in the batch folder using the internal standard selections you made while in the DA Method Editor.

5. To generate the file for import into LIMS you must first select all the data rows needed for your run, starting with the ICIS down to the last row in your run. If you restarted the run only select the most recent ICIS and all samples below it.

6. Once the appropriate rows of data are selected click on Tools and select “Upload to TALs” to run the script that compiles the file for import.

7. A pop up will appear once the script is complete stating that the file was created successfully. While the batch is still highlighted click on the Report tab. Generate the raw data PDF's and save them into the respective run's folder.

8. Open the ITUNE app and select the .rep file that was generated along with the tune file for that day. This will generate a new .rep file that will then be copied to the import folder. This will put the run into the LIMs system.

Calculations

1. Final Result

a. Water sample

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Volume}}$$

b. Solid sample (mg/kg)

$$\text{Instrument Reading} \times \frac{\text{Dilution Volume}}{\text{Aliquot Volume}} \times \frac{\text{Final Volume}}{\text{Sample Weight (grams)}}$$

2. Relative percent different (RPD)

$$RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value

D = duplicate sample value

3. Spike recovery

$$\%\ Recovery = \frac{SSR - SR}{SA} \times 100$$

Where:

SSR = spiked sample result

SR = sample result

SA = spike added

4. Correlation Coefficient

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Where :

X = the known concentration

Y = the instrument response

N = the total number of data points

5. Serial Dilution

$$\%\ Difference = \frac{(5 \times SDR) - SR}{SR} \times 100$$

Where:

SDR = serial dilution result

SR = sample result

6. Methods of standard additions (MSA)
Take either 4 identical aliquots (for 3 point MSA) or 2 identical aliquots (for one point MSA) of the same sample. Leave one unspiked. Spike the other 3 aliquots with different levels of a standard solution (for 3 point MSA) and spike the other aliquot at approximately the indigenous concentration of the sample (for one point MSA). Add blank solution to sample aliquots so that the final volume is the same for all. Use small volumes of spiking solution to avoid diluting the sample more than 10%. Analyze the 4 aliquots or 2 aliquots and record the instrument readings in absorbance. Use the readings and spike values to find the slope and x- and y- intercepts. The x- intercept is the result.

$$\text{Slope} = m = \frac{\sum x_i y_i - (\sum x_i \sum y_i)/n}{\sum x_i^2 - (\sum x_i)^2/n}$$

$$\text{Y-Intercept} = b = \bar{y} - m\bar{x}$$

$$\text{Result} = -\frac{b}{m}$$

$$\text{Correlation Coefficient} = r = \frac{\sum\{(x_i - \bar{x})(y_i - \bar{y})\}}{\sqrt{\left[\sum (x_i - \bar{x})^2\right]\left[\sum (y_i - \bar{y})^2\right]}}$$

The correlation coefficient (r) for the least squares fit must be ³0.995. If the r value is <0.995, the MSA must be repeated at the same dilution. If the r value is again low, the result with the higher r value is verified and both are flagged with a "+" in the data package. If the r value is <0.990, the sample is run at an interference dilution to overcome matrix effects. This usually requires a raised limit of quantitation. If a client requests a particular limit of quantitation that prohibits further dilution, then the sample is repeated at the same dilution and the best of the two results is verified.

7. Average, Standard Deviation and Relative Standard Deviation

The average result, $\bar{x}$, is calculated by summing the individual results and dividing this sum by the number (n) of individual values:

$$\bar{x} = \frac{x_1 + x_2 + x_3 + x_4 + \ldots x_n}{n}$$

Standard deviation is a measure of how precise the average is or how well the individual numbers agree with each other.

$$\text{Standard deviation, S} = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n-1}}$$

Relative standard deviation (RSD) is expressed in percent and is obtained by multiplying the standard deviation by 100 and dividing this product by the average.

$$\text{Relative standard deviation, RSD} = \frac{100 \times S}{\bar{x}}$$

Statistical Information/Method Performance

Generate MDLs and LOQs according to *QA-SOP11892*.

The department principal scientist and manager maintain annual study data. The department principal scientist, manager, and/or group leader requests that a Quality Assurance Specialist update to the LIMS as needed by department email.

Refer to *QA-SOP11896* for statistical information.

Quality Assurance/Quality Control

A. For 6020, 6020A and 6020B, each digestion batch (up to 20 samples) must contain a method blank, LCS, and either an BKG, DUP, MS, MSD or an LCS/LCSD (limited volume or approved by manager and QA only).

B. For 200.8, each digestion batch (up to 10 samples) must contain a method blank, LCS, and either an BKG, DUP, MS or an LCS/LCSD (limited volume or approved by manager and QA only). An additional BKG and MS are added for batches over 10 samples up to 20 samples.

C. QC limits for MS/MSD, and LCS/LCSD are established through statistical analysis of historical data.

1. The limits are maintained in the LIMS in Method Limit Groups.

2. The limits are evaluated every 6 months and updated as needed.

3. The limits are subject to change without notification.

D. Batch Quality Control

1. For the preparation and concentrations of Quality Control samples see *T-MET-WI12065*.

2. For the frequency, acceptance criteria and corrective action see *T-MET-WI35797*.

E. Raw data quality checks

1. Make sure that the run is correctly labeled, and dated and that the corresponding prep sheet is attached to the run.

2. Verify that the appropriate Tuning Report is with the run.

3. For run and batch QC/Calibration frequency, acceptance criteria and corrective action, see *T-MET-WI35797* tables.

4. Spike levels of batch QC are available in the LIMS and on T-MET-WI9082.

5. LOQs (RLs), MDLs, and IDLs are available to analysts in the LIMS in Method Limit Groups and Equipment Limit Groups.

6. Check to make sure that all results are not> 90% of the Linear Range, according to LIMS Equipment Limit Groups. If a sample reading is above 90% of the linear range, then reread the sample at a dilution sufficient to bring the sample concentration to approximately the middle of the calibration range.

7. Check that the **absolute** value of all non-detected analytes is less than the RL. A technical decision must be made as to whether a reread is warranted for readings <|RL|.

8. Check for carryover between samples. Sample RSD >20%, with a concentration > the LOQ decreasing progressively over time (i.e., Reading 3<2<1). Flag any suspect samples for reread.

NOTE: Whenever a sample is encountered that exceeds the calibration range, the following sample must be checked for carryover for the over range analyte (s) and any suspect results must be deselected and reanalyzed. During reanalysis the sample order must be modified as needed to avoid carryover from any over range sample(s).

9. For all EW (samples from public drinking water sources), highlighted mint green in the LIMS, check the results against the MCL (maximum contaminant level) by reviewing the limits tab in analyst desktop II. If an analyte **exceeds** the MCL, is a certified analyte for the SDWA method, and is associated with a mint green compliance drinking water sample, notify the verification group at once by NCM or email. An automated email is sent to the Client Service Representative and the state for the analytes listed below with the exception of Pb and Cu which follow the 90th percentile rule (the CSR tracks the lead and copper and notifies the supplier when necessary). Suppliers must be notified within the required time limit as stated in QA-SOP11886.

10. To avoid the risks associated with polyatomic interferences in wastewater and soil matrices all analytes must be analyzed on the collision cell ICP-MS instruments which include Agilent 7900, Equipment E07 - 27813, Equipment E08 - 30647, Equipment E09 - 30921).

a. Because EPA 200.8 rev. 5.4 does not currently allow the analysis of drinking water samples using collision cell ICP-MS all drinking water samples must be analyzed using a method with no gas mode for all analytes on the Agilent 7700, which includes Equipment E05 - 19204.

11. Check the internal standard level for the entire run. Reference the Internal Standard Reference attachment in this SOP for the appropriate internal standards to use for each metal. If the internal standard reading for any sample is out of the acceptance range of the S0 reading, evaluate whether this is a result of the sample matrix or drift from other samples in the run. Only reread the sample at a dilution if the internal standard appears to be out of range due to the sample matrix. For samples where an internal standard is above the acceptance range it is acceptable to reprocess the data using an alternate internal standard. This is the preferred approach in order to avoid raised reporting limits. The acceptance criteria differ based on the method being used. Refer to *T-MET-WI35797* for the method acceptance criteria.

NOTE: The internal standard is added in equal concentration to all of the samples and standards via a dedicated line on the peristaltic pump. The analytical lines referenced to an internal standard report a corrected concentration value based on the ratio of analyte to internal standard intensities. All the calculations for determining concentration are based on Intensity Ratio (IR). The IR is defined as the background corrected intensity signal of the analyte line (Ia) divided by the internal standard value (Iis). IR= Ia/Iis.

12. For TCLP and SPLP samples, an MSA (method of standard additions) is required if:

a. The sample concentration falls between 80% and 100% of the regulatory limit.

b. If the TCLP or SPLP matrix spike (QA) recovers <20%, all samples in the leachate batch must be reanalyzed using the method of standard additions for that analyte.

13. When items 1 – 12 are complete, check the following:

a. All samples requiring reread/redigestion are listed on the reread paperwork, and redigestions are communicated to the verification group by email.

b. The data are uploaded to LIMS via data transfer to TALS.

Figure I - Daily Performance Acceptance Criteria and Tuning Solution Concentrations

Be (9)	10 or 100 PPB
Mg (24)	10 or 100 PPB
Co (59)	10 or 100 PPB
In (115)	10 or 100 PPB

Pb (208)	10 or 100 PPB
CeO/Ce	<3%
Ce++/Ce	<3%
Background	<30 cps @ Mass 220
RSD	<5%
Peak Width at 10% Peak Height	<0.9 AMU
Res/Axis	< +/- 0.1 AMU from unit mass

Attachment:
Internal Standard Reference (.pdf)

10695 Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8
11178 Demonstrations of Capability
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
11892 Determining Method Detection Limits and Limits of Quantitation
11896 Establishing Control Limits
11901 Instrument Maintenance and Calibration
11925 Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples
11938 Digestion of Waters by EPA 200.7/200.8 for Analysis of Metals by ICP/ICPMS
11941 Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS)
12065 Working Instructions for Preparation of ICP-MS Solutions and Standards
21590 Instrument Maintenance for Agilent 7900
35797 Metals Data Verification Process
6869 Nonconformance Form
8636 Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS
8639 Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS
8732 Lab and Field Filtered Waters and <1NTU Drinking Water Preparation for ICP (EPA 200.7, 6010B/C/D) or ICP-MS (EPA 200.8, 6020/A/B)
8822 ICPMS Analysis

End of document

Version history

Version	Approval	Revision information	
11	12.NOV.2020		
12	15.APR.2022		
13	27.JUL.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-MET-WI11941**	**Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS)**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015159**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **08-FEB-2022**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Block Digestion Instructions
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 14	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Update to current practice	Added new TALS method IDs
Reagents and Standards	Update to current practice	Updated reagent supplier and grade
Throughout Document	Clarification	Updated terminology to new LIMS terminology
Throughout Document	Clarification	Updated to D4 references
Procedure	Update to current practice	Updated procedure for preparation of leachate samples and the method blank and LCS for leachate batches.

Revision:	13	**Effective Date:**	14-DEC-2020
Section	**Justification**	**Changes**	

Revision:	13	**Effective Date:**	14-DEC-2020
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356	Removed revision logs up to the previous version	
LIMs ID	Update to current practice	Added new LIMs method IDs	
Cross Reference	Update to current practice	Updated Document number and added Document 11933	
Purpose	Update to current practice	Added information for ICPMS	
Throughout Document	Clarification	Updated terminology to new LIMs terminology	

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3010A, July 1992

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11931	Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
QA-SOP11178	Demonstrations of Capability

Purpose

This digestion procedure is used to prepare wastewater and leachate samples for measurement of total/total recoverable metals by ICP and ICP-MS following SW-846.

Scope

This digestion procedure is used by the Metals department of the Environmental Sciences division.

Basic Principles

A mixture of nitric acid and the sample is refluxed in a covered beaker or a covered polypropylene container (digestion vessel) at low volume. Then it is refluxed with hydrochloric acid and brought up to volume with reagent water.

Reference Modifications

1. A 50-mL final volume is used instead of 100-mL to improve digestion throughout, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses are not used; samples are evaporated without watch glasses in nonmetallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

Definitions

1. ACS – American Chemical Society

2. ASTM – American Society of Testing and Materials

3. DUP – Sample Duplicate

4. DOC – Demonstration of Capability

5. IDOC – Initial Demonstration of Capability

6. LCS/LCSD – Laboratory Control Sample/Laboratory Control Sample Duplicate

7. LIMS – Laboratory Information Management Systems

8. LOQ – Limit of Quantitation

9. MDL – Method Detection Limit

10. MS – Matrix Spike

11. MSD – Matrix spike duplicate

12. MB– Method Blank equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

13. QC – Quality Control

14. SOP – Standard Operating Procedure

15. SPLP – Synthetic Precipitation Leaching Procedure

16. STLC – Soluble Threshold Limit Concentration

17. TCLP – Toxicity Characteristic Leaching Procedure

18. BKG – unspiked background sample

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to *QA-SOP11178* for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of < 2 with HNO_3 (Samples submitted for soluble metals that are to be lab filtered must be unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Sample must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

2. Watch glasses or reflux caps

3. 50-mL graduated cylinders or other appropriate graduated cylinders if necessary

4. 50-mL volumetric flasks or other appropriate Class A volumetric flasks if necessary

5. 250-mL beakers, or other appropriate beakers

6. Hotblocks or hot plates, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see T-MET-FRM9082.

1. Nitric Acid, HNO_3 - J.T. Baker, Reagent Grade, or equivalent. Store at room temperature and re-evaluate annually.

2. Hydrochloric acid, HCl - J.T. Baker, Reagent Grade, or equivalent. Store at room temperature and re-evaluate annually.

3. Hydrochloric Acid (1:1) - Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this procedure.

Procedure

This SOP has been set up to outline the procedures for both hot plate and HotBlock digestions (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. HotBlocks

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the method blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The method blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Transfer 50 mL of well-mixed sample to a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see *T-MET-WI9082*.

NOTE: For leachate samples, transfer 5 mL of well-mixed sample to a 68-mL digestion vessel. Bring to a final volume of 50 mL using reagent water. Use 5 mL of the appropriate extraction fluid for the MB and LCS/D and bring to a final volume of 50 mL using reagent water. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the digestion vessel in a HotBlock at 90° to 95°C, and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the digestion vessel is allowed to go dry.

3. Allow the digestion vessel to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the digestion vessel with a reflux cap and return to the HotBlock. Increase the temperature of the HotBlock so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the digestion vessel and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the digestion vessel to go dry. Allow the digestion vessel to cool.

7. Add 5 mL (1:1) HCl, cover the digestion vessel, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the digestion vessel to cool.

8. Adjust sample volume to 50-mL mark on the certified digestion vessel with reagent water, cap and mix.

9. The sample is now ready for analysis.

B. Hotplates

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the method blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The method blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Use a 50-mL graduated cylinder to transfer 50 mL of well-mixed sample to a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see *T-MET-WI9082*.

NOTE: For leachate samples,transfer 5 mL of well-mixed sample to a 68-mL digestion vessel. Bring to a final volume of 50-mL using reagent water. Use 5 mL of the appropriate extraction fluid for the MB and LCS/D and bring to a final volume of 50-mL using reagent water. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the beaker on a hot plate and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the beaker is allowed to go dry.

3. Allow the beaker to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the beaker and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the beaker to go dry. Allow the beaker to cool.

7. Add 5 mL (1:1) HCl, cover the beaker, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the beaker to cool.

8. Transfer the solution to a 50-mL volumetric flask. Adjust sample volume to the 50-mL mark with reagent water and mix.

9. Pour the mixed sample into a polypropylene container and cap.

10. The sample is now ready for analysis.

Block Digestion Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold Star (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations

Not applicable to this procedure.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

Perform a method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP.

11178 Demonstrations of Capability
11931 Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
11933 Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)
9082 Working Instructions for Prep Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
12	19.JAN.2015		
13	30.NOV.2020		
14	25.JAN.2022		

eurofins	Always check on-line for validity.	Level:
Document number: **T-MET-WI11941**	**Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS)**	**Work Instruction**
Old Reference: **1-P-QM-WI-9015159**		
Version: **14**		Organisation level: **5-Sub-BU**
Approved by: **ULJC** Effective Date: **08-FEB-2022**	Document users: **6_EUUSLA_Metals_ICP Prep, 6_EUUSLA_Metals_ICP Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Purpose
Scope
Basic Principles
Reference Modifications
Definitions
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
Block Digestion Instructions
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 14	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Update to current practice	Added new TALS method IDs
Reagents and Standards	Update to current practice	Updated reagent supplier and grade
Throughout Document	Clarification	Updated terminology to new LIMS terminology
Throughout Document	Clarification	Updated to D4 references
Procedure	Update to current practice	Updated procedure for preparation of leachate samples and the method blank and LCS for leachate batches.

Revision:	13	**Effective Date:**	14-DEC-2020
Section	**Justification**		**Changes**
Revision Log	Formatting requirement per 1-P-QM-QMA-9017356		Removed revision logs up to the previous version
LIMs ID	Update to current practice		Added new LIMs method IDs
Cross Reference	Update to current practice		Updated Document number and added Document 11933
Purpose	Update to current practice		Added information for ICPMS
Throughout Document	Clarification		Updated terminology to new LIMs terminology

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 3010A, July 1992

2. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI11931	Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
T-MET-WI11933	Metals by Inductively Coupled Plasma Mass Spectrometry for SW-846 Methods 6020/6020A/6020B(aqueous, solid, tissue) and EPA 200.8 (aqueous)
T-MET-WI9082	Working Instructions for Prep Solutions and Standards
QA-SOP11178	Demonstrations of Capability

Purpose

This digestion procedure is used to prepare wastewater and leachate samples for measurement of total/total recoverable metals by ICP and ICP-MS following SW-846.

Scope

This digestion procedure is used by the Metals department of the Environmental Sciences division.

Basic Principles

A mixture of nitric acid and the sample is refluxed in a covered beaker or a covered polypropylene container (digestion vessel) at low volume. Then it is refluxed with hydrochloric acid and brought up to volume with reagent water.

Reference Modifications

1. A 50-mL final volume is used instead of 100-mL to improve digestion throughout, conserve sample usage, and limit waste generation. Because all reagents are also adjusted so that concentrations are equivalent to a 100-mL aliquot, there is no impact on the data.

2. Ribbed watch glasses are not used; samples are evaporated without watch glasses in nonmetallic hoods to speed evaporation. No contamination trends have been observed in prep blanks evaporated without using watch glasses.

Definitions

1. ACS – American Chemical Society

2. ASTM – American Society of Testing and Materials

3. DUP – Sample Duplicate

4. DOC – Demonstration of Capability

5. IDOC – Initial Demonstration of Capability

6. LCS/LCSD – Laboratory Control Sample/Laboratory Control Sample Duplicate

7. LIMS – Laboratory Information Management Systems

8. LOQ – Limit of Quantitation

9. MDL – Method Detection Limit

10. MS – Matrix Spike

11. MSD – Matrix spike duplicate

12. MB– Method Blank equivalent to a Preparation Blank. A designated sample designed to monitor for sample contamination during the analysis process. A volume of reagent laboratory water is typically used to monitor water sample analysis, while solids blanks consist of a purified solid matrix or just the reagents used in the test. The blank demonstrates that no artifacts were introduced during the analysis process.

13. QC – Quality Control

14. SOP – Standard Operating Procedure

15. SPLP – Synthetic Precipitation Leaching Procedure

16. STLC – Soluble Threshold Limit Concentration

17. TCLP – Toxicity Characteristic Leaching Procedure

18. BKG – unspiked background sample

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

Nitric acid (HNO_3) – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.

Hydrochloric acid (HCl) – This acid can cause skin burns. Never mix HCl with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills (small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and a documented Demonstration of Capability for this or an equivalent procedure.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure. Proficiency is measured through documentation of the critical steps in this procedure, over checking of data as well as an IDOC.

The IDOC and the DOC consists of four laboratory control samples that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Refer to *QA-SOP11178* for specific requirements. A DOC is performed annually and is maintained in the analyst's training records.

Sample Collection, Preservation, and Handling

Samples are collected in plastic containers and preserved to a pH of < 2 with HNO_3 (Samples submitted for soluble metals that are to be lab filtered must be unpreserved. The sample is run through a 0.45 micron filter within 5 days of receipt and then preserved.) The pH is checked upon receipt and adjusted as necessary by

Sample Support; samples that are pH adjusted at the lab must not be digested for a minimum of 24 hours. If samples fail to maintain a pH of <2 the Client Service Representative is notified for further direction. Samples are stored at 0° to 6°C, but not frozen, prior to digestion. Sample must be digested within 6 months of collection. Digested samples are stored in plastic at room temperature and have a 6 month holding time.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) – certified clean and Class A equivalent

2. Watch glasses or reflux caps

3. 50-mL graduated cylinders or other appropriate graduated cylinders if necessary

4. 50-mL volumetric flasks or other appropriate Class A volumetric flasks if necessary

5. 250-mL beakers, or other appropriate beakers

6. Hotblocks or hot plates, adjustable and capable of maintaining a temperature of 90° to 95°C

Reagents and Standards

For reagent preparation, shelf life, and storage conditions, see T-MET-FRM9082.

1. Nitric Acid, HNO_3 - J.T. Baker, Reagent Grade, or equivalent. Store at room temperature and re-evaluate annually.

2. Hydrochloric acid, HCl - J.T. Baker, Reagent Grade, or equivalent. Store at room temperature and re-evaluate annually.

3. Hydrochloric Acid (1:1) - Add 500 mL of HCl to 500 mL of reagent water. Store at room temperature. Expires in 6 months.

NOTE: It is acceptable to prepare solutions using multiples of indicated volumes if exact ratios are maintained.

Calibration

Not applicable to this procedure.

Procedure

This SOP has been set up to outline the procedures for both hot plate and HotBlock digestions (see below). Choose the procedure that corresponds to the sample heating technique being used for sample digestion.

A. HotBlocks

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the method blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The method blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on

sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Transfer 50 mL of well-mixed sample to a 68-mL digestion vessel. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see *T-MET-WI9082*.

NOTE: For leachate samples, transfer 5 mL of well-mixed sample to a 68-mL digestion vessel. Bring to a final volume of 50 mL using reagent water. Use 5 mL of the appropriate extraction fluid for the MB and LCS/D and bring to a final volume of 50 mL using reagent water. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the digestion vessel in a HotBlock at 90° to 95°C, and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the digestion vessel is allowed to go dry.

3. Allow the digestion vessel to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the digestion vessel with a reflux cap and return to the HotBlock. Increase the temperature of the HotBlock so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the digestion vessel and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the digestion vessel to go dry. Allow the digestion vessel to cool.

7. Add 5 mL (1:1) HCl, cover the digestion vessel, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the digestion vessel to cool.

8. Adjust sample volume to 50-mL mark on the certified digestion vessel with reagent water, cap and mix.

9. The sample is now ready for analysis.

B. Hotplates

NOTE: When insoluble matter is present in the digested sample, allow it to settle by gravity or filter prior to introduction to the instrument. If any samples are filtered, the method blank and LCS must also be filtered.

NOTE: For soluble metals analysis, filter unpreserved sample through 0.45-micron filter paper. Adjust the filtered sample to pH <2 with nitric acid preserving solution. Measure the volume of sample, as stated in this procedure, and digest as normal. The method blank and spiked LCS must also be prepared with filtered reagent water.

NOTE: If the sample contains high solids, use a smaller aliquot of the sample and bring sample to final volume as stated in this procedure. Make appropriate acid, reagent, and spike volume adjustments based on sample final volume.

NOTE: It is acceptable to reduce the volume of sample being analyzed as long as the sample reagent ratios are maintained.

1. Shake sample well. Use a 50-mL graduated cylinder to transfer 50 mL of well-mixed sample to a 250-mL beaker. After the sample has been poured, add the spiking solution. For sample batch spiking procedures see *T-MET-WI9082*.

NOTE: For leachate samples,transfer 5 mL of well-mixed sample to a 68-mL digestion vessel. Bring to a final volume of 50-mL using reagent water. Use 5 mL of the appropriate extraction fluid for the MB and LCS/D and bring to a final volume of 50-mL using reagent water. The extraction fluid are as follows: TCLP, SPLP, STLC, ASTM, Filtration, and Elutriate.

2. Add 1.5 mL of concentrated HNO_3. Place the beaker on a hot plate and cautiously evaporate to low volume (about 5 mL), making certain that the sample does not boil and that no portion of the bottom of the beaker is allowed to go dry.

3. Allow the beaker to cool then add another 1.5-mL portion of concentrated HNO_3.

4. Cover the beaker with a watch glass and return to the hot plate. Increase the temperature of the hot plate so that a gentle reflux action occurs.

NOTE: If a sample is allowed to go to dryness, low recoveries result. If this occurs, discard the sample and re-prepare in a new batch.

5. Continue heating (refluxing), adding additional acid as necessary, until the digestion is complete (generally indicated when the digestate is light in color or does not change in appearance with continued refluxing).

6. When digestion is complete, uncover the beaker and evaporate to low volume (about 3 mL). Do not allow any portion of the bottom of the beaker to go dry. Allow the beaker to cool.

7. Add 5 mL (1:1) HCl, cover the beaker, and reflux for an additional 15 minutes to dissolve any precipitate or residue from evaporation. Allow the beaker to cool.

8. Transfer the solution to a 50-mL volumetric flask. Adjust sample volume to the 50-mL mark with reagent water and mix.

9. Pour the mixed sample into a polypropylene container and cap.

10. The sample is now ready for analysis.

Block Digestion Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold Star (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 90° to 95°C.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

NOTE: Polypropylene containers must not be heated above 130°C.

Calculations

Not applicable to this procedure.

Statistical Information/Method Performance

Not applicable to this procedure.

Quality Assurance/Quality Control

Perform a method blank, sample duplicate, sample matrix spike, sample matrix spike duplicate, and laboratory control sample with every digestion batch (20 samples or less). Each piece of batch QC is digested following the procedure in this SOP.

11178 Demonstrations of Capability
11931 Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)
11933 Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)
9082 Working Instructions for Prep Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
12	19.JAN.2015		
13	30.NOV.2020		
14	25.JAN.2022		

eurofins	Always check on-line for validity. **Preparation of Solids by EPA 7471A or B for Mercury Analysis**	Level: **Work Instruction**
Document number: **T-MET-WI11948**		
Old Reference: **1-P-QM-WI-9015161**		
Version: **22**		Organisation level: **5-Sub-BU**
Approved by: **X6TJ** Effective Date: **01-JUL-2022**	Document users: **6_EUUSLA_Metals_Hg Prep, 6_EUUSLA_Metals_Hg Prep Verifiers, 6_EUUSLA_Metals_Management**	Responsible: **5_EUUSLA_Metals_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Reference Modifications
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Block Digestor Instructions
Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control

Revision Log

	Revision: 22	**Effective date:** This version
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Updated	Removed old LIMS references
Basic Principles and Procedure	Clarification	Added notes about sample splitting process

	Revision: 21	**Effective date:** 13.MAY.2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
LIMS ID	Enhancement	Added TALS Method IDs
Appartus and Equipment	Reflects current procedure	Removed references to LLENS
Reagents and Standards	Enhancement	Clarified acid manufacturer. removed g/mL. Added "or equivalent".

	Revision: 21	**Effective date:** 13.MAY.2021
Section	**Justification**	**Changes**
Procedure	Reflects current procedure	Enter weight as 1, add actual weight to Comments
Quality Assurance/Quality Control	Reflects current procedure	Corrected QC names

Reference

1. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471A, Rev. 1, September 1994.
2. Test Methods for Evaluating Solid Wastes, SW-846 Method 7471B, Rev. 2, February 2007
3. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by Cold Vapor AA
T-MET-WI9084	Working Instructions for Preparation of Mercury Solutions and Standards

Scope

This procedure is used to prepare soil, sediment, sludge, oil, tissue and wipe samples for the measurement of mercury by atomic absorption cold vapor technique following SW-846 7471A or 7471B protocol. If this dissolution procedure is not sufficient to dissolve a specific matrix type or sample, then this method is not applicable for that matrix. Samples that require additional homogenization are addressed on a case-by-case basis and homogenized by the Sample Support Group (Department 6055).

Basic Principles

Soil and solid samples are mixed and aliquoted during soil sample splitting by Sample Administration staff or by metals staff. Full homogenization must be requested additionally by clients.

Samples are digested with aqua regia and potassium permanganate to oxidize mercury compounds to mercuric ions and eliminate possible interference from sulfide. Samples high in chlorides require additional permanganate. At the time of analysis, excess permanganate is reduced with sodium chloride/hydroxylamine hydrochloride. Mercuric ions are reduced to mercury metal using stannous chloride. Mercury measurement is performed using mercury cold vapor technique.

Reference Modifications

To increase efficiency, polypropylene containers are used in place of BOD bottles. Prior to analysis (after excess potassium permanganate is reduced with sodium chloride/hydroxylamine hydrochloride solution) samples are adjusted to 100 mL in volumetric flasks. This allows aliquots to be taken as required for analysis; aliquots cannot be taken when BOD bottles are used. No impact on the quality of the data generated using this modification has been observed.

Interferences

Not applicable to this procedure.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Preparing samples for inorganic analysis involves working with concentrated acids and other chemicals which are dangerous if not handled carefully:

> **Nitric acid (HNO_3)** – This acid can cause skin burns. Add nitric acid to samples in a hood or use the designated dispensing equipment to avoid exposure to toxic fumes.
>
> **Hydrochloric acid (HCl)** – This acid can cause skin burns. Never mix HCl with concentrated H_2SO_4 to avoid a violent reaction. Always use in a fume hood or use the designated dispensing equipment.

When diluting strong acids, never add water to acid; always add acid to water.

Store concentrated acids in the prep room acid lockers. Only acids are to be stored in these lockers. (Store solvents in the flammable liquid storage cabinet.) Some concentrated acids are kept in the acid reagent bottles on prep room counters. Fill reagent bottles in an operating fume hood using caution to avoid spills.

Perform acid digestions in hoods that are turned on and have active alarms. Notify a supervisor immediately if the hood is malfunctioning or the alarm sounds.

Samples that contain dust may be hazardous. Open in a fume hood.

When a hazardous flag is added indicating possible cyanide, special precautions are required to avoid exposure to hydrogen cyanide gas. Contact your supervisor prior to adding acid. Always open these samples and add the acid in a hood.

Use spill pillows to absorb large acid spills. (Small spills are cleaned with wet paper towels.) Use SPILL-X-A powder or equivalent to neutralize any remaining acid and then rinse the area thoroughly with water. Spill pillows and SPILL-X-A are stored on the prep room shelf.

Dispose of acid waste properly. Collect all acid digestions, waste solutions, and expired reagent solutions in waste containers. When the acid waste containers are full, a designated acid waste handler transfers the waste to the acid neutralization tank.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each employee performing this digestion procedure must work with an experienced employee for a period of time until they can independently set up batches and perform the necessary steps outlined in this procedure.

Proficiency is measured through an Initial Demonstration of Capability (IDOC) that consists of four laboratory control samples (LCS) that are carried through all steps of the analysis and meet the defined acceptance criteria. The criteria include the calculation of mean accuracy and standard deviation. Various options are available for a DOC and can include four LCS's or one blind sample.

Sample Collection, Preservation, and Handling

Samples are collected in either glass or plastic containers with no preservatives. They must be stored at 0° to 6°C, not frozen and digested and analyzed within 28 days of collection.

Digested samples are stored in plastic containers at room temperature. Store samples, standards, and digested samples separately.

Apparatus and Equipment

1. Polypropylene containers (digestion vessels) - Certified clean and Class A equivalent

2. Balance, capable of reading 0.1 mg

3. Polypropylene covers, (digestion vessel covers)

4. Chemware Ultra-Pure PTFE boiling stones, or equivalent

5. Environmental Express HotBlock (block digestor), adjustable and capable of maintaining a temperature of 95° ± 1°C

Reagents and Standards

A. Store all prepared standards and reagents in glass or polyethylene bottles at room temperature. Label the bottle with the solution name, lot number, date prepared, the expiration date, the initials of the person preparing the solution, and the storage conditions.

B. Standard/ spiking concentration and reagent vendors are subject to change without notification.

C. Reagents - Follow manufacturer's storage conditions and expiration date. If no expiration date is provided, re-evaluate annually or set a one year expiration date. Use the following or equivalent:

1. Hydrochloric acid, 36.5% to 38.0% HCl, JT Baker Trace Metal Grade reagent

2. Nitric acid, 70.0% to 71.0% HNO_3, JT Baker. Trace Metal Grade reagent

3. Potassium permanganate, $KMNO_4$, Fisher or equivalent. Certified ACS.

4. Sodium chloride, NaCl, J.T. Baker or equivalent. Certified ACS.

5. Hydroxylamine hydrochloride, $NH_2OH{\cdot}HCl$, J.T. Baker or equivalent. Certified ACS.

6. 1000 mg/L Hg standard solution, Inorganic Ventures or equivalent.

D. Working instructions for the preparation of mercury solutions and standards are contained within *T-MET-WI9084*. This form includes shelf life and storage conditions.

1. Hg intermediate standard (10 mg/L).

2. Hg intermediate standard (1.0 mg/L).

3. 40 ppb Hg Water Standard.

4. 100 ppb Hg Soil Standard.

5. Potassium permanganate solution (5%).

6. Aqua regia.

7. Sodium chloride/hydroxylamine hydrochloride solution.

E. Adjust all additions according to final solution volume if larger or smaller volumes are needed. Thoroughly mix the solution after diluting to volume.

Calibration

Not applicable to this procedure.

Block Digestor Instructions

1. Turn block digestor on by pressing rocker switch located on the cord.

2. Wait about 8 seconds until controller display indicates current block temperature.

3. Press and hold STAR (*) key.

4. The display shows the Set Point Temperature.

5. The digits can be changed to the desired value by pressing the up and down arrow keys while holding the (*) key.

6. Confirm Control Point temperature is set to the block temperature that provides 95° ± 1°C sample temperature.

NOTE: See HotBlock Control Point Temperature Logbook to obtain control point temperature setting for the HotBlock being used for digestion. If necessary, adjust Control Point temperature to the proper setting.

Procedure

1. Turn block digestor on and allow block to reach the Control Point setting that provides 95° ± 1°C sample temperature.

   Note: Soil samples for metals typically go through soil splitting. Mixing and aliquoting is performed in soil splitting, and splits are delivered to the metals preparation laboratory in the digestate tube. Solids are mixed. Full homogenization must be requested additionally by the client.

2. Collect samples and batch from the split bins. If a sample is not located in a split bin, weigh three aliquots, ~ 0.2000g each, taken from three different areas (combined 0.6000 to 0.6500 g to the nearest 0.0001 g) of a well-mixed, as-received sample into a polypropylene digestion vessel.

3. Add 0.6000g to 0.6499g of Chemware Ultra-Pure PTFE boiling stones to the vessel for the MB and LCS.

4. Enter the MB weight as 1.0 g with final volume of 100 mL and the LCS weight as 1.0 g with final volume 100 mL in the LIMS. In the notes section, record the actual weight in grams of boiling stones used.

5. Matrix exceptions:

   a. Samples with a liquid consistency: increase weight to 1 g (1.00 to 1.05 g).

   b. Oil samples: weigh 0.2000 g to 0.2500 g (to the nearest 0.0001 g) of sample and add 0.2000 g to 0.2499 g of Teflon Chips to the MB and LCS container. Enter the blank weight as 0.2000 to 100.0000 final volume, and the LCS weight as 1.0000 to 100.0000 final volume in LIMS.

   c. Wipes: one blank media each must be used for the batch MB, the LCS, and the LCSD. Use reagent water to rinse any particulate matter from the wipe container into the vessel containing the wipe before digesting. Digest wipes in their own batch.

   d. Tissue samples: spike the LCS, LCSD in the same manner as the matrix spike and matrix spike duplicate (Refer to *T-MET-WI9084*). Digest tissue samples in their own batch.

6. For sample batch quality control preparation, spiking procedures and concentration levels see *T-MET-WI9084*.

7. All spiking must be performed prior to starting the digestion procedure.

8. Add about 5 mL reagent water and about 5 mL of aqua regia solution.

9. Place sample containers in block digestor, bring to 95°C ± 1°C and heat approximately 2 minutes. (Place a calibrated thermometer in batch blank container.)

10. Remove sample containers from block and allow to cool.

11. Add 50 mL of reagent water and 15 mL of 5% $KMnO_4$ solution and mix by carefully swirling the container.

    a. Add additional portions of 5% $KMnO_4$ solution (in 5-mL increments, up to as much as 25 mL), if necessary, until the purple color persists for at least 15 minutes.

    b. Add the same amount of $KMnO_4$ solution to entire digestion batch.

    c. If the maximum amount of 25 mL of 5% $KMnO_4$ solution was added and the purple color did not persist for at least 15 minutes, then contact group leader, further dilutions are required. A comment must be placed on the batch sheet documenting the reason for the dilution.

12. Transfer sample containers to block digestor.

13. Place a calibrated thermometer in batch blank container.
14. Put a polypropylene cover on each container.
15. When the thermometer indicates 95° ± 1°C, continue heating for 30 minutes.
16. Remove sample containers from digestion block and allow to cool.
17. Add 6 mL of sodium chloride/hydroxylamine hydrochloride solution to reduce excess permanganate. Adjust volume to the 100 mL mark with reagent water, seal container with screw cap and mix.
18. The sample is now ready for analysis.

Calculations
Not applicable to this procedure.

Statistical Information/Method Performance
Not applicable to this procedure.

Quality Assurance/Quality Control

Each digestion batch (up to 20 samples) must contain a method blank (MB), LCS, and either an unspiked background sample, duplicate (DU), matrix spike (MS), matrix spike duplicate (MSD) or an LCS/LCSD.

Refer to *T-MET-WI7965* for sample batch quality control requirements, acceptance criteria, and corrective action.

7965 Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA
9084 Preparation of Mercury Solutions and Standards

End of document

Version history

Version	Approval	Revision information	
20	06.MAR.2019		
21	13.MAY.2021		
22	22.JUN.2022		

eurofins	Always check on-line for validity. **Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422-63 (reapproved 2007) - Modified**	Level: **Work Instruction**
Document number: **T-WC-WI46354**		
Old Reference: **NA**		
Version: **1**		Organisation level: **5-Sub-BU**
Approved by: **XL3S** Effective Date: **25-NOV-2021**	Document users: **6_EUUSLA_Water Quality_Misc Analysis, 6_EUUSLA_Water Quality_Misc Verification**	Responsible: **5_EUUSLA_Water Quality_Manager**

This documentation has been prepared by Eurofins Lancaster Laboratories Environmental LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Revision Log
Reference
Cross Reference
Scope
Basic Principles
Interferences
Safety Precautions and Waste Handling
Personnel Training and Qualifications
Sample Collection, Preservation, and Handling
Apparatus and Equipment
Reagents and Standards
Calibration
Procedure
A. % Solids Test
B. Hydrometer Analysis
C. Sieve Procedure
Calculations
Statistical Information/Method Performance
Quality Assurance/Quality Control
Table 1 - Hydrometer Reading Table (For up to 12 Sedimentation Cylinders)
Table 2 - Percent Solids Table for Weight Determination for D422

Revision Log

Revision	1	**Effective Date:**	This version
Section	**Justification**		**Changes**
			New Procedure

Reference

1. ASTM Standard D422-63 (Re-approved 2007) "Standard Test Method for Particle-Size Analysis of Soils", ASTM International, West Conshohocken, PA 2003, DOI: 10.1520/C0033-03, www.astm.org

2. ASTM Standard D2217-8585 (Re-approved 1998) "Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants", ASTM International, West

Conshohocken, PA 2003, DOI: 10.1520/C0033-03, www.astm.org

4. ASTM Standard D6913-17 "Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using SieveAnalysis"

5. STM Standard D7928-17 "Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained SoilsUsing the Sedimentation (Hydrometer) Analysis"

6. *Chemical Hygiene Plan*, current version.

Cross Reference

Document	Document Title
S-SS-WI10697	% Moisture Calculation and % Solids Calculation (Gravimetric)
T-WC-FRM46355	D422-Mod Particle Size Distribution / Grain Size Classification
T-WC-WI9901	Equipment Muffle Furnaces and Ovens

Scope

This procedure is applicable to the determination of the distribution of particle sizes in soils and solids. Particle sizes in the range 75 to 0.075 mm are determined by sieving. Distribution of particle sizes smaller than 0.075 mm is determined by a sedimentation process using a hydrometer.

Basic Principles

A portion of sample is soaked in a dispersing agent then partitioned into separate portions: material retained on a #10 sieve and material passing the #10 sieve. The material retained on the #10 sieve is dried to constant weight then passed through a large size sieve stack; the material retained on each sieve is measured and recorded. Material passing the #10 sieve is subject to hydrometer analysis then passed through a small size sieve stack; the material retained on each sieve is measured and recorded. All measurements: large and small sieves and hydrometer readings, and the hygroscopic moisture are used to establish the particle size distribution of the sample.

This SOP is based on the following reference methods: ASTM Standard D2217-8585 (Re-approved 1998), ASTM Standard D422-63 (Re-approved 2007), ASTM Standard D6913-17, and ASTM Standard D7928-17.

NOTE: ASTM D2217 was withdrawn without replacement by ASTM in 2007. A withdrawn standard is an ASTM standard that has been discontinued by the ASTM Sponsoring Committee responsible for the standard.

NOTE: ASTM D422-63 was withdrawn by ASTM in January 2016. Individual methods for gradation by sieve analysis (ASTM D6913-17) and gradation by sedimentation/hydrometer analysis (ASTM D7928-17) were promulgated as replacement approaches. At the time of this writing, ASTM has not yet developed a combined sieve/hydrometer approach. The laboratory's procedure will utilize elements of these two new methods into a combined approach.

Interferences

Not Applicable.

Safety Precautions and Waste Handling

All laboratory waste is accumulated, managed, and disposed of in accordance with all federal, state, and local laws and regulations.

See *Chemical Hygiene Plan* for general information regarding employee safety, waste management, and pollution prevention.

Personnel Training and Qualifications

All personnel performing this procedure must have documentation of reading, understanding, and agreeing to follow the current version of this SOP and an annual documented Demonstration of Capability (DOC) which is maintained in the analyst's training records.

Initially, each technician performing these techniques must work with an experienced technician for a period of time until they can independently perform the procedure. Analysts are considered proficient when they have successfully demonstrated competency under supervision of a supervisor or other trained analyst, with a documented OJT form.

Sample Collection, Preservation, and Handling

Sample are collected in a glass jar or plastic bag. A minimum of 500g of sample is recommended. There is no holding time for this analysis. Samples are stored at 0 to 6 degrees C; not frozen.

Apparatus and Equipment

1. Top-Loading Balance, capable of weight measurement to 0.01 g
2. Mechanical Stirring Device and Dispersion Cup
3. Thermometer: Accurate to 0.5°C
4. Mortar and Rubber Tipped Pestle
5. Sedimentation Cylinder(s) 1000 mL
6. Hydrometer: ASTM 151H in specification E 100.
7. Sieves, of the following size(s): Gilson Company, Inc. or equivalent
    1. 3.0" (75.00 mm)
    2. 2.0" (50.00 mm)
    3. 1.5" (37.50 mm)
    4. 1.0" (25.00 mm)
    5. 3/4" (19.00 mm)
    6. 3/8" (9.50 mm)
    7. # 4 (4.75 mm)
    8. #10 (2.00 mm)
    9. #20 (850.0 um)
    10. #40 (425 um)
    11. #60 (250.0 um)

12. #80 (180.0 um)
13. #100 (150.0 um)
14. #200 (75.0 um)

8. Drying Oven with temperature range of 60-110°C
9. Stainless Steel Spatulas & Spoons
10. Metal & Bristle Brushes
11. Sieve Shaker
12. Timer

Reagents and Standards

Alternate weights may be used as long as the final concentrations remain the same.

1. Sodium hexametaphosphate solution
   a. Using a 1000-mL volumetric flask, dissolve 40 g of sodium hexametaphosphate in reagent water.
   b. Dilute to final volume once dissolved.
   c. Store at room temperature in a glass or plastic container.
   d. Solution expires one month from date of preparation.

Calibration

Balance calibration must be checked each day before use.

Procedure

A. % Solids Test

Check to be sure that the balance has been calibrated each day before use.

1. Label an aluminum pan with the Lab ID for each sample.

2. Tare the balance. Weigh the aluminum pan and record in spreadsheet *T-WC-FRM46355*.

3. Mix the sample with a stainless steel spatula. Measure at least 10-15 g of each sample into the labeled aluminum pan and record the weight of sample in the spreadsheet.

4. Place the pan and sample in an oven maintained at a temperature of 110°C +/- 5°C and dry the sample for at least 16 hours. Reweigh each pan and record the weight measurement in the spreadsheet.

B. Hydrometer Analysis

Check to be sure that the balance has been calibrated each day before use.

1. Use calculated % Solids from Procedure A. and Table 2 to determine the amount needed for analysis. Add an NCM and contact the PM if there is insufficient sample to perform the test.

2. Using the sample in the 250-mL beaker add 125 mL of sodium hexametaphosphate solution. Stir the soil-water slurry until it is thoroughly moistened. Cover and label beaker with sample number. Allow this slurry to soak for at least 16 hours.

3. At the end of the soaking period, transfer the soil-water slurry into a dispersion cup using room temperature reagent water. Be sure to rinse all residue from the beaker into the dispersion cup.

NOTE: Extra care needs to be taken when rinsing the sample into another container or when using any apparatus. **All particles need to be rinsed into the new container or a loss in sample weight is possible to occur.**

4. Stir for one minute using the stirring apparatus. **Rinse stirring apparatus well into dispersion cup to prevent loss of sample.**

5. Place the #10 sieve in a funnel above a 1000-mL glass sedimentation cylinder. Transfer the soil-water slurry into the cylinder, rinsing well. Add room temperature reagent water until the total volume is 1000 mL.

a. Label an aluminum pan with the sample ID. Transfer the sample retained on the #10 sieve to the aluminum pan. Place the pan in the oven set to 110°C +/- 5°C and dry the sample for at least 16 hours. Inspect materials in Procedure C.1 and perform Sieve Analysis in procedure C.2.

6. Cover the open end of the cylinder with parafilm, then placing the palm of the hand over the end, invert the cylinder and agitate for a period of one minute. Place the cylinder in a location where it will not be disturbed or moved during the sedimentation readings (for 24 hours). Start a timer.

7. Remove the parafilm and immediately begin the hydrometer readings, recording the temperature reading after each suspension. Record the readings at the following intervals (measured from the beginning of sedimentation): 2, 5,15, 30, 60, 250, and 1440 minutes. Insert the hydrometer about 20 to 25 seconds before the reading is due to the approximate depth. Read the hydrometer from the top of the meniscus to the nearest 0.0005 and enter the reading on the worksheet *T-WC-FRM46355*. Clean the hydrometer before the first reading, and between readings, by placing it into reagent water and twisting with a spinning motion.

NOTE: The hydrometer used in the process will be calibrated on an annually basis by a certified vendor.

8. After hydrometer reading, insert a calibrated thermometer into the cylinder to the same depth as the hydrometer reading. Read the temperature to the nearest 0.5°C and enter the temperature measurement on the worksheet. Rinse the temperature probe in the hydrometer rinse bath.

9. After hydrometer analysis, proceed to Small Sieve Analysis in Procedure C.3.

C. Sieve Procedure

1. Inspect the sample material in the aluminum pan and record a description of the non-soil material (e.g.- sticks, grass, wood, plastic), hardness of material, and shape of material in the worksheet. Hardness qualifiers include hard, soft, and brittle. Shape qualifiers include well-rounded, rounded, subrounded, subangular, and angular.

2. Sieve Analysis

a. Weigh the 3/4”, 3/8”, #4 and #10 sieves and enter the weight measurements in the worksheet as the tare weight.

b. Stack the sieves and then transfer the sample material from the aluminum dish to the sieve stack. If the sample material is less than 30 g, manually shake the sieve stack for 2 minutes. If the sample material is greater than 30 g, place the sieve stack into the Ro-tap machine and shake the sieve stack for 10 minutes.

c. Weigh each sieve and record these measurements in the worksheet.

3. Small Sieve Analysis

a. Quantitatively transfer the sample from the graduated cylinder to a #200 wet wash sieve. Ensure the entire sample has been transferred to the #200 wet wash sieve by rinsing the graduated cylinder several time with reagent water. Using reagent water, wash the sample through the #200 sieve until the water runs clear, then transfer the material retained on the sieve into a 250-mL glass beaker labeled with the sample ID.

b. Place the beaker in the drying oven and dry at a temperature of 110ºC for at least 16 hours. After 16 hours, remove the beaker from the oven and allow it to cool.

c. Gently mix the dried contents of the beaker with a rubber-tipped pestle to break up any soil aggregates that may have formed during the drying stage.

d. Tare the balance and weigh the sieve stack sized between #20 and #200 and record the tare weights.

e. Transfer the sample to the sieve stack and ensure complete transfer. Use hair or wire brushes to clean the beaker. Place the sieve stack on the RoTap machine and shake for ten minutes.

f. Weigh each sieve and record these measurements in the worksheet.

Calculations

A. Sample Used (SU): Dry Preparation

SU = (pan+ dry sample - pan) - (pan + non- soil material - pan) x HMCF

Where:
HMCF = Hygroscopic moisture correction factor.

B. Sieve Analysis (Percent Finer = PF)

Large Sieves:

3 inch: PF = 100-100* (Sieve and Sample (3 inch) - Sieve (3 inch))/SU

2 inch: PF = PF (3 inch) - 100*(Sieve and Sample (2 inch) - Sieve (2 inch))/SU

and so on through the #10 Sieve.

Small Sieves:

#20: PF = PF(#10) - 100*(mass passing #10/sample mass (Hyd))*(sieve and sample (#20) - sieve(#20))/sample used

#40: PF = PF (#20) - 100*(mass passing #10/sample mass (Hyd))*(sieve and sample (#40) - sieve (#40))/sample used and so on up through #10 sieve.

B. Hydrometer Analysis

Particle size, Micron

1000*sqrt [930*viscosity/980*(SG-1))*(effective depth/time)]

Viscosity at sample temperature, poises

Effective Depth, cm = 16.29-264.5*(actual Hydrometer reading - 1) above equation for effective depth based on equation found with table 2 in method, in which 16.29 = 0.5*(14.0-67.0/27.8)+10.5 and 264.5 = (10.5-2.3)/0.031

Time, minutes = Time of hydrometer reading from beginning of sedimentation

Sqrt - square root

SG - Specific Gravity of soil

Viscosity - is the resistance of a liquid to flow

C. Percent Finer (PF):

PF = Constant*(actual hydrometer reading - hydrometer correction factor - 1)

Where:

Constant = (100,000/W)*SG/(SG-1)

W = (Total sample used *sample used for hydrometer analysis*HMCF)/Amount of total sample passing #10 sieve

Hydrometer Correction = slope*sample temperature + Intercept

Slope = ((low temp. reading -1)-(high temp. reading -1)/(low temp. - high temp.))

Intercept = (low temp. reading -1) - (low temp. * slope)

Statistical Information/Method Performance

Not applicable to this procedure

Quality Assurance/Quality Control

When possible, perform duplicate analyses for particle size on a routine basis.

Batch size is limited to 20 samples or less.

Table 1 - Hydrometer Reading Table (For up to 12 Sedimentation Cylinders)

Table 1: Hydrometer Reading Table (For up to 12 Sedimentation Cylinders)

Elapsed Time (hr:min)	Task	Cyl. No.	Actual Time (min)	Elapsed Time (hr:min)	Task	Cyl. No.	Actual Time (min)
0:00	Shake	1		1:01	Read	10	5
0:01	Place	1		1:02	Shake	11	
0:01	Shake	2		1:03	Place	11	
0:02	Place	2		1:04	Read	9	15
0:03	Read	1	2	1:05	Read	11	2
0:04	Read	2	2	1:06	Read	7	31
0:06	Read	1	5	1:07	Read	3	58
0:07	Read	2	5	1:08	Read	11	5
0:08	Shake	3		1:09	Shake	12	
0:09	Place	3		1:10	Place	12	
0:09	Shake	4		1:11	Read	10	15
0:10	Place	4		1:12	Read	12	2
0:11	Read	3	2	1:13	Read	4	63
0:12	Read	4	2	1:14	Read	8	32
0:14	Read	3	5	1:15	Read	12	5
0:15	Read	4	5	1:18	Read	11	15
0:16	Read	1	15	1:19	Read	9	30
0:17	Read	2	15	1:21	Read	5	60
0:20	Shake	5		1:25	Read	12	15
0:21	Place	5		1:26	Read	10	30
0:23	Read	5	2	1:27	Read	6	59
0:24	Read	3	15	1:33	Read	11	30
0:25	Read	4	15	1:34	Read	7	59
0:26	Read	5	5	1:41	Read	12	31
0:27	Shake	6		1:42	Read	8	60
0:28	Place	6		1:52	Read	9	63
0:30	Read	6	2	1:53	Read	10	57
0:31	Read	1	30	2:06	Read	11	63
0:32	Read	2	30	2:07	Read	12	57
0:33	Read	6	5	4:17	Read	1	256
0:34	Shake	7		4:18	Read	2	256
0:35	Place	7		4:19	Read	3	250
0:36	Read	5	15	4:20	Read	4	250
0:37	Read	7	2	4:21	Read	5	240
0:38	Read	3	29	4:22	Read	6	234
0:39	Read	4	29	5:00	Read	7	265
0:40	Read	7	5	5:01	Read	8	259
0:41	Shake	8		5:02	Read	9	253
0:42	Place	8		5:03	Read	10	247
0:43	Read	6	15	5:04	Read	11	241
0:44	Read	8	2	5:05	Read	12	235
0:47	Read	8	5	24:01	Read	1	1440
0:48	Shake	9		24:02	Read	2	1440
0:49	Place	9		24:03	Read	3	1434
0:50	Read	7	15	24:04	Read	4	1434
0:51	Read	9	2	24:05	Read	5	1424
0:52	Read	5	31	24:06	Read	6	1418
0:54	Read	9	5	24:07	Read	7	1412
0:55	Shake	10		24:08	Read	8	1406
0:56	Place	10		24:09	Read	9	1400
0:57	Read	8	15	24:10	Read	10	1394
0:58	Read	10	2	24:11	Read	11	1388
0:59	Read	6	31	24:12	Read	12	1382
1:00	Read	1	59				
1:00	Read	2	58				

Table 2 - Percent Solids Table for Weight Determination for D422

% solids	Specific Gravity	Silt/Clay	Silt/Sand	Sand	Sand/Gravel
1	2500	5000	7500	10000	20000
2	1250	2500	3750	5000	10000
3	833	1667	2500	3333	6667
4	625	1250	1875	2500	5000
5	500	1000	1500	2000	4000
6	417	833	1250	1667	3333
7	357	714	1071	1429	2857
8	313	625	938	1250	2500
9	278	556	833	1111	2222
10	250	500	750	1000	2000
11	227	455	682	909	1818
12	208	417	625	833	1667
13	192	385	577	769	1538
14	179	357	536	714	1429
15	167	333	500	667	1333
16	156	313	469	625	1250
17	147	294	441	588	1176
18	139	278	417	556	1111
19	132	263	395	526	1053
20	125	250	375	500	1000
21	119	238	357	476	952
22	114	227	341	455	909
23	109	217	326	435	870
24	104	208	313	417	833
25	100	200	300	400	800
26	96	192	288	385	769
27	93	185	278	370	741
28	89	179	268	357	714
29	86	172	259	345	690
30	83	167	250	333	667
31	81	161	242	323	645
32	78	156	234	313	625
33	76	152	227	303	606
34	74	147	221	294	588
35	71	143	214	286	571
36	69	139	208	278	556
37	68	135	203	270	541
38	66	132	197	263	526
39	64	128	192	256	513
40	63	135	188	250	500
41	61	122	183	244	488
42	60	119	179	238	476
43	58	116	174	233	465
44	57	114	170	227	466
45	56	111	167	222	444
46	54	109	163	217	435

47	53	106	160	213	426
48	52	104	156	208	417
49	51	102	153	204	408
50	50	100	150	200	400
51	49	98	147	196	392
52	48	96	144	192	385
53	47	94	142	189	377
54	46	93	139	185	370
55	45	91	136	182	364
56	45	89	134	179	357
57	44	88	132	175	351
58	43	86	129	172	345
59	42	85	127	169	339
60	42	83	125	167	333
61	41	82	123	164	328
62	40	81	121	161	323
63	40	79	119	159	317
64	39	78	117	156	313
65	38	77	115	154	308
66	38	76	114	152	303
67	37	75	112	149	299
68	37	74	110	147	294
69	36	72	109	145	290
70	36	71	107	143	286
71	35	70	106	141	282
72	35	69	104	139	278
73	34	68	103	137	274
74	34	68	101	135	270
75	33	67	100	133	267
76	33	66	99	132	263
77	32	65	97	130	260
78	32	64	96	128	256
79	32	63	95	127	253
80	31	63	94	125	250
81	31	62	93	123	247
82	30	61	91	122	244
83	30	60	90	120	241
84	30	60	89	119	238
85	29	59	88	118	235
86	29	58	87	116	233
87	29	57	86	115	230
88	28	57	85	114	227
89	28	56	84	112	225
90	28	56	83	111	222
91	27	55	82	110	220
92	27	54	82	109	217
93	27	54	81	108	215
94	27	53	80	106	213
95	26	53	79	105	211

96	26	52	78	104	208
97	26	52	77	103	206
98	26	51	77	102	204
99	25	51	76	101	202
100	25	50	75	100	200

Use the attachment of Table 2 to determine the amount of sample to use in Procedure B.1.

Attachment:
Table 2 - Percent Solids Table for Weight Determination for D422 (.xls)

10697 % Moisture Calculation and % Solids Calculation (Gravimetric)
11188 Reagents and Standards
11880 Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment
46355 D422-Mod Particle Size Distribution / Grain Size Classification
9901 Equipment Muffle Furnaces and Ovens

End of document

Version history

Version	Approval	Revision information	
1	11.NOV.2021		

eurofins	Always check on-line for validity.	Level:
Document number: **QA-QM11872**	**Environmental Quality Policy Manual**	**Quality Manual**
Old Reference: **1-P-QM-GDL-9015377; DOD - EQPM**		
Version: **20**		Organisation level: **5-Sub-BU**
Approved by: **UKL3** Effective Date: **26-AUG-2022**	Document users: **4_EUUSLA_ELLE_All_Support, 4_EUUSLA_ELLE_All_Technical**	Responsible: **5_EUUSLA_Env Quality Assurance_All**

This documentation has been prepared by Eurofins Lancaster Laboratories Environment Testing, LLC and its affiliates ("Eurofins"), solely for their own use. The user of this document agrees by its acceptance to return it to Eurofins upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use if for any other purpose other than that for which it was specifically provided. The user also agrees that where consultants or other outside parties are involved in the evaluation process, access to these documents shall not be given to said parties unless those parties also specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES.

Title Page
Revision Log
1) INTRODUCTION
1.1) Mission Statement
1.2) Quality Policy Statement
1.3) Value Statement
1.4) Scope
1.5) Company History
2) MANAGEMENT REQUIREMENTS
2.1) Organizational Structure
2.2) Roles and Responsibilities
2.2.1) Laboratory Director/Director of Operations
2.2.2) Quality Assurance Manager
2.2.3) Technical Managers
2.2.4) Quality Assurance Department
2.2.5) Client Services/Project Management Department
2.3) Business Continuity and Contingency Plans
3) PERSONNEL
3.1) Personnel Qualifications and Responsibilities
3.2) Personnel Training
3.3) Business Conduct
4) BUILDING, FACILITIES, AND ENVIRONMENTAL CONDITIONS
4.1) Physical Facilities
4.2) Environmental Monitoring
4.2.1) Water Systems
4.2.2) Housekeeping/Cleaning
4.2.3) Insect & Rodent Control
4.2.4) Facility Changes
4.2.5) Labware Cleaning
4.3) Employee Safety
4.4) Emergencies
4.5) Security and Building Access
4.6) Computer System Security and Access
4.6.1) Passwords
4.6.2) Viruses
4.6.3) Software Policy
5) QUALITY SYSTEM
5.1) Quality System Overview
5.2) Ethics and Data Integrity
5.3) Quality System Documents
5.3.1) Level 1 - Quality Policy Manual and Company Policies
5.3.2) Level 2 - Standard Operating Procedures
5.3.3) Level 3 - Work Instructions (at a department level)

5.3.4) Level 4 - Quality Records
5.4) Overview of the Quality Assurance Program
5.5) Quality Control Charts for Quality Indicators
5.6) Statistical Quality Control
5.7) Quality Metrics
6) DOCUMENT CONTROL
6.1) Overview
6.2) Document Approval, Issue, Control, and Maintenance
6.3) Client-Supplied Methods and Documentation
6.4) Control of External Documents
7) SERVICE TO CLIENTS
7.1) Overview
7.2) Review of Work Requests, Tenders, and Contracts
7.3) Balancing Laboratory Capacity and Workload
7.4) Communication and Documentation
7.5) Client Feedback
8) SUBCONTRACTING
8.1) Overview
8.2) Qualifying and Monitoring Subcontractors
8.3) Responsibilties
8.4) Use of NELAP and A2LA Logo
9) PURCHASING SERVICES AND SUPPLIES
9.1) Supplier Evaluation
9.2) Procurement
10) COMPLAINTS
10.1) Receipt and Investigation of Complaints
11) CONTROL OF NON-CONFORMING WORK
11.1) Evaluation of Significance and Actions Taken
11.2) Responsibilities
11.3) Prevention of Nonconforming Work
12) CORRECTIVE ACTION
12.1) Investigation Process
12.2) Root Cause Analysis
13) PREVENTATIVE ACTION AND RISK ASSESSMENT
13.1) Preventative Actions
13.2) Change Control
14) CONTROL OF RECORDS
14.1) Data Documentation Requirements
14.1.2) Laboratory Notebooks, Logbooks, and Forms
14.1.2) Electronic Data
14.2) Data Storage, Security, and Archival
14.2.1) Computer System Backup, Data Restoration, and Data Archival
15) AUDITS
15.1) Internal Audits
15.2) Client Audits
15.2.1) Confidentiality
15.3) Agency Inspections
15.4) Proficiency Testing
15.5) Good Laboratory Practice Critical Phase Inspections
16) MANAGEMENT SYSTEM REVIEW
16.1) Quality Reports
16.2) Annual Management Review
17) TEST METHODS AND METHOD VALIDATION

17.1) Scope of Testing
17.2) Analytical Test Methods
17.2.1) Procedural Deviation
17.2.2) Client Supplied Methods
17.3) Method Validation
17.4) Reporting Limits
17.5) Measurement Uncertainty
18) EQUIPMENT AND CALIBRATIONS
18.1) Laboratory Equipment Requirements
18.2) Calibration
18.3) Maintenance
19) MEASUREMENT TRACEABILITY
19.1) Reference Standards and Materials
19.2) Calibration Standards
20) SAMPLING
20.1) Sample Collection
20.2) Sampling Instructions
20.3) Sample Containers
21) SAMPLE HANDLING
21.1) Chain of Custody
21.1.1) Legal Chain of Custody
21.2) Sample Receipt
21.2.1) Sample Acceptance / Rejection Policy
21.2.2) Sample Preservation Check
21.3) Sample Entry
21.4) Sample Identification and Tracking
21.5) Sample Storage
21.6) Representativeness of Samples
21.7) Sample Return/Disposal
22) ASSURING THE QUALITY OF TEST RESULTS
22.1) Ongoing Evaluation of Data Quality
22.2) Reagents and Solvents
22.3) Laboratory Quality Control Samples and Acceptance Criteria
22.3.1) Quality Control Sample Frequency and Corrective Action
22.4) Negative Controls
22.4.1) Method Blanks (MB)
22.4.2) Instrument Blanks
22.4.3) Trip and Field Reagent Blanks
22.4.4) Storage Blanks
22.5) Positive Controls
22.5.1) Laboratory Control Samples (LCS)
22.5.2) Second Source Check
22.5.3) Duplicates, Matrix Spike Duplicates and Laboratory Control Sample Duplicates (DU, MSD, LCSD)
22.6) Sample Matrix Controls
22.6.1) Matrix Spikes (MS)
22.6.2) Surrogates
22.6.3) Internal Standards
23) REPORTING RESULTS
23.1) Sample and Data Flow
23.1.1) Identification of Approved Signatories
23.1.2) Timely Delivery
23.2) Data Reporting

23.3) Data Calculations
23.4) Data Review
23.5) Data Qualification
23.6) Client and Data Confidentiality

Title Page

Environmental Quality Policy Manual

Eurofins Lancaster Laboratories Environment Testing, LLC (ELLE)

2425 New Holland Pike
Lancaster, PA, 17601
Phone: 717-656-2300
Fax: 717-656-2681

Reviewed and Approved by:
President
Technical Director
Quality Assurance Manager
(as recorded in the electronic document control system)

Revision Log

	Revision: 20	**Effective date:** This version

Section	**Revision:** 20	**Effective date:** This version
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Section	**Justification**	**Changes**
Throughout document	Enhancement	Reordered sections to reflect TNI2016 organization. Updated company name. Removed references to "biological" testing. Updated QA Director to QA Manager Removed redundant language within the document.
Section 4.2 (previously 3.4)	Correction	Temperatures must be checked once per day if not connected to the ETM.
Section 15.2 (formerly 11.4)	Enhancement	Removed responsibilities. This is discussed in SOP7547
Section 6.4.1.5	Current Process	Removed LabLinks, no longer applicable
Section 16.1 (previously 11.2) Section 16.2	Current Process	Added new language on monthly QA Reports
Section 18	Enhancement	Included current TNI2016 V1M4 criteria for calibrations.
Section 21	Enhancement	Updated language for current LIMS
Section 22	Enhancement	Added and removed QC to reflect the standard QC performed - method-specific QC are in Work Instructions.
Section 23	Current process	Updated Analysis reports to reflect current LIMS

	Revision: 19	**Effective date:** 5/27/2021
Section	**Justification**	**Changes**
Revision Log	Formatting requirement	Removed revision logs up to the previous version
Procedure 11.1	LADEQ requirement	Changed audit retention to 10 yrs.
Section 5.2.2	Reflects current procedure	Clarified the tracking of samples
Section 10.4	Enhancement	RLs adjusted by prep
Section 8.1	Enhancement	Removed NDMA
Section 9.1.6	Enhancement	Removed the term "organic." IS applies to both inorganic and organic.
Appendix A	Updated Documents	Some document identifications changed or new ones created; edited to reflect current references

Section	Justification	Changes
Appendix C	Org structure change	Appendix revised
Appendix E	Addition of Signature SOP reference	Appendix revised

1) INTRODUCTION

This *Environmental Quality Policy Manual*, or EQPM, is based upon Eurofins Lancaster Laboratories Environment Testing, LLC's, (herein referred to as the laboratory) overall business and management philosophies, mission, and goals. This manual is written to present the policies employed by the laboratory as well as the support departments that serve the environmental laboratories and to comply with the requirements of the National Environmental Laboratory Accreditation Program (also referred to as NELAP or TNI), ISO 17025, the Department of Defense (DoD), Quebec Accreditation Program for Analytical Laboratories (PALA) as well as individual state agency requirements. These policies define the "what" we do with emphasis on management's responsibilities and commitment to quality.

Governing SOPs are in place within the organization to ensure the proper execution of this policy document (refer to *Appendix A*). This manual is required reading for laboratory personnel. The most recent and up-to-date EQPM and all referenced documents are available to all laboratory personnel who work in or support the laboratory. As described within this document, the laboratory actively strives for continuous improvement of its quality systems to better serve our clients.

1.1) Mission Statement

The laboratory offers analytical and consulting services in the chemical and biological sciences with comprehensive expertise in environmental laboratory applications. The company mission statement describes the corporate philosophy:

At Eurofins Lancaster Laboratories Environment Testing, LLC, we are people working together to serve the health and environmental needs of society through science and technology. We strive to be the recognized leader in all that we do.

Our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. As a corporate community, we:

- Deliver quality by fully understanding and always meeting the requirements of those we serve.
- Live our values by relating to our clients, coworkers, shareholders, suppliers, and community in a fair and ethical manner.
- Manage our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders, and maintain our meaningful and enriching workplace.

1.2) Quality Policy Statement

The Executive Management Group recognizes quality as a key element of the laboratory's standard of service. The group supports the laboratory's commitment to quality as defined by NELAP, ISO 17025, DoD, PALA and other regulatory agencies (i.e. states) through the strict adherence to the Quality Policy Statement. The policy cannot be revised without their approval of Eurofins National Division Service Center (NDSC) QA Directors.

The Quality Policy Statement gives employees clear requirements for the production of analytical data. Employees are trained on the components of the Quality Policy Statement during their first day of orientation. Each employee signs the statement upon hire as agreement to implement the policy in all aspects of their work. Employee agreement to any subsequent revisions of the statement is obtained by documented reading and understanding of an agreement to follow the Quality Manual, which contains the current version of the statement. The statement is as follows:

As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Reading and understanding all of the quality documents applicable to each position and implementing the process in our work.
- Following all recordkeeping requirements; describing clearly and accurately all activities performed; recording "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Ensuring data integrity through the completeness, consistency, impartiality and accuracy of the data generated. Data is attributable, legible, contemporaneously recorded, original or a true copy, and accurate (ALCOA). This applies to manual paper documentation and electronic records.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification/validation, analysis, and reporting; establishing an audit trail (the who, what, when, and why) that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process which provides impartiality, accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concerns on quality issues to management. Eurofins

recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff

- Continually improve systems and manage risk to support quality improvement efforts in laboratory, administrative and managerial activities
- We each take personal responsibility to provide this quality product while meeting the company's high standards of integrity and ethics, understanding that improprieties, such as failure to conduct the required test, manipulation of test procedures or data, or inaccurate documentation will not be tolerated. Intentional misrepresentation of the activities performed is considered fraud and is grounds for termination.

I understand the expectations and commit to implementation of all applicable policies and procedures and to providing quality data.

1.3) Value Statement

Eurofins Lancaster Laboratories Environment Testing, LLC, is a team of people who work together to serve the health and environmental needs of society through science and technology.

At Eurofins Lancaster Laboratories Environment Testing, our mission is to provide independent laboratory services in the chemical and biological sciences with excellent quality and service. We fulfill our mission by incorporating our values into our work every day.

As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

- Fairness and honesty in all our relationships
- Mutual trust
- A respect for ourselves and others
- A sense of caring that leads us to act responsibly toward each other and society, now and in the future
- Loyalty to our clients and one another
- A spirit of open-mindedness as we deal with all
- Dedication to service
- Good stewardship of our resources
- A commitment to flexibility and continuous improvement

We are committed to:

- Delivering quality by fully understanding and always meeting the requirements of those we serve.
- Living our values by relating to our clients, coworkers, shareholders, suppliers and community in a fair and ethical manner.

- Managing our growth and financial resources so we can serve our clients well, provide a satisfactory return to shareholders and maintain our meaningful and enriching workplace.

At Eurofins Lancaster Laboratories Environment Testing, LLC, we each take personal responsibility to live these values in all of our dealings, knowing full well that our pledge may involve difficult choices, hard work, and courage.

1.4) Scope

The laboratory analyzes a broad range of environmental and industrial samples. Sample matrices vary among air, drinking water, waste water, soil, hazardous waste, tissues, and wipes. The QA Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients, and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs), or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory President, Laboratory Vice-President, Director of Operations, Laboratory Director and/or Business Unit Manager, and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory President, Director of Operations, Laboratory Director and/or Business Unit Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

1.5) Company History

The laboratory was founded in 1961 by Dr. Earl Hess in response to a need for high quality technical services by the agricultural and industrial communities in southeastern Pennsylvania. Nourished in a culture of quality and caring about all those associated with the business, the corporation became an industry leader known for innovative business practices and people-friendly policies. The company was independently owned until the retirement of Dr. Hess in 1995. At that time, the laboratory was acquired by a publicly held company, Thermo TerraTech, Inc., a Thermo Electron company. Ownership changed in September 2000 when the laboratory was acquired by Goldner, Hawn, Johnson, and Morrison, Inc. (GHJ&M), a private equity investment firm. In August 2005, the laboratory was acquired by Fisher Scientific under their BioPharma Division. On November 9, 2006, Thermo Electron and Fisher Scientific merged to form Thermo Fisher Scientific. In April 2011, Thermo Fisher Scientific sold the laboratory to Eurofins Scientific. In July 2013, the Pharmaceutical and Environmental Divisions were split into separate business entities and the company name became Eurofins Lancaster Laboratories Environmental, LLC. In November 2018, Eurofins Scientific acquired TestAmerica, adding a network of laboratories across the United States. In January 2022, the company's legal name was changed to Eurofins Lancaster Laboratories Environment Testing, LLC, a holding of Eurofins Environment Testing America Holdings, Inc. The laboratory continues to operate as an independent laboratory and is incorporated by the State of Delaware.

2) MANAGEMENT REQUIREMENTS

2.1) Organizational Structure

Although the laboratory is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to the Lancaster Business Unit and associated service centers. The Lancaster Business Unit is an individual entity, which can be held legally responsible for providing accurate laboratory testing and results. The laboratory President, in conjunction with the Director of Operations and senior management staff, is responsible for the daily operations of the laboratory. Duane Luckenbill is designated as the laboratory's Technical Director relative to accreditations. The laboratory management staff includes directors, managers and group leaders. Organizational charts of the management staff are presented in *Appendix C*. Individual departmental staff lists are maintained in the company's internal intranet.

2.2) Roles and Responsibilities

In order for the QA Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The responsibility for quality resides with every employee of the laboratory. All employees have access to the QA Manual, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks impartially and in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs.

Deputies temporarily fill a role if the primary employee is absent for more than 15 consecutive calendar days. The Technical Director and Quality Assurance (QA) Manager have identified deputies for all key management personnel. The deputies must meet the same qualifications as the primary person should they be required to take on the responsibilities. Notification to agencies is performed by QA.

See Section 3 for the requirements for personnel qualifications, training, and business conduct.

2.2.1) Laboratory Director/Director of Operations

The Technical Director ensures that the laboratory's policies and objectives for quality of testing services are documented in this quality manual. The Technical Director must assure that the manual is communicated to, understood, and implemented by all personnel and reports directly to the Business Unit President.

2.2.2) Quality Assurance Manager

The Quality Assurance Manager ensures that the quality system is followed at all times. The QA Manager reports directly to the President thus ensuring corrective actions to quality issues are taken promptly and are separate from business decisions. The QA Manager has no direct supervisory responsibility for the generation of technical data to avoid any conflict of interest in administrating the QA program. The QA Manager has the final authority to stop work that compromises our integrity or data quality. The situation must be investigated and appropriate corrective action must be put in place before the QA Manager will authorize the resumption of work. The specific duties of the QA Manager are communicated in the position qualification description (PQD) and include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Have functions independent from laboratory operations for which he/she has quality assurance oversight.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.

- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Review of external audit reports and data validation requests.
- Captains the QA team to enable communication and to distribute duties and responsibilities.
- Have a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).

2.2.3) Technical Managers

Laboratory management duties are outlined for supervisory personnel using a job plan format, which details each individual's responsibilities along with expected results. Department management report to the Lab Director. Typically, management duties include, but are not limited to:

- Personnel hiring and training
- Supervision of personnel
- Providing resources to ensure a work environment free from commercial, financial, and other undue pressures that may adversely affect the quality of their work
- Providing resources to ensure a safe work environment
- Directing daily work operations, including scheduling of work
- Ensuring compliance with applicable laboratory SOPs, the TNI Standards, ISO 17025, Department of Defense Quality Systems Manual, regulatory programs, analytical methods, and client requirements.
- Assessing laboratory capacity and workload; ensuring holding times are met and any issues communicated to clients
- Resource allocation
- Ensuring quality of data produced
- Contributing to the continuous improvement of the laboratory operation

- Ensuring that corrective actions are carried out in an appropriate and agreed upon time-frame
- Communicating problems, risks, and concerns to Senior and Executive Management to enlist a higher level of support for corrections and continuous improvements.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformances, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Develop, implement, and enhance calibration programs.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. Responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Maintaining awareness of technical developments and regulatory requirements

2.2.4) Quality Assurance Department

The QA Manager assigns tasks with input from the company President. The primary responsibilities of QA include, but are not limited to the following:

- Oversee the laboratories' internal audit program which consists of various audit types and applies to all laboratory activities (technical and administrative).
- Review and approve standard operating procedures and analytical methods.
- Review and approve validation documentation.
- Review non-conforming quality control data.
- Perform tracking and trending of quality measurements and report the status, effectiveness, and potential risk areas of the quality system to management.
- Review and approve investigation and corrective action reports (ICARs) and audit responses to ensure that they are completed in a timely manner, evaluated for root cause, that corrective actions are implemented as needed and to monitor corrective action for effectiveness.
- Host client and regulatory agencies during facility audits and follow-up to any cited deficiencies.
- Provide regulatory guidance to the laboratory and support areas.

- Communicate quality issues to management in a timely manner.
- Provide and/or coordinate on-going regulatory training (e.g., Ethics).
- Participate in the vendor and supplier approval process, including subcontractors.
- Review analytical data for compliance with our procedures.
- Prepare and review QA project plans (QAPPs) as required by EPA and client projects.
- Maintain and update this EQPM.
- Maintenance of the Laboratory's accreditations, including but not limited to, administration of the proficiency test sample programs.
- Communication to the relevant regulatory authorities is required when there are management or facility changes that impact the laboratory. Changes in the technical director must be communicated within a period of time and in the manner dictated by each regulatory authority.

2.2.5) Client Services/Project Management Department

Members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager (a.k.a. "CSR" or "PM") who serves as their primary contact at the laboratory. It is the project manager's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements. While most communication occurs and is stored via email, all client verbal communications are documented by the project manager in a controlled notebook. In addition to information management, Project Management responsibilities include:

- Coordinating and preparing proposals in conjunction with technical staff.
- Confirming certification status.
- Assisting QA with hosting client visits and audits.
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution.
- Providing clients with sample status report or results (partial reports) prior to receipt of the final Analysis Reports.
- Scheduling sample submissions, sample containers orders, and sample pick-up via the laboratory courier service.
- Informing the client of deviation from their contract.
- Documenting client concerns in the LIMS; directing priority or high risk concerns to QA when formal investigation is needed.

2.3) Business Continuity and Contingency Plans

The following business and contingency plans are in place to ensure continued operations or minimal disruption in operations should unplanned events occur (natural disasters, unexpected management changes, etc.):

- Deputies as defined in Section 2.2 are identified for all key management personnel. Notification to agencies is performed by QA as noted
- A disaster recovery plan - see Section 4.4.
- Computer security and backups - see Section 4.5
- Client record handling in the event of a change of company ownership or should the company go out of business - see Section 14.1.

3) PERSONNEL

3.1) Personnel Qualifications and Responsibilities

Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum preferred education and training requirements for laboratory employees are outlined in Position Qualification Descriptions, or PQDs. PQDs for all positions are maintained in the laboratory's document control system. Resumes or curricula vitae (CVs) are maintained on file for all staff in the training record system. Responsibilities are outlined in the PQD at the position level. Individual responsibilities and expectations are documented in each employee's job plan. The job plan is evaluated and discussed with each employee on an annual basis. The job plan is a confidential personnel record. The PQDs for senior staff (Technical Director, QA Manager, Laboratory Operations Director, Science Officer, Technical Manager and Support Manager) are provided in *Appendix D*.

3.2) Personnel Training

The experience and training received by personnel is of great importance to our company, our clients, and regulatory agencies. Curricula Vitae (CVs) and on-going training documentation are available to demonstrate how personnel have been prepared for the tasks they routinely perform. To ensure the highest quality of services at the laboratory, training programs and plans are developed to match skills with job functions. Accurate training documentation is the responsibility of both the employee and their supervisor. On a routine basis, the supervisor reviews and approves training documentation to verify that it is complete and current.

Training requirements can be met through education, prior job experience, internal and external training classes, on-the-job training, training modules, procedure reading, or any combination thereof, to enable the person to perform assigned job functions and meet regulatory compliance.

Each analyst training to perform a new analysis is required to perform an initial demonstration of capability and meet the requirements for accuracy and precision before working independently on the test method. Typically, this is accomplished by the successful analysis of four known samples (i.e. a quad study). However, there are certain tests performed that are not required by the mandated test

method or regulation to perform the above procedure since they are not conducive to spiking. In this case, the analyst's documentation of proficiency is achieved by documentation of having read, understood, and agreed to follow the SOP as written, on-the-job training and observation by a senior analyst.

Management personnel are responsible for planning ongoing professional growth and development activities for an employee through on-the–job training and/or internal and external training courses so an employee can maintain a current skill set to match job responsibilities.

An annual performance review based on job responsibilities, accountabilities, objective measures, and pre-defined standards is completed by management personnel for each employee. This assessment is documented and maintained. Input is obtained from other managerial personnel as needed. Performance reviews are maintained in the employee's personnel file and are confidential.

The QA Department is responsible for coordinating and conducting initial and ongoing regulatory training (e.g., Ethics) for all applicable laboratory and support personnel. It is the responsibility of management within each department to ensure that personnel attend the required training sessions.

The choice of training format and topics covered for ongoing regulatory training is left to the discretion of QA and the trainer. All training sessions reinforce the concepts in the regulations as they are relevant to the laboratory.

Whenever possible, after training is completed, a demonstration of proficiency of the training topic is given. The demonstration of proficiency is generally in the form of a quiz although other demonstrations of proficiency are acceptable depending on the scope and content of the training. If necessary, training is presented and/or repeated one-on-one with individuals who do not demonstrate proficiency in the training topic. This is performed by QA in conjunction with applicable laboratory management personnel.

New employees are oriented as part of a year-long process that is designed to make the employee feel welcome and comfortable by defining our culture, traditions, philosophies, and work practices. During the orientation process an employee learns about personnel and safety policies and business strategies in addition to quality, ethics, and customer satisfaction expectations through a formal process administered by collaboration of our Human Resources staff, QA, and the management of the employee's assigned department.

New employees are required to attend "core" technical orientation, as applicable, which can entail the participation in training module exercises, short session attendance, and/or other skill training specific to their assigned department or job function. Additional job-specific training required for an employee is based upon their assigned duties and is identified by their supervisor. Technical orientation occurs during the first few weeks of employment.

Note: Seasonal and temporary employees have reduced "core" training requirements based on the assigned tasks and as defined by QA, Safety, and the assigned department management.

The orientation process is designed to enable employees to initiate and take responsibility for their personal and professional career growth at the laboratory. The orientation process is conducted without regard to employee race, color, creed, national origin, sex, age, or disability in accordance with the laboratory's Employee Equal Opportunity (EEO) policy.

Refresher and ongoing training occurs through various means, which include but are not limited to, training in or independent review of new/updated standard operating procedures and work instructions; on-going regulatory training; in-house or off-site classes or seminars. The goal of this training is to

ensure that employees remain current with changes to laboratory systems and practices, as applicable to their job function. Retraining and re-qualification activities occur as directed by procedures or regulations. Employees are retrained if an issue or investigation warrants that retraining is a necessary corrective action. Management directs when employee re-training is required, and the extent of the re-training.

3.3) Business Conduct

Our business conduct policy applies to all operations of the company. All employees must avoid involvement in any activities that would diminish confidence in their competence, impartiality, judgment, or operational integrity. All employees must further avoid any relationship with other individuals or organizations that might impair, or even appear to impair, the proper performance of their company-related responsibilities. Employees must avoid any situation that might affect their independence of judgment with respect to any business dealings between the company and any other organization or individual. Any employee who believes that they have such a conflict, whether actual or potential, or who is aware of any conflict involving any other employee must report all pertinent details to the President, QA Manager, and/or Operations Director of the company. The company's management vigorously enforces this policy and takes prompt and appropriate action, including termination, against any employee found to be in violation.

4) BUILDING, FACILITIES, AND ENVIRONMENTAL CONDITIONS

4.1) Physical Facilities

The laboratory is located at 2425 New Holland Pike, Lancaster, PA. The facility consists of two campuses with multiple buildings located on the North and South sides of Route 23. The two campuses are connected by a pedestrian bridge that spans Route 23.

Building A resides on a commercial plot measuring 13.6 acres on the north side of Route 23. It is a three-story building of concrete and steel construction which houses both laboratory space and administrative offices. It is approximately 108,000 square feet and consists of approximately 47,000 square feet of laboratory space; 29,000 square feet of office space; and 32,000 square feet of storage, mechanical, and common areas. On this parcel, adjacent to Building A, sit two chemical storage buildings (Buildings I and L) with a total space of 2500 square feet. In addition, a 10,500 square foot storage building houses stability chambers (Building J). The bottles packing area, which includes preservation of bottles being sent to clients for sampling, is located in a separate 3100 square foot building (Building K). In addition, there are two other buildings (Buildings G and H) with a total square footage of 20,000 square feet that host recycling, storage, workshop and facilities maintenance areas.

The remaining buildings reside on a commercial plot measuring 36.48 acres on the south side of Route 23. These building are connected to the north campus buildings via a pedestrian walkway over the highway.

Building B is a three-story building of steel and concrete construction. It is approximately 56,000 square feet and consists of approximately 17,000 square feet of laboratory space; 14,000 square feet of office space; and 25,000 square feet of storage, mechanical, and common areas.

Building C resides between buildings B and D and consists of a three-story building of steel and concrete construction. It is approximately 47,000 square feet and consists of approximately 25,000 square feet of laboratory space; 6,900 square feet of office space; and 15,100 square feet of storage, mechanical, and common areas. The first floor houses the main lobby and visitor's entrance.

Building D is connected to building C. It is a 78,000 square foot, four-story building of steel and concrete construction and provides approximately 43,000 square feet of laboratory space, 10,000 square feet of office space, and 25,000 square feet of storage, mechanical, common area.

Building M is a five-story building constructed of steel and concrete connected to Building D by a pedestrian bridge on the third floor. The building is 168,000 square feet, 33,000 square feet of laboratory space, 27,000 square feet of office space, and 108,000 square feet of support area including conference rooms, restrooms, hallways, cafeteria, dining, shipping dock, and mechanical spaces. There is also 24,000 square feet of parking located on the first floor north side.

Building E is a 400 square foot structure designed for solvent storage and solvent waste. Building F is a 200 square foot medical waste storage building. Building U is approximately 17,000 square feet, a free standing building, and is used for sample storage. Building R is a single-story 920 square-foot masonry building adjacent to building "M" that housed chilled water pumps and cooling towers. Buildings V,W, and X are storage buildings adjacent to building "M" that support new chemical storage and waste.

Building N is a two-story, masonry, 18,800 square-foot building that houses administrative services for Eurofins US operations. This building is located in a nearby condominium complex. Services provided include accounting, purchasing and human resource operations.

Building S is a two-story stone, masonry, and wood-frame barn consisting of approximately 13,700 square feet. This building is used for storage of facility materials and equipment.

Building T, located on an adjacent parcel, consists of a single-story, 21,000 square-foot, pre-engineered metal building hosting storage, pharmaceutical medical device testing, and training facilities.

There is an automatic fire alarm and security system hooked up at the facility. This system is monitored off-site by Choice Security. The entire campus and all exterior doors are monitored by video surveillance. All laboratory operations and support buildings have electronic access control. Sub-areas within the larger building may have further access restriction for security or safety reasons.

All facilities are serviced by public sewer. Drinking water and the facility sprinkler system is fed by the public water supply. Laboratory process water is supplied via on-site wells. The closest surface water is the Conestoga River.

4.2) Environmental Monitoring

The air handling system for the main laboratory is specially designed to protect sensitive instruments from harmful vapors to ensure that samples are not contaminated. The Physical Services/Maintenance Group is responsible for maintaining the HVAC and exhaust hood systems. This is particularly important in our instrumentation rooms and computer center where a controlled environment, positive pressure system is maintained.

Most refrigerators, freezers, incubators, and ovens used for analysis are monitored by a computerized system equipped with stationary thermometer temperature probes linked to a master panel that is accessed through a computer. If a unit is outside of a predefined temperature range for a specified period of time, the system alarms. Units not on the computerized system must be monitored manually by recording thermometer temperature readings once daily.

The laboratory is set up so that there is effective separation between neighboring areas in which there is potential for contamination. Laboratory storage blanks are also used to evaluate conditions under

which samples for volatile analysis are stored to monitor for cross-contamination potential. QA provides oversight of the environmental monitoring system.

QA and technical management, in consultation with facilities management as needed, evaluate any issues with environmental conditions that could have adverse effects on data to determine if alternative operational plans (moving testing to alternate laboratories, temporary shutdowns, etc.) need to be employed.

4.2.1) Water Systems

Well water and the public sewer system service the facility. The water system is monitored to meet the permit requirements of the Pennsylvania Department of Environmental Protection.

Reagent water is available to analysts for sample preparation (including dilution) and glassware cleaning. Two reverse-osmosis deionized water systems deliver highly purified water to a sealed fiberglass storage tank. From the storage tank the water is delivered to an ion-exchange-carbon filter system for further polishing. The water is also exposed to an in-line ultraviolet sterilization lamp before being circulated to taps throughout the laboratory.

Daily monitoring and preventive maintenance for the system is the responsibility of the Physical Services Department. Monthly and annual testing is performed as required by regulatory guidance. QA provides oversight of the water system monitoring. In addition, method blanks are tested with each batch (less than or equal to 20) of samples.

4.2.2) Housekeeping/Cleaning

The laboratory is dedicated to providing a clean workplace. A third party professional cleaning service provides routine cleaning of “common areas” that include lavatories, drinking fountains, floors, and windows. Technical staff are responsible for the cleaning (or the contract of cleaning) of specific laboratory work areas.

Detergents used for cleaning contain no to very low levels of metals, pesticides/herbicides/fungicides, or volatile solvents.

4.2.3) Insect & Rodent Control

Steps are taken to prevent, monitor, and control insect and rodent infestation. The coordination of this program is the responsibility of the Physical Services Department under the direction of QA. An outside service firm is contracted to perform routine and ongoing monitoring of the facility to ensure that preventive measures which are in place are effective and are working as intended.

No insect or rodent control chemical agents in a liquid or vapor form are applied or sprayed in any laboratory building, unless there is no other option, in which case department management must be contacted for approval.

4.2.4) Facility Changes

Procedures are in place to manage change, ensure communication, and to minimize negative consequences through active participation of personnel involved in a facility change. The goal is to

ensure that physical and environmental condition changes are adequately evaluated for impact and reduction of risk to quality, safety, health, employee, environment, property, analytical services, and business operations before and after the change is implemented.

4.2.5) Labware Cleaning

Dedicated washroom personnel support the laboratory operations in regard to labware preparation, washing, rinsing, and drying. Labware can include, but is not limited to glassware, plastic ware, utensils, and pipettes. Procedures are in place to outline the washing process for each type of labware. Most labware is cleaned using a Miele glass washing machine. Some labware is still washed by hand and either air-dried or dried in specifically designed ovens.

Most of the labware used in the laboratory is "common or non-dedicated" labware (common to a department), but some of the labware used in the laboratory may be identified as "dedicated" labware and exclusively used for certain analyses. This labware is isolated and cleaned only with "like" labware.

All glassware is class A and 100% visually inspected for breakage (e.g., cracks, chips), cleanliness, and dryness before being returned to the laboratory for use. Generally, each test has controls in place to ensure that results are not adversely affected by unclean labware. These controls include blanks to detect positive interferences and recovery controls to detect negative interferences.

4.3) Employee Safety

The laboratory, being mindful of its responsibilities as an employer and active corporate citizen, has established the following objectives of its safety program:

- Provide a safe environment for its employees, visitors, and the community surrounding its place of business.
- Provide ongoing safety training for employees.
- Provide all necessary facilities and equipment to ensure the safety of its employees and to minimize all chemical exposure during the normal performance of their required tasks, and to take all necessary precautions to safeguard the surrounding environment.
- Provide periodic health physicals for employees.
- Foster and encourage safe operations and a proper safety attitude on the part of our employees through general operations and systems, training, and the *Chemical Hygiene Plan* (CHP).

The CHP addresses various aspects of our safety program in greater detail.

A Safety Committee works to enhance our overall safety program. The committee meets on a routine and ongoing basis and its specific responsibilities are detailed below:

- Review accident and incident reports. Make recommendations for methods of prevention to eliminate further accidents.
- Promote safety awareness and distribute safety information by various means (e.g., posters, videotapes, pamphlets, and books). Use internal communication channels to promote safety awareness.

- Enhance and recommend safety-training programs for all employees, as necessary.
- Maintain up-to-date information on employee concerns that are safety related. Offer input and information to the Chemical Hygiene Officer and/or Safety Officer, as needed.

4.4) Emergencies

A disaster recovery plan is in place to provide direction for situations where normal operations of the laboratory are not possible. In the event that the building or information technology (IT) systems would be severely challenged, a designated disaster recovery team, which includes Physical Services, Maintenance, Safety, Corporate Management, Public Relations, IT, QA and other applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

The plan addresses, in general terms, how to approach the following issues: electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic flu, disruption of phone service, and stability chamber failures.

The laboratory is located at the junction of two power grids that supply electrical service to the facility. If one of the power grids fails, we have the ability to work with the power company to have service switched to the other grid. Various types of diesel and natural gas generators are also available on a standby basis to supply power to selected areas of the laboratory in case of a power outage.

To reduce spikes and spurious line voltage changes to laboratory instruments that can affect results or damage electronic equipment, “conditional power” is fed to these sensitive instruments. All essential computer systems are on uninterrupted power supply (UPS) which is a battery system that provides continuous conditional power for a limited time period in the event of a short power outage.

4.5) Security and Building Access

The laboratory is considered a secure facility. All outside doors (except the main lobby entrance) are locked during normal business hours to prevent unauthorized entry. (An attendant monitors this entrance at all times.) Video cameras are utilized by Security personnel to monitor the facility grounds. Building keys and alarm codes are distributed to employees as necessary. Employees wear photographic identification name cards while on the premises.

All visitors must register with the lobby attendant and are issued a visitor badge. A staff person must accompany visitors while in the facility. Additional visitor rules are outlined in the *Visitor Security and Safety Rules* pamphlet which is provided to all guests.

Building access cards are issued on a temporary basis to contractors or service technicians (e.g., electricians and plumbers) who need access to the building to work on a project. These cards provide the contractor with limited access during the normal workday and must be returned when the work is complete.

4.6) Computer System Security and Access

In order to protect computer hardware from misuse, theft, unauthorized access, and environmental hazards, the corporate computer area and computer “Hot-Site” is locked and requires

identification/building card access. All vendors, contractors, or other visitors must be escorted into this area.

The e-mail system is used primarily for the laboratory's business purposes. The *Eurofins Lancaster Laboratories' Employee Handbook* provides additional information in regard to system usage. Employee access to the internet is restricted to those employees who have a business need for it. All employees have access to e-mail. Access to the internet is configured through a user's Windows network account. All internet and e-mail activity is subject to monitoring. All messages created, sent or received over the internet are company property and can be regarded as public information. E-mail and website filtering software is utilized.

Designated employees are able to remotely connect to the laboratory computer systems through an encrypted (SSL) login. When logging in, users are authenticated with their Windows Active Directory account and password.

4.6.1) Passwords

Passwords are important for the security of company data and resources. The laboratory's primary network operating system is Windows and each employee must have a user ID and password combination to access the system. Other computer systems also require a user ID password combination for access. The following procedures apply regardless of which system(s) is being utilized:

- Passwords must be created as strong passwords in accordance with Eurofins Password Policy and must be kept confidential.
- Users must log-out of a system when not in use to prevent unauthorized access. In addition, the network access will automatically timeout after a set period of inactivity, requiring a user to log-in to access the system.
- Forgotten passwords can only be reset by the IT Department or by an appropriate System Administrator.
- Network and LIMS passwords automatically expire at designated intervals. The computer prompts a user to change the password when the expiration date nears. If the password is not changed, the user will be locked out of the system.

4.6.2) Viruses

The laboratory centrally and continuously monitors the computer network for computer viruses. Employees are prohibited from using the company's computer equipment to propagate any virus. Anti-virus software is employed to detect viruses on the Windows network. A notification is sent when there is a particularly dangerous or virulent data destructive program that employees need to be aware of. However, employees are instructed to always be cautious and observant even if there are no current warnings. Employees must report any virus concerns to the anti-virus administrator or IT Management as soon as possible. Employees who share files between their home computer and the laboratory should install anti-virus software on their home computer. If an employee does not have such software, the laboratory can suggest various no-cost anti-virus software products.

4.6.3) Software Policy

Copyright laws protect software, and the laboratory's intent is to abide by all software agreements.

Software purchases must be formally requested and approved by management and/or validation personnel, as necessary.

All software is used in accordance with applicable license agreements.

Employees are not to install any software on computer(s) unless authorized by the IT Department.

Software upgrades must occur in accordance with applicable change control procedures.

Employees must not give software to outsiders (e.g., clients, contractors), unless approval is granted by management.

Users must not make copies of any licensed software or related documentation without permission. Any user that illegally reproduces software is subject to civil and criminal penalties including fines and imprisonment.

5) QUALITY SYSTEM

5.1) Quality System Overview

In addition to this *Quality Policy Manual*, aspects of the QA program are documented in a series of standard operating procedures that support the proper execution of this document. Technical operation procedures with required quality components are also in place. A list of the titles of relevant SOPs is provided in *Appendix E*. There are a variety of mechanisms used to communicate requirements and verify compliance with the QA program, including:

- Management requires that all employees read and be trained in the policies and SOPs that are pertinent to their jobs.
- Employee job plans define individual responsibilities. All job plans include data quality aspects, and performance is reviewed annually.
- Laboratory audit findings are communicated to management and require a response and follow-up to items needing corrective action.
- Cross-functional meetings, including representatives from QA, Client Services, Business Development, management, and technical operations are held as needed to review specific projects and quality issues.
- The Quality Policy Statement is in Section 1.2.
- The Ethics and Data Integrity Policy is in Section 5.2.
- The Quality System Documentation is explained in Section 5.3.

5.2) Ethics and Data Integrity

All employees review and sign the Employee Ethics Statement on their first day of employment and annually thereafter. All employees are instructed in regard to how ethics and data integrity are relevant to every position in the company. Employees responsible for generating, handling, or reviewing laboratory data understand that the laboratory mission is to perform all sample processing and testing

with the highest level of integrity. Under no circumstances are shortcuts or generating results to suit a client's purpose rather than good scientific practice considered acceptable. Any violation of the laboratory ethics policy results in a detailed investigation that could lead to termination, debarment or civil/criminal prosecution.

All levels of management consider the following activities unacceptable:

- Knowingly recording inaccurate data.
- Fabrication of data without performing the work needed to generate the information. This includes creating any type of fictitious data or documentation.
- Time travel or adjusting clocks on computerized systems to make it appear that data was acquired at some time other than the actual time.
- Manipulation of data for the express purpose of passing system suitability or quality control criteria.
- Selective use of data generated, or not using data that was legitimately generated and has an impact on the outcome of the test.
- Executing significant deviations from approved test methods and procedures without prior approval from the laboratory management, QA, and/or the client.

If an issue does arise which could compromise data integrity, personnel are instructed to perform the following activities:

- Clearly document the situation and maintain all data generated. There is a big difference between poor judgment and fraud. Fraud usually involves intent to conceal an action taken. Therefore, the more documentation that is maintained, the less likely an action is considered fraudulent if further scrutinized.
- When out-of-specification results or quality type issues are detected, all supporting data and relative background information must be documented and presented for management review. Problem resolution and client contact, as applicable, must also be documented.
- Review any questionable situations and decisions with a supervisor.
- Bring a questionable or uncomfortable issue directly to the QA Director or a member of the QA Department as part of our QA open door policy.
- Utilize the company's anonymous Ethics hotline service at www.lighthouse-services.com/eurofinsus, via email at reports@lighthouse-services.com (include company name), or calling 855-910-0005 (Spanish Speaking 800-216-12888).

5.3) Quality System Documents

The laboratory's Quality System is communicated through a variety of documents.

The order of precedence is as follows:

1. NDSC Guidance Documents

2. The Environmental Quality Policy Manual QA-QM11872

3. Document Levels are defined in sections 5.3.1 through 5.3.4 of this document. The development of new procedures and the review and updating of current procedures is ongoing based on laboratory changes, new method development and regular review cycles.

5.3.1) Level 1 - Quality Policy Manual and Company Policies

The intent of these documents is to define "what" we do with emphasis on Executive and Management's responsibility for quality.

The purpose of the Quality Policy Manual is to provide a framework to outline the quality systems at the laboratory. Information on key quality system processes is described within the manual. Organizational charts, list of SOPs, a list of equipment, instrumentation, and PQDs for senior personnel are included as attachments to this manual.

- Executive Management is responsible for ensuring that adequate personnel, resources, and support are available to carry out the requirements of this Quality Policy Manual.

- Management is responsible for ensuring that SOPs, Work Instructions, or other appropriate documents are written and available to personnel to define the practices and systems which support these policies.

- All employees are responsible for conducting business in a manner which is compliant with quality and company policies and associated SOPs, Work Instructions, or other appropriate documents. Review of these policies and procedures must be documented.

Additional company policies are written to support and expand upon this Quality Policy Manual. These policies contain more detailed information about a subject with approval signatures executed at the Executive and/or Management level.

5.3.2) Level 2 - Standard Operating Procedures

The intent of these standard operating procedures is to define "who, what, where, and when." These procedures provide specific information for a process or topic so that the requirements outlined in this *Quality Policy Manual* and company policies can be achieved. The review and approval of these SOPs is performed at the director/manager/group leader level, including QA review and signoff, and the responsibility of these SOPs lies with the area or person directing the operation.

SOPs can apply to site-wide operations, the entire company, across multiple departments, or a specific operating area.

5.3.3) Level 3 - Work Instructions (at a department level)

The intent of these procedures or documents is to define in greater detail the specific "how to". The level of detail in these documents must be sufficient so any appropriately trained person can perform the task accurately. Examples include, but are not limited to departmental standard operating procedures (SOPs); maintenance and calibration procedures; and the laboratory analytical methods.

Departmental level procedures/documents are reviewed and approved at the manager or group leader level including QA review and signoff.

5.3.4) Level 4 - Quality Records

The intent of these documents is to provide documented evidence to support our quality systems and operations. Examples include but are not limited to, data notebooks/logbooks, and preformatted data recording forms.

5.4) Overview of the Quality Assurance Program

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP, ISO 17025, DoD, PALA, and any other regulatory agencies (i.e. states) in which we hold accreditation. Although the laboratory is a wholly owned subsidiary of Eurofins Scientific, the Quality Assurance and Quality Systems operations described in this manual are specific to the Lancaster Business Unit and associated service centers.

The administration of the QA program is the responsibility of the QA Manager in cooperation with all levels of management.

The QA program, as directed by executive management, was established to:

- Ensure accountability, accuracy, traceability, and impartiality for all analytical data generated.
- Ensure that current regulatory, agency, and client requirements are being met.
- Ensure that operating procedures are in place to minimize risk, the possible loss, damage, and tampering with data, in addition to ensuring that raw data is stored in a secured area and is maintained by designated archivists and/or system administrators.
- Ensure that curriculum vitae (CVs) and training records are maintained to document that staff members have the necessary education, training, and experience to perform their job responsibilities and functions.
- Ensure that regulatory training is provided to applicable employees on a routine and ongoing basis.
- Ensure that all procedures are available, controlled, and current.
- Ensure that documentation demonstrates that procedures are carried out in a compliant and effective manner.
- Ensure that all equipment and instrumentation is qualified, maintained, and calibrated, as appropriate, in accordance with written standard operating procedures.
- Ensure that all significant laboratory problems are investigated, evaluated for root cause and corrective action is put in place as documented

- Ensure that an internal audit program is in place to provide on-going monitoring, evaluate areas of risk, and confirm that laboratory personnel are adhering to standard operating procedures and applicable regulations.

- Ensure that quality issues are brought to the attention of management in a timely manner.

5.5) Quality Control Charts for Quality Indicators

The LIMS quality control system is used to report QC data to clients, to collect data for assessment of precision and accuracy statistical limits, and to generate control charts. Control charts are accessible to all employees through the LIMS interface. The system charts results from blanks, surrogates, matrix spike/matrix spike duplicates, duplicates, and laboratory control samples/laboratory control sample duplicates. These charts provide a graphical method for monitoring precision and bias over time. They can be used to detect quality problems by observation of patterns. The QA staff uses the charts to evaluate potential data trends.

5.6) Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846). The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts use the current limits entered into LIMS. The QA department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be re-analyzed, re-extracted and re-analyzed, or if a comment should be added to the report explaining the reason for the QC outlier.

5.7) Quality Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics. These metrics are used to drive continuous improvement in the laboratory's Quality System. See Section 16.1.

6) DOCUMENT CONTROL

6.1) Overview

The administration of the document control system including tracking, filing, updating, and archiving of inactive copies is managed by the laboratory and QA staff using an electronic record keeping system. All documents are maintained and accessed through the electronic system. If an employee or department uses hardcopy versions of the documents, they are responsible to ensure that they are using the active version of the document.

It is laboratory policy to restrict the distribution of our internal procedures to clients, the distribution of company confidential documents outside of the facility is discouraged. Clients are permitted to review our procedures while on-site as part of an audit or visit. Any documents that are distributed are only sent with the approval of QA and are marked with the "Uncontrolled Copy" watermark before sending.

The laboratory maintains SOPs for all aspects of its testing and quality procedures. The document control process ensures that documents are approved by qualified personnel and adequate for use. It ensures that documents are readily available to personnel and at locations where essential operations are performed through the electronic system.

6.2) Document Approval, Issue, Control, and Maintenance

Controlled policies, procedures, and work instructions are reviewed and approved by qualified individuals and are formally issued and administered through the electronic document management system. The editor, reviewer and approval personnel are recorded within the document as through the document control interface. The recording of these steps is through the employee's secure network log-in and password. Designated personnel are assigned the editor, reviewer, and approval roles. Administration of the role assignments is managed by QA.

Analytical Work Instructions undergo scheduled annual review to ensure that they are accurate, current, and compliant. QA is the final approver and publisher on SOPs and Work Instructions, which gives QA the authority to implement the procedure. Forms may be approved and published by department management. Upon the effective date of new or updated documents, all copies of obsolete documents are removed from service.

Each procedure is uniquely identified and includes effective date, version identification, designated user groups, and the "approved by" employee. Document editors and reviewers are recorded in the electronic system for each version of a document. All documents are searchable and uniquely identified in the document management system. Procedures can be printed from this system for reference by employees as the corresponding task is being performed. Prior to using a printed document, the employee **must** ensure that it is the current version.

Interim amendments to procedures are not allowed. Any needed changes require a revision to the document. The document management system has a feedback function which enables information to be given to the assigned document editors. If minor edits (e.g. typos) are identified that can wait until the next review cycle, these can be communicated through the feedback function.

6.3) Client-Supplied Methods and Documentation

Client documentation to support environmental testing at the laboratory is maintained in a centralized area. This information is organized by client/project in the Client Services/Project Management Group. Client documentation includes the following information depending on project size and scope:

- Client supplied analyte lists
- Client supplied project plans
- Client contract quality manuals with specified limits, QC criteria, etc.
- Communication/correspondence records which relate to testing requirements, interpretation of results, or reporting formats

6.4) Control of External Documents

Hard copy versions of external documents are controlled using an inventory form in the document management system. Any external document that is maintained in the laboratory are inventoried and listed on a department specific controlled form.

External documents such as copies of the 40 CFR and ASTM methods are stored exclusively in the QA Department. QA also keeps applicable agency documents on file, these include, but are not limited to, the TNI (The NELAC Institute) and ISO 17025 Standards.

Environmental methods from the EPA or Standard Methods are available in the QA Department, but the technical areas also have copies that pertain to the tests that they perform. Some methods are available on-line and are accessed through the Internet.

It is the laboratory's understanding that the need to control external documents is to ensure that the most current version of a method is referenced or appropriate manual is being used. Regulatory methods are used as references by the laboratory and testing is performed as per written SOPs that fall under our existing document control system and have scheduled reviews. The scheduled review of SOPs is used to ensure that the proper version of a method is referenced. While using the most current version of an analytical method is our typical practice, there are specific client needs and accreditation rules that require previous versions of a method to be used.

The technical areas are responsible for ensuring that all manufacturers' manuals are current and available to analysts. The vendor provides instrument manuals when new equipment is purchased or existing instruments are updated. These manuals are kept with the instruments to which they are associated.

7) SERVICE TO CLIENTS

7.1) Overview

We value our client relationships and support these partnerships through the following principles:

- Honesty and Fairness – Our corporate culture is founded on the principles of professionalism and high ethical standards in dealing with our clients. This may mean declining to provide the service requested (if we are convinced that to do so would be meaningless) or it may mean referring clients outside of our laboratory if we believe that another company can better meet their needs.

- Complete Service – We will give our clients full value on every service provided. We will provide detailed information on our methods, procedures, and QA programs if requested, and take a personal interest and initiative in helping solve our client's problems within the area of our professional expertise.

- Trustworthiness – All data and information developed for a client will be held confidential and not disclosed to a third party except on written request of the client. If information is subpoenaed, we must, by law, release it, but the client will be informed of the release.

- Commitment to Quality – We constantly strive to improve our service in quality, flexibility, and dependability, to keep our competitive edge. We will achieve this through: meeting the requirements of those we serve, staying apprised of regulatory and industry expectations, and providing prompt responses to client concerns.

- Basics of Superlative Service – Our focus is on our client's success. Through proactive collaborative communication, our leadership ensures we understand our client's expectations and strives to exceed them. We foster a service culture in our training, reward and recognition, and performance management process so each employee takes ownership to deliver superlative service to our clients. Feedback from clients, whether positive or negative, is an important part of our continuous improvement system. Ways in which feedback is gathered can include, but is not limited to, customer satisfaction surveys, client audits, and the customer complaint system.

We also view our fellow employees as our clients since they frequently receive the results of our labor. Meeting the requirements of the next employee in the workflow process is just as important as meeting the needs of an external client.

7.2) Review of Work Requests, Tenders, and Contracts

The laboratory places great importance on understanding and meeting client requirements for a project. We ensure, to the best of our ability, that client/project requirements are identified and communicated throughout the laboratory. Project evaluation can be achieved in various ways, including the review of analytical methods, protocols, business contracts, and quality project plans (QAPPs). The project review encompasses our Project Cycle process and individual topics to be evaluated for a project include, but are not limited to: scope of testing; required accreditations (i.e. individual state agencies, PALA, NELAP, DoD, and ISO 17025) held by the laboratory; appropriate and current testing methods; ability to meet project required reporting limits and QC (if applicable); inconsistencies clarified; and nonstandard work requests.

Project kick-off meetings can be arranged through the PM or Business Development Group. These meetings allow the client and key technical personnel to discuss project issues and requirements prior to project initiation. Any differences between laboratory processes and the project requirements are discussed and addressed with the client and the laboratory staff before the project is accepted and samples arrive. Project-specific requirements are communicated to the laboratory through use of Project Notes or Method Comments. Accreditation-specific requirements (i.e. NJ DKQP, MA MCP, CT RCP, PALA, NELAP, DoD, and ISO 17025) have template PNs maintained by QA, and these are used to add to the project's PNs. Testing that cannot be performed at the laboratory may be subcontracted to another laboratory (see Section 8).

A key client contact, the PM is assigned to oversee the project. Communication between the client and laboratory staff is available and is coordinated through the PM. As a project continues, the PMs provide continuous communication and status reports (if requested) about the project to the client. The PM relays any project changes or modifications to the technical groups. If the client submits revised project documents (QAPPs, etc.) then the Project Cycle review process is repeated. The PM also communicates any issues encountered by the technical laboratories back to the client and vice-versa.

7.3) Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the laboratory Operations Director, in conjunction with the President, and management team. Input from business development, sample registration, and client services management is also evaluated. These responsibilities are documented in the individual job plans for these positions.

The laboratory facilities and staff size are very large compared to other laboratories serving the environmental industry. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and

medium size projects against capacity available to complete them. Large projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met.

Regularly scheduled meetings are held with upper management, laboratory middle management, Client Services and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory. Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Information Management System (LIMS) including turnaround time, and work in progress.

7.4) Communication and Documentation

Documentation is maintained on the Environmental Project Management network folder and, if necessary, the LIMS. A key client contact, the PM is assigned to oversee the project. Communication between the client and laboratory staff is available and is coordinated through the PM. As a project continues, the PMs provide continuous communication and status reports (if requested) about the project to the client. The PM relays any project changes or modifications to the technical groups. If the client submits revised project documents (QAPPs, etc.) then the Project Cycle review process is repeated. The PM also communicates any issues encountered by the technical laboratories back to the client and vice-versa.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel. All stages of the contract review process are documented and include records of any significant changes.

PMs are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project. Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client. Technical Managers are available to discuss any technical questions or concerns that the client may have.

7.5) Client Feedback

The laboratory is in the business of providing high quality analytical testing services. The data that we supply to our clients must be technically complete, accurate, and compliant with applicable regulations. Complaints can be received via letter, phone call, e-mail, or face-to-face meeting.

When a complaint is received, it is our responsibility to determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a data reporting error is discovered, the final report and/or data must be regenerated with the correct value(s).

The PM is responsible for entering client concerns into the LIMS. QA reviews these issues on a monthly basis to evaluate for trends and potential risks to laboratory data/systems. In some cases, an ICAR is initiated to address and document the situation. While an individual issue may not warrant a formal investigation, QA monitors these issues for potential trends and will issue an ICAR if a trend is evident. If the client requires a formal investigation, then the PM notifies QA so the ICAR can be initiated.

The laboratory includes a client satisfaction survey to clients in all email communications. The results of these surveys are compiled, routed to the laboratory executive management and the QA Director, and

used to identify areas of improvement for the laboratory.

8) SUBCONTRACTING

8.1) Overview

For the purpose of this quality manual, the phrase "subcontract laboratory" refers to a laboratory external to Eurofins Lancaster Laboratories Environment Testing. The phrase "work sharing" refers to internal transfers of samples between the Eurofins laboratories.

The client must be notified and approve of their sample to be sent to a subcontract or workshare laboratory. When subcontracting our clients' work, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity, or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client.

When subcontracting analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a quality program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025, and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

8.2) Qualifying and Monitoring Subcontractors

Subcontracting laboratory(s) shall be selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.
- Subcontractors reviewed by Eurofins – Firms which have been reviewed by the company were confirmed to meet accreditation and technical requirements for the project and are appropriately insured.

A listing of vendors is available on the LIMS. All Eurofins laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations and can adhere to the project/program requirements. Client approval is not necessary unless specifically required by the contract.

When the potential subcontract laboratory has not been previously approved, the PM may nominate a laboratory as a subcontractor based on need. QA requests that the PM begin the process of approving the subcontract laboratory.

8.3) Responsibilties

- Client - the client assumes responsibility for the quality of the data generated when they specify the subcontractor to be used

- ELLE - the laboratory assumes responsibility for the review and approval of the subcontracted laboratory's credentials.

- Project Manager - informs the client, preferably in writing, of the need to subcontract work. Email notification is acceptable.

Note: Subcontracted laboratories must receive project-specific approval from the DoD customer before any samples are analyzed.

- Project Manager/Sales - requests information from potential subcontract laboratory (via the Laboratory Analytical Services Subcontract Form)

- Quality Assurance - ensures the subcontracted laboratory complies with ELLE's overall management system

8.4) Use of NELAP and A2LA Logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

9) PURCHASING SERVICES AND SUPPLIES

9.1) Supplier Evaluation

Procedures are in place to evaluate vendors who supply us with: new equipment, instrumentation, computerized systems and computer software; commercially purchased glassware, including sample bottleware, reagents, chemicals, solvents, gases, media, and standards; and contracted and subcontracted services.

The laboratory strives to ensure that our suppliers continually improve their quality systems and we reserve the right to purchase from suppliers of our choice in order to best fulfill the needs of our clients and our business. When directed by a client to purchase from a specific supplier, we will do so. In this instance it is the client's responsibility to "qualify" the specified supplier. We attempt to purchase from businesses that we have an established purchase history or have previously acquired information regarding the supplier's quality programs.

The laboratory does not evaluate every supplier. Risk assessment is taken into consideration when making this decision. The risk assessment analysis includes system, material, services, and number of samples or operations the purchase may affect or support. Evaluations are not required for computer operating systems, utilities, toolsets, or systems software. They also are not required for any off-the-shelf configurable software package that has an extensive market performance history (e.g., Microsoft Word, Excel, Access).

Additional quality systems are also in place within the laboratory to further verify and support the materials used:

- Certificate of Analysis (COA) for every lot of purchased chemicals, where available, are reviewed and maintained on file.

- For most chemical analyses a blank and a recovery check are routinely analyzed and serve as real time suitability testing of the reagent being used.

- Whenever possible, the laboratory will use Class A, Pyrex glassware.
- Purchasing guidelines for equipment, consumables and reagents must meet the requirements of the specific method and testing procedures for which they are purchased. Solvents and acids are pre-tested in accordance with laboratory criteria.

9.2) Procurement

It is the responsibility of management personnel within each department to ensure that the appropriate supplies are available and/or ordered with sufficient lead-time to perform analytical testing or to provide support to the testing areas. The individual technical departments have trained personnel who enter the supply order into the company's purchasing system. The selection of these products is based on technical input at the analyst level and authorized by technical departmental management. The Purchasing Department maintains an ordering system in which purchase requisitions are managed. Common laboratory items (e.g., beakers, flasks, reagents) are ordered directly through the purchasing system. Purchase orders over a specified dollar amount require approval from the appropriate member(s) of the Executive Management Group before an order can be placed.

Upon receipt of an order, the Shipping and Receiving Department checks the order to ensure that all items were received as specified. Products that have specific storage requirements are taken to the technical area upon receipt. It is the technical area's responsibility to ensure that the product is stored in the appropriate manner. Any checks on the quality of the materials received for use in a specific test are the responsibility of the laboratory using them. This is based upon the experience of the laboratory with the usability of the product. Generally, each test has controls in place to ensure that test results are not adversely affected by the materials.

Any problems encountered when using a material in the laboratory must be brought to the attention of the Purchasing Department and/or Quality Assurance, as applicable, to ensure that follow-up and corrective action occur.

10) COMPLAINTS

10.1) Receipt and Investigation of Complaints

The laboratory considers an effective client complaint handling process to be of significant business and strategic value. Listening to and documenting client concerns captures client knowledge that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints, or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner. The nature of the complaint is identified, documented and investigated, and appropriate actions are determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department follows the Investigation and Root Cause Analysis procedure as described in Section 11 and 12. A

written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

11) CONTROL OF NON-CONFORMING WORK

11.1) Evaluation of Significance and Actions Taken

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately as appropriate. First, the laboratory evaluates the significance of the nonconforming work and the response is based on the outcome of the evaluation. The action could be as simple as addition of a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, an investigation and root cause analysis is performed (see Section 12).

The following list provides examples of the type of issues that warrant investigation:

- Noncompliant QC results*
- Failed PT samples
- Reporting incorrect results
- Contamination issues
- Client complaints resulting from an established policy or procedure that was not followed
- Procedural errors
- A trend of missed holding times
- Systematic problems that compromise the accuracy or compliance of the data generated
- Problems with instrumentation and equipment which could compromise the data generated

These investigations must include the following:

- Identification of the problem
- Determination of samples or systems affected by the problem
- Steps taken to investigate the problem
- Explanation of probable root cause(s) of the problem
- Identification and timeline for implementation of corrective action(s)

The information is tracked through our Investigation and Corrective Action Report (ICAR) process.

*Note: individual QC noncompliance does not require in depth investigation. Actions are taken as defined in the corresponding method and documented in the data. An adverse trend with noncompliance would be investigated. All results from quality control (QC) samples are logged into the LIMS quality control system, which is programmed to alert analysts to unacceptable results. Analysts are required to review the results and determine the source of the problem. The source of the problem and proposed action must be documented. Action for QC outliers may include, but is not limited to, re-analysis, re-extraction or re-digestion, instrument maintenance, or re-calibration. If these actions do not yield compliant data within the required hold time, a Nonconformance Memo (NCM) is created to document actions and communication with the client. The NCM is archived with the associated raw data in LIMS. NCMs are reviewed by the technical department's management, or designee. A copy of the form is reviewed by QA.

11.2) Responsibilities

Any member of laboratory staff can contact QA for initiation of an investigation. The QA staff initiate the investigation in the electronic tracking system. The QA staff track documentation and investigative process, evaluates investigations for completeness and appropriateness, monitors corrective action(s) for effectiveness, and follows up if needed. Department personnel complete the investigation with the oversight of the Department Manager. Technical management and/or QA may issue a stop work notice if issues indicate the potential for problems on a broad scale or present a critical concern regarding the validity of the laboratory methods. The investigation would need to be completed, authorized by the QA Manager in consultation with Lab Management, and the issue resolved before work could continue. Project Management handles the communications with the client(s) if necessary.

Tracking and trending of laboratory issues is performed by QA staff and reported to management on a monthly basis or immediately upon detection of a trend with potential for putting the laboratory or our clients at risk. The QA Department is responsible for preparing reports to Management to keep them apprised of outstanding quality issues. Reports to management foster communication, review, and refinement of QA activities to ensure that the QA program is adequate to meet regulatory and the laboratory's quality objectives.

11.3) Prevention of Nonconforming Work

See Section 13.1 for description of preventative actions that the laboratory employs. In addition to this, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

12) CORRECTIVE ACTION

12.1) Investigation Process

The laboratory has established procedures for determining the root cause(s) and implementing corrective action(s). Problems having potential impact on data quality or involving deviations to ELLE processes are investigated and documented using an Investigation and Corrective Action Report (ICAR). The process ensures documentation of the investigation, root cause evaluation, identification and implementation of corrective action(s), and laboratory management review and QA approval. Follow-up to ensure effective corrective action is managed by QA staff.

These investigations are initiated and managed through a workflow interface (JIRA). Any employee can initiate an ICAR through this system to document a laboratory problem. The investigation must be completed by designated members of management and approved/closed by QA. Each investigation has a unique tracking number assigned by JIRA.

If a laboratory error is identified from the outcome of the investigation that impacts validity of client data, the client must be notified in writing of the situation and corrected data provided as soon as possible. If the root cause of the problem has affected any other client sample results, all affected clients are notified of the problem. Every effort must be made to notify the clients within 2 business days of confirmation of the problem.

12.2) Root Cause Analysis

A major component of the laboratory's QA Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide

insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence.

Cause Analysis

- The event is defined and documented in the JIRA software. Department Management works with QA and a team of relevant staff to investigate
- Good cause analysis is the key to implementing effective, long-term corrective action(s).

Implementation of Corrective Action(s)

- The laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented.
- Corrective actions are proportional to the magnitude of the problem.
- The results of the corrective action(s) are documented in the JIRA software.

Monitoring Effectiveness

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective. Ineffective actions are documented and re-evaluated until acceptable resolution is achieved
- Follow-up audits may be scheduled if QA or the Technical Department deems necessary, or compliance with standards/procedures have come into question.

13) PREVENTATIVE ACTION AND RISK ASSESSMENT

13.1) Preventative Actions

All employees are empowered and encouraged to use the concept of Preventive Action to avoid a problematic situation. The company supports, embraces and drives the process for continuous quality improvement by several means, such as: Ethics Hotline and training classes that include new hire orientation and Ethics. If an employee identifies a potential problem or an area of concern or it should be brought to the attention of his/her supervisor, Human Resources, QA Manager or the Ethics Hotline.

The laboratory also utilizes a formal program to encourage preventive action through development of Lean processes. The goal of this program is to optimize processes to ensure efficiency and operational improvements while maintaining compliance. The efficiency gains are inherently coupled with minimizing errors and rework. Teams of employees learn the tools and techniques to evaluate a process, identify potential sources of errors, delays or problems in an operation, determine system changes that will minimize these and work to implement the improvements. Each project includes thorough documentation of the evaluation, measurement, and implementation phases. The process is continually monitored to ensure that the anticipated results are sustained.

Employees are also encouraged to communicate to their supervisor any area(s) or operation(s) that they believe could be streamlined, make their job easier, would provide a quality improvement, or could provide a cost savings to the company.

Described below are some of the systems available to employees to assist with building quality and efficiency into their daily jobs. They stress a proactive approach/environment to problem solving and to review quality systems and operational efficiencies.

- "Ethics" is a course required for all employees to teach the laboratory's Statement of Values by examining how it translates to our everyday jobs and ethical decision making. Topics discussed include: Statement of Values, data integrity, ethics, confidentiality, etc.. Mandatory ethics training refresher is scheduled on an annual basis.

- The laboratory has contracted with an Ethics Hotline to provide an anonymous means of reporting ethics concerns or issues. The issue is forwarded by the service to the NDSC QA Director who notify the appropriate business unit personnel who need to address the issue. All communication and actions are documented in a secure web interface managed by the hotline service company.

- The QA staff prepares monthly program status reports for management (section 16.1). The reports include a variety of metrics and graphs which are used to evaluate trends in laboratory performance across all quality and compliance areas. Management responds to any negative trends by developing a corrective action plan.

- The laboratory uses a Project Cycle process (further described in section 7.2) to proactively review and prepare for client projects in an effort to ensure full understanding by all laboratory staff of the client's needs and resolve any concerns in advance of receiving the work.

13.2) Change Control

Procedures are in place to define how to maintain facilities, processes, instrumentation, equipment, computerized systems, and computer software in a validated or controlled state through a plan of change control. Successful changes require a thorough evaluation and testing for potential consequences prior to implementation. Planning, authorizing, testing, and reviewing of proposed changes are documented throughout the change process. Changes are planned or could be made in response to an emergency situation. The following "general" elements apply to changes, as appropriate:

- Request to perform a change
- Evaluation of a change
- Authorization of a change request
- Preparation for an authorized change
- Execution and testing of the change
- Documentation of the change
- Approval of the change
- Change implementation and follow-up (Formal approval of the change is performed by designated responsible individuals and QA.)

Note: The DoD will be notified in advance of the migration to a new LIMS platform and/or relocation of any data center(s) from the Lancaster Business Unit.

14) CONTROL OF RECORDS

14.1) Data Documentation Requirements

Most data are acquired, documented, and stored in the LIMS. In some cases, data are documented in bound notebooks. Analysts review data as it is generated to determine that the instruments/systems are performing within specifications. If any problems are observed during an analytical run or the testing process, corrective action is taken and documented.

Procedures are in place to ensure that all data is traceable, authentic, and complete. Electronic data records are maintained and tracked through the LIMS, requiring authorized, password protected user access. The following general requirements outline our system for notebook, logbook, and electronic documentation recording:

- Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task.
- Entries must be legible, signed, and dated. The signature may be a wet or electronic signature.
- Errors are corrected in a manner that does not obliterate the original entry, initialed and dated, and coded with an explanatory identifier. Changes to electronic data are tracked through audit trail functions.
- Blank pages or substantial portions of pages which are left blank are crossed-out to eliminate the possibility of data entry at a later date.
- Notebook pages and instrument printouts are signed/dated to indicate second party data review; this may be a wet or electronic signature.
- At periodic intervals a supervisor or data reviewer checks equipment/instrument logbook entries and temperature recordings for completeness, legibility, and conformance to procedures.
- At a minimum, the following information is recorded as part of data documentation:
    - Date of analysis/operation
    - Signature/date of analyst performing test/operation
    - Identification of client sample(s) and material(s) analyzed
    - Materials, reagents, standards used to perform the testing/operation
    - Method used to perform testing/operation (including version number and/or effective date)
    - Equipment/instrumentation used to perform testing/operation
    - Calculations and how they were derived
    - Departures, planned or unplanned, from the analytical method
    - Signature/date of person reviewing data documentation
- For computer generated data, the following information is recorded:

- Sample(s) analyzed/operations performed
- Date of analysis/operation
- Unique instrument identification
- Name/date of person operating the instrument
- Name/date of person reviewing data
- Any manual notations made on instrument printouts are signed, dated, and reviewed

14.1.2) Laboratory Notebooks, Logbooks, and Forms
Procedures are in place to ensure that all data is traceable, authentic, complete, and retrievable. Most documentation and records are maintained within the LIMS. The laboratory has a procedure in place for data that requires a physical log.

The following general requirements outline our system for the issuing, control, and archival of physical laboratory notebook and logbooks.

- The administration of notebooks and logbooks is controlled by the Office Services Group. They maintain a master index to uniquely number and identify each book distributed.
- Notebooks and logbooks are bound, uniquely identified and have sequentially pre-numbered pages. In specific situations, records may be bound to create books at the time of archival (e.g., temperature charts).
- If notebooks or logbooks contain preprinted laboratory form pages, the form is managed as a Controlled Document in the laboratory's Document Control system.
- Completed notebooks are returned to an archivist. Incomplete books are returned to the Office Services group in accordance with the defined schedule. At that time any blank page(s) in the notebook or logbook are crossed-out, or a statement is written on the last page used to note that the book is complete to prevent data from being entered at a later date.

14.1.2) Electronic Data
Instrument software used for processing data must, when available, have password access and audit trails enabled. All data processed through the LIMS includes tracking features to document who and when data was entered and/or changed.

14.2) Data Storage, Security, and Archival

The laboratory has documented procedures and instructions for the identification, collection, access, indexing, filing, storage, maintenance, and disposition of data records. Records are in the form of paper records or electronic data files.

All data records are maintained in a confidential manner in an environment to minimize deterioration or damage and to prevent loss. Some records are stored in off-site facilities, in such a way that they are readily retrievable. Retention time for records is in accordance with specific procedures or instructions. Prior to the destruction of data/records, and if requested by a client or agency, the laboratory will notify

the client/agency that their data is scheduled for destruction so arrangements can be made to have the original data sent to the client.

If specified in client contract(s), archived records are transferred according to their instructions in the event of a change in laboratory ownership or if the laboratory goes out of business. If not specified by the client, the sale agreement must require that archived records be maintained as scheduled by the new owners. In the case of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed.

The laboratory maintains all documentation which is necessary for historical reconstruction of data:

- Analysis reports
- Data notebooks
- Data logbooks
- Instrument output
- Correspondence and client files
- Instrument and equipment logbooks
- QA records
- Corporate documents
- Electronic records

14.2.1) Computer System Backup, Data Restoration, and Data Archival

Mission critical data is stored on several computers throughout the laboratory. These computers are connected through the local area network. Selected files on these computers are backed up using an enterprise-level backup software program. The objective of this backup is to have the ability to restore data after a total loss (e.g., theft, fire, natural disaster). Procedures are in place to perform data backups and restores.

15) AUDITS

15.1) Internal Audits

The QA Department, which is independent of laboratory activities, is responsible for periodic internal audits of the laboratory activities. Audit personnel are trained in accordance with *Q-EQA-FRM6851*. System, traceability, and observation audits are performed to objectively review current systems, operations, and procedures as well as automated data integrity audits of electronic data records. The goal of the audits is to ensure that the quality system activities are effective and in compliance with referenced methods, regulatory programs (including NELAP, ISO 17025, DoD, PALA, and state agencies), and internal policies and procedures. Audits are documented and tracked in a QA database. All records maintained as part of an audit are kept on file for ten years. The specific content and findings of internal audits are considered company confidential and are not shared with clients.

Audits are scheduled and conducted following a predefined schedule, based on criticality of operation and prior audit results, with the goal of evaluating systems and technologies across the operation to identify issues or potential risks as well as best practices. If warranted, additional audits are performed to follow up on promised corrective action or areas of concern. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management. Results of an audit are distributed to applicable management personnel responsible for the area(s) under audit. Management is responsible to address all non-conformances found during an audit with root cause analysis and application of a corrective action plan. If any of the audit findings cast doubt on the validity of the results, the clients must be notified within one business day from confirmation of the issue. Should an audit issue present a major concern regarding validity of laboratory methods, QA personnel can issue a stop work notice.

15.2) Client Audits

Because clients place great importance on compliance with applicable regulations, data quality, and project requirements, they may audit our facility as assurance that their objectives are being met. QA, management staff, PMs, the analytical laboratories, and the support staff play a key role in these audits. Visits by clients can range anywhere from a tour (to verify laboratory facilities and instrumentation) to an intensive inspection of technical operations, procedures, regulatory compliance, and/or review of specific project(s). The option for a remote audit via MSTeams is available.

Audits are scheduled directly with the PM or QA. The request to audit is communicated to all applicable laboratory departments. An escort (designated laboratory employee) remains with an auditor at all times. In accordance with our policy on client confidentiality, a client is permitted to review only data and results that apply to their work, or which have been approved by laboratory management.

15.2.1) Confidentiality

Strict confidentiality is maintained in all of our dealings with clients. Confidentiality agreements, therefore, are willingly provided.

All employees are required to protect company data, including client names and test results from disclosure to any third party. This policy, as described in the *Eurofins Lancaster Laboratories Employee Handbook*, is provided and presented to employees during their orientation period and whenever revisions are made.

Intellectual property associated with the testing that we perform under contract for a client is the property of the client.

In an attempt to ensure the confidentiality of our systems and procedures within our laboratory, it is our policy to restrict the distribution of our internal procedures to clients. Requests for copies of SOPs to be provided to clients must be approved through QA. Audit and investigation reports are considered company confidential. Audit or investigation summaries will be generated as needed for a client. Personnel files are strictly confidential and facility floor plans may only be viewed on site.

15.3) Agency Inspections

It is laboratory policy to cooperate to the fullest extent and maintain cordial relations with all government agencies. The QA Department is assigned the responsibility of hosting and working with agency representatives. The QA role includes, escorting the investigator(s); ensuring all questions are

answered promptly and accurately; making note of all unresolved issues; informing management of the audit status and outcome; responding to the audit report and ensuring that appropriate corrective action is completed. PMs and laboratory staff responsibilities are similar to those noted above for client audits.

Inspections can be performed by investigators or auditors from the EPA, states, third-party accreditation bodies (i.e. A2LA, United States Department of Agriculture (USDA)), or other regulatory agencies. Government agencies have the right to investigate and inspect the laboratory during normal business hours and permission to inspect is granted by Executive Management. The option for a remote audit via MSTeams is available.

Designated members of the QA Department are primary contacts for announced inspections. The QA Manager is the primary contact for all unannounced agency inspections. If the QA Manager is unavailable, Executive Management is notified, in addition to a member of the QA Department. The QA Manager, or their designee, must obtain evidence of the investigator's authority either in the form of a letter or examination/explanation of credentials.

15.4) Proficiency Testing

Many of the organizations that certify the laboratory to perform various analyses require proof of competency. Laboratory performance is checked regularly by participation in a variety of proficiency testing (PT) programs. PT samples are obtained from TNI-accredited vendors. The matrices and analytes defined in the TNI Field of Proficiency Testing (FOPT) tables must be analyzed. In addition, some individual certification programs require analysis of specific sets of proficiency samples.

Generally, the PT programs consist of samples or ampulated spiking solutions used to fortify laboratory samples. The laboratories analyze the samples in the same manner as a client sample, and the data is sent to the agency or vendor for evaluation. After the study results are returned to the laboratory, any data falling outside the acceptance criteria is investigated, root cause is identified, and corrective action is implemented. Results are circulated to management. No PT samples or portion of a PT sample are sent to another laboratory for analysis.

Double blind samples may be submitted to the laboratories with some client projects so that the laboratory is not aware that the samples are PTs. The acceptance criteria for these double blind samples are developed statistically using data from participating laboratories, providing a source of inter-laboratory comparison. Investigations and corrective actions are implemented for these PTs as well. Additional blind PTs or QC check samples can be ordered for a specific test as corrective action if requested by the department or recommend by QA.

15.5) Good Laboratory Practice Critical Phase Inspections

The laboratory no longer performs formal GLP compliance testing.

16) MANAGEMENT SYSTEM REVIEW

16.1) Quality Reports

The QA Department is responsible for preparing a comprehensive monthly metrics report to Management to keep them apprised of current quality issues. This report fosters communication,

review, and refinement of the QA system to evaluate the suitability of policies and procedures to meet both regulatory and laboratory quality objectives.

In addition, all levels of management are continually updated on the status of quality and compliance by circulation of pertinent documents. Management review is documented by signatures on the documents, electronic records of each person's review, along with any comments or request for additional follow-up. The types of documents circulated real-time include:

- Internal, client, and agency audit reports and responses
- Proficiency test results
- Monthly QA status reports

16.2) Annual Management Review

Executive management reviews the elements of the total quality program on an annual basis to ensure its continuing suitability and effectiveness in meeting the stated objectives outlined in Section 5.4 of this manual. The evaluation entails review of reports to management, all audit findings, client complaints, laboratory investigations, staff adequacy and training, and projected growth in workload. Patterns or trends in any of these areas are reviewed as a means to continually improve the quality system. This review also includes an evaluation of any audit findings resulting from the audit of the QA Department. At the conclusion of this quality system review, executive management determines the need to introduce changes or improvements into the quality systems at the laboratory. The minutes from the meeting and any recommendations for improvement are documented and a copy is forwarded to the QA staff for review and follow-up. See *QA-QP38702* for more detail.

17) TEST METHODS AND METHOD VALIDATION

17.1) Scope of Testing

Samples are analyzed in accordance with official published methods, standard methods, client-supplied methodology, or validated in-house methods. We recognize the importance of providing verifiable results and, therefore, use methods accepted and approved by a broad range of federal and state regulatory agencies. The laboratory can also assist in developing and validating analytical methods for specific products and matrices. All methods submitted for our review, as well as all analytical results, are considered confidential.

The laboratory performs a wide variety of environmental testing in support of the Safe Drinking Water Act (SDWA); Clean Water Act (CWA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA/Superfund); and the Clean Air Act (CAA). Methods approved by ASTM are also used in testing. Potable water, wastewater, soil, sediment, sludge, oils, biota, tissue, soil gas, and air are among the matrices typically analyzed.

Our areas of expertise include:

Standard Services	**Specialty Services**
• Volatiles • Semivolatiles • Metals • Pesticides/PCBs/Herbicides • Petroleum Analysis • Waste Characterization • Non-potable Water Testing • Drinking Water	• Dioxins & Furans • Hydrazines • Perchlorate • 1,4-Dioxane • Pharmaceutical Manufacturing Industry (PMI) Wastewater • EPA Method 25D • PCB Congeners

• Soil and Surface Water Testing • Vapor and Air Analysis • Sediment and Tissue Testing • Method Development • Shale Oil & Gas Analysis	• Explosives • Alkyl PAHs, Alkanes, Biomarkers • PFAS • Organic Acids • Aldehydes

All current certificates and scopes of accreditation are available on the laboratory's website https://www.eurofinsus.com/environment-testing/resources/certifications/. A complete list of the tests routinely performed by the laboratory can be found in the *Schedule of Services*.

17.2) Analytical Test Methods

Each laboratory is required to establish and maintain analytical procedures for all the methods referenced in standard testing. The sources for these methods include the most recent versions of these compendia:

- Test Methods for Evaluating Solid Waste, SW-846
- Standard Methods for the Examination of Water and Waste
- Code of Federal Regulations, Chapter 40
- EPA 100 through 600 and 1600 series methods
- ASTM

The test methods used are re-written into a laboratory standard format, which provides consistency in content and allows the analysts to locate the information they need quickly. Procedures are in place to define the format, required approvals, and the control system for these method documents. Elements to address in SOPs are based on TNI and DoD required sections. The format requirements include, but are not limited to, the following:

- LIMS defined method designation, which is used extensively for scheduling and documentation purposes.
- Reference to the original source of the method (e.g. SW-846)
- Scope
- Basic Principles
- Apparatus and Reagents
- Personnel Training and Qualifications
- Safety and Waste Disposal
- Detailed procedure (including any method modifications)
- Calculations
- QA/Quality Control
- Revision Log
- Review and approval by technical management and QA personnel

Analytical methods are maintained as controlled documents to ensure that analysts are always working with the most current version and are reviewed annually for accuracy.

17.2.1) Procedural Deviation

Analysts are required to follow a documented method for all tests performed. Procedures are in place to ensure that deviations from analytical methods are documented, approved, and justified in an appropriate and consistent manner. We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the deviation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Electronic Signature/date of analyst performing the test
- Electronic Signature/date of Quality Assurance and Laboratory Management approving the deviation
- Electronic Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records or through the ICAR (Investigation and Corrective Action Report) system. Both types of documentation require management and QA review and approval.

NOTE: Deviations to analytical methods are NOT permitted by PALA. If samples are analyzed for compliance to a regulatory program, deviations may be allowed with approval from the appropriate compliance officer and/or program.

17.2.2) Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria, reporting limits (RL), and/or method detection limits (MDL) using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. The PM notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we set up the client's method and perform some initial evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we determine linearity, specificity, precision, accuracy, MDL, and RL by performing calibrations, analyzing method blanks, and carrying out method detection limit and quad studies.

In the case of method development, we work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples. Data related to the setup of the method are archived.

17.3) Method Validation

Before new or revised analytical methods are authorized for routine use in the laboratory, validation data is required to demonstrate that the method as performed in our laboratory and analysts performing it are capable of meeting data quality objectives for precision and accuracy. A procedure is in place to outline this process.

Many methods published by USEPA include instructions for performing an initial demonstration of capability, which typically consist of determining the method detection limit and analyzing fortified samples in quadruplicate (i.e. a quad study). This demonstration is performed and compared to acceptance limits for precision, accuracy, and detection limits, when available.

Methods that do not include specific validation requirements are validated by analyzing fortified samples or standard reference materials in replicate. The results of these analyses are used to assess accuracy and precision. Results of validation studies are documented and subject to review and approval by technical and QA management.

17.4) Reporting Limits

It is important to ascertain the reporting limit (RL), also referred to as the limit of quantitation (LOQ), that can be achieved by a given method, particularly when the method is commonly used to determine trace levels of an analyte. The Environmental Protection Agency has set forth one method for determining method detection limits (MDLs) from which RLs/LOQs can be extrapolated. This process is summarized in a laboratory procedure.

MDLs are determined annually using quarterly MDL analyses performed for each method across all instruments used for that method. The MDL is the basis for the RL/LOQ used in the default reporting format. Because MDLs change each time they are re-evaluated, they are not included in this manual, but are maintained in the LIMS and available to clients upon request.

The reporting limit used to determine whether a result is significant and reported as detectable is dependent upon agency and client requirements. A variety of formats are available and include use of the MDL, RL/LOQ, method specified limits, and project specific limits. The MDL and RL/LOQ for each analyte are programmed into the LIMS for reporting purposes. The reported value is adjusted to account for sample aliquots.

Under the DoD program, the laboratory must establish a Detection Limit (DL) and Limit of Detection (LOD). As defined by the DoD program, the DL is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration with 99% confidence. The laboratory determines the DL using the calculated value from the MDL Study. The DL can be derived from pooled MDL values obtained across instruments. The LOD is the smallest amount of a substance that must be present in a sample in order to be detected at the DL with 99% confidence. It is established by spiking a quality system matrix at a concentration of 2-4 times the DL and must be less than the RL/LOQ. The LOD must be verified on a quarterly basis or with each batch of samples.

17.5) Measurement Uncertainty

Per ISO 17025-2017 section 7.6.1 "Laboratories shall identify the contributions to measurement uncertainty. When evaluating measurement uncertainty, all contributions that are of significance, including those arising from sampling, shall be taken into account using appropriate methods of analysis." This means the laboratory must determine the uncertainty contribution of all steps in the testing process such as equipment, calibration, standards, reagents, preparation, cleanups, etc. Since, in most methods, the laboratory control sample (LCS) goes through the entire process of preparation to analysis; all factors that would contribute to uncertainty is evident through the LCS results. LCSs are performed with every batch of samples where appropriate for the method. Tests that do not have LCSs (i.e. TCLP; paint filter test), are evaluated on a case-by-case basis by taking into account the uncertainty of each of the steps taken to perform the test. Our laboratory does not perform field sampling so our ability to assess uncertainty is limited to the processes that we perform. Thoroughly mixing samples prior to taking the testing aliquot minimizes the uncertainty risk with our aliquot.

Measurement Uncertainty is calculated as two times the standard deviation of the LCS recoveries for the group and date range of data points selected for all applicable methods. This is reported as a percentage. It is not necessary to apply or report the uncertainty value with sample results. When a client requests the measurement uncertainty it is applied by multiplying the determined analyte concentration by the uncertainty percentage.

18) EQUIPMENT AND CALIBRATIONS

18.1) Laboratory Equipment Requirements

This document defines equipment as instrumentation used for the determination of analytical results, measurement equipment used for sample preparation and analysis, and support equipment used that may be outside of direct analysis.

The laboratory stocks all equipment required for testing the scope of work which it supports. Equipment is operated by authorized personnel. All equipment is maintained in proper working order and is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. A master list of laboratory equipment is maintained by our accounting department and includes the date received and the condition at receipt (new v. used). Major equipment and instrumentation capabilities are summarized in *Appendix F*. In addition to this list, the laboratory stocks support equipment such as pH meters, ovens, incubators, centrifuges, balances, etc.

Laboratory procedures include, a routine schedule for equipment preventive maintenance (where applicable), a calibration schedule, calibration acceptance criteria and remedial action to be taken in the event of failure. These procedures are maintained in the document control system and reviewed on a regular basis to verify they remain current and accurate. Vendor supplied manuals are also available to provide additional information in regard to operation and maintenance.

Equipment is assigned a unique designation. This unique number or system identification is used to track equipment in logbooks and in the LIMS.

A maintenance logbook is established in conjunction with installation and is readily available to document all incidents and/or routine maintenance processes that pertain to the equipment as they occur. The corrective action taken, the date that the equipment/instrument is returned to service, and performance checks performed is documented.

All equipment or instruments taken out of service are tagged "DO NOT USE". The following minimum information is documented on the tag:

- Date taken out of service
- Employee who took the equipment/instrument out of service
- Reason for tag-out

18.2) Calibration

Calibration is the establishment of, under specified conditions, the relationship between the values/response indicated by a measuring instrument or system and the corresponding known/certified values associated with the standards used. Before being placed into service, equipment must be calibrated or checked to establish that it meets the criteria in the applicable laboratory SOP. Some types of calibrations are performed with a set frequency (e.g. daily) while others provide intermediate checks to ensure that the instrument response has not changed significantly.

The calibration procedures, schedules, and acceptance criteria are defined in the corresponding SOPs and Work Instruction documents. Equipment requiring calibration shall be labeled or otherwise identified with the calibration date and status. (i.e. Analytical equipment calibrations dates are maintained within the instrument software.) All measuring and testing instruments and equipment having an effect on the accuracy, precision, validity, or measurement uncertainty of results are calibrated and/or verified at least annually.

Methods for calibration of instruments and equipment vary widely with the nature of the device and the direction given by analytical procedures, departmental procedures, manufacturer recommendations, or regulatory requirements. Frequency of calibration can also depend on additional factors including ruggedness of the instrument or equipment and the frequency of use. Calibrations must be compliant with TNI2016 V1M4, including a calculations of error (RSD for average curve fits, and Relative Error or Relative Standard Error for other curve types such as linear or quadratic).

Departmental management is responsible for developing or acquiring written calibration procedures for the types of instruments and equipment employed within their area, as applicable. Procedures address the following aspects: description of the calibration method, frequency/schedule for calibration, acceptance criteria, and corrective actions if failure occurs.

Calibrations data is generated and filed to document the activity and recorded either in the equipment logbook, the LIMS, and/or a calibration certificate is maintained.

Calibration failures are documented in the associated logbook and/or within the data generated from the instruments or equipment. Management personnel perform an evaluation and review of failures and assess any potential impact the failure might have on previously generated data. The laboratory utilizes "real-time" controls to ensure the accuracy of the data. These controls are used to assist in assessing the impact of the situation.

After repair, adjustments, or relocation that could affect instrument response, calibration/verification activities are performed, as applicable, before the unit is returned to service.

Analytical data is not reported from instrumentation or equipment with noncompliant calibration unless the client has agreed to receipt of the data and appropriate qualifiers or comments are applied to the final Analysis Report.

18.3) Maintenance

Instrument and equipment maintenance is performed as either a preventive or corrective operation. These processes and schedules are defined in the corresponding SOPs and Work Instruction documents.

Preventive maintenance procedures and schedules are developed for each instrument or piece of equipment, where applicable. Preventive maintenance operations are performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel). Documentation is maintained in the associated maintenance log for the procedure(s) performed as part of the preventive maintenance operation. It is the responsibility of departmental management to ensure that a preventive maintenance schedule is addressed by a procedure where appropriate and is followed.

Corrective maintenance is performed by an analyst, equipment maintenance specialist, or contracted (manufacturer's representative or service firm personnel) in response to indications of equipment or instrument malfunctions. The unit must be clearly tagged as out of service. All corrective actions taken to bring the unit back into service are documented in the associated maintenance log. After repair, further notation is made in the log regarding the functional status. Calibration activities are performed, as applicable, and documented in the log before the unit is placed back into service.

A supply of commonly needed replacement parts is maintained by the laboratory.

19) MEASUREMENT TRACEABILITY

19.1) Reference Standards and Materials

The laboratory has procedures to ensure traceability of measurements with documentation of calibration activities and analysis of reference standards. Laboratory support equipment whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy.

Calibration measurements are traceable to national standards of measurement (e.g., NIST) where available. Physical standards, such as NIST certified weights or thermometers are re-certified on a routine basis. Calibration certificates are maintained on file, where applicable, to indicate the traceability to national standards of measurement. These physical standards are used for no other purpose than calibration.

19.2) Calibration Standards

The laboratory's ISO 17025 and DoD accreditations require calibration materials to be certified and purchased from a reference material producer accredited to ISO 17034 and ISO 17025, when available. A list of accredited suppliers is maintained by QA. This is applicable to the tests under these scopes of accreditation and can be met through the stock standards used for calibration; a standard processed under the calibration such as an ICV or LCS; or comparison to a separate reference material at a frequency defined by at the test level (i.e. annually).

Standards are usually purchased from commercial supply houses either as neat compounds or as solutions with certified concentrations. Upon receipt at the laboratory, the material must be labeled with the date of receipt. The accuracy and quality of these purchased standards is documented on a Certificates of Analysis (COAs) and maintained on file in the laboratory.

Records of all working standard preparations include the dilution(s) made and a reference to the original and any intermediate mixtures. Solutions are labeled according to laboratory procedures and assigned unique names or code numbers that provide traceability to the original components.

All standards are stored separately from samples and in conditions as stipulated by the method or vendor (refrigerator, freezer, room temperature, etc.).

Each new preparation of standard is tested for integrity by comparison to standards from another source or previously prepared solutions. Standards are not used for sample analyses in the laboratory past their expiration date. In some method development or research work, expired standards may be used. These must be labeled as such or stored in a designated location.

20) SAMPLING

20.1) Sample Collection

The laboratory does not provide sampling services. It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples for their collection event. The laboratory provides the appropriate sample containers, required preservative, chain of custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks.

If additional sample volume is necessary to complete testing or perform retesting, the laboratory contacts the client to submit additional volume to supplement current work being performed within our facility. Additional sample received is either assigned a new laboratory sample ID number and/or a comment noted on the final report to state that additional sample was received, depending on the situation. It is our goal to provide accurate traceability between sample submission and when testing is performed.

20.2) Sampling Instructions

The laboratory provides instructions with all bottle orders that define how to sample, preserve, store, and ship the samples prior to their delivery at the laboratory. These instructions inform the client of the importance of proper sampling and advise them that non-compliant samples are rejected or reported with a qualifier.

20.3) Sample Containers

Sample containers are purchased pre-cleaned by the supplier. For pre-preserved bottles, each lot of preservative is checked for contaminants before use. This also serves as a check on the associated containers. An annual bottle lot check is performed to evaluate the cleanliness of any containers not already covered by the preservative checks. The evaluation is to assess cleanliness to the laboratories' detection limits. These checks are processed through the LIMS as samples. Results are documented through the LIMS Analysis Report.

21) SAMPLE HANDLING

21.1) Chain of Custody

The Chain of Custody (COC) form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the

primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect.

21.1.1) Legal Chain of Custody

Samples being tested for litigation require locked storage and documentation of the time and personnel responsible when the sample was not in storage. This level of documentation is available upon client request and procedures to define these activities are in place and include the following:

- A legal internal COC is initiated for each bottle type submitted by the client.
- The legal internal COC is signed each time the sample is stored, removed from storage, or changes hands.
- Clients requesting legal internal COC documentation receive the completed forms after the analysis is complete.

21.2) Sample Receipt

Samples can be received at the laboratory 24 hours a day, 7 days a week, 365 days of the year. Receipt can occur in one of three ways:

- The laboratory courier services (i.e., Transportation Department)
- Personal delivery
- Commercial courier

All samples received for testing are delivered to the Sample Registration group immediately upon arrival. This group is responsible for the unpacking and organizing of the samples. This process includes checking custody seals if present, paperwork agreement, signing the COC, recording cooler temperatures, documenting the condition of containers, accounting for all sample bottles, and observing any safety hazards, and reporting any problems to Client Services for communication to the client. This receipt process is documented in the LIMS.

21.2.1) Sample Acceptance / Rejection Policy

Regulated (e.g. drinking water, NPDES) samples are rejected if receipt requirements are not met. The laboratory's Sample Acceptance Policy *S-SA-FRM10734* is communicated to clients with each bottle order. Any time a sample is received in a condition that does not meet the method, regulatory, or client requirements, the condition of the sample is clearly documented through the LIMS using a sample registration receipt checklist and receipt comments. This information is communicated to the PM and the client is contacted to discuss the best course of action. The client is given the option to resample or have the sample analyzed and reported with a qualifying comment. Some regulatory programs do not allow qualification. Details are provided in the Sample Acceptance Policy.

21.2.2) Sample Preservation Check

Sample Registration personnel check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are released to the laboratory for testing or placed into storage. Any checks of volatile samples are performed and documented at the time of analysis.

21.3) Sample Entry

As soon as practical after sample receipt, all samples are entered into our LIMS. Samples awaiting log-in are stored in temporary holding areas, at appropriate storage conditions to maintain sample integrity. Samples scheduled for Volatile analysis are stored separately. If there is doubt about the suitability of items received or if items do not conform to the description provided or the testing required is not clear or specified, the client is contacted and the conversation documented.

At the time of entry, the LIMS assigns a unique laboratory job and sample number to each sample. This job number is sequentially assigned and a label is generated and is attached to the sample container. Each sample container is uniquely identified with a container descriptor and unique container designation. The sample number and container used are documented on laboratory data records to ensure traceability from the test data to the sample container that was used. The label includes a barcode that can be used to confirm/enter the sample identification information throughout sample processing.

Sample receipt processing is tracked and documented in the laboratory from arrival through receipt, unpacking, and entry.

A sample acknowledgement is generated from the LIMS per sample entry group. Upon request, a copy of the Acknowledgement may be sent to the client on the day following sample log-in to confirm sample receipt and entry. Internally, appropriate personnel audit all applicable sample entries against the client paperwork.

21.4) Sample Identification and Tracking

The sample label generated at time of entry contains the following information:

- A unique sample number
- A unique container identification
- Container type
- Storage location
- Client sample designation.
- Sample date and time
- A unique barcode that contains this information about the sample/container and tracks each container's storage location, traceable within LIMS.

The unique sample number assigned is used to identify the sample in all laboratory data documentation, including notebooks, instrument printouts, and final reports. Each container for a sample is tracked through the sample number and container designator code when there are multiple containers of the same type received. This is used to identify which specific container was used for testing. Laboratory subsamples, extracts, and digests generate unique container identification in the LIMS.

Routine sample tracking is documented using the Laboratory Chronicle which captures the date, time and analyst for each sample preparation and analysis. The information is compiled in the LIMS using electronic record tracking from the data upload and entry functions. This displays, per sample, on each Analysis Report.

21.5) Sample Storage

After sample registration is complete, samples are placed in an assigned and identified storage location until needed for analysis. Room temperature, refrigerated, and frozen storage are available and samples are stored in accordance with regulatory, method, or client direction. The LIMS is used to assign storage locations, which assists in the orderly storage of samples. Sample storage locations are

secured and monitored for accurate temperature control. Samples are stored separately from standards and reagents.

The central locked storage facility contains 3430 square feet of refrigerated space, including 2740 square feet equipped for automated sample retrieval. Samples are stored in the laboratory's automated storage and retrieval system (ASRS) or other assigned storage locations (separate volatiles areas) within the laboratory until completion of all analytical work.

When a sample is scheduled for analysis, the analyst requisitions it through the LIMS from the storage area. Barcode readers are used for LIMS documentation of the movement of the samples between storage and the laboratories. To maintain the integrity and security of the sample(s), the aliquot needed for analysis is removed and the sample(s) returned to storage as soon as possible.

21.6) Representativeness of Samples

Each analytical method provides specific procedures to ensure that a representative aliquot of the sample is used for testing. These procedures include shaking water samples and mixing solid samples prior to removing the aliquot for testing. Analysts are also instructed in sampling techniques that prevent contamination of samples and for handling volatile samples to minimize loss of volatiles.

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample. We also assume that it is acceptable to deplete one container and move to the next without implications unless otherwise indicated by the client.

21.7) Sample Return/Disposal

Samples remain in the storage area following analysis until the testing results have been verified and the Analysis Report has been generated. On a regular basis, a list is generated from the LIMS that summarizes samples that can be removed from the storage area. At a minimum, water samples are held for 1 week and soil samples for 2 weeks after reporting before they would be eligible for disposal. Samples are either returned to the client or disposed of in accordance with local, state, and federal regulations. Removal of the containers from storage for permanent discard is also documented in the LIMS using the barcode reader.

Due to the variety of waste generated at the laboratory, several general categories of wastes and waste streams have been identified. Identification of waste occurs through information provided by the client, historical information, and/or analytical testing. The laboratory uses a sophisticated, computerized LIMS, which includes programming to assist in the identification of hazardous wastes at time of discard.

For reasons of environmental liability, client confidentiality, proprietary product formulation protection, etc., wastes generated by the laboratory are disposed of via incineration at EPA licensed facilities. The three exceptions include bulk neutralized acid waste, COD analysis waste, and lab pack waste containing mercury. None of these exceptions involve containers with client information.

22) ASSURING THE QUALITY OF TEST RESULTS

22.1) Ongoing Evaluation of Data Quality

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process using the following:

- Instrument calibration and evaluation as discussed in Section 18
- Routine process quality control sample (QC) analysis (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DU), surrogates, Internal Standards (IS)).
- Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance as discussed in Section 15.4.

22.2) Reagents and Solvents

The reliability of our analytical results can be directly affected by the quality of reagents used in the laboratory. Procedures are in place to address labeling, storage, and evaluation of these materials. Reagents and solvents include acids, bases, indicators, buffer solutions, colorimetric solutions (CS), test solutions (TS), and volumetric solutions (VS). The *Chemical Hygiene Plan* provides safety information in regard to the storage and handling of laboratory chemicals. All reagents are stored separately from samples.

Each analytical method includes a list of reagents needed to perform the test. Reagents/solvents are fully described, including chemical name, purity, and description of preparation. Where applicable, shelf life and storage conditions are also listed. The laboratory is responsible for checking that new supplies meet the method requirements. These checks are documented and maintained.

Departmental management ensures that an adequate inventory of reagents needed to perform testing is maintained. Reagents received at the laboratory funnel through the Shipping and Receiving Department and deliveries are verified and labeled with the date of receipt. Large volume reagents (e.g., solvents, acids) are stored in a building outside of the laboratory until needed for use.

In addition to the name and concentration of the reagent, all reagents are labeled with the manufacturer/vendor, storage conditions, the date opened, and an expiration or re-evaluation date. Before using any reagent, the analyst must ensure that the material was properly stored and labeled. If a reagent has passed its expiration date or shows signs of deterioration, the material is not to be used in the laboratory and must be discarded or segregated as expired. In some method development or research work, expired reagents may be used. These must be labeled as such or stored in a designated location.

If a re-evaluation date is reached before a reagent is completely consumed, the reagent will be inspected by physical observation for signs of degradation. Physical signs include, but are not limited to, color changes, clumping or other texture changes for solids and formation of precipitate in solutions. This evaluation is performed by an experienced chemist.

Subsequent reagent solutions or mixtures prepared at the laboratory are fully documented in a log and labeled to include: unique name, concentration, date prepared, name of analyst who prepared the reagent, storage conditions or reference to the log containing these details, and expiration/re-evaluation date. The information recorded allows these solutions to be traced to the original stock solution. The reference to the log is intended for use on containers that are too small to clearly document all of the information. The "log" may be a LIMS identifier for reagents/standards with preparation tracked via the LIMS.

All reagent certificates and SDSs are retained by the laboratory.

22.3) Laboratory Quality Control Samples and Acceptance Criteria

Quality control (QC) samples are analyzed with each batch of samples to demonstrate that all aspects of the analysis are in control within established limits of precision and accuracy. Management is responsible for ensuring that QC is analyzed as required by the referenced method. Each analytical SOP specifies (or cross-references another procedure) the type of QC sample, frequency of analysis, acceptance criteria for QC sample results, and corrective action to be taken if QC sample results fall outside of the acceptable range.

The laboratory provides additional bottleware to the client for matrix QC sampling as determined by the method or regulatory requirements.

QA staff, at the direction of the technical department, must program the LIMS with the acceptance criteria for each QC type (other than blanks). The acceptance criteria are based on statistically generated limits from historical laboratory data, on method defined limits, government agency recommendations, or on client/project specific limits.

These limits are used to flag samples that are out of specification.

The types of QC samples and the information each provides are discussed in the following paragraphs.

22.3.1) Quality Control Sample Frequency and Corrective Action

Each analytical method defines the frequency for the required QC samples and the corrective action required when a QC result fails to meet the acceptance criteria.

The QC acceptance criteria are available to analysts in the laboratory through their SOPs or Work Instructions and the LIMS. If the method reference requires the use of specific limits then the laboratory uses the published limits that are documented as part of the analytical method. Many methods require that each laboratory determine their own acceptance criteria based on statistical data obtained from performance of the method. In these cases, the limits are available to the analysts and are entered into the LIMS described below. Statistically determined acceptance criteria are subject to change as the laboratory recalculates its control limits. Due to their dynamic nature, acceptance criteria are not included in this manual.

The results of all quality control samples are entered into the LIMS in the same way as the results of client samples. The LIMS compares the individual values with the acceptance limits and identifies quality control sample results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. This includes, but is not limited to, checking calculations, examining other quality control analyzed with the same batch of samples, qualifying results with a flag and/or comment stating the observed deviation, and actions applied to the samples in the batch (e.g. reprep, reanalysis).

Qualifiers are applied to the data report, but additional comments are **not** needed for the following scenarios:

- QC with high bias and nondetects in the associated samples.
- Matrix QC outliers
- Surrogate outliers due to dilution effects or where confirmatory analysis supports the original result
- Blank detections where the associated sample is nondetect or has the analyte detected at >10x the blank level

The laboratory allows for marginal exceedances based on the number of analytes in the LCS. The exceedances are carefully monitored so that any systemic problems would be identified and corrective

action taken. If the LCS is being reported based on the marginal exceedance allowance, a comment is added to the analytical report.

22.4) Negative Controls

Negative controls are used to monitor for possible contamination. The following are examples of negative controls used by the laboratory:

22.4.1) Method Blanks (MB)

A method blank is a designated sample designed to monitor for sample contamination during the laboratory testing processes. The method blank consists of a clean matrix (i.e. reagent water, Ottawa sand, glass beads, Teflon chips) taken through the entire sample preparation and analysis process. The method blank and field samples are treated with the same reagents, internal standards, and surrogate standards. Ideally, method blanks demonstrate that no artifacts were introduced during the testing processes. The specific acceptance criteria for each test are usually based on the required reporting limit (MDL or RL).

22.4.2) Instrument Blanks

Instrument blanks are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. Instrument blanks differentiate between contamination caused by the analytical system and that caused by the sample handling or sample preparation process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

22.4.3) Trip and Field Reagent Blanks

Trip blanks (TB) are provided by the laboratory, pre-filled with clean reagent water. Field reagent blanks (FRB) are filled at time of sample collection by the sample collector.

TBs or FRBs are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles and PFAS analyses (or as specified in the client's project plan). Additionally, TBs may be prepared and analyzed for volatile analysis of air samples, when required by the client. A TB may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The TB is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the TB in the cooler with the field samples.

22.4.4) Storage Blanks

Storage blanks are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory.

22.5) Positive Controls

Positive controls are reference materials with a known amount of analyte (see Section 19) that are used to demonstrate accuracy and precision.

22.5.1) Laboratory Control Samples (LCS)

Laboratory control samples (LCS) are samples of known composition that are analyzed with each batch of samples to demonstrate laboratory accuracy. Laboratory fortified blank (LFB) is another term used to describe a LCS. The samples are a clean matrix fortified with known concentrations of the analyte. Percent recovery is calculated and compared to acceptance limits.

22.5.2) Second Source Check

A second source check is analyzed using either the LCS and/or an Initial Calibration Verification (ICV). The second source is a standard that is made from a solution or neat purchased from a different vendor than that used for the calibration standards. For some custom mixes, the same vendor but a different lot and preparation is used. This ensures that potential problems with a vendor supply would be evident in the analysis. Some tests use the continuing calibration verification standards as a second source from the initial calibration.

22.5.3) Duplicates, Matrix Spike Duplicates and Laboratory Control Sample Duplicates (DU, MSD, LCSD)

A duplicate is a second aliquot of a sample that is treated identically to the original to determine precision of the test. To compare the values for each analyte, the relative percent difference (RPD) is calculated by dividing the difference between the numbers by their average. Precision for analytes that are not typically found in environmental samples (i.e., organic contaminants) is determined by analyzing a pair of matrix spike duplicates, defined as two spiked samples and comparing the RPD for the spiked compounds. The acceptance criteria are described as a maximum for the RPD value.

22.6) Sample Matrix Controls

The following are examples of controls used by the laboratory to identify the impact of potential sample matrix interferences:

22.6.1) Matrix Spikes (MS)

A matrix spike sample is created by fortifying a second aliquot of a water or soil sample with some or all of the analytes of interest. Blanks are not used for matrix spike QC. The concentration added is known and compared to the amount recovered to determine percent recovery. Matrix spike recoveries provide information about the potential matrix effects on the data relative to the parent sample. Matrix effects can cause results to be outside of the acceptance criteria. Matrix QC is reported only on the Analysis Report for the job that includes the parent sample. Batch acceptance is not dependent on matrix QC. Unless stipulated in a method or by the client, corrective actions are not applied to matrix QC outliers.

22.6.2) Surrogates

Surrogates are organic compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the analytical method, surrogates are spiked into all the field and QC samples to monitor analytical efficiency by measuring recovery on an individual sample basis. The percent recovery is determined and compared to the acceptance criteria.

Isotope dilutions analyses use labeled isotopes, not surrogates, in each field and QC sample.

22.6.3) Internal Standards

Internal standards are compounds, which are chemically similar to the analytes of interest but are not naturally occurring in environmental samples. When required by the method, internal standards are added to every field and QC sample after extraction but prior to analysis. Comparison of the peak areas

of the internal standards is used for quantitation of target analytes. Internal standard peak area and retention time also provide a check for changes in the instrument response. The acceptance criteria are stipulated in the analytical method.

23) REPORTING RESULTS

23.1) Sample and Data Flow

At a minimum, data management is initiated when the laboratory receives the samples from the client. More often the process begins with client communication of their needs and requirements for a specific project and/or testing. When requested, bottle orders for the client's sampling efforts are generated through the LIMS by the PM. The PMs are responsible for entering the information in the sample set up function of the LIMS. Upon receipt of the samples a unique tracking number for the sample group and the samples within the group is generated based on this information. At this point, the LIMS becomes an integral part of tracking the samples through laboratory operations. The flow of data from the time samples enter the laboratory until the data is reported is summarized in the following table:

Sample and Data Flow

Action	Personnel Involved
Bottle orders generated upon request · Bottles packed and shipped to the client under chain of custody documentation	PM Bottles Preparation
Sample received at Lancaster Labs · Unpacked and reconciled against the client paper work or COC · Sample Entry Documentation log completed	Sample Registration
Sample is entered into the LIMS · Lab ID number assigned · Analyses entered · Storage location assigned · Electronic record of sample number · Labels generated · Acknowledgement generated (record of samples received and analyses entered)	Sample Registration
Preservation checks performed Sample stored in assigned location (refrigerator, freezer, etc.) · Electronic record of sample #, container type, and location	Sample Registration
Acknowledgment sent to client (when requested)	PM
Samples requisitioned and removed from storage for analysis · Electronic requisition of sample number by container type · Necessary aliquot taken · Remaining sample returned to storage	Sample Registration Technical Personnel

Action	Personnel Involved
Analysis is performed according to selected analytical method and applicable Project Notes* · Raw data recorded · Data Reviewed · Data uploaded to the LIMS from the instrument or manually entered by the analyst* (This is tracked by the unique sample number and batch number.)	Technical Personnel
LIMS performs calculations as programmed according to methods	Data Processing
Designated analyst or supervisor verifies raw data	Technical Personnel
Generation/release of reports	PM or designee
Data package deliverables are assembled, reviewed and released to client Electronic copy saved in the LIMS	PM or desginee
Electronic Data Deliverables (EDDs) are generated in LIMS	EDD staff
Designated Data packages are overchecked by QA prior to release	QA
Hard copy of raw data is archived Electronic data files and records are backed up and archived	Technical Personnel, Office Services, IT

*Project Notes contain client- and agency-specific requirements (i.e. DoD, PALA, NJ DKQP, CT RCP, MA MCP)
**Analyses requiring the analyst's interpretation may involve manual data reduction before entry into the LIMS.

23.1.1) Identification of Approved Signatories

All data is reviewed and verified by a second level reviewer at the department level prior to release to the client. The signature of the assigned project manager (PM) is applied to the Analysis Report. The PM performs a basic content check of the report. The authorization of the data is stipulated by the technical reviews performed and documented in the LIMS (1st and 2nd level reviews).

Based on complexity or regulatory needs, some projects are designated for additional QA review of the Analysis Reports and/or data deliverables. Designated QA staff are the "approved signatories" for these secondary reviews. Completion of the QA review is documented in the LIMS job tasks.

Note: "signatures" are attached through the LIMS interface and employee login.

23.1.2) Timely Delivery

Evaluating laboratory capacity and ability to perform specific projects is a joint responsibility between the laboratory President, Operations Director, Business Development, and the laboratory managers. We recognize that one of the most important aspects of the service we offer is turnaround time.

Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in the laboratory area creating operation flexibility for routine work. Larger projects are reviewed against capacity estimates before bids are submitted to ensure that the client's schedule is met. Turnaround time is continually measured.

Regularly scheduled meetings are held with technical and support management, and project management personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory.

Management receives a daily report of the status of all samples in the lab, including those with priority status or those that have exceeded a preset turnaround time. This enables the planning and organizing of the workload through efficient scheduling.

Any changes to the established timeline by the client or the laboratory must be communicated to the client or laboratory as soon as possible. Upon communication of changes, a new timeline is established and agreed upon by both parties. If a client requires a change in the scope of the project (e.g., number of samples submitted, change in analyses, revised protocol) the laboratory must be informed in writing and a new timeline and cost estimate is be provided.

23.2) Data Reporting

When all analyses are completed and overchecked, the Analysis Report is generated and released from the LIMS. The client receives a copy of the report containing the results of the analysis and, where necessary, qualifier flags and/or explanatory comments to address non-conformances.

Copies of reports and associated supporting raw data are retained in our archives. The report contains the signature of the assigned client service representative who is the key contact for any questions concerning the results. Data release authorization is managed and tracked through the individual analysis first and second level reviews documented in the LIMS.

Standard Level 2 Analysis Report Sections

Section	Description
1. Cover Page	Report signatory and reporting laboratory Revision date and time Laboratory Job ID
2. Table of Contents	
3. Definitions/Glossary	Explanation of all symbols and abbreviations used in the report
4. Case Narrative	
5. Detection Summary	

Section	Description
6. Client Sample Results	Lab Sample ID Client Sample ID Date and time Collected Date and time Received Matrix Method Analyte Result Qualifier Reporting Limits Units Dilution Factor Date and Time of Analysis Surrogate recoveries
7. Surrogate Summary	
8. QC Sample Results	Analysis Batch Analyte Result Qualifier Reporting Limits Unit Dilution Factor Date and Time of analysis %Recovery Acceptance Criteria
9. QC Association Summary	Analysis Batch Prep Batch Lab Sample ID Client Sample ID Prep Type Matrix Method
10. Lab Chronicle	Date and Time of analysis and preparation Identification of laboratory analyst
11. Certification Summary	Authority, Program, Certification ID and Expiration Date List of analytes reported by the laboratory that do not come under the certification scope
12. Method Summary	
13. Sample Summary	
14. Chain of Custody	
15. Receipt Checklists	

The laboratory offers a variety of data reporting levels and formats, from a basic report of sample and QC results only, to a comprehensive data package of QC/calibration information and raw data. The client and any agency involved direct the selection of report type. Various electronic formats are also available formatted to client-specified file structure and sent via e-mail, direct upload, secure web-site access, or common courier. The secure web-site access is used for clients that require secure transfer of electronic data.

Client confidentiality of web-site data is ensured by the use of a secured firewall internet environment coupled with the use of a user ID and password to gain login access to the system. User accounts are configured to only allow access to specific data associated with the user's business account number.

Amendments to a final report after issue are in the form of an additional document or data transfer and include a reference to the original report. When a completely new final report is required, it is uniquely identified and includes a reference to the original report it replaces.

Analytical reports are generated with a cover page that identifies the laboratory contact person's name and phone number if there is a question about the report. Within this package, each page is uniquely identified and paginated. Analytical test results for methods listed on the laboratory's accreditation scope meet all requirements of the relevant regulatory body accreditation, NELAP accreditation, and ISO 17025 unless noted otherwise.

23.3) Data Calculations

Most instruments either include or are connected to a data system programmed to perform calculations to reduce the raw data to a reportable form. All calculations are maintained in the instrument manuals and/or as part of the analytical method.

In many cases, the data from the local instrument system are uploaded directly to the LIMS for review and reporting. This direct upload eliminates the need to retype data and an associated source of transcription errors from the analytical scheme.

Some instruments report data that require application of additional factors before the data is in final form. For example, an extract concentration may be reported by the instrumental data system, but additional dilution and preparation factors may be needed before the result represents the concentration of analyte in the sample. Analysts input these additional factors into the LIMS, where final calculations are performed.

Analysts manually enter collected data, such as titration data, into the LIMS, which is programmed to perform calculations for final reporting. Documentation of the programming for each calculation performed by the LIMS is maintained.

23.4) Data Review

Final review and verification of the data are performed by designated employees using the sample results, quality control information, method criteria and Project Notes entered into the LIMS. Data are initially evaluated by the analyst and then a second designated employee knowledgeable in the test, other than the employee responsible for performing the test, reviews the data. The reviews include checks for correct transcription, calculations, passing calibrations, compliant quality control results, holding time compliance, and project specific requirements. Any issues or errors identified during this stage are addressed, corrected, and reviewed with the responsible person.

After determining that all necessary requirements for valid data and for the project are met, the reviewer electronically approves the data by changing the LIMS status of the data from "1st level

reviewed" to "2nd level reviewed". The lab has designated personnel to perform 2nd level review. The system is password protected to ensure traceability.

Designated projects require further review by QA prior to release of the Analysis Report and/or data package to the client. These projects are identified in the LIMS through QA review task assignment.

23.5) Data Qualification

Data qualifiers are used to provide additional information about the results reported. The most typical use for data qualifiers is for results that fall below the quantitation limit, in the region where it becomes more difficult to distinguish a positive result from the background instrument signal. The data systems used to generate and report results are programmed to flag values in this range as estimates.

Other qualifiers are applied to advise data users of any validation issues associated with the data. The laboratory makes every effort to meet all of the requirements for generation of data. Occasionally, generation of data that does not meet all the method requirements occurs due to sample matrix or other analytical problems. If the test cannot be repeated or reanalysis would not yield better quality data, qualified data is reported. Qualifiers can be in the form of comments on the analytical report or flags applied to the results.

Qualifications for regulated samples (e.g. drinking water, NPDES) may not be permissible.

23.6) Client and Data Confidentiality

The laboratory will ensure the highest standards of quality and integrity of the data and services provided to our clients. The laboratory is responsible for maintaining in confidence all client information obtained or created. In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

The laboratory will not intentionally divulge to any person (other than the client or any other person designated by the client in writing) any information regarding the services provided by the laboratory or any information disclosed to the laboratory by the client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released. Information about the client obtained from sources other than the client (e.g., complainant, regulators) shall be confidential between client and the laboratory. The source of this information shall be confidential to the laboratory and shall not be shared with the client, unless agreed by the source.

Note: This applies to the scope of testing performed by the laboratory and to all personnel acting on the laboratory's behalf.

Attachment:
Appendix A - Procedure Cross Reference (.pdf)
Appendix B – Certifications, Accreditations, Registrations, and Contracts (.pdf)
Appendix C - Organizational Chart (.pdf)
Appendix D – Personnel Qualifications and Responsibilities (.pdf)
Appendix E – SOPs and Analytical Methods (.pdf)
Appendix F – Instrument and Equipment List (.pdf)

10734 Sample Acceptance Policy
38702 Management Systems Review

6851 Training of ELLE QA Staff for Internal Audits
Attachment: Appendix A - Procedure Cross Reference (pdf)
Attachment: Appendix B – Certifications, Accreditations, Registrations, and Contracts (pdf)
Attachment: Appendix C - Organizational Chart (pdf)
Attachment: Appendix D – Personnel Qualifications and Responsibilities (pdf)
Attachment: Appendix E – SOPs and Analytical Methods (pdf)
Attachment: Appendix F – Instrument and Equipment List (pdf)

End of document

Version history

Version	Approval	Revision information	
18	03.SEP.2020		
19	27.MAY.2021		
20	26.AUG.2022		

NOTE: SOPs and Forms are indicated in the table with the unique D4 document number. The topic of the document is given in parentheses.

EQPM	EQPM Section Title	ISO 17025-2017	TNI -2016	Procedure(s)
1	INTRODUCTION	5.3		
1.1	Mission Statement	NA	NA	14499 (Employee Handbook)*
1.2	Quality Policy	5.7	4.2.2	5252 (Ethics and Data Integrity Policy)**
1.3	Statement of Values	NA	NA	14499 (Employee Handbook)*
1.4	Scope	NA	NA	
1.5	Company History		NA	
2.0	MANAGEMENT REQUIREMENTS			
2.1	Organizational Structure	5.1	4.1	Organizational Charts
2.2	Roles and Responsibilities	5.5	4.1	16196 (Position Qualification Descriptions and Essential Job Functions)
2.3	Business Continuity and Contingency Plans		4.1	13101 (Incident Response Plan)* 14735 (Preparedness, Prevention, and Contingency Plans)* 12233 (Archiving SOP) Form 6843 (Deputies)
3	PERSONNEL			
3.1	Personnel Qualifications and Responsibilities		4.2.1	16196 (Position Qualification Descriptions and Essential Job Functions)
3.3	Personnel Training	5.6		16134 (Employee Training Program) 11178 (Demonstrations of Capability)
3.4	Business Conduct			
4	BUILDING, FACILTIES, AND ENVIRONMENTAL CONDITIONS			
4.1	Physical Facilities	NA	NA	15553 (Facility Operation Manual)*
4.2	Environmental Monitoring	NA	NA	11191 (Monitoring Temperatures) 11919 (VOA Storage Blanks) 11916 (Use and Maintenance of Reagent Water)* 19712 (Laboratory Housekeeping and Cleaning)* 16117 (Insect and Rodent Control)* 14744 (Facility Change Management)*
4.3	Employee Safety			11893 (Chemical Hygiene Plan)* 39542 (EHS Manual)* 14738 (Safety Glasses)* 28743 (Ergonomics Program)* 25567 (Fall Protection Plan)*
4.4	Emergencies			14735 (Preparedness, Prevention, and Contingency Plans)* 13101 (Incident Response Plan)* 14741 (Emergency Evacuation Plan)*
4.5	Security and Building Access			12733 (Building Security)*
4.6	Computer System Security and Access			
5	QUALITY SYSTEM			
5.1	Quality System Overview			
5.2	Ethics and Data Integrity		4.8.1	11176 (Manual Integration) 11177 (Laboratory Ethics and Data Integrity Policy) 11197 (Conflict of Interest)
5.3	Quality System Documents			

EQPM	EQPM Section Title	ISO 17025-2017	TNI -2016	Procedure(s)
5.4	Overview of the Quality Assurance Program			
5.5	Quality Control Charts for Quality Indicators			
5.6	Statistical Quality Control			11896 (Establishing Control Limits)
5.7	Quality Metrics			
6	DOCUMENT CONTROL			
6.1	Overview			16131 (Document Control)
6.2	Document Approval, Issue, Control, and Maintenance			12233 (Data and Record Storage) 16244 (Writing and Reviewing Procedures)
6.3	Client-Supplied Methods and Documentation			11193 (analytical Decision Making) 6825 (QA Review of QAPPs) 11895 (Project Cycle) 12039 (Auditing Paperwork)
6.4	Control of External Documents			16131 (Document Control)
7	SERVICE TO THE CLIENT			
7.1	Overview			11895 (Project Cycle) 6825 (QAPP Review)
7.2	Review of Work Requests, Tenders, and Contracts			11160 (Scheduling Rush Samples) 11197 (Conflict of Interest) 12039 (Client Paperwork)
7.3	Balancing Laboratory Capacity and Workload			11895 (Project Cycle) 6825 (QAPP Review) 11160 (Scheduling Rush Samples) Departmental LIMS Backlogs
7.4	Communication and Documentation			11912 (ICARs, Nonconformances, Concerns) 12039 (Client Paperwork)
7.5	Client Feedback			10251 (Client Concerns)
8	SUBCONTRACTING			
8.1	Overview			11181 (Subcontracting)
8.2	Qualifying and Monitoring Subcontractors			11181 (Subcontracting)
8.3	Responsibilities			11181 (Subcontracting)
8.4	Use of NELAP and A2LA Logo	NA		NA
9	PURCHASING EQUIPMENT AND SUPPLIES			
9.1	Supplier Evaluation			11181 (Subcontracting) 6826 (Preservative Checks)
9.2	Procurement			11192 (Procurement) 9018236 (Receipt of Lab Supplies)
10	COMPLAINTS			
10.1	Receipt and Investigation of Complaints			10251 (Client Concerns)
11	CONTROL OF NON-CONFORMING WORK			
11.1	Evaluation of Significance and Actions Taken			10251 (Client Concerns) 11912 (ICARs, Nonconformances, Concerns)
11.2	Responsibilities			
11.3	Prevention of Nonconforming Work			
12	CORRECTIVE ACTION			
12.1	Investigation Process			11912 (ICARs, Nonconformances, Concerns)
12.2	Root Cause Analysis			26968 (Root Cause and Corrective Actions)
13	PREVENTATIVE ACTION/RISK ASSESSMENT			
13.1	Preventative Actions			7547 (Internal Audit Program) 6822 (QA Reports to Management)
13.2	Change Control			11195 (Change Control)

EQPM	EQPM Section Title	ISO 17025-2017	TNI -2016	Procedure(s)
14	CONTROL OF RECORDS			
14.1	Data Documentation Requirements			11913 (Notebooks)
14.2	Data Storage, Security, and Archival			12233 (Data and Record Storage)
15	AUDITS			
15.1	Internal Audits			7547 (Internal Audits)
15.2	Client Audits			6824 (Client and Agency Audits)
15.3	Agency Inspections			6824 (Client and Agency Audits)
15.4	Proficiency Testing			11185 (PT Program)
16	MANAGEMENT SYSTEM REVIEW			
16.1	Quality Reports			6822 (ELLE QA Reports to Management)
16.2	Annual Management Review			
17	TEST METHODS AND METHOD VALIDATION			
17.1	Scope of Testing			LIMS Certifications Analytical Work Instructions
17.2	Analytical Test Methods			6853 (Writing Procedure Guidance)
17.3	Method Validation			11189 (Method Validation)
17.4	Reporting Limits			11892 (MDL, LOD, RL Verifications)
17.5	Measurement Uncertainty			11896 (Establishing Control Limits)
18	EQUIPMENT AND CALIBRATIONS			
18.1	Laboratory Equipment Requirements			11880 (Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment) 11183 (Thermometers)
18.2	Calibration			11901 (Instrument Maintenance and Calibration)
18.3	Maintenance			11901 (Instrument Maintenance and Calibration) Departmental Maintenance Work Instructions
19	MEASUREMENT TRACEABILITY			
19.1	Reference Standards and Materials			11188 (Reagents and Standards)
19.2	Calibration Standards			11188 (Reagents and Standards)
20	SAMPLING			
20.1	Sample Collection	NA	NA	
20.2	Sampling Instructions			6830 (Sampling Instructions Form)
20.3	Sample Containers			
21	SAMPLE HANDLING			
21.1	Chain of Custody			11914 (Legal COC)
21.2	Sample Receipt			
21.3	Sample Entry			
21.4	Sample Identification and Tracking			11184 (Lab Chronicle)
21.5	Sample Storage			
21.6	Representativeness of Samples			Analytical Work Instructions 11190 (Representative Solid Samples)
21.7	Sample Return/Disposal			12042 (Sample Discard) 22000 (Hazardous Wastes – Lab) EtQ 9017756 (Hazardous Wastes – Storage) 11915 (quarantine soils)
22	ASSURING THE QUALITY OF RESULTS			
22.1	Ongoing Evaluation of Data Quality			
22.2	Reagents and Solvents			Analytical Work Instructions 11188 (Reagents and Standards)

EQPM	EQPM Section Title	ISO 17025-2017	TNI -2016	Procedure(s)
22.3	Laboratory Quality Control Samples and Acceptance Criteria			Analytical Work Instructions
22.4	Negative Controls			Analytical Work Instructions
22.5	Positive Controls			Analytical Work Instructions
22.6	Sample Matrix Controls			Analytical Work Instructions
23	REPORTING RESULTS			
23.1	Sample and Data Flow			11186 (Data Entry, Verification and Reporting) 11895 (Project Cycle)
23.2	Data Reporting			11186 (Data Entry, Verification and Reporting)
23.3	Data Calculations			
23.4	Data Review			11186 (Data Entry, Verification and Reporting)
23.5	Data Qualification			Form 11133 (Standardized Report and Case Narrative Comments)
23.6	Client and Data Confidentiality	4.2		14499 (Employee Handbook) 11197 (Conflict of Interest Plan)

* = Campus-wide SOP
** = US Environment Testing document

Program	Authority	Parameter	Field of Accreditation Matrix	Lab ID. No or EPA Lab Code
Misc. Programs:				
A2LA	Wyoming (UST) **(4)**	Inorganics, Organics	Solid Hazardous Waste (Aqueous/Solid)	0001.01
Canada	Programme d'accréditation des laboratoires d'analyse (PALA) - Quebec	Dioxins/Furans, PCB Congeners	Water Chemistry; Sludge, Waste and Soil Chemistry	1978
Dept. of Defense ELAC	American Association for Laboratory Accreditation (A2LA)	Inorganics, Organics, Dioxins/Furans, PFAS, PCB Congeners	Drinking Water, Non-Potable Water, and Solid Hazardous Waste (Aqueous/Solid)	0001.01
ISO/IEC 17025	American Association for Laboratory Accreditation (A2LA)	WHO 29 Dioxins and Dioxin-Like PCBs	Food and Feed	0001.01
US Federal Program	USDA Quarantine Soil Permit	All	Solid	P330-19-00197
State Programs:				
State	State of Alaska, Department of Environmental Conservation: Drinking Water Program	Inorganics, Organics, and PFAS	Drinking Water	PA00009
State	State of Alaska, Department of Environmental Conservation: Contaminated Sites Program	Inorganics, Organics, PFAS, Dioxins/Furans	Water, Soil, UST/LUST	17-027
State	State of Arizona, Department of Health Services	Dioxins/Furans, and PFAS	Drinking Water (SDW), Wastewater and Solid Waste	AZ0780
State	State of Arkansas, Department of Environmental Quality	Dioxins/Furans, Inorganics, and Organics	Non-Potable Water and Solid and Chemical Materials	88-0660
State	State of California, CA Waterboards ELAP	Dioxins/Furans, Inorganics, Organics, and PFAS	Drinking Water, Non-Potable Water, Hazardous Waste (Solid), Hazardous Waste (Matrix Aqueous)	2792
State	State of Colorado, Department of Health and Environment	Dioxin, Inorganics and Organics	Drinking Water	PA00009
State	State of Connecticut, Department of Public Health	Dioxins/Furans, Inorganics, Organics, and PFAS	Drinking Water (SDWA), Non-Potable Water/Wastewater (CWA), and Solid Waste/Soil (RCRA)	PH-0746
State	State of Delaware, Health and Social Services	Dioxin, Inorganics, and Organics	Drinking Water	None
State	State of Delaware, Department of Natural Resources & Environmental Control	Dioxins, Inorganics, and Organics	Non-Potable Water and Solid and Chemical Materials	None

NELAP	State of Florida, Department of Health **(3)**	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Air and Emissions, Drinking Water, Non-Potable Water, and Solid and Chemical Materials	E87997
State	State of Georgia, Department of Natural Resources	PFAS	Drinking Water	C048
State	State of Hawaii, Department of Health	Dioxin, Inorganics, Organics, and PFAS	Drinking Water	None
NELAP	State of Illinois, Environmental Protection Agency **(3)**	Dioxins/Furans, Inorganics, Organics, and PFAS	SDWA (Potable Water), Non-Potable Water (CWA/RCRA) and Solid and Hazardous Material (RCRA)	200027
State	State of Iowa, Department of Natural Resources	Inorganics, Organics, and UST analysis	Wastewater (CWA), UST, and Solid Waste/Contaminated Sites	361
NELAP	State of Kansas, Department of Health and Environment **(3)**	Dioxins/Furans, Inorganics, Organics, and PFAS	Drinking Water (SDWA), Non-Potable Water (CWA), Non-Potable Water (RCRA), and Solid and Hazardous Materials (RCRA)	E-10151
State	Commonwealth of Kentucky, Energy and Environment Cabinet, Drinking Water Laboratory Certification Program	Dioxin	Drinking Water	KY90088
State	Commonwealth of Kentucky, Energy and Environment Cabinet, Wastewater Laboratory Certification Program	Dioxins/Furans, Inorganics, and Organics	Wastewater	KY90088
State	Kentucky UST **(4)**	Inorganics, Organics	UST	108139
NELAP	State of Louisiana, Department of Environmental Quality **(1) (3)**	Dioxins, Inorganics, Organics, and PFAS	Air Emissions, Biological Tissue, Non-Potable Water, and Solid Chemical Materials	02055
State	State of Maine, Department of Health and Human Services	PFAS	Drinking Water	PA00009
State	State of Maryland, Department of the Environment	Dioxin, Inorganics, and Organics	Drinking Water	100
State	Commonwealth of Massachusetts, Department of Environmental Protection	Inorganics, Organics, and PFAS	Potable and Non-Potable Water	M-PA009
State	State of Michigan, Department of Environment, Great Lakes, and Energy	Dioxin, Inorganics, Organics, PFAS	Drinking Water	9930
NELAP	State of Minnesota, Department of Health **(3)**	Dioxins, Furans, PCB Congeners and PFAS	Drinking Water, Non-Potable Water (CWA/RCRA), Solid and Chemical Materials (RCRA)	042-999-487
State	State of Missouri, Department of Natural Resources	Dioxin, Inorganics, and Organics	Drinking Water	450
State	State of Montana, Department of Public Health and Human Services	Dioxin, Inorganics, Organics, and PFAS	Drinking Water	0098

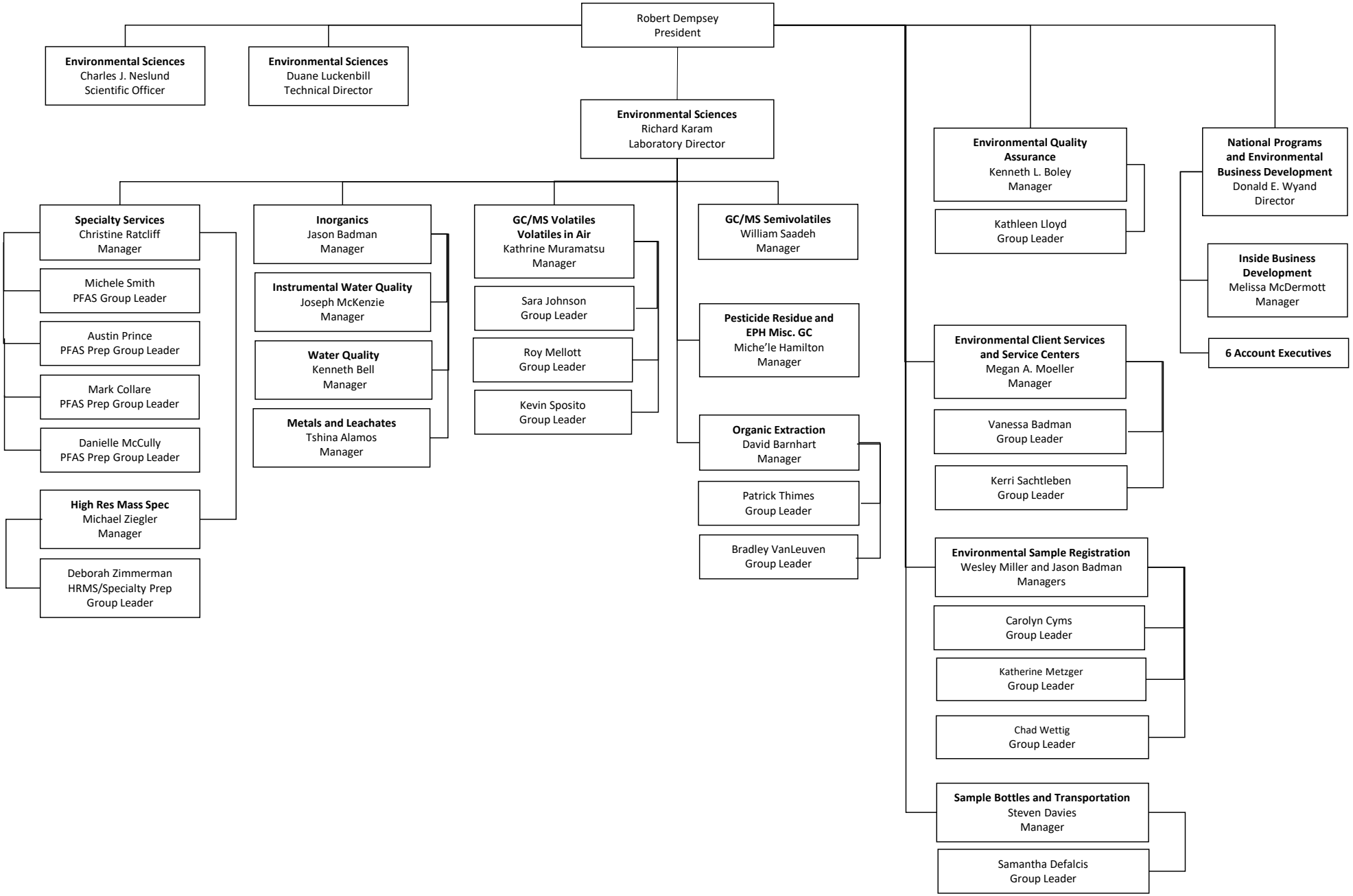
State	State of Montana, Department of Environmental Quality	Organics, UST analysis	Non-Potable Water and Solid and Chemical Materials	None
State	State of Nebraska, Department of Health and Human Services	Dioxin, Inorganics, Organics, and PFAS	Drinking Water	NE-OS-32-17
NELAP	State of New Hampshire, Department of Environmental Services **(3)**	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Drinking Water, Non-Potable Water and Solid and Chemical Materials	2730
NELAP	3State of New Jersey, Department of Environmental Protection **(3)**	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Air and Emissions, Biological Tissue, Drinking Water, Non-Potable Water and Solid and Chemical Materials	PA011
NELAP	State of New York, Department of Health **(3)**	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Air and Emissions, Potable Water, Non-Potable Water, and Solid and Chemical Materials	10670
State	State of North Carolina, Department of the Environmental Quality	Inorganics and Organics	Wastewater/Ground Water (Aqueous/Non-Aqueous)	521
State	State of North Carolina, Department of Health and Human Services	Organics	Potable (SDWA)	42705
State	State of North Dakota, Department of Environmental Quality	Dioxins/Furans, Inorganics, Organics	CWA (Non-Potable Water), Potable Water (SDWA), RCRA (Water, Solid)	R-205
NELAP	State of Oklahoma, Department of Environmental Quality **(3)**	Dioxins/Furans, Inorganics, Organics, and PCB Congeners	Non-Potable Water and Solids	9804
NELAP	State of Oregon, Public Health Laboratory **(3)**	Dioxins, Furans, Inorganics, Organics and PFAS	Air, Drinking Water, Non-Potable Water, Solid and Chemical Waste	PA200001
NELAP	Commonwealth of Pennsylvania, Department of Environmental Protection **(2)**	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Drinking Water, Non-Potable Water, and Solid and Chemical Materials	36-00037
State	State of Rhode Island, Department of Health	Inorganics and Organics	Potable Water and Non-Potable Water	LAO00338
State	State of South Carolina, Department of Health and Environmental Control	Dioxins/Furans, Inorganics, and Organics	Non-Potable Water (CWA) and Solid and Hazardous Wastes (Aqueous/Solid)	89002
State	State of Tennessee, Department of Environment & Conservation	Dioxin, Inorganics and Organics	Drinking Water	02838
NELAP	State of Texas, Commission on Environmental Quality **(3)**	Dioxins, Inorganics, and Organics	Air and Emissions, Biological Tissues, Drinking Water, Non-Potable Water, and Solid and Chemical Materials	T104704194
State	State of Vermont, Department of Health	Dioxin, Inorganics, Organics, and PFAS	Drinking Water	VT 36037
NELAP	Commonwealth of Virginia, Department of General Services **(3)**	Dioxins/Furans, Inorganics, Organics, and PCB Congeners	Air, Drinking Water, Non-Potable Water and Solid and Chemical Materials	460182

State	State of Washington, Department of Ecology	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Air, Drinking Water, Non-Potable Water and Solid and Chemical Materials	C457
State	State of West Virginia, Department of Health and Human Resources	Dioxin, Inorganics, and Organics	Drinking Water	9906C
State	State of West Virginia, Department of Environmental Protection	Dioxins/Furans, Inorganics, Organics, PCB Congeners, and PFAS	Non-Potable Water and Solid and Chemical Materials	055
State	State of Wyoming and all Tribal Public Water Systems in Region 8	Dioxins, Inorganics and Organics	Drinking Water	8TMS-L

1 NELAP Primary AB: Air and Emissions, Biological Tissue
2 NELAP Primary AB: Drinking Water, Non-Potable Water, Solid and Chemical Materials
3 NELAP Secondary AB
4 Approval for UST work by A2LA

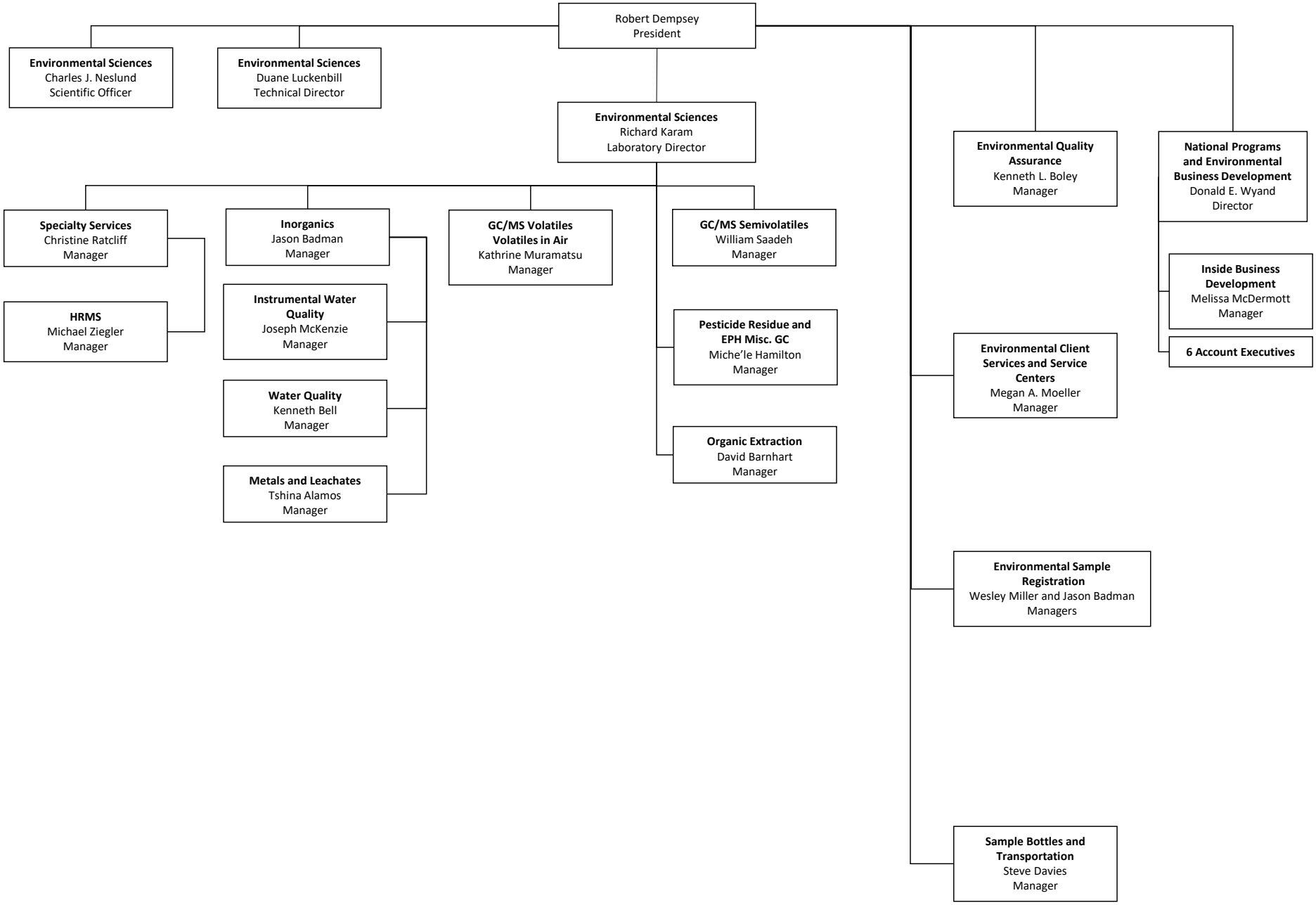
NOTE: This list accurately reflects the certifications, accreditations, registrations, and contracts held at the time of publication and is subject to change. Check with your account manager on the status of any certification needed for a specific project. Our current scopes of accreditation can be viewed at https://www.eurofinsus.com/environment-testing/resources/certifications/.

Eurofins Lancaster Laboratories Environment Testing



Revised 07/29/2022

Eurofins Lancaster Laboratories Environment Testing



Revised 07/29/2022

Job Title:	Vice President, Eurofins Lancaster Laboratories Environmental	
Reports To:	President	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Essential Duties and Responsibilities:

- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Does everything reasonably possible to meet the annual budget
- Ensure that the quality policy/program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Oversee operations in accordance with policies set forth in the Key Group Documents
- Develop efficient and effective operations and systems that support the strategic goals of the company
- Utilize management operating system to track key performance indicators and drive continuous improvement
- Coach and develop individual and team to maximize performance
- Interact with clients as necessary to maintain and grow the business
- Build strategic relationships within the organization to achieve company goals
- Identify and evaluate issues and explore continuous improvement initiatives
- Perform administrative functions as needed, e.g., attend meetings and share information; prepare reports, job plans, and performance reviews
- Stay technologically current in field; attend seminars and/or training courses; publicize technical expertise through writing an article, presenting a poster session, or speaking at a seminar or technical meeting
- Perform other duties as requested by President
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Equal Employment Opportunity and Affirmative Action Employer

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least fifteen years related experience at ELLE or equivalent experience elsewhere
Additional preferences:	Bachelor's degree in appropriate field or equivalent experience; graduate courses are recommended; experience in a variety of technical areas
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of Directors, Managers, and other leadership employees
Ability and/or Skills (BMQ):	Demonstrated expertise in laboratory operations and leadership skills; communicate effectively and to relate well to people in direct communication, as well as formal presentation; manage the work of other personnel; understand and promote company policy; excellent business sense; motivation to excel, both in technical matters and in management; professional appearance and conduct; consciousness of and a positive attitude toward quality, service, and safety procedures; sound reasoning and decision making; technical expertise; organization and problem-solving skills; good judgement, versatility and flexibility in dealing with people; ability to coordinate multiple priorities; foresight and planning; ability to synthesize and retain information; computer skills; ability to communicate effectively in written and oral forms; leadership skills
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information may not be used or duplicated by others without written consent.

Job Title:	Operations Director, Eurofins Lancaster Laboratories Environmental	
Reports To:	President	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Leading departments in accordance with vision, values, and strategic goals of company; overseeing and facilitating efficient operations and systems, sound business practices, consistent client service, and motivated staff

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Does everything reasonably possible to meet the annual budget
- Ensure that the quality policy/program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Oversee operations in accordance with policies set forth in the Key Group Documents
- Develop efficient and effective operations and systems that support the strategic goals of the company
- Utilize management operating system to track key performance indicators and drive continuous improvement
- Coach and develop individual and team to maximize performance
- Interact with clients as necessary to maintain and grow the business
- Build strategic relationships within the organization to achieve company goals
- Identify and evaluate issues and explore continuous improvement initiatives
- Perform administrative functions as needed, e.g., attend meetings and share information; prepare reports, job plans, and performance reviews
- Stay technologically current in field; attend seminars and/or training courses; publicize technical expertise through writing an article, presenting a poster session, or speaking at a seminar or technical meeting
- Perform other duties as requested by President or designee
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Equal Employment Opportunity and Affirmative Action Employer

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least five years related experience at ELLE or equivalent experience elsewhere
Additional preferences:	Bachelor's degree in appropriate field or equivalent experience; graduate courses are recommended; experience in a variety of technical areas
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of Directors, Managers, and other leadership employees
Ability and/or Skills (BMQ):	Demonstrated expertise in laboratory operations and leadership skills; communicate effectively and to relate well to people in direct communication, as well as formal presentation; manage the work of other personnel; understand and promote company policy; excellent business sense; motivation to excel, both in technical matters and in management; professional appearance and conduct; consciousness of and a positive attitude toward quality, service, and safety procedures; sound reasoning and decision making; technical expertise; organization and problem-solving skills; good judgement, versatility and flexibility in dealing with people; ability to coordinate multiple priorities; foresight and planning; ability to synthesize and retain information; computer skills; ability to communicate effectively in written and oral forms; leadership skills
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information may not be used or duplicated by others without written consent.

Equal Employment Opportunity and Affirmative Action Employer

Job Title:	Quality Assurance Manager	
Reports To:	President and/or designee	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:

Overseeing all managerial and quality operations of the company; providing leadership and mentoring/coaching to QA staff; participating in short-term and long-term planning and goal setting for the company; facilitating adherence to government regulations; sustaining quality improvement and providing quality policy development; providing sound consultation to laboratories and clients on problems or interpretation of quality/compliance issues; keeping abreast of evolving regulatory and industry quality assurance requirements

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Ensure that corrective action is appropriate; ensure that follow-up requirements are completed
- Encourage employee participation in process improvement initiatives
- Interview and make recommendations for new hires; train and develop staff; maintain job plans; handle personnel issues
- Handle agency audits, client audits, visits, and phone calls; prepare letters to clients; attendance at some local and national industry meetings
- Keep abreast of regulatory climate; assist technical operations with interpretation; advise on adjustment of lab policy as appropriate
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Coach/mentor other members of the quality team
- Oversee regulatory training program; assist with, and present departmental and corporate training at a frequency to meet regulatory expectations and ensure compliance
- Work with operations and clients to drive challenging/complex resolutions and/or negotiate appropriate position or compromise; offer compliance options
- Identify and drive system improvements; diagnose complex issues
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Equal Employment Opportunity and Affirmative Action Employer

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least six years' experience with QA
Additional preferences:	Bachelor's degree in chemistry or biology
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Provide leadership and direct management of any Group Leaders (if applicable) and other non-management employees in the department
Ability and/or Skills (BMQ):	Exhibit self-confidence and leadership; expertise in laboratory quality operations and regulatory environment; sound reasoning, decision making and problem-solving skills; good judgment and flexibility in dealing with others; ability to coordinate multiple priorities; communicate effectively in written and oral form; ability to manage the work of others and see projects through to completion; translate government regulations into laboratory policy/processes; utilize planning, organization and work management tools; ability to manage stress in self and others; dedication to quality, ethics, and customer service
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information may not be used or duplicated by others without written consent.

Equal Employment Opportunity and Affirmative Action Employer

Job Title:	Technical Department Manager	
Reports To:	Director or designee	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Performing a variety of technical and administrative tasks to develop, evaluate, and supervise staff; planning and monitoring work flow; designing, implementing, and utilizing departmental operations systems; promoting safety; remaining current on technical developments; communicating with clients; maintaining a strong commitment to quality

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Utilize the MOS to track key performance indicators and drive continuous improvement
- Produce motivated and satisfied employees
- Encourage employee participation in process improvement initiatives
- Oversee inventory, maintenance, and repair of departmental machines, tools, equipment, materials, and/or products
- Manage scheduling of personnel; evaluate personnel performance
- Participate in interview process, make recommendations for new hires; train and develop staff
- Review, prepare, and approve methods, data, and SOPs
- Communicate with clients on technical matters; meet with clients to discuss operations and conduct tours and audits
- Maintain client confidentiality
- Investigate and solve laboratory problems
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Equal Employment Opportunity and Affirmative Action Employer

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	At least five years related experience
Additional preferences:	Bachelor's degree in chemistry or related science; supervisory experience preferred
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of the departmental Group Leaders
Ability and/or Skills (BMQ):	Knowledge of departmental techniques; manage personnel, resolve conflicts, and correct poor performance; attention to detail; tolerance for stress; integrity; computer skills; communicate effectively (verbally and written); perform multiple tasks simultaneously; logical thought; make decisions for self and others; independently develop solutions to complex problems
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information is for exclusive use and may not be used or duplicated by others without written consent.

Equal Employment Opportunity and Affirmative Action Employer

Job Title:	Support Department Manager	
Reports To:	Director	
Position Location:	Lancaster, PA	
Day/Shift:	Varies	
FLSA Status:	Exempt	(Exempt/Non-Exempt)

Position Summary:	Overseeing all managerial operations of the department, managing the department in an efficient and financially sound manner; providing leadership and coaching to assigned individuals; participating in long- and short-term planning and goal-setting for the group; coordinating functions and responsibilities of assigned department members to provide consistent service; coordinating internal efforts between departments; relaying corporate information appropriately

Essential Duties and Responsibilities:

- Applies GMP/GLP in all areas of responsibility, as appropriate
- Demonstrates and promotes the company vision
- Regular attendance and punctuality
- Ensure that the quality policy program is understood, implemented, and maintained at all levels of the organization; identify, prevent, or correct any departures from the quality system
- Administrative including human resource interviews, job plans, performance reviews, personnel issues, group meetings, and sharing of corporate information
- Training of and delegation to members of the department to provide consistent service to internal and external clients
- Work with other departments to set goals, develop pricing strategies, manage workload, and resolve problems
- Create, implement, and oversee budgets and goals for the department in the context of corporate philosophy
- Evaluate, plan for, and provide adequate staffing, equipment, consumables, etc., for the department to function in an effective manner
- Communicate verbally, in writing, and face-to-face with clients to discuss and resolve problems, build strong relationships, and increase sales
- Perform all functions in support of and in compliance with all state and federal employment regulations
- Administrative activities (photocopying, word processing, paperwork delivery, etc.)
- Assist with financial and purchase order issues as needed
- Help coordinate interdepartmental cross-training and/or assistance as needed to balance workload
- Conducts all activities in a safe and efficient manner
- Performs other duties as assigned

Equal Employment Opportunity and Affirmative Action Employer

Basic Minimum Qualifications (BMQ):	To perform this job successfully, the individual must be able to perform each essential duty satisfactorily. The requirements below are representative of the knowledge, skill or ability required. (List three to five key quantifiable skills or position requirements that the candidate must have to be considered for this position.)
Education/Experience (BMQ):	Five years of related experience at LL or demonstrated equivalent experience elsewhere; computer skills in a variety of software; supervisory experience
Additional preferences:	Bachelor's degree in science (chemistry preferred)
Certificates and/or Licenses (BMQ):	N/A
Additional preferences:	
Supervisory Responsibility:	Responsible for the direct management of the Group Leaders of the department
Ability and/or Skills (BMQ):	Self confidence and leadership, ability to reason, make sound decisions, and delegate; empathy and sensitivity towards others; motivation to excel and inspire excellence in others; ability to develop strong relationships with clients resulting in client satisfaction and additional sales; ability to manage the work of others and see projects through to completion; strong communication including verbal, writing, and presentation skills; ability to communicate effectively and relate well to people; mental and emotional stability and maturity, ability to handle personal stress and diffuse stress in others; strong organizational and financial skills, ability to handle multiple priorities; good judgement and tact recognizing and solving problems; recognized as understanding, interpreting, and following company policy; sets example for others; dedication to quality, ethics, and customer service; pride in appearance, conduct, and company; sound persuasion and negotiation abilities; ability to view situations from a variety of perspectives; foresight and planning ability
Additional preferences:	
Other Factors:	N/A

Disclaimer:

This position description is written as a guideline to inform employees of what is generally expected of them at each job level. The description is not intended to be all encompassing or limiting in any manner; rather, it is hoped it will add understanding and better reflect the work performed at all levels of employment. Duties and responsibilities other than those listed may be included as needed within the work group or the company as a whole.

The above information is for exclusive use and may not be used or duplicated by others without written consent.

Equal Employment Opportunity and Affirmative Action Employer

Document ID	Document name	Document Responsible

1.01 Document Control

Standard Operating Procedure

G-DC-SOP12233	Data and Record Storage, Security, Retention, Archival, and Disposal	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16131	Document Control	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16196	Position Qualification Descriptions (PQDs) and Essential Job Functions (EJFs)	5_EUUSLA_Env Quality Assurance_Director
G-DC-SOP16244	Writing and Reviewing ELLE Policies and Operating Procedures	5_EUUSLA_Env Quality Assurance_Director

1.02 EHS

Policies

G-EHS-QP12356	Chemical Hygiene Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-QP39542	EHS Manual	5_EUUSLA_Env Quality Assurance_Director
G-EHS-QP28711	Exposure Control Plan for Bloodborne Pathogens	5_EUUSLA_Env Quality Assurance_Director
G-EHS-QP14735	Preparedness, Prevention, and Contingency Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-QP47636	Space Utilization SOP	5_EUUSLA_Env Quality Assurance_Director

Standard Operating Procedure

G-EHS-SOP14741	Emergency Evacuation Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP11893	Environmental Hazardous Sample Communication Procedure	5_EUUSLA_Env Quality Assurance_All
G-EHS-SOP28741	Environmental, Health, and Safety (EHS) Assessments	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP28743	Ergonomics Program	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP25567	Fall Protection Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP13101	Incident Response Plan	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14740	Lockout/Tagout	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP22000	Management of Hazardous Wastes in the Laboratory	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP33477	Radiation Safety Program	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP46418	Rave Mobile Operating Procedures	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14739	Reporting Work Related Incidents	5_EUUSLA_Env Quality Assurance_Director
G-EHS-SOP14738	Safety Glasses	5_EUUSLA_Env Quality Assurance_Director

1.03 Facilities

Standard Operating Procedure

G-FAC-SOP12733	Building Security	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP14744	Facility Change Management	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP15553	Facility Operation Manual	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP16117	Insect and Rodent Control	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP19712	Laboratory Housekeeping and Cleaning	5_EUUSLA_Env Quality Assurance_Director
G-FAC-SOP16118	Maintenance Connection Service Requestor Guidelines	5_EUUSLA_Env Quality Assurance_Director

1.06 External Documents

External Documents

G-EXT-EX41450	25 PA Regulations	5_EUUSLA_Env Quality Assurance_All
G-EXT-EX49672	CT RCP Compendium of Methods	5_EUUSLA_Env Quality Assurance_All
G-EXT-EX49671	MA MCP Compendium of Methods	5_EUUSLA_Env Quality Assurance_All
G-EXT-EX51967	NJ DKQP	5_EUUSLA_Env Quality Assurance_All

2 Management

Work Instruction

M-WI7615	Director	5_EUUSLA_Env Quality Assurance_Director

3 Quality

Policies

QA-QP37583	Electronic Reporting and Signature Policy	5_EUUSLA_Env Quality Assurance_Director
QA-QP11177	Laboratory Ethics and Data Integrity Policy	5_EUUSLA_Env Quality Assurance_All
QA-QP11176	Manual Integration for ELLE	5_EUUSLA_Env Quality Assurance_All

Quality Manual

QA-QM11872	Environmental Quality Policy Manual	5_EUUSLA_Env Quality Assurance_All

Standard Operating Procedure

QA-SOP11195	Change Control Procedures for ELLE	5_EUUSLA_Env Quality Assurance_All
QA-SOP11882	Chromatography Integration and Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11197	Conflict of Interest Plan	5_EUUSLA_Env Quality Assurance_All
QA-SOP11186	Data Entry, Data Review, and Reporting	5_EUUSLA_Env Quality Assurance_All
QA-SOP11178	Demonstrations of Capability	5_EUUSLA_Env Quality Assurance_All
QA-SOP11892	Determining Method Detection Limits and Limits of Quantitation	5_EUUSLA_Env Quality Assurance_All
QA-SOP16134	Employee Training Program	5_EUUSLA_Env Quality Assurance_Director
QA-SOP11895	Environmental Project Cycle	5_EUUSLA_Env Quality Assurance_All
QA-SOP11896	Establishing Control Limits	5_EUUSLA_Env Quality Assurance_All
QA-SOP11193	Guidelines for Analytical Decision Making in Environmental Testing	5_EUUSLA_Env Quality Assurance_All
QA-SOP11180	Guidelines for Writing Technical Reports	5_EUUSLA_Env Quality Assurance_All
QA-SOP11901	Instrument Maintenance and Calibration	5_EUUSLA_Env Quality Assurance_All
QA-SOP11912	Investigation and Corrective Action for Client Complaints, Noncompliant Data, and Laboratory Problems	5_EUUSLA_Env Quality Assurance_All
QA-SOP11184	Lab Chronicle Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11880	Laboratory Equipment Verifications - Balance, Syringe, Pipette, Weights, and Other Equipment	5_EUUSLA_Env Quality Assurance_All
QA-SOP7547	Laboratory Internal Audit Program	5_EUUSLA_Env Quality Assurance_All
QA-SOP11913	Laboratory Notebooks, Logbooks, and Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11196	Laboratory/Quality Systems Procedures Summary	5_EUUSLA_Env Quality Assurance_All
QA-SOP11914	Legal Chain-of-Custody Documentation	5_EUUSLA_Env Quality Assurance_All
QA-SOP11919	Monitoring of the Volatile Organics Analysis (VOA) Storage Areas for Contamination	5_EUUSLA_Env Quality Assurance_All
QA-SOP11191	Monitoring Temperatures in Refrigerators, Freezers, Incubators, and Ovens Using the ETM	5_EUUSLA_Env Quality Assurance_All
QA-SOP11190	Obtaining a Representative Environmental Solid Sample Aliquot	5_EUUSLA_Env Quality Assurance_All

QA-SOP11886	Processing Regulatory Compliance (i.e. SDWA, NPDES) Samples	5_EUUSLA_Env Quality Assurance_All
QA-SOP11192	Procurement of Environmental Laboratory Supplies	5_EUUSLA_Env Quality Assurance_All
QA-SOP11185	Proficiency Test Samples	5_EUUSLA_Env Quality Assurance_All
QA-SOP11915	Quarantine Soils Procedures	5_EUUSLA_Env Quality Assurance_All
QA-SOP11188	Reagents and Standards	5_EUUSLA_Env Quality Assurance_All
QA-SOP26968	Root Cause, Investigation, and Corrective Action Processes	5_EUUSLA_Env Quality Assurance_All
QA-SOP11182	Sample Requisition	5_EUUSLA_Env Quality Assurance_All
QA-SOP11181	Subcontracting Analytical Testing	5_EUUSLA_Env Quality Assurance_All
QA-SOP11183	Thermometer Use and Calibration	5_EUUSLA_Env Quality Assurance_All
QA-SOP11916	Use and Maintenance of Reagent Water Supply	5_EUUSLA_Env Quality Assurance_All
QA-SOP11189	Validation and Authorization of Analytical Methods	5_EUUSLA_Env Quality Assurance_All

3.01 Environmental Quality Assurance

Work Instruction

Q-EQA-WI6823	Approval of Work Instructions and Standard Operating Procedures	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI12060	Director	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI6822	ELLE QA Reports to Management	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6824	Hosting of Environmental Client and Agency Audits	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6820	Maintenance of Environmental Certifications and Accreditations	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI14754	Performing Administration and Handbook Editor Tasks in D4	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI7671	Principal Specialist	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI6816	Proficiency Test Samples	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI6826	QA Processing for Bottle Lot and Preservative Checks	5_EUUSLA_Env Quality Assurance_All
Q-EQA-WI7670	Senior Specialist	5_EUUSLA_Env Quality Assurance_Director
Q-EQA-WI14178	Specialist (Support)	5_EUUSLA_Env Quality Assurance_Director

4.06 IT/Software Development

Standard Operating Procedure

R-SD-SOP20940	Computer Backup, Recovery, and Archive Procedure Resources	5_EUUSLA_Env Quality Assurance_Director

4.07 Transportation

Work Instruction

R-TR-WI11282	Administrator	5_EUUSLA_Transportation_Manager
R-TR-WI11285	Manager	5_EUUSLA_Transportation_Manager
R-TR-WI11289	Sample Administrator	5_EUUSLA_Transportation_Manager
R-TR-WI11288	Sample Pick-Up, Transportation, and Delivery	5_EUUSLA_Transportation_Manager
R-TR-WI11290	Specialist	5_EUUSLA_Transportation_Manager
R-TR-WI11294	Transportation Summary SOP	5_EUUSLA_Transportation_Manager
R-TR-WI11297	What to Do in Case of Vehicular Accident or Breakdown	5_EUUSLA_Transportation_Manager

5.01 Sample Bottles

Work Instruction

S-BOT-WI10641	Bottle Preparation	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10657	Manager	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10642	Packing Bottle Orders	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10643	Preparation of Acid Dilutions	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10644	Preparation of Trip Blanks	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10645	Processing Bottle Orders	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10660	Senior Administrator	5_EUUSLA_Sample Bottles_Manager
S-BOT-WI10661	Specialist	5_EUUSLA_Sample Bottles_Manager

5.02 Client Services

Work Instruction

S-CS-WI12039	Auditing Client Paperwork	5_EUUSLA_Client Services_Manager
S-CS-WI10251	Client Concerns	5_EUUSLA_Client Services_Manager
S-CS-WI11141	Creating Bottle Orders	5_EUUSLA_Client Services_Manager
S-CS-WI11143	Daily or Weekly DEP Reporting	5_EUUSLA_Client Services_Manager
S-CS-WI11149	Group Leader	5_EUUSLA_Client Services_Manager
S-CS-WI11151	Manager	5_EUUSLA_Client Services_Manager
S-CS-WI11152	Monthly and Quarterly DEP Reporting	5_EUUSLA_Client Services_Manager
S-CS-WI11155	Phone Log and Email Documentation	5_EUUSLA_Client Services_Manager
S-CS-WI11157	Principal Specialist (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11159	Project Creation Guide	5_EUUSLA_Client Services_Manager
S-CS-WI11160	Scheduling and Pricing of Rush Samples	5_EUUSLA_Client Services_Manager
S-CS-WI11161	Senior Administrator (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11162	Senior Specialist (Client Services)	5_EUUSLA_Client Services_Manager
S-CS-WI11163	Specialist (Client Services)	5_EUUSLA_Client Services_Manager

5.03 Sample Administration

Work Instruction

S-SA-WI10713	Administrator (Unpacking)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10717	Entry of Environmental Samples Requiring Subcontracting/Workshare	5_EUUSLA_Sample Administration_Manager
S-SA-WI10723	Environmental Sample Entry	5_EUUSLA_Sample Administration_Manager
S-SA-WI10725	Environmental Sample Receipt and Unpacking	5_EUUSLA_Sample Administration_Manager
S-SA-WI28305	ETM System Probe Calibration	5_EUUSLA_Sample Support_Manager
S-SA-WI10727	Group Leader	5_EUUSLA_Sample Administration_Manager
S-SA-WI10730	Manager	5_EUUSLA_Sample Administration_Manager
S-SA-WI10070	Moisture by Moisture Analyzer in Solids	5_EUUSLA_Sample Administration_Manager
S-SA-WI12043	Sample Receipt at the Sample Receipt Desk	5_EUUSLA_Sample Administration_Manager
S-SA-WI10736	Senior Administrator (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10737	Senior Administrator (Unpacking)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10738	Senior Specialist (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10741	Specialist (Sample Administration)	5_EUUSLA_Sample Administration_Manager
S-SA-WI10742	Specialist (Unpacking)	5_EUUSLA_Sample Administration_Manager

S-SA-WI10743	Taking the Temperature of Environmental Samples Upon Arrival at the Lab	5_EUUSLA_Sample Administration_Manager

5.04 Sample Support

Work Instruction

S-SS-WI10697	% Moisture Calculation and % Solids Calculation (Gravimetric)	5_EUUSLA_Sample Support_Manager
S-SS-WI10666	ASRS Emergency Failure Procedure	5_EUUSLA_Sample Support_Manager
S-SS-WI10668	Automated Storage and Retrieval System (ASRS) Lockout/Tagout Procedure	5_EUUSLA_Sample Support_Manager
S-SS-WI12042	Automated Storage, Retrieval, and Discarding of Samples	5_EUUSLA_Sample Support_Manager
S-SS-WI10673	Chemist	5_EUUSLA_Sample Support_Manager
S-SS-WI10683	Glassware Cleaning	5_EUUSLA_Sample Support_Manager
S-SS-WI10684	Group Leader	5_EUUSLA_Sample Support_Manager
S-SS-WI10685	Hardware Procedures for ASRS	5_EUUSLA_Sample Support_Manager
S-SS-WI10686	Homogenization, Sample Splitting, and Subsampling of Solid Waste Samples from Environmental Sources	5_EUUSLA_Sample Support_Manager
S-SS-WI10692	Laboratory Assistant	5_EUUSLA_Sample Support_Manager
S-SS-WI10693	Laboratory Technician	5_EUUSLA_Sample Support_Manager
S-SS-WI10695	Liquid Sample Preservation, Sample Splitting, and Turbidity for metals by EPA Methods 200.7 and 200.8	5_EUUSLA_Sample Support_Manager
S-SS-WI7963	Maintenance and Calibration of HACH Model 2100Q Laboratory Turbidimeter	5_EUUSLA_Sample Support_Manager
S-SS-WI10696	Maintenance of Dessicators	5_EUUSLA_Sample Support_Manager
S-SS-WI11260	Preservation and Bottles Room Preservative Traceability	5_EUUSLA_Sample Support_Manager
S-SS-WI11268	Sample Preparation of Solid Samples Including Sieving and Milling for Extraction and Analysis	5_EUUSLA_Sample Support_Manager
S-SS-WI11220	Sample Support Ovens	5_EUUSLA_Sample Support_Manager
S-SS-WI11270	Senior Technician	5_EUUSLA_Sample Support_Manager
S-SS-WI11225	Subsampling for Subcontracted Analyses	5_EUUSLA_Sample Support_Manager

5.06.01 Bay Area Service Center

Work Instruction

S-SC-BA-WI11332	Sample Receipt for the Bay Area Service Center	5_EUUSLA_Sample Bottles_Manager

5.07 Business Development

Work Instruction

S-BD-WI10778	Director	5_EUUSLA_Env Sciences_Manager
S-BD-WI10783	Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI11156	Preparing Quotations	5_EUUSLA_Env Sciences_Manager
S-BD-WI10785	Principal Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10786	Principal Specialist Account Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI26410	Project Win Cycle	5_EUUSLA_Env Sciences_Manager
S-BD-WI10787	Proposal Preparation	5_EUUSLA_Env Sciences_Manager
S-BD-WI10788	Review of Client Contracts, Terms and Conditions and other non-technical documents	5_EUUSLA_Env Sciences_Manager

S-BD-WI10791	Senior Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager
S-BD-WI10792	Senior Specialist Account Manager	5_EUUSLA_Env Sciences_Manager
S-BD-WI10793	Specialist (Business Development)	5_EUUSLA_Env Sciences_Manager

8.02 Volatiles

Work Instruction

T-VOA-WI22997	1,2,3-Trichloropropane Water by CA SRL 524M-TCP by GC/MS	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8515	1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8260B/C/D in Waters and Soils	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7865	Associate Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7613	Calibrating the 1-µL Standard Delivery Groove on the Archon Model 5100A and O.I 4660 Autosampler Systems	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7620	Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7627	Client Specific - Client Specific Target Compounds by GC/MS in Soils	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7711	Client-specific Determination of Client Specific Target Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) in Waters	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8614	Determination of Target Compounds by GC/MS using Selective Ion Monitoring (SIM) by Method 8260C/D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7619	GC and GC/MS Instrumentation Maintenance	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI10682	GC/MS - Bulk Solids Matrix Sample Preparation	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8220	GC/MS Determination of 1,2,3-Trichloropropane in Waters Using Isotope Dilution and Selective Ion Monitoring (SIM) by EPA Method 524.2, Modified	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7629	GC/MS Volatile Standards Traceability	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8373	GC/MS Volatiles Audit Process	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7691	Glassware Washing	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8221	GRO by GC in Soils by Method AK101	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7706	GRO by GC in Waters and Wastewaters by Method AK101	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8224	GRO in Soil and Water by GC using Northwest GX Method	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7675	GRO in Soils by GC by SW-846, Methods 8015B, 8015C, 8015D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7690	GRO in Waters and Wastewaters by GC by SW-846, Methods 8015B, 8015C, 8015D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7624	Group Leader	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7614	Laboratory Technician	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7861	Manager	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI11168	Pipette Dispenser Calibration Procedure	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7692	Preparation and Analysis of Cleaning Blanks for GC and GC/MS Volatiles	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7870	Preparation and Testing of Storage Blanks for GC/MS Volatile Analysis	5_EUUSLA_GC/MS Volatiles_Manager

T-VOA-WI7605	Preparation and Testing of Trip Blanks for GC/MS Volatile Analyses	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8196	Preparation of Oil Samples by EPA 5035/5035A	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI11169	Preparation of Soil and Solid Samples for GC Volatile Analyses by methods SW-846-5030A and SW-846-5035A Modified	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI11170	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035 and Method 5035A	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI11242	Preparation of Vials for Field Preservation of Soils for Volatile Analysis	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI11259	Prescreening Water and Soil Samples for Volatile Organic Compounds	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7869	Preservation and Residual Chlorine Checks of Samples for GC/MS Volatile Water Analysis	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7626	Principal Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7625	Principal Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8480	Purgeable Organic Compounds in Water by GC/MS Using EPA Method 524.2	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7621	Senior Chemist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7622	Senior Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7623	Senior Technician	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7866	Specialist	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7607	Statistical Calculations Used in the Analysis of Samples by EPA Methodology	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7717	Targeted Library Search by GC/MS	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8544	Toxicity Characteristic Leachate Procedure (TCLP) and Synthetic Precipitate Leaching Procedure (SPLP); VOCs by GCMS in Zero Headspace Extraction (ZHE) by 8260B/C/D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI7606	Use of 40-mL Vials for Volatile Organic Analyses	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8225	VOCs and GRO by GC/MS in Soils and Solids by EPA 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8236	VOCs and GRO by GC/MS in Soils and Solids by EPA 8260C/D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8197	VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8194	VOCs and GRO by GC/MS in Waters and Wastewaters by EPA 8260C/D	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8265	Volatile Organic Compounds in Wastewater by Isotope Dilution and GC/MS by EPA Method 1666/1666A	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI8584	Volatile Target Compounds by GC/MS in Waters and Wastewaters by Method 6200B	5_EUUSLA_GC/MS Volatiles_Manager
T-VOA-WI18576	Waters for Volatile Organic Compounds by Purge and Trap Gas Chromatography/Mass Spectrometry using EPA Method 624.1	5_EUUSLA_GC/MS Volatiles_Manager

8.03 Metals

Work Instruction

T-MET-WI7882	Associate Chemist	5_EUUSLA_Metals_Manager
T-MET-WI7886	Bottletop Dispensers	5_EUUSLA_Metals_Manager

T-MET-WI7887	Chemist	5_EUUSLA_Metals_Manager
T-MET-WI11925	Client Specific - 3030 C. Treatment for Acid-Extractable Metals for North Carolina Groundwater Samples	5_EUUSLA_Metals_Manager
T-MET-WI11939	Digestion by EPA 200.8 for the Analysis of Total Recoverable Metals in Water by ICPMS	5_EUUSLA_Metals_Manager
T-MET-WI11938	Digestion of Waters by EPA 200.7/200.8 for Analysis of Metals by ICP/ICPMS	5_EUUSLA_Metals_Manager
T-MET-WI11924	Digestion of Aqueous Samples by SW-846 Method 7470A	5_EUUSLA_Metals_Manager
T-MET-WI26740	Digestion of Aqueous Samples for Mercury by EPA 245.1	5_EUUSLA_Metals_Manager
T-MET-WI11926	Digestion of Oils by EPA 3050B for ICP Analysis	5_EUUSLA_Metals_Manager
T-MET-WI7920	Dilute/Run and AVS/SEM Sample Handling for Metals	5_EUUSLA_Metals_Manager
T-MET-WI7922	Glassware Cleaning	5_EUUSLA_Metals_Manager
T-MET-WI7923	Group Leader	5_EUUSLA_Metals_Manager
T-MET-WI12063	ICP Solutions and Standards Preparation	5_EUUSLA_Metals_Manager
T-MET-WI21590	Instrument Maintenance for Agilent 7900	5_EUUSLA_Metals_Manager
T-MET-WI8732	Lab and Field Filtered Waters and	5_EUUSLA_Metals_Manager
T-MET-WI7941	Laboratory Technician	5_EUUSLA_Metals_Manager
T-MET-WI7943	Langelier Index in Water	5_EUUSLA_Metals_Manager
T-MET-WI7964	Manager	5_EUUSLA_Metals_Manager
T-MET-WI7965	Mercury in Aqueous, Solid and Tissue Samples by EPA 7471A, 7471B, 7470A, and 245.1 rev 3 by Cold Vapor AA	5_EUUSLA_Metals_Manager
T-MET-WI11931	Metals by ICP for Methods SW-846 6010B/C/D (aqueous, solid, tissue) and EPA 200.7 (aqueous)	5_EUUSLA_Metals_Manager
T-MET-WI11933	Metals by ICPMS by Methods SW-846 6020/6020A/6020B(waters, solid, tissue) and EPA 200.8 (waters)	5_EUUSLA_Metals_Manager
T-MET-WI35797	Metals Data Verification Process	5_EUUSLA_Metals_Manager
T-MET-WI9084	Preparation of Mercury Solutions and Standards	5_EUUSLA_Metals_Manager
T-MET-WI11948	Preparation of Solids by EPA 7471A or B for Mercury Analysis	5_EUUSLA_Metals_Manager
T-MET-WI7972	Principal Chemist	5_EUUSLA_Metals_Manager
T-MET-WI8636	Sample Prep of Sediments, Sludges, Soils, and Tissues by SW846 3050B for ICP and ICP-MS	5_EUUSLA_Metals_Manager
T-MET-WI11937	Sample Preparation of Leachates and Other Wastewater for Analysis of Total Metals by Inductively Coupled Plasma-Mass Spectrometer (ICP-MS)	5_EUUSLA_Metals_Manager
T-MET-WI11941	Sample Preparation of Wastewater and Leachates for Analysis of Total Metals by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP) and Inductively Coupled Plasma Mass Spectrometer (ICP-MS)	5_EUUSLA_Metals_Manager
T-MET-WI8639	Sample Preparation of Waters for Analysis of Total Recoverable Metals by ICP-OES and ICP-MS	5_EUUSLA_Metals_Manager

T-MET-WI8640	Senior Chemist	5_EUUSLA_Metals_Manager
T-MET-WI8641	Senior Specialist	5_EUUSLA_Metals_Manager
T-MET-WI8721	Senior Technician (Instrument Room)	5_EUUSLA_Metals_Manager
T-MET-WI8723	Senior Technician (Prep Room)	5_EUUSLA_Metals_Manager
T-MET-WI8729	Specialist	5_EUUSLA_Metals_Manager
T-MET-WI9082	Working Instructions for Prep Solutions and Standards	5_EUUSLA_Metals_Manager
T-MET-WI12065	Working Instructions for Preparation of ICP-MS Solutions and Standards	5_EUUSLA_Metals_Manager

8.04 Pesticides

Work Instruction

T-PEST-WI9202	Analysis of Chlorinated Herbicides by 8151A in Water	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9232	Analysis of Pesticides by 8081B in Solid Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9238	Analysis of Polychlorinated Biphenyls (PCBs) by 8082A in Aqueous Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9842	Associate Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9844	Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9845	Chlorinated Herbicides by 8151A in Solids by GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9847	Common Equations Used During Chromatographic Analyses	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9952	EDB/DBCP/and TCP by Method 8011 in Waters and Solids Using Microextraction and GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11965	Formaldehyde and Other Aldehydes by Method 8315A in Aqueous and Solid Samples using HPLC	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9953	Group Leader	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9954	Interpretation of Chromatographic Data	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9961	Low Level PCBs in Water by Method 8082/8082A using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9962	Manager	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9981	Nitroaromatics and Nitroamines by Method 8330B in Water and Solids using HPLC with UV Detection	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9983	N-Methylcarbamate Pesticides by Method 8318/8318A in Solids Using HPLC	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9984	N-Methylcarbamates by Method 531.1 in Groundwater and Drinking Water using High Performance Liquid Chromatography (HPLC)	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11967	Organic Acids in Water by Methods 8015B/D using HPLC/UV	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9987	PCBs in Oil by SW-846 Method 8082/8082A	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9992	Pesticides by Method 8081A in Solid Samples using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager

T-PEST-WI9997	Pesticides in Aqueous Samples by Method 608	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI17994	Pesticides in Aqueous Samples by Method 608.3	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI9998	Pesticides in Water by Method 8081A and 8081B using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11971	Polychlorinated Biphenyls (PCBs) by Method 608 or 8082 in Waters	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI18000	Polychlorinated Biphenyls (PCBs) by Method 608.3	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI11972	Polychlorinated Biphenyls (PCBs) by Method 8082 in Solids and Wipes	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10004	Polychlorinated Biphenyls (PCBs) in Solid Samples by 8082A Using GC-ECD	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10006	Prescreening Water and Soil Samples for Pesticides and PCBs	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10007	Preventative and Corrective GC Maintenance	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10008	Preventative and Corrective HPLC Maintenance for the Pesticide Residue Analysis Department	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10009	Principal Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10010	Principal Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10011	QC Data Acceptability and Corrective Action	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10012	Senior Chemist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10013	Senior Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10017	Specialist	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10018	Standards Preparation, Coding, and Storage	5_EUUSLA_Pesticide Residue Analysis_Manager
T-PEST-WI10019	Standards Traceability and Monitoring	5_EUUSLA_Pesticide Residue Analysis_Manager

8.05 GCMS Semivolatiles

Work Instruction

T-SVOA-WI11981	Analysis of Chlorinated Herbicides in Water by 8270C/D SIM by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11979	Associate Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9592	Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI34848	Client Specific Dinoseb by 8270C in Water Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI31758	Client Specific Methylphenols by Method 8270D in Water Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI34439	Client Specific SAN Trimer by Method 525.3 in Water Using SIM by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9613	Client Specific Semivolatile Compounds by Method 525.2 in Drinking Water using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI31271	Client Specific Semivolatiles in Waters by Method 612 by SIM GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager

T-SVOA-WI9590	Dioxin Screening (2,3,7,8-TCDD) of Aqueous and Solid Matrices using GC/MS SIM	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9596	GC/MS Electronic Data Management and Handling	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9598	GC/MS Preventative and Corrective Maintenance	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9594	GC/MS Semivolatile Audit Process	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9603	Group Leader	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9604	Monitoring GC/MS Semivolatile QC Data Acceptance Limits	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9252	Parent and Alkyl Substituted PAHs and Geochemical Biomarkers by 8270C/D/E SIM by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9610	Principal Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11980	Principal Specialist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI18565	Priority Pollutants by Method 625.1 in Water Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9623	Semivolatile Organic Compounds by Method 8270C in Aqueous and Non-Aqueous Matrices Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9617	Semivolatile Organic Compounds by Method 8270D/E in Aqueous and Non-Aqueous Matrices using GC-MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11997	Semivolatile Organics Tentatively Identified Compound Method	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI11998	Semivolatile Spiking and Calibration Standards	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9995	Semivolatiles in Waters and Soils by Methods 8270C/D/E SIM and 625.1 SIM by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9634	Senior Chemist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9635	Senior Specialist	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9587	Tetraethyl lead (TEL) in Water and Solids by 8270D/E by GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI13634	The Determination of 1,4-Dioxane by GC/MS using Isotope Dilution and Selective Ion Monitoring (SIM) by Method 8270C/D/E	5_EUUSLA_GC/MS Semivolatiles_Manager
T-SVOA-WI9626	THPA, THPI and PA by CELP 440 in Waters Using GC/MS	5_EUUSLA_GC/MS Semivolatiles_Manager

8.06 Instrumental Water Quality

Work Instruction

T-WC-WI11640	Maintenance of ICS 1100 and ICS-2000 Ion Chromatography Systems	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9861	Accusterilizer - Steam Sterilizer	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10024	Ammonia Nitrogen by EPA 350.1 in Waters Using Segmented Flow Analysis and Gas Diffusion	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11626	Anions by Ion Chromatography in Waters and Soil by EPA 300.0, SW 846 9056, and SW 846 9056A	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10287	Chemist	5_EUUSLA_Instrumental Water Quality_Manager

T-WC-WI40688	CLIENT SPECIFIC - Hexavalent Chromium by Ion Chromatography in Solids	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10085	Cyanide (Total and Amenable) Distillation in Waters and Solids by SW-846 9012A/B, EPA 335.1/3/4, and SM 4500-CN G-1999/2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11629	Cyanide (Total, Amenable, Free, WAD, Reactive) in Waters and Soils by Methods SW-846 9012A/B, EPA 335.4, and SM 4500-CN G/E/I-1999/2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11636	Determination of Total and Soluble Phosphorus in Water, Wastewater, and Soils (Colorimetric, Ascorbic Acid, Automated) by EPA 365.1 or SM 4500-P F-2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10037	Determination of Total Carbon in Water and Wastewater by SM-5310 C and EPA 415.1	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10039	Digestion of Total and Soluble Phosphorus in Water, Wastewater, and Soils EPA 365.1, and SM 4500-P B-2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11494	Dissolved Silica (Colormetric) in Water by SM4500SIO2 C-2011, SM4500SIO2 C-1997 or EPA 370.1	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11495	Ferrous Iron (colorimetric) in Waters by Method 3500-Fe B-2011	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10290	Group Leader	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11625	Hexavalent Chromium by Ion Chromatography in Solids and Waters SW-846 7199 and Waters by EPA 218.6	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10291	Laboratory Technician	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9889	Maintenance and Calibration of A.I. Scientific AIM600 Digestor	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11643	Maintenance of Continuous Flow Analyzers	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9890	Maintenance of the OI Analytical Model 1030 Total Organic Carbon Analyzer	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10292	Manager	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11649	Nitrate Nitrogen in Water and Wastewater by EPA 353.2 (Colorimetric, Automated Cadmium Reduction)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11650	Nitrite Nitrogen in Water and Wastewater by EPA 353.2	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI9891	pH Electrodes and Meters	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11651	Phenol Distillation in Solids by EPA SW-846 9065	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11619	Phenols in Water and Soils By Automated Flow Colorimetry EPA 420.4, SW-846, 9066	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11652	Quality Control for Analyses Performed in Instrumental Water Quality	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10083	Reagent Water Extraction of Ions in soil, for analysis by method EPA 300.0 or SW 846 9056	5_EUUSLA_Instrumental Water Quality_Manager

T-WC-WI10293	Senior Chemist	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10294	Senior Technician	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11627	TOC and TC in Solids and Sludges by Combustion by SM 5310B, EPA 415.1, SW-846 9060/9060A, Lloyd Kahn	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11635	Total and Available Cyanide in Water using Amperometric Detection by ASTM D 7511-09e2, -12 and Method OIA-1677-09	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10107	Total Kjedahl Nitrogen Digestion by EPA 351.2	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI12055	Total Kjeldahl Nitrogen (TKN) by EPA 351.2 in Waters and Solids using Automated Flow Analysis or Discrete Analysis	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI11637	Total Organic Carbon (TOC), Dissolved Organic Carbon (DOC), and Total Inorganic Carbon (TIC) by SM 5310C or EPA 415.1 in Waters	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10038	Total Organic Carbon in Water by SW-846 9060/9060A (Quadruplicate Studies)	5_EUUSLA_Instrumental Water Quality_Manager
T-WC-WI10285	Weak Acid Dissociable Cyanide Distillation by method Method 4500 CN-I 2011	5_EUUSLA_Instrumental Water Quality_Manager

8.07 Leachate Preparation

Work Instruction

T-TL-WI14428	Associate Chemist	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7142	Calibration of the Leachate Tumblers	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7143	Glassware Cleaning for Leachate Extractions	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI29717	Laboratory Technician	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7144	Leachate Blank Evaluations	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7140	Manager	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7146	Manually Pressurized Zero Headspace Extractor (ZHE)	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7151	Nonvolatiles-Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI46585	PFAS Leaching Procedure (TCLP, SPLP) by EPA 1311-Modified and 1312-Modified in Solids and Wastes	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7141	pH Meters and Probes	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7257	Procedure for Calculating and Reporting Weighted Average Results for TCLP Extracts	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7148	Shake Extraction of Solid Waste with Water by ASTM D3987-12, D3987-85	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7145	Subsampling and Preservation of Leachates - ASTM D3987-12/85, EPA 1311, and EPA 1312	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7258	Volatiles by Zero Headspace Extractor (ZHE) - Toxicity Characteristic Leaching Procedure (TCLP) by EPA 1311 and Synthetic Precipitate Leaching Procedure (SPLP) by EPA 1312	5_EUUSLA_Leachate Preparation_Manager
T-TL-WI7563	Waste Extraction Test Leaching Procedure for Volatile and Non-Volatile Analytes	5_EUUSLA_Leachate Preparation_Manager

8.08 Water Quality

Work Instruction

T-WC-WI10422	Acid Volatile Sulfide in Solids	5_EUUSLA_Water Quality_Manager
T-WC-WI10424	Ammonia-Nitrogen for Soils (Tritrimetric Distillation Procedure) by 4500-NH3 B/C - 2011, or EPA 350.2	5_EUUSLA_Water Quality_Manager
T-WC-WI11474	Ammonia-Nitrogen for Waters (Titrimetric Distillation Procedure) by 4500-NH3 B/C -2011, or EPA 350.2	5_EUUSLA_Water Quality_Manager
T-WC-WI10425	Bellack Distillation for Fluoride in Waters and Solids by SM 4500 F B-2011, EPA 340.1 Procedure 6.1 or SM 4500 F B-1997	5_EUUSLA_Water Quality_Manager
T-WC-WI10426	BOD and CBOD in Waters by SM 5210 B-2011, Hach 10360, EPA 405.1, SM 5210 B-2001	5_EUUSLA_Water Quality_Manager
T-WC-WI9898	Calibration of Hach 2100AN Turbidimeter	5_EUUSLA_Water Quality_Manager
T-WC-WI12050	Chemical Oxygen Demand (COD) in Water by EPA 410.4	5_EUUSLA_Water Quality_Manager
T-WC-WI11478	Chemical Oxygen Demand (Low-Level) by 410.4	5_EUUSLA_Water Quality_Manager
T-WC-WI10358	Chemical Review	5_EUUSLA_Water Quality_Manager
T-WC-WI11479	Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI10431	Chloride (Titration) in Water by SM 4500-CL C-2011/1997 or EPA 325.3	5_EUUSLA_Water Quality_Manager
T-WC-WI11480	Chlorine Residual for waters by 4500 Cl F-2011, or EPA 330.4	5_EUUSLA_Water Quality_Manager
T-WC-WI11482	Color by 2120 B-2011, or EPA 110.2	5_EUUSLA_Water Quality_Manager
T-WC-WI11483	Colorimetric Sulfide in Waters, Sulfide as H2S, Dissolved Sulfide in Waters by 4500-S2 D-2011, 4500-S2 H-2011, or EPA 376.2	5_EUUSLA_Water Quality_Manager
T-WC-WI10618	Digestion of Hexavalent Chromium in Solids by SW-846 3060A	5_EUUSLA_Water Quality_Manager
T-WC-WI10609	Dissolved Oxygen by 4500 O G-2011, EPA 360.1 or Hach Method 10360	5_EUUSLA_Water Quality_Manager
T-WC-WI11616	Dissolved Oxygen Meter Calibration	5_EUUSLA_Water Quality_Manager
T-WC-WI9900	Equipment Incubators and Refrigerators	5_EUUSLA_Water Quality_Manager
T-WC-WI9901	Equipment Muffle Furnaces and Ovens	5_EUUSLA_Water Quality_Manager
T-WC-WI10610	Fixed Suspended Solids (Gravimetric) Volatile Suspended Solids (Gravimetric)by SM 2540 E - 2011 or EPA 160.4 in Water	5_EUUSLA_Water Quality_Manager
T-WC-WI10348	Fixed Volume Hand-Held Pipettes	5_EUUSLA_Water Quality_Manager
T-WC-WI10437	Flash Point for Liquids and Solids by ASTM D93, EPA 1010A or EPA 1010B	5_EUUSLA_Water Quality_Manager
T-WC-WI10352	Genesys 30 Spectrophotometer	5_EUUSLA_Water Quality_Manager
T-WC-WI11499	Group Leader	5_EUUSLA_Water Quality_Manager
T-WC-WI11500	Hexane Extractable Material (HEM) and Silica Gel Treated Hexane Extractable materials (SGT-HEM) in Waters by EPA Method 1664A, 1664B, and 1664.	5_EUUSLA_Water Quality_Manager
T-WC-WI11501	Hexavalent Chromium in Waters and Soils (Colorimetric) by SW-846 7196A	5_EUUSLA_Water Quality_Manager
T-WC-WI10627	Ignitability of Solids by 40 CFR, Part 261.21	5_EUUSLA_Water Quality_Manager

T-WC-WI11504	Laboratory Assistant	5_EUUSLA_Water Quality_Manager
T-WC-WI11505	Laboratory Technician	5_EUUSLA_Water Quality_Manager
T-WC-WI11506	Low-Level Hexavalent Chromium in waters (Colorimetric) by 3500-Cr B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI10350	Maintenance of Desiccators	5_EUUSLA_Water Quality_Manager
T-WC-WI11507	Manager	5_EUUSLA_Water Quality_Manager
T-WC-WI10629	Methylene-Blue-Active Substances (MBAS) by 5540 C-2011 or EPA 425.1	5_EUUSLA_Water Quality_Manager
T-WC-WI11509	Moisture (Gravimetric), Total Residue, Volatile Residue, Total Fixed Residue/Ash by SM 2540 G-2011/1997 in Solids	5_EUUSLA_Water Quality_Manager
T-WC-WI11475	Multi-Parameters in Solids and Waters by ManTech Multi-Parameter System	5_EUUSLA_Water Quality_Manager
T-WC-WI11510	n-Hexane Extractable Material (HEM) and Silica Gel Treated HEM (SGT-HEM) in Solids by EPA 9071B	5_EUUSLA_Water Quality_Manager
T-WC-WI11511	Orthophosphate (Colorimetric) by EPA 365.3 in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI15537	Orthophosphate in waters by Colorimetry SM 4500 P E-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11512	Oxidation-Reduction Potential for Wastewaters and Soils by ASTM D1498, SM 2580 B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI11513	Paint Filter Liquids Test (Free Liquids Test) in Waste by SW-846 9095B	5_EUUSLA_Water Quality_Manager
T-WC-WI46354	Particle Size Distribution of Soils and Solids/Grain Size Classification by ASTM D422-63 (reapproved 2007) - Modified	5_EUUSLA_Water Quality_Manager
T-WC-WI11515	Percent Solids for GC/MS by EPA 1666, Revision A - 1998	5_EUUSLA_Water Quality_Manager
T-WC-WI11518	pH by EPA 9045C, 9045D and Corrosivity by SW-846 Chap 7 of Solids, Soils, and Solvents using Electrometic Methods	5_EUUSLA_Water Quality_Manager
T-WC-WI11519	pH Probes and Meters	5_EUUSLA_Water Quality_Manager
T-WC-WI11521	Principal Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI10360	Quality Control Data for Wet Chemistry	5_EUUSLA_Water Quality_Manager
T-WC-WI11572	Reactive Sulfide (titration) by SW-846 9034 (1996) Prepared by Chapter 7.3.4 (1996) in Waste	5_EUUSLA_Water Quality_Manager
T-WC-WI11574	Reactivity of Waste	5_EUUSLA_Water Quality_Manager
T-WC-WI11575	Senior Chemist	5_EUUSLA_Water Quality_Manager
T-WC-WI11577	Senior Specialist	5_EUUSLA_Water Quality_Manager
T-WC-WI11576	Senior Technician	5_EUUSLA_Water Quality_Manager
T-WC-WI11578	Settleable Solids in waters by 2540 F-2015, 2540 F-2011, or EPA 160.5	5_EUUSLA_Water Quality_Manager
T-WC-WI10349	SKALAR COD Robot Analyzer and COD Spectrophotometers	5_EUUSLA_Water Quality_Manager
T-WC-WI11584	Specific Conductance in Solids by SM 2510B-2011, SM 2510B-1997, SW-846 9050A, SW-846 9050, or EPA 120.1	5_EUUSLA_Water Quality_Manager

T-WC-WI10421	Specific Gravity by SM 2710F-1997, SM 2710F-2011 in Waters and Wastes, Bulk Density by ASTM E868-82 Sec 9.9 in Solids	5_EUUSLA_Water Quality_Manager
T-WC-WI10362	Standardization of 0.02 and 0.1 Normal Sulfuric Acid	5_EUUSLA_Water Quality_Manager
T-WC-WI11585	Standardization of 0.02 Normal Sodium Hydroxide	5_EUUSLA_Water Quality_Manager
T-WC-WI11586	Sulfate (turbidimetric) by EPA 375.4 in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI11587	Sulfide Titration for Waters by 4500 S2 F-2011, EPA 376.1, SW-846 Method 9034 or 4500 S2 F-2000	5_EUUSLA_Water Quality_Manager
T-WC-WI11589	Sulfite in waters by 4500-SO3 B-2011, or EPA 377.1	5_EUUSLA_Water Quality_Manager
T-WC-WI11598	Total Dissolved Solids (TDS)(Gravimetric) by SM 2540 C-2015, SM 2540 C-2011, SM 2540 C-1997 or EPA 160.1 in Waters and Wastewaters	5_EUUSLA_Water Quality_Manager
T-WC-WI11600	Total Fixed Solids (TFS), Total Volatile Solids (TVS) Gravimetric by SM 2540 E-2011, SM 2540 G-2011 or EPA 160.4 in Waters, Wastewaters and Sludges	5_EUUSLA_Water Quality_Manager
T-WC-WI11603	Total Solids (Gravimetric) by SM 2540 B-2011, SM 2540 G-2011, EPA 160.3, SM 2540 G-1991, SM 2540 B-1997, or SM 2540 G-1997 in Waters, Wastewaters and Sludges	5_EUUSLA_Water Quality_Manager
T-WC-WI11604	Total Suspended Solids (TSS)-Gravimetric by SM 2540 D-2011 or SM 2540 D-1997 and Total Filtered: Total Volume Test by NJDEP in Waters	5_EUUSLA_Water Quality_Manager
T-WC-WI15618	Turbidity by EPA 180.1 Rev. 2 or SM 2130 B-2011	5_EUUSLA_Water Quality_Manager
T-WC-WI10364	Water Quality Washroom Procedures	5_EUUSLA_Water Quality_Manager

8.09 Air Quality

Work Instruction

T-AQ-WI7174	Analysis of Air for Selected Volatile Organic Compounds by Gas Chromatography with Flame Ionization Detector and Photo Using EPA Method 18 and 25	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI26671	Ashcroft ATE-100 Hand Held Calibrator	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7162	Calibration of Pressure Gauges	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7157	Chemist	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7165	Cleaning and Handling of Flow Controllers	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7164	Cleaning and Handling of Summa Canisters	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7159	Group Leader	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7275	Low-Level Volatiles in Air by EPA Method TO-15 Using GC/MSD in SIM Mode	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7161	Manager	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7168	Preparing Summa Can Order	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7160	Principal Specialist	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7163	Routine Instrument Maintenance for Volatiles in Air by GC and GC/MS	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7158	Senior Chemist	5_EUUSLA_Volatiles in Air_Manager

T-AQ-WI7169	Standards Preparation, Validation, and Documentation Using EPA Method TO-14 and TO-15	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7436	The Determination of Volatile Organic Compounds in Air by GC/MS Using EPA Method TO-15	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7271	Volatiles in Air Audit Process	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7173	Volatiles in Air Tentatively Identified Compound Method	5_EUUSLA_Volatiles in Air_Manager
T-AQ-WI7171	Volatiles in Air Tentatively Identified Compound Method (Interpretive)	5_EUUSLA_Volatiles in Air_Manager

8.10 EPH/Miscellaneous GC

Work Instruction

T-GC-WI9253	Analysis of DRO/RRO by Alaska 102/103 in Waters and Soils	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9643	Associate Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9644	Carbon Dioxide in Water Using Headspace Sampling Techniques and GC-TCD, Method RSK-175 or 8015	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9650	Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9656	Client Specific - Total Extractable Hydrocarbons (TEH) by Method 8015B Modified Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9791	Client Specific - TPH-DX with Fuel Identification in Waters by NWTPH-DX Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9657	Common Equations Used During Chromatographic Analyses	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9788	DRO and ORO by 8015B/8015C/8015D in Solids using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9786	DRO and ORO by 8015B/C/D in Water using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9672	EPH by Massachusetts Protocol (MA EPH), LA RECAP Ranges (LAEPH) and Montana DEQ (MT EPH) in Waters and Solids Using GC	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9676	Extraction of Soils/Solids for Glycol Analysis by 8015B/C/D	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9677	Extraction of Solids/Soils for Analysis of Alcohols by Method 8015B, C, or D	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9678	Fractionated EPH using LA RECAP Ranges in Waters and Solids by GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9679	GC Routine and Nonroutine Maintenance for Instrumentation Used for VPH Analysis	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9680	Glycols by Method 8015B/8015C/8015D in Water and Solid Matrices Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9681	Group Leader	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9684	Laboratory Technician	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9689	Maintenance and Troubleshooting Procedures for GC-FID Instrumentation	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9690	Manager	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9736	New Jersey Extractable Petroleum Hydrocarbons (NJEPH) in Waters and Solids using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager

T-GC-WI9740	PMI VOCs (Direct Injection) by Method 1671A in Waters Using GC/FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9748	Principal Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9749	QC Data Acceptability and Corrective Action	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9756	Qualitative/Quantitative GC Fingerprint in Petroleum Distillates, Fuels, and Oils by 8015B/C/D using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9757	Senior Chemist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9758	Senior Specialist	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9759	Senior Technician	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9770	TNRCC TX Method 1005 - Total Petroleum Hydrocarbons (Gasoline Range, Diesel Range, and Extended Range Organics) in Waters and Solids	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9771	Total Petroleum Hydrocarbons with Ranges by Methods 8015B/8015C/8015D in Waters and Solids by GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9772	Total Saturated Hydrocarbons by Method 8015C in Waters and Solids using GC/FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9778	TPH and Quantitative Fuel Fingerprinting by Methods 8015B/C/D mod. in Waters and Solids Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9773	TPH by CT ETPH in Solids and Waters Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9781	TPH by NWTPH-Dx (modified) in Soils using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9783	TPH by NWTPH-Dx (modified) in Waters using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9792	TX 1006 Characterization of C6-C35 Petroleum Hydrocarbons in Waters and Solids by GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI24004	Volatile Hydrocarbons in Water by ASTM Standard Test Method D8028-17 Using Headspace Sampling Techniques and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9796	Volatile Hydrocarbons in Water by Method RSK-175 and SW-846 8015B/C/D Using Headspace Sampling Techniques and GC-FID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9798	Volatile Organic Concentration of Waste Samples by Method 25D Using FID and ELCD	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9685	VPH in Waters and Solids Using GC/FID/PID	5_EUUSLA_EPH/Misc. GC_Manager
T-GC-WI9824	Water Miscible Solvents by Method 8015B/8015C/8015D Using GC-FID	5_EUUSLA_EPH/Misc. GC_Manager

8.11 Organic Extraction

8.11.01 Prep for Pesticides

Work Instruction

T-OE-PEST-WI1028	Cleanup Procedures for the Extraction of Pesticides and Polychlorinated Biphenyls (PCBs)	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1090	Extraction By Method 8318/8318A for Carbamate and Urea Pesticides in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1091	Extraction of Chlorinated Herbicides in Water by SW-846 8151A	5_EUUSLA_Organic Extraction_Manager

T-OE-PEST-WI1137	Extraction of Formaldehyde and Other Aldehydes in a Water Matrix by Method 8315A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1094	Extraction of Nitroaromatics and Nitroamines by Method 3535A in Water	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1137	Extraction of Solid Samples for Formaldehyde and Aldehydes by Method 8315A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1138	Microextraction by Method 8011 for EDB, DBCP, and TCP in Water	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1095	Microextraction of EDB and DBCP in Solids by Method 8011	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1092	Microwave Extraction Method 3546 for PCBs in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1092	Microwave Extraction Method 3546 for Pesticides in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1141	Pesticide Extract Cleanup Using GPC by Method 3640A	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1092	Separatory Funnel Extraction by Method 3510C, 608, or 608.3 for Pesticides and PCBs in a Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1092	Ultrasonic Extraction for PCBs in a Solid Matrix by Method 3550B and 3550C	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1093	Ultrasonic Extraction for Pesticides in a Solid Matrix by Method 3550	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1091	Ultrasonic Extraction of Chlorinated Herbicides by Method 3550B/C in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1094	Ultrasonic Extraction of Nitroaromatics and Nitroamines by Method 8330B in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1091	Waste Dilution by EPA 3580A for PCBs in Oil	5_EUUSLA_Organic Extraction_Manager
T-OE-PEST-WI1092	Waste Dilution by EPA 3580A for Pesticides in a Non-Water Soluble Leachate Matrix	5_EUUSLA_Organic Extraction_Manager

8.11.02 Prep for SVOA

Work Instruction

T-OE-SVOA-WI1028	Alumina Column Cleanup	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI3445	Extraction of SAN Trimer by Method 525.3 in Waters	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1091	Low-Level Sonic Probe Extraction Procedure by Method 3550C for the Determination of Semivolatiles in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1092	Microwave Extraction by Method 3546 for Semivolatiles	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1055	Semivolatile Extract Cleanup Using GPC by Method 3640A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1093	Separatory Funnel Extraction (Method 3510C) of Base Neutrals and Acid Extractables in Leachates	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1143	Separatory Funnel Extraction by Method 3510C for BNAs in Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1092	Separatory Funnel Extraction by Method 3510C for Tetraethyl Lead in Waters	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1094	Separatory Funnel Extraction for BNAs in Wastewater by Method 612 or 625.1	5_EUUSLA_Organic Extraction_Manager

T-OE-SVOA-WI1805	Separatory Funnel Extraction of Chlorinated Herbicides in Water by SW-846 Method 8151A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1088	Solid Phase Extraction Procedure for the Determination of THPA, THPI, and PA in a Water Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1093	Waste Dilution Procedure for the Determination of Acid Extractables and Base-Neutrals in a Non-Water Soluble Leachate Matrix by Method 3580A	5_EUUSLA_Organic Extraction_Manager
T-OE-SVOA-WI1091	Waste Dilution, EPA 3580A for Acid Extractables and Base-Neutrals in a Non-Water Soluble Matrix	5_EUUSLA_Organic Extraction_Manager

8.11.03 Prep for GC

Work Instruction

T-OE-GC-WI10278	10g Silica Gel Cleanup by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10949	3 g Silica Gel Column Cleanup for DRO by Method 3630C	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI21921	Acid Cleanup Procedure for Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10932	Extraction by EPA 3546 for DRO and/or RRO in Solids for Alaska Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI11364	Extraction of Total Petroleum Hydrocarbon Organics in Waters by Texas Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI11365	Extraction of Total Petroleum Hydrocarbons in a Solid Matrix by Texas Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10906	Microextraction by Method 3511 for DRO in Water and Wastewater	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10899	Microwave Extraction for EPH in a Solid Matrix by Montana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10930	Microwave Extraction Method 3546 for DRO and Saturated Hydrocarbons in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10883	Microwave Extraction Method 3546 for NJ EPH in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10909	Microwave Extraction, Method 3546, for MA EPH in a Solid Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10910	Quick Silica Gel Cleanup by Methods 3630C and ECY 97-602 for Hydrocarbons by GC in Solid and Water Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10894	Separatory Funnel Extraction for DRO and RRO by AK 102/103 in a Water Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10890	Separatory Funnel Extraction for EPH in Water or Wastewater by Montana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10914	Separatory Funnel Extraction for EPH in Waters by Massachusetts, New Jersey, and Louisiana Protocol	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10892	Separatory Funnel Extraction for ETPH in Water or Wastewater Matrix by Connecticut Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10944	Separatory Funnel Extraction Method 3510C for DRO in Water or Wastewater	5_EUUSLA_Organic Extraction_Manager

T-OE-GC-WI10908	Separatory Funnel Extraction Method ECY 97-602 NWTPH-DX for TPH in a Water or Wastewater Matrix	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10879	Silica Gel Fractionation by Method 3630C for Hydrocarbons by GC in Water and Solid Matrices	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10913	Sonic Probe Extraction for TPH in Solids by Washington DX	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10897	Ultrasonic Extraction by Method 3550B/C for DRO and Fingerprint on Petroleum Products in Solids	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10901	Ultrasonic Extraction for ETPH in Solid Matrix by Connecticut Methodology	5_EUUSLA_Organic Extraction_Manager
T-OE-GC-WI10905	Waste Dilution for the Determination of Saturated Hydrocarbons in an Oil Matrix	5_EUUSLA_Organic Extraction_Manager

8.11.04 General

Work Instruction

T-OE-GEN-WI14427	Associate Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11363	Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11369	Determining QC Sample Volume for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10862	Electrothermal Heating Mantles	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI7154	Food and Tissue Preparation	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10864	Glassware Cleaning for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10873	Glassware Cleaning Using Automatic Washers for non-Organic Extraction Glassware	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11376	Group Leader	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11377	Laboratory Assistant	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11378	Laboratory Technician	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10877	Maintenance and Calibration of the Microwave Accelerated Reaction System	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11379	Manager	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11400	Multipette Stream Operation and Calibration	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10876	Organic Extraction Standards Storage and Handling	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11408	Percentage Lipids Using Soxhlet Extraction by Method 3540C	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10871	Pesticide Extract Concentration Using a Zymark TurboVap II Concentration Workstation	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10866	pH Meters and Electrodes	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI13363	Pore Water Generation Procedure	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11415	Principle Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10867	Procedure for Containment and Clean Up of Hazardous materials Spills in Organic Prep Lab	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11418	Refrigerated Recirculators	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11420	Routine Maintenance of Miele Glass Washers	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10868	Scheduling Sample Request Forms (SRFs)	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11427	Semivolatile Extract Concentration Using a Zymark TurboVap II Concentration Workstation	5_EUUSLA_Organic Extraction_Manager

T-OE-GEN-WI11428	Senior Administrator	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11429	Senior Chemist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11430	Senior Specialist	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI11431	Senior Technician	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI38993	Sep Funnel Separation of Bulk Waste	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10865	Solvent, Reagent, and Amber GC Vial Lot Testing for Organic Extractions	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10869	Spike Solution Testing and Approval	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10861	Steam Bath, N-Evap, and RapidVap Usage, Calibration, and Maintenance	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10870	Ultrasonic Probe Horn Cleaning	5_EUUSLA_Organic Extraction_Manager
T-OE-GEN-WI10860	Ultrasonic Processor Maintenance and Tuning	5_EUUSLA_Organic Extraction_Manager

8.12 PFAS by LC/MS/MS

Work Instruction

T-PFAS-WI49208	Analysis of Per and Polyfluoroalkyl Substances (PFAS) in Aqueous Samples by LC-MS/MS Using Draft Method 1633 (Validation study)	5_EUUSLA_PFAS_Manager
T-PFAS-WI46412	Analysis of Per and Polyfluoroalkyl Substances (PFAS) in Aqueous Samples by LC-MS/MS Using Draft Method 1633/QSM5.4 Table B24	5_EUUSLA_PFAS_Manager
T-PFAS-WI48593	Analysis of Per and Polyfluoroalkyl Substances (PFAS) in Solid Samples by LC-MS/MS Using Draft Method 1633/QSM5.4 Table B24	5_EUUSLA_PFAS_Manager
T-PFAS-WI7732	Associate Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20032	Associate Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7733	Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI21864	Client Specific Table 3 PFAS in Water and Soil Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI34886	Client Specific: Determination of Bi-functional Surfactants (BFS) in Aqueous and Solid Samples by Extracted Internal Standard Quantitation using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI34027	Client Specific: Determination of Mono-functional Surfactants (MFS) in Aqueous and Solid Samples by Extracted Internal Standard Quantitation using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI32768	Client Specific: Determination of Table 6 Compounds by LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI20127	Client Specific: Table 3 Compounds by Direct Injection Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI39592	Client specific-Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples Using Isotope Dilution and LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI43681	Determination of Total Fluorine (TF) and Extractable Organic Fluorine (EOF) from Solids/soil by Combustion Ion Chromatography (CIC)	5_EUUSLA_PFAS_Manager

T-PFAS-WI38299	Extraction and Analysis of Adsorbable Organic Fluorine (AOF) from Water by Carbon Adsorption coupled with Combustion Ion Chromatography (CIC). Determination of Total Fluorine (TF) in Water by Combustion Ion Chromatography	5_EUUSLA_PFAS_Manager
T-PFAS-WI36393	Extraction of Perfluoroalkyl and Polyfluoroalkyl Substances(PFAS) in Food by FDA C-010.01	5_EUUSLA_PFAS_Manager
T-PFAS-WI7746	Group Leader	5_EUUSLA_PFAS_Manager
T-PFAS-WI7737	Laboratory Technician	5_EUUSLA_PFAS_Manager
T-PFAS-WI20005	Manager	5_EUUSLA_PFAS_Manager
T-PFAS-WI21568	Manifold and N-EVAP Cleaning for PFAS Extractions	5_EUUSLA_PFAS_Manager
T-PFAS-WI35937	Minnesota - Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by Minnesota Pollution Control(MPCA) Guidance PFAS Method eao2-06, Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI35936	Minnesota - Polyfluorinated Alkyl Substances (PFAS) in Solids by Minnesota Pollution Control(MPCA) Guidance PFAS Method eao2-06, Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI21398	New Jersey - Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples using LC/MS/MS and Isotope Dilution	5_EUUSLA_PFAS_Manager
T-PFAS-WI43626	New Jersey - Polyfluorinated Alkyl Substances (PFAS) in Solid Samples using LC/MS/MS and Isotope Dilution	5_EUUSLA_PFAS_Manager
T-PFAS-WI33376	Pennsylvania - Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples using LC/MS/MS and Isotope Dilution	5_EUUSLA_PFAS_Manager
T-PFAS-WI30676	Per- and Polyfluoalkyl Substances in Drinking Water Using Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry by Method 533	5_EUUSLA_PFAS_Manager
T-PFAS-WI12017	Perfluorinated Alkyl Substances (PFASs) in Drinking Water by Method 537 Version 1.1	5_EUUSLA_PFAS_Manager
T-PFAS-WI25232	Perfluorinated Alkyl Substances (PFASs) in Drinking Water by Method 537.1 Version 1.0	5_EUUSLA_PFAS_Manager
T-PFAS-WI40610	PFAS Prescreen Method in Solid Samples Requesting QSM5.3 Table B-15	5_EUUSLA_PFAS_Manager
T-PFAS-WI40571	PFAS Prescreen Method in Water Samples Requesting QSM5.3 Table B-15	5_EUUSLA_PFAS_Manager
T-PFAS-WI14355	Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by EPA Method 537 Isotope Dilution; and for WV only - SW-846 8321B, Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI36458	Polyfluorinated Alkyl Substances (PFAS) in Aqueous Samples by Method 537 Version 1.1 Modified QSM5.4 Table B-15 Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI12031	Polyfluorinated Alkyl Substances (PFAS) in Solids by Method 537 Isotope Dilution; and for WV only - SW-846 8321B, Using LC/MS/MS	5_EUUSLA_PFAS_Manager

T-PFAS-WI36459	Polyfluorinated Alkyl Substances (PFAS) in Solids by Method 537 Version 1.1 Modified QSM 5.4 Table B-15 Using LC/MS/MS	5_EUUSLA_PFAS_Manager
T-PFAS-WI23588	Preventative and Corrective Maintenance for the API 4000 and AB Sciex 4500, 5500, 5500+ Liquid Chromatograph Mass Spectrometers (LC/MS/MS)	5_EUUSLA_PFAS_Manager
T-PFAS-WI7742	Principal Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7743	Principal Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI7744	Senior Chemist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20052	Senior Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI20034	Specialist	5_EUUSLA_PFAS_Manager
T-PFAS-WI13881	Standards Management in the PFAS Laboratory	5_EUUSLA_PFAS_Manager
T-PFAS-WI18548	Total Oxidizable Precursors in Aqueous Samples by LC/MS/MS with Isotope Dilution	5_EUUSLA_PFAS_Manager
T-PFAS-WI25971	Total Oxidizable Precursors in Solid Samples by LC/MS/MS with Isotope Dilution	5_EUUSLA_PFAS_Manager

8.13 Specialty Services

Work Instruction

T-SSG-WI35928	(Client Specific) Analysis of FRD-920 in Wastewater by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI7750	Analysis of Fluorotelomer Alcohols in Water, Waste Water, and solids using GC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14557	Associate Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14572	Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI35758	Client Method: Analysis of Indirect Precursors and Telomer Intermediates by GC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9093	Client Specific - Analysis of Glycerol Monolaurate and Propylene Glycol Monolaurate in BioPolySan by Gas Chromatography Mass Spectroscopy (GC/MS)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI33739	Client Specific Method- Extraction and Analysis of Chlorpyrifos in Wastewater by GC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI13642	Determination of Endothall in Aqueous Samples Using LC-MS by Method 8321B	5_EUUSLA_Specialty Services_Manager
T-SSG-WI12005	Determination of Endothall in Solid Matrix Using LC-MS by Method 8231B	5_EUUSLA_Specialty Services_Manager
T-SSG-WI23830	Determination of Ethanolamines in Waters by LC/MS/MS following SW-846 8321B Modified Method	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9448	Determination of Hydrazine Monomethylhydrazine and 1,1-Dimethylhydrazine in Aqueous Samples by LC/MS/MS Using SW-846 8315A Modified	5_EUUSLA_Specialty Services_Manager
T-SSG-WI9431	Determination of Hydrazine, Monomethylhydrazine and 1,1-Dimethylhydrazine in Soil samples by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI10940	Extraction for Perchlorate by Method 6850 in Solids	5_EUUSLA_Specialty Services_Manager
T-SSG-WI41726	Extraction of Solid Samples for Fluorotelomer Alcohols by Method 3546	5_EUUSLA_Specialty Services_Manager

T-SSG-WI9483	Extraction of Waters for Fluorotelomer Alcohols by Method 3510C	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14626	Group Leader	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14575	Laboratory Technician	5_EUUSLA_Specialty Services_Manager
T-SSG-WI20054	Manager	5_EUUSLA_Specialty Services_Director
T-SSG-WI9989	Perchlorate by Method 6850 in Waters and Solids by LC/MS/MS	5_EUUSLA_Specialty Services_Manager
T-SSG-WI36413	Preventative and Corrective Maintenance for the API 4000 and AB Sciex 4500/5500 Liquid Chromatograph Mass Spectrometers (LC/MS/MS)	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14578	Principal Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14614	Principal Specialist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI14620	Senior Chemist	5_EUUSLA_Specialty Services_Manager
T-SSG-WI7748	Thermo Scientific Trace 1310 Gas Chromatograph Tandem Mass Spectrometer (GC/MS/MS) Preventative and Corrective Maintenance	5_EUUSLA_Specialty Services_Manager

8.14 HRMS Group

Work Instruction

T-HRMS-WI14558	Associate Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI14574	Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI9452	Determination of PCB Homologs in Waters and Solids by Method 680	5_EUUSLA_HRMS_Manager
T-HRMS-WI12013	Determination of Percentage Lipids in Animal and Marine Tissue using EPA Method 1613B	5_EUUSLA_HRMS_Manager
T-HRMS-WI21311	Determination of Tetra- Through Octa- Chlorinated Dioxins and Furans in water and solid samples using HRGC/HRMS	5_EUUSLA_HRMS_Manager
T-HRMS-WI9476	Determination of Tetra- Through Octa- Chlorinated Dioxins and Furans in water/solid/food/feed samples using HRGC/HRMS by EPA 1613B or SW-846 Method 8290A	5_EUUSLA_HRMS_Manager
T-HRMS-WI12003	Determination of Tetra- Through Octa-chlorinated Dioxins and Furans, Dioxin-like Polychlorinated Biphenyls, and Indicator Polychlorinated Biphenyls by HRGC/HRMS in Aqueous, Solid, Oil and Oleoresin Matrices(foods/feeds) by Methods 1613B and 1668 Modified	5_EUUSLA_HRMS_Manager
T-HRMS-WI19229	DFS HRGC/HRMS Preventative and Corrective Maintenance	5_EUUSLA_HRMS_Manager
T-HRMS-WI9480	Extraction of Water and Soil Samples by Method 680	5_EUUSLA_HRMS_Manager
T-HRMS-WI9485	Glassware Cleaning for HRMS Extractions	5_EUUSLA_HRMS_Manager
T-HRMS-WI14627	Group Leader	5_EUUSLA_HRMS_Manager
T-HRMS-WI39008	HRMS Extract Cleanup Using GPC by Method 3640A	5_EUUSLA_HRMS_Manager
T-HRMS-WI14577	Laboratory Technician	5_EUUSLA_HRMS_Manager
T-HRMS-WI20068	Manager	5_EUUSLA_HRMS_Director

T-HRMS-WI21285	PCB Congeners by HRGC/HRMS in Aqueous and Solid Matrices	5_EUUSLA_HRMS_Manager
T-HRMS-WI9432	PCB Congeners by Method 1668 HRGC/HRMS in Aqueous and Solid Matrices	5_EUUSLA_HRMS_Manager
T-HRMS-WI9487	Preparation of Aqueous and Solid Samples for Food and Feed Using Microwave or Soxhlet Extraction for Analysis by HRMS	5_EUUSLA_HRMS_Manager
T-HRMS-WI9489	Preparation of Oils and Oleoresins for Food and Feed Analysis by HRMS	5_EUUSLA_HRMS_Manager
T-HRMS-WI14579	Principal Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI14616	Principal Specialist	5_EUUSLA_HRMS_Manager
T-HRMS-WI14623	Senior Chemist	5_EUUSLA_HRMS_Manager
T-HRMS-WI21528	Separatory Funnel Extraction Procedure for HRMS Analysis in an Aqueous Matrix	5_EUUSLA_HRMS_Manager
T-HRMS-WI12032	Separatory Funnel Extraction Procedure for HRMS Analysis in an Aqueous Matrix Using Method 1613B, 8290A, 1668A, and 1668C	5_EUUSLA_HRMS_Manager
T-HRMS-WI21536	Soxhlet Extraction Procedure for HRMS Analysis in a Solid matrix	5_EUUSLA_HRMS_Manager
T-HRMS-WI9488	Soxhlet Extraction Procedure for HRMS Analysis in a Solid Matrix by Methods: 1613B, 8290A, 1668C, and 1668A	5_EUUSLA_HRMS_Manager
T-HRMS-WI9446	Standards Management in the High Resolution Mass Spectrometry Laboratory	5_EUUSLA_HRMS_Manager

Instrument	# of Units	Detector Type/Manufacturer
Liquid Chromatography/Gas Chromatography/Mass Spectrometry (LC/GC/MS)		
LC/MS/MS *(2 – 4033)*	2	AB Sciex X500R QTOF with Exion LC
LC/MS/MS *(5 – 4033)*	5	AB Sciex Tripple Quad 4500 with Exion LC
LC/MS/MS *(1 – 4033)*	1	AB Sciex Tripple Quad 5500 with Exion LC
LC/MS/MS *(2 – 4033)*	2	AB Sciex Tripple Quad 7500 with Exion LC 2.0
LC/MS/MS *(6 – 4033)*	6	AB Sciex 4000 with Exion LC
LC/MS/MS *(1 – 4024)*	1	Agilent
LC/MS/MS *(2 – 4034)*	2	Agilent LC with Micromass Quattro micro MS/MS and Waters 2996 Photodiode Array UV-Vis Detector
LC/MS/MS *(1 – 4034)*	1	Thermo Scientific TSQ Quantum Access with Acella LC
GC/MS *(26 – 4021) (3 – 4030) (1 – 4037) (16 – 4026)*	46	Agilent
GC/MS *(1 – 4034)*	1	DSQ II MS
GC/MS/MS *(1 - 4034)*	1	Thermo TSQ 8000 MSMS
HRGC/HRMS	5	Thermo Scientific DFS
Gas Chromatograph *(1 – 4030) (1 – 4032) (5 – 4021)*	7	Flame Ionization / Photoionization
Gas Chromatograph *(1 – 4024)_*	1	Flame Ionization / ELCD
Gas Chromatorgraph *(1 – 4024)*	1	Flame Ionization / Thermoconductivity
Gas Chromatograph *(2 – 4030)*	2	Thermal Conductivity
Gas Chromatograph *(16 – 4024)*	17	Electron Capture
Gas Chromatograph *(16 – 4032)*	16	Flame Ionization
Auxiliary Equipment for Gas Chromatographs		
Most of the GC/MS and GC systems include autosamplers and approximately half are fitted with purge and trap concentrators for analysis of volatiles.		

High Performance Liquid Chromatography		
High Performance Liquid Chromatograph	2	Agilent 1100 LC (4024)
High Performance Liquid Chromatograph	3	Agilent 1200 HPLC (4024)
High Performance Liquid Chromatograph	1	Waters alliance 2695 (4024)
High Performance Liquid Chromatograph	1	Waters alliance 2795

Gel Permeation Chromatography		
Gel Permeation Chromatograph	3	J2Scientific AccuPrep

Combustion Ion Chromatography		
Combustion Chromatograph	1	Metrohm

Ion Chromatography		
Ion Chromatograph	1	Metrohm 881 IC Pro
Ion Chromatograph	1	Dionex ICS1000
Ion Chromatograph	1	Dionex ICS3000
Ion Chromatograph	1	Dionex ICS2000
Ion Chromatograph	4	Dionex ICS1100
Ion Chromatograph (Specialty Services)	1	Dionex ICS5000 with UltimMate 3000 Aux Pump

Atomic Absorption/Emission Spectrophotometry		
ICP	1	Thermo ICAP™ 7000 Duo ICP Analyzer

ICP	5	Thermo ICAP™ 6000 Duo ICP Analyzer
ICP/MS	1	Agilent 7700
ICP/MS	3	Agilent 7900
Mercury Analyzer	2	Leeman Labs Hydra II
Mercury Analyzer	1	Leeman Labs M-7600

UV Vis/IR Spectrophotometry:		
UV-Vis Spectrophotometer	3	Thermo Genesys 30
UV-Vis Spectrophotomenter	1	Hach DR2800

Miscellaneous Chemistry Instrumentation		
Auto-titrator System	2	Mantech
Automated COD Analyzer	1	Skalar
Turbidimeter	2	Hach 2100AN, VWR
Block Digestion Systems	8	Environmental Express SC150
Block Digestion Systems	8	Environmental Express SC154
Centrifuge	5	Various
Chilled water recirculators		Various
Closed Cup Flashpoint Apparatus, Pensky-Martin	1	Fisher Scientific TA6
Automated SPE HEM Extractor	2	Horizon SPE-DEX 3100
Automated SPE HEM Extractor	2	Environmental Exprerss SPE-Express
Cyanide Midi Distillation Kits	3	Various
Automated BOD Analyzer	3	Mantech
Dissolved Oxygen Meter	6	YSI
Flow Solution Autoanalyzer	1	Astoria Pacific 302
Flow Solution Autoanalyzer	2	OI FS3700
Flow Solution Autoanalyzer	1	OI FS3100
Flow Solution Autoanalyzer	1	Skalar San++
Discrete Autoanalyzer	1	Thermo Gallery Plus
Glassware washer - automated	6	Miele – (2) PG8257 (1) G7827 (1) G7704 (2) G7883 (10 G7804
Kjehldal Distillation Apparatus	2	Fisher
Microwave Extractors	3	CEM MarsXpress
pH meters	13	Various
Phenol Midi Distillation	2	Andrews Glass
Pressurized Solvent Extractor	2	Dionex ASE200
Puck Mill	1	ESSA/2000
Sonicators	12	Various
Total Organic Carbon Analyzer	4	O.I. Corp. 1030
Total Organic Carbon Automated Combustion Analyzer	1	Skalar Primacs ATC-100
Turbidimeter	1	Hach 2100AN
Zero Headspace Extractor	74	Various Models

Computer Equipment

Our laboratories make extensive use of computers for business applications, technical operations (e.g., our sample management system), and QA Program (see section on Quality Assurance). Numerous physical and virtual servers are used to support the systems. Internet access is provided with an ASA firewall to control incoming and outgoing traffic. The laboratory uses 3 phase power supply and backup generators for life safety and sample integrity preservation.

Standard Operating Procedure for Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils by SW 3051A, Rev. 1, February 2007, for analysis by ICP and ICP- MS

DOCUMENT CONTROL PAGE

Deepak Pandey, Metals Dept. Supervisor — 08/13/2020 Date

Julian Martinez, Operations Manager — 08/13/2020 Date

1. Scope and Application

This standard operating procedure (SOP) provides guidance for microwave digestion of sediments, sludges soil, and oil samples for total metals determination by inductively coupled plasma mass spectroscopy (ICP-MS) and inductively coupled plasma atomic emission spectroscopy (ICP-AES). The Reporting limits from the associated analytes can be found in Xenco LIMS.

The metals suited for this type of digestion are listed below:

Element		CAS Registry No.
Aluminum	(Al)*	7429-90-5
Antimony	(Sb)*	7440-36-0
Arsenic	(Ar)	7440-38-2
Barium	(Ba)*	7440-39-3
Beryllium	(Be)*	7440-41-7
Boron	(B)	7440-42-8
Cadmium	(Cd)	7440-43-9
Calcium	(Ca)	7440-70-2
Chromium	(Cr)*	7440-47-3
Cobalt	(Co)	7440-48-4
Copper	(Cu)	7440-50-8
Iron	(Fe)*	7439-89-6
Lead	(Pb)	7439-92-1
Lithium	(Li)	7439-93-2
Magnesium	(Mg)*	7439-95-4
Manganese	(Mn)	7439-96-5
Mercury	(Hg)	7439-97-6
Molybdenum	(Mo)	7439-98-7
Nickel	(Ni)	7440-02-0
Phosphorus	(P)	7723-14-0
Potassium	(K)	7440-09-7
Selenium	(Se)	7782-49-2
Silicon	(Si)*	7440-21-3
Silver	(Ag)*	7440-22-4
Sodium	(Na)	7440-23-5
Strontium	(Sr)	7440-24-6
Thallium	(Tl)	7440-28-0

Tin	(Sn)*	7440-31-5
Titanium	(Ti)*	7440-32-6
Vanadium	(Va)*	7440-62-2
Zinc	(Zn)	7440-66-6

* Indicates the elements that need addition of HCl to achieve equivalent results to Method 3050.

2. Summary

A representative 0.5 gm of wet sample is extracted and/or dissolved in concentrated nitric acid, or concentrated nitric acid and concentrated hydrochloric acid using a suitable laboratory microwave unit. The samples and acids are placed in a 55mL TFM vessel. The vessel is sealed and heated in the microwave for the specified time suggested by CEM. After cooling, the content is then filtered, centrifuged, or allowed to settle and then diluted to volume and analyzed by the appropriate determinative method.

3. Definitions

Preparation Batch: Defined as twenty or less samples prepared and digested at the same time.

4. Responsibilities

4.1 The laboratory technician or analyst shall:

4.1.1 Perform the prep procedure in accordance with this SOP.
4.1.2 Resolve non-conformances in SOP and data, first individually, then, if necessary, with the help of the laboratory section supervisor or other technical resource, and report unresolved non-conformances with a Non-Conformance Report form.

4.2 The laboratory section supervisor shall:

4.2.1 Assist the laboratory technician or analyst in resolving non-conformances.
4.2.2 Review and approve the data, methodology, and final reports for all analyses, tests, and procedures, which are performed in his or her laboratory section.

4.3 The QA/QC Officer, Laboratory Director, or designee shall monitor adherence to this SOP and conformance to the QC criteria of the cited method.

5. Interferences, Limitations, Comments, and Helpful Hints

5.1 **Interferences**

5.1.1 Due to varied matrix types, the type of interferences present also varies. To evaluate if this digestion procedure is appropriate and free of interferences it is important to analyze method blanks and spike method blanks to evaluate if analytical method recoveries are met and the batch is free of contamination and interferences.

5.2 **Comments and Helpful Hints**

5.2.1 Potential contamination of zinc, copper and chromium may occur at very low detection limits if the water used for analysis of blank and associated QC is not ASTM type I grade.

5.2.2 Clean all glassware and other sample processing hardware with at least 10% nitric acid.

5.2.3 It is mandatory that the sample be discarded if it went dry during the digestion procedure due to high organic material content causing the evolution of gaseous digestion products. This will cause your vessel to vent with potential loss of sample and/or analytes. In this case, it is recommended to use less than 0.25 grams of sample and when adding the acid allowing the acid reaction to happen before sealing the vessel.

6. Sample Collection, Sample Preservation, Shipment and Storage

The samples are to be collected in glass or plastic containers that have been cleaned according to EPA specifications. Refrigerate the samples at 0-6°C until analysis. The recommended maximum holding time for metal samples is 6 months from the date of sampling except for mercury.

7. Safety

7.1 Be knowledgeable of the MSDS information for each chemical that is used in the procedure.

7.2 Comply with the chemicals manufacturer and supplier's safety precautions.

7.3 Comply with all applicable safety regulations and safety SOPs.

7.4 Reagent preparation, the first contact of the sample with acid, and the digestion of the samples are to be performed in a fume hood.

8. Quality Control

8.1 Method Blank

For each preparation batch of samples processed, laboratory blanks should be carried throughout the entire sample preparation and analytical process. Method blanks are to be digested at a frequency of one for every 20 or less samples per matrix. The method blank must contain the same acid concentration in the final solution as the sample solutions used for analysis. For solid matrix, PTFE boiling chips are used to matrix match.

The analyzed concentration of analyte in the method blank should be less than one half the MQL or client RL. If the method blank is higher than the method detection limit or higher that one half the MQL and target analytes are detected in the samples, the complete digestion batch should be checked for source of contamination and re-digested if appropriate.

8.2 Matrix Spikes

Matrix spike samples are to be digested at a frequency of one for every twenty or one spiked sample per matrix per preparation batch, whichever is greater. Two separate sample aliquots (MS/MSD) are spiked with an appropriate concentration of spike solution prior to digestion and carried through the entire analytical procedure.

8.3 Laboratory Control Standard

A laboratory control standard (LCS/LCSD) is a fortified blank, which is carried through the digestion and analysis procedure as if it were a sample. For each analytical batch of samples processed, LCS/LCSD should be carried throughout the entire sample preparation and analytical process. LCS/LCSD are to be digested at a frequency of one for every 20 samples or one blank per batch per matrix, whichever is greater. For solid matrix, PTFE boiling chips are used to matrix match.

9. Equipment and Supplies

9.1 CEM-Mars 6 iWave Microwave, compliant with EPA method 3051 Specifications in section 6.0.

9.2 55 mL TFM Vessels (<500psi), MARSXpress vessels.

9.3 110 mL TFM Vessels (>2000psi), EasyPrep vessels.

9.4 FilterMate Filtration devices from Environmental Express SC0404 (0.7um).

9.5 Analytical balance capable of accurately weighing to the nearest 0.01 g.

9.6 Pipettes and Dispensers

9.7 50 mL polypropylene tubes, verified for leachable metals by ICP-MS.

10. Reagents and Standards

NOTE: Acids used in the digestion of samples or in preparing reagents procedure must be trace metal grade or better.

10.1 Nitric acid (HNO_3), concentrated. Trace metal select or better.

10.2 Hydrochloric acid concentrated (HCl). Trace metal select or better.

10.3 Reagent Water. Reagent water should be ASTM type I, free of any organic or other interference.

10.4 Peak Performance Uranium Standard 1000 mg/L P/N S4400-100064.

10.5 Peak Performance Phosphorus Standard 1000 mg/L P/N S4400-1000391.

10.6 Peak Performance Bismuth Standard 1000 mg/L P/N S4400-100061.

10.7 Spiking solution: High Purity standards custom spiking mixture, Catalog Number SM-2636-003 A, B and C. This spiking mixture is to be used when preparing the Matrix Spike (MS/MSD), and LCS working standard solutions for ICP and ICP-MS.

10.7.1 Working Standard A for ICP: 50 mL of SM2636-003 A + 20 mL of Phosphorus Standard + 20 mL of Bismuth Standard + 12.5 mL of concentrated HNO_3 into a 250 mL Volumetric Flask and fill to the line with type I water.

10.7.2 Working Standard B for ICP: 50 mL of SM2636-003 B + 50 mL of SM-2636-003 C + 12.5 mL of concentrated HNO_3 into a 250 mL Volumetric Flask and fill to the line with type I water.

10.7.3 Working Standard A for ICP-MS: 5 mL of SM2636-003 A + 5 mL of Uranium Standard + 6.25 mL of concentrated HNO_3 into a 250 mL Volumetric Flask and fill to the line with type I water.

10.7.4 Working Standard B for ICP-MS: 5 mL of SM2636-003 B + 5 mL of SM-2636-003 C + 6.25 mL of concentrated HNO_3 into a 250 mL Volumetric Flask and fill to the line with type I water

11. Procedure

11.1 CEM-Mars 6 iWave Microwave Operating Conditions:
- 11.1.1 Power Range: 1200 … 1800 W
- 11.1.2 Ramp Time: 5.5 ± 0.25 min
- 11.1.3 Final Temperature: 175 ± 5 ºC
- 11.1.4 Hold Time: 4.5 min

11.2 Mix the sample thoroughly to achieve homogeneity. For each digestion procedure, weigh to the nearest 0.01 g into the vessel. For soils, sediments, and sludges, use no more than 0.5 grams. For oil or oil contaminated soils, and paint chips use no more than 0.25 grams. If the samples cannot be homogenized properly on an as received basis, then perform air or drying oven at 60 degrees Celsius or less, crushing, sieving, grinding, and mixing as necessary to homogenize the sample.

NOTE: All steps requiring the use of acids should be conducted under a fume hood by properly trained personnel using appropriate laboratory safety equipment.

11.3 Add 625uL of working standard A and working standard B to the LCS and MS/MSD. Use ICP working standards for SW-846 6010B analysis and ICP-MS working standards for SW-846 6020 analysis

11.4 Add 9 mL of concentrated HNO_3 + 3 mL of concentrated HCl into the vessel with sample. If samples contain volatile or easily oxidized organic species allow the sample to react of about 15 minutes with the acid before proceeding to the next step.

11.5 Seal the vessel according to CEM specifications. Properly place the vessels in the microwave system per CEM recommended specifications.

11.6 Make sure the instrument is turned on the exhaust fume motor is functioning properly. Once the instruments system is ready go to the touch screen and press one touch methods, look US EPA 3051 A press on it and then press start.

- 11.6.1 The temperature of each sample should rise to 175±5°C in approximately 5.5 minutes and remain at 175±5°C for 4.5 minutes, or for the remainder of the 10-minute digestion period. The pressure should peak around 5 to 10 minutes.
- 11.6.2 A minimum of 8 sample vessels are recommended to be digested (blanks are also considered sample vessels), when fewer than recommended number of samples are to be digested, the remaining vessels should be

filled with the same acid mixture to achieve the full complement of vessels. This provides energy balance.

11.7 At the end of the microwave program, allow the vessels to cool down for at least 5 minutes before removing them from the microwave system. Please refer to section 5.2.3 to determine if the sample is considered to be compromised and needs to be re-digested.

11.8 Open vessels inside of a fume hood to avoid inhaling a rush of acid vapor that may still be in the headspace. Transfer the sample to 50 mL propylene tubes and fill with type I water to the 50mL mark. If the sample contains particulates that may clog the nebulizer then filter the sample using the FilterMate filtration devices.

12. Method Performance

Check method performance by annually generating MDLs and DOCs. Review the SOP annually. Test the method applicability by also running a Performance Evaluation Sample (PE) Semi-annually.

13. Microwave Power Calibration

Microwave power and temperature calibration will be performed annually by the vendor and appropriate certificate of calibration will be saved on the U drive.

14. Corrective Action for Out of Control Data

If any QC acceptance limit is exceeded, a post-digestion spike should be run to check for interference. If the sample is outside the established recovery limits and no instrument analysis error has been detected, then the samples or standards in question may require re-digestion and reanalysis. If the QC limits are exceeded in the re-digestion and reanalysis, notify the laboratory section supervisor or QA\QC coordinator, initiate a Non-Conformance Report, and take corrective action as advised.

15. Data assessment & acceptance criteria for QC Measure

Measures are found in this SOP and XENCO Laboratories Quality Assurance – Data Reduction, Validating and Reporting

16. Contingencies for handling out-of-control or unacceptable data

The laboratory contingency plan for handling "out of control" or unacceptable data is found in the current XENCO Laboratories Quality Assurance Plan.

17. Waste Disposal and Pollution Prevention

Laboratory Waste must be handled in accordance with Xenco laboratory Waste Disposal and Pollution Prevention SOP QS-16-002.

18. References

16.1 U.S. Environmental Protection Agency, Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils by SW 3051A, Rev. 1, February 2007.
16.2 Current TNI Standard.
16.3 Current Xenco Laboratory's QA Manual.
16.4 Current Laboratory Health & Safety and Chemical Hygiene Plan.
16.5 Current Xenco Laboratory's Waste Disposal and Pollution Prevention SOP.
16.6 Current Xenco Laboratory's, Corrective Action SOP.

Standard Operating Procedure for

Metals Analysis by ICP

SW846 6010B Revision 2, December 1996
Total Hardness Calculation SM 2340-B-2011
SW846 6010C, Revision 3, February 2007
SW846 6010D, Revision 5, July 2018

Document Control Page

Deepak Pandey, Department Supervisor — 06/15/2020 Date

Julian Martinez, Laboratory Manager — 06/15/2020 Date

1.0 Scope and Application

1.1 Inductively coupled plasma-atomic emission spectrometry (ICP-OES) is used to
1.2 determine metals and some nonmetals in solution. This method is a consolidation of existing methods for water, wastewater, and solid wastes. All matrices require digestion prior to analysis. Appendix A contains a list of elements determined by ICP and the wavelengths at which they are determined.
1.3 Ca Hardness, Mg Hardness and Total Hardness are also determined by this procedure with final calculations according to SM2340B.
1.4 Refer to Xenco LIMS for reporting limits or Appendix A and method detection limits of elements determined by ICP. The calculated reporting limit for total hardness is 400 ppb. Refer to SOP MET -05-060 for non-aqueous digestion.

2.0 Summary

2.1 This method describes the simultaneous multi-elemental determination of elements by the Agilent 5100 ICP-OES. The basis of this method is the measurement of atomic emission by an optical spectroscopic technique. Characteristic atomic line emission spectra are produced by a radio frequency inductively coupled plasma (ICP).
2.2 Samples are digested prior to analysis. Upon analysis, samples are nebulized and the aerosol that is produced is transported to the plasma where excitation occurs. In this region the sample is volatized, atomized, and the elements are excited and emit their characteristic radiation. The spectra are dispersed and the intensities of the individual emission lines (wavelengths) are detected and quantified by a Charge Injection Device (CID) detector.
2.3 Digested water, solid, and waste samples are analyzed and reported as “total recoverable metals”. Samples filtered through a 0.45µm filter prior to preservation are reported as “dissolved metals”. Soils, sludges, and sediments are reported on a dry weight basis, wastes are reported on a wet weight basis.

3.0 Definitions

3.1 **Calibration Blank (CB) --** A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogate analytes.
3.2 **Calibration Standard (CAL)** -- A solution prepared from the primary dilution standard solution or stock standard solutions and the internal standards and surrogate analytes. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.
3.3 **Dissolved Analyte** - The concentration of analyte in an aqueous sample that will pass through a 0.45 µm membrane filter assembly prior to sample acidification.
3.4 **Instrument Performance Check Solution (IPC)** -- A solution of one or more method analytes, surrogates, internal standards, or other test substances used

to evaluate the performance of the instrument system with respect to a defined set of criteria

3.5 **Internal Standard** - Pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution. The internal standard must be an analyte that is not a sample component

3.6 **Laboratory Fortified Blank (LFB)** -- An aliquot of reagent water or other blank matrices to which known quantities of the method analytes are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements

3.7 **Laboratory Duplicates (LD1 and LD2)** - Two aliquots of the same sample taken in the laboratory and analyzed separately with identical procedures. Analyses of LD1 and LD2 indicates precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures.

3.8 **Laboratory Fortified Sample Matrix (LFM)** -- An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The LFM is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations.

3.9 **Laboratory Reagent Blank (LRB) or Preparation Blank (PB)** -- An aliquot of reagent water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The LRB I s used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

3.10 **Linear Dynamic Range (LDR)** -- The concentration range over which the instrument response is linear.

3.11 **Material Safety Data Sheet (MSDS)** -- Written information provided by vendors concerning a chemical's toxicity, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions

3.12 **Method Detection Limit (MDL)** -- The minimum concentration of an analyte that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero.

3.13 **Instrument Detection Limit (IDL)** - The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the same wavelength

3.14 **Plasma Solution** - A solution that is used to determine the optimum height above the work coil for viewing the plasma

3.15 **Quality Control Sample (QCS)** -- A solution of method analytes of known concentrations that is used to fortify an aliquot of LRB or sample matrix. The

QCS is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check laboratory performance with externally prepared test materials.

3.16 **Stock Standard Solution (SSS)** -- A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source.

3.17 **Spectral Interference Check (SIC) Solution** - A solution of selected method analytes of higher concentrations which is used to evaluate the procedural routine for correcting known interelement spectral interferences with respect to a defined set of method criteria

3.18 **Standard Addition** - The addition of a known amount of analyte to the sample in order to determine the relative response of the detector to an analyte within the sample matrix. The relative response is then used to assess either an operative matrix effect or the sample analyte concentration

3.19 **Total Recoverable Analyte** - The concentration of analyte determined either by "direct analysis" of an unfiltered acid preserved drinking water sample with turbidity of <1 NTU (Section 11.2.1), or by analysis of the solution extract of a solid sample or an unfiltered aqueous sample following digestion by refluxing with hot dilute mineral acid(s) as specified in the method

3.20 **Batch**- Environmental samples, which are prepared and or analyzed together with the same process, using the same lot(s) of reagents.

3.20.1 A preparation batch is composed of 1 – 20 environmental samples of a similar matrix, meeting the above-mentioned criteria. Where no preparation exists, the batch is defined as environmental samples that are analyzed together with the same process, using the same lots of reagents, not to exceed 20 environmental samples.

3.20.2 An analytical batch is composed of prepared environmental samples, extracts, digestates, or concentrates that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

4.0 Interferences

4.1 Spectral interferences are caused by overlap of a spectral line from another, unresolved overlap of molecular band spectra, background contribution from continuous phenomena, and stray light from the line emissions of highly concentrated elements.

4.1.1 Background emission and stray light can usually be compensated for by subtraction of background emission adjacent to the analyte wavelength peak. Selection of background points is determined by the complexity of the spectrum adjacent to the analyte peak. The location of the points should be free of spectral interferences or corrected using interelement corrections. When determining the location of background points the analyst must scan the area adjacent to the emission wavelength and maintain the spectral information on file by printing the “Element Summary Report” under method reports whenever changes to the background points are made. In the case of extreme spectral interference, the use

of alternate wavelengths may be appropriate.

4.1.2 Spectral overlaps may be compensated for by use of alternate wavelengths or interelement correction factors.

4.2 **Physical interferences**

4.2.1 Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity can cause significant inaccuracies, especially in samples containing high concentrations of dissolved solids, salts or high acid concentrations.

4.2.2 Physical interferences are corrected for through the use of a high solids nebulizer, mass flow controllers, peristaltic sample pumps, and in-line addition of Yttrium as an internal standard. If physical interferences are still present, they must be reduced by diluting the sample.

4.3 **Chemical interferences**

4.3.1 Chemical interferences include molecular-compound formation, ionization effects, and solute-vaporization effects. These interferences can be reduced by selection of operating conditions (see instrument User's Manual), sample dilution, standard addition methods, addition of an ionization buffer (ex. Scandium), or matrix matching.

4.4 **Memory interferences**

4.4.1 Memory interferences result when analytes from a previous sample contribute to the signal in the next sample. This is often referred to as carry-over and can result from sample build-up in the sample tubing, nebulizer, spray chamber and torch. Appropriate rinse times should be established for each instrument to prevent these interferences. This is accomplished by aspirating a multi-element standard at a concentration ten times higher than those normally encountered or at their LDR followed by a series of blanks. The time required to reduce the analyte signals to less than two times their MDL should be noted. If carry-over is still encountered in the analytical run the sample must be re-analyzed.

5.0 Safety

5.1 Lab coats, safety glasses, and gloves should be worn at all times during the preparation of stock, standards, and reagents to assure the safety of the analyst

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable.

5.3 Each laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) should be made available to all personnel involved in the chemical analysis. The preparation of a formal safety plan is also advisable.

5.4 The following chemicals have the potential to be moderately toxic, extremely irritating to skin and mucus membranes and hazardous, consult MSDS.

5.4.1 Nitric acid

5.4.2 Hydrochloric acid

5.5 Fire extinguisher, emergency shower, eye wash center and spill kits are all located in the Lab.

5.6 The acidification of samples containing reactive materials may result in the

release of toxic gases, such as cyanides or sulfides. Acidification of samples should be done in a fume hood

5.7 The inductively coupled plasma should only be viewed with proper eye protection from the ultraviolet emissions.

6.0 Apparatus and Supplies

6.1 Agilent 5100 ICP-OES
- 6.1.1 Dual view torch
- 6.1.2 Nebulizer
- 6.1.3 Radio frequency generator
- 6.1.4 ICP-Expert Software,
- 6.1.5 Peristaltic pump (2-stop)
- 6.1.6 Instrument compatible PC

6.2 Conical spray chamber
6.3 Cetac ASX-520 autosampler
6.4 17 x 100 mL polypropylene culture tubes
6.5 50 mL polypropylene centrifuge tubes
6.6 White-White Tygon tubing – 2stop
6.7 Blue-BlueTygon tubing – 2stop
6.8 Argon gas
6.9 0.05 – 0.2 mL variable pipette and tips
6.10 0.2 – 1.0 mL variable pipette and tips
6.11 1.0-5.0 mL variable pipette and tips
6.12 1.0 – 10.0 mL variable pipette and tips
6.13 500mL, 1000mL, and 2000mL volumetric flasks
6.14 0.45um syringe filter
6.15 Internal standard mixing kit

7.0 Reagents and Standards

7.1 Concentrated Hydrochloric acid HCL, Trace Metals grade or better
7.2 Concentrated Nitric acid HNO3, Trace Metals grade or better
- 7.2.1 A logbook is kept in the metals prep lab that indicates the acids date of receipt, expiration date, manufacturer, Lot#, analyst initials and date.
- 7.2.2 When a new acid is received it is given a Lab Lot ID (which is referenced whenever the acid is used) and the date and analyst's initials are recorded in the logbook. The Lab Lot ID date received and date opened are recorded on the acid bottle. Disposal date of the acid bottle is also recorded in the logbook. The same procedure is followed for the (1:1) acid solutions preparation.

7.3 Interference Free Reagent Water
- 7.3.1 Water used should be de-ionized (DI) which is monitored for impurities by use of method blanks.
- 7.3.2 Reagent water may be purchased from vendor
  - 7.3.2.1 80 mL HNO3 and 50 mL HCl in 1 liter of DI water.

7.4 Standard Stock Solutions

7.4.1 Stock standards are purchased as custom multi-element mixes or as single-element solutions. Purchased standards are obtained from a reputable supplier and are NIST traceable. A logbook is kept in the metals lab that indicates the standards date of receipt, expiration date, manufacturer, Lot#, analyst initials and date.

7.4.2 When a new standard is received and/or opened it is given a Lab Lot ID (which is referenced whenever the standard is used), the date and analyst's initials are recorded on both the bottle and in the logbook. The Lab Lot ID and received date are also recorded on the certificate of analysis, which is kept in the metals department.

7.5 Working calibration standards, working calibration verification standards, and working internal standard solutions

7.5.1 Working standard solutions are prepared by combining appropriate volumes of stock solutions in volumetric flasks. The working standard solutions also contain a combination of HCL and HNO3 acid so that they are "matrix matched" to that of the sample digestates. All working standards have a shelf life of three months from the date of preparation.

7.5.1.1 Instructions for the preparation of each working standard and their concentrations are included in each working standards log book.

7.5.1.2 Calibration standards are purchased from High Purity Standards (catlog # SM 3847-012 Solution A and B)

7.5.2 When preparing working standards check expiration date of stock standard and visually inspect standard for any precipitate or cloudiness. If any particulate is present or the standard is cloudy, it should not be used and a supervisor should be notified.

7.5.3 Separate logs are kept for stock standards and working standards.

7.5.3.1 When preparing a working standard, record the Lab Lot ID, the ID of the stock standard used, date, and preparer's initials in the working standards logbook.

7.5.4 All standards must be stored in FEP Fluorocarbon or unused polyethylene or polypropylene bottles.

7.5.5 ICV/CCV Standards: Multi-element stock standards are purchased from High Purity standards, Catalog # SM3847-004- Solution A and B or can be purchased AccuScience product number: ACS070063-MC-500 mL and ACS070062-MC-500 mL

8.0 Sample Collection, Preservation, Containers, Handling and Storage

8.1 Samples are preserved to a pH < 2.0 with nitric acid 24 hours prior to digestion. Sample pH is initially checked and recorded by sample custody upon receipt and verified by the prep analyst prior to digestion. Liquid samples are stored in the metals department according to lab log number. Solid samples are stored in sample custody. Digested samples are stored in the metals department according to prep batch.

8.2 If properly acid preserved, the sample can be held up to six months before analysis.

8.3 For the determination of the dissolved elements, the sample must be filtered through a 0.45 µm pore diameter membrane filter at the time of collection oras soon thereafter as practically possible. Acidify the filtrate with (1+1) nitric acid immediately following filtration to pH <2.

8.4 Solid samples require no preservation prior to analysis other than storage at 0-6°C. There is no established holding time limitation for solid samples.

9.0 Quality Control

9.1 All analysts using this procedure must comply with the formal quality control program specified by Xenco Laboratories. The laboratory, through the analyst, is required to maintain all performance records that define the quality of the data that are generated. The minimum requirements of this program consist of:

- 9.1.1 Initial Demonstration of Capability (IDOC).
- 9.1.2 Linear Dynamic Range
- 9.1.3 Interelement Correction Factor
- 9.1.4 Performance Evaluation
- 9.1.5 MDL Study
- 9.1.6 LOD/LOQ
- 9.1.7 Background Correction Points
- 9.1.8 Inter-element Corrections (IECs)

9.2 Initial Demonstration of Capability (IDOC) Each analyst must perform an IDOC prior to analyzing actual samples. This test is performed by the analysis of four replicate, the true concentrations of which should be one to four times the LOQ. Each analyst must repeat a Demonstration of Capability (DOC) whenever there is a change in instrument, or approved method deviation. Demonstration of capabilities are documented and attached to a signed NELAC Demonstration of Capability Certificate for each analyst performing the test. The Certificate is signed by the Department Manager and QA manager. Analyst must sign and date the certificate acknowledging that the latest SOP, method and QAM are being followed.

- 9.2.1 Recovery must be 80 to 120 % of the true value.
- 9.2.2 Relative Percent Different (s/mean X 100%) must be ≤ 20%

9.3 Instrument QC Linear Dynamic Range Verification (LDR)

- 9.3.1 The linear range is determined every 6 months for each analyte of interest using the 10% criteria. When performing the LDR study, standards must run at increasing concentration until the analytes of interest are no longer within 10% of the true value. The highest concentration where the analyte was within 10% of the true value is considered the upper linear range. For 6010 D, the LDR must be analyzed on a daily basis and if not analyzed, the highest standard in the calibration becomes the linear range.

9.4 Interelement Correction Factor

- 9.4.1 Tests to determine the interelement correction factors must be performed at least every six month or when needed using single analyte standards normally at a concentration of 100 mg/L. For analytes found in high concentrations (ex. Fe, Al, Mg, Ca), a higher concentration near the

upper analytical range of the instrument may be more appropriate.

9.4.1.1 Calculation of the correction factors is determined automatically by the instrument as explained in the user's manual for the instrument.

9.4.1.2 Interelement correction factors must be determined separately for each instrument as they can vary between instruments based on choice of wavelength, background points, resolution, and operating conditions.

9.4.2 When interelement correction factors are used, their accuracy must be verified by daily by analyzing a spectral interference check solution (ICSA/ICSAB).

9.4.2.1 ICSA is a zero-analyte solution that contains only Al, Fe, Ca, Mg. These four elements should recover within ±20% of their true value and all other analytes should recover less than PQL for that analyte. ICS A is purchased from Environmental Science with catlog number ICL 500-6 and prepared by using 50 ml of standard to a final volume of 500 ml.

9.4.2.2 ICSAB is a positive analyte solution containing all method elements and should recover within ±20% for each reportable element. ICS AB is purchased from Environmental Science with catlog number ICL 500-6 for ICS A and HP-4218-250 solution A and B for ICS AB and prepared by using 50 ml of ICS A and 5 ml of ICS AB solution A and B standard to a final volume of 500 ml.

9.4.2.3 Method Detection Limit Study. The MDL must be prepared and analyzed per the current version of 40 CFR136 appendix A. See SOP QS-16-042 (SOP for initial test method evaluation).

9.5 Limit of Detection (LOD) Quarterly analysis of digested laboratory reagent blanks and other quality control solutions as a continuing check on method performance Quantitation limits are laboratory derived from the MDL study data set.

9.6 Background correction points should be set prior to determining IEC's upon initial set up of the ICP system. Refer to the ICP instrument manual for specific procedures to be used in setting background correction points. Tests to determine spectral interference must be done using analyte concentrations that will adequately describe the interference.

9.7 The IECs are evaluated, verified, and updated (if necessary) on a daily basis by analyzing the ICSA and ICSAB solutions at the beginning of every analytical run. When initially determining the IECs for an instrument, wavelength scans must be performed to ensure that the solutions in use are free from contaminants. The purity of the IEC check solutions can be verified by using a standard from a second source or an alternate method (ICP MS). Published wavelength tables can also be consulted to evaluate the validity of the IECs. An IEC must be established to compensate for any interelement interference which results in a false analyte signal greater than 2X the MDL. To determine an IEC, divide the observed concentration of the analyte by the observed concentration of the interfering analyte.

9.8 Control limits and control charts are updated annually and reside in the QA Department and in LIMS.

9.9 Documentation of data: Document and record all analytical sequence, standard preparation, sample digestions, instrument maintenance and any procedure deviations in appropriate logbooks, LIMS, and in the appropriate areas of the appropriate computer programs.

9.10 An instrument maintenance log documents routine maintenance and any instrument troubleshooting. The date and the initials of the analyst as well as instrument identification, Instrument/software description, Manufacturer, Model, Serial #, Date received/date in service, condition when received, current location, date of next calibration and/or verification, details of planned future maintenance are also documented

9.11 All instrument runs are dated and initialed by the analyst

9.12 Data must be reviewed by peer analyst or manager dated and signed

9.13 All quality control data and raw data must be maintained and available for reference and inspection for 5-7 years, depending on client, state and/or program requirements

9.14 Document the preparation of any standard or reagent according to Xenco Laboratories (Standards Materials Traceability). All analytical procedures must be documented and raw data must be signed and dated by the analyst.

9.15 All reagents, standards and spiking solutions are logged in upon arrival and given a Lab Log ID. The Name of the chemical, Lot #, Manufacturer, Expiration Date, Date Received, Date Opened, and Analyst's initials are documented. The purity of the reagent documented on the label is checked (√) and documented in the receiving log. Whenever the chemical is used it is identified by its Lab Log ID. The Lab Log ID is also documented on the manufacturer's certificate of analysis if available, and is kept on file. Xenco Laboratories SOP.

9.16 Corrections to record keeping errors must be made by one line marked through the error, with the individual making the correction signing (or initialing) and dating the correction. where the reason of the correction is not clear, explain by documenting with correction codes or side notes

10.0 Calibration and Standardization

10.1 Instrument Start-Up, Shutdown, Standby Procedure

10.1.1 Start-Up: After plasma ignition, allow the instrument to rinse and become thermally stable before beginning calibration (about 20 minutes of warm-up time is recommended).

10.2 Calibrate the instrument according to the instrument manufacturer's recommended procedures. Flush the system with the calibration blank between each standard. Refer the instrument manual for detailed set up and operation protocols.

10.3 A minimum of two exposures for each standard, field sample, and QC sample is required. The average of all exposures is recorded.

10.4 Daily Calibration

10.4.1 Instrument calibration must be performed at a minimum of every 24 hours. Instrument runs may be continued over periods exceeding 24 hours as long as all calibration verification and interference check QC criteria are met. Instrument standardization data and time must be included in the raw data.

10.4.2 Initial Calibration Sequence is comprised of a blank and four calibration standards. Calibration standard 1 is the same solution as the PQL check

10.4.3 Low-level read back or verification (6010 D) - For a multi-point calibration, the low level standard should quantitate to within 80-120% of the true value.

10.4.4 Mid-level read back or verification (6010 D) - For a multi-point calibration, the midlevel standard should quantitate to within 90-110% of the true value.

10.4.5 Typical Analytical Sequence

Calibration Blank
Calibration standard(s)
ICV
ICB
PQL/ LLICV
ICSA
ICSAB
Rinse
CCV
CCB
LRB/PB
LCS
LCSD
Sample
Sample MS
Sample MSD
Sample PDS
Sample SDL
CCV
CCB
10 samples
CCV
CCB
LLCCV

10.5 For additional guidelines, refer to the Initial calibration SOP (QS-16-001).

11.0 Procedure

11.1 The soil sample digestion procedure is found in SOP MET-05-060,Metals Digestion for Solid Samples and SOP for 3010 waters.

11.1.1 The use of automated QC checks through the instrument software is highly recommended for all calibration verification samples (ICV,CCV), blanks (ICB,CCB, MB), interference checks (ICSA, ICSAB), and field samples (linear range) to facilitate the data review

process.

11.1.2 The use of a high solids nebulizer and a mass flow controller is utilized and the calibration and QC standards are matrix matched. The approximate acid concentrations are 8%HNO3 and 5% HCL.

11.1.3 All measurements must fall within the defined linear range where spectral interference correction factors are valid. Dilute and reanalyze all samples for required analytes that exceed the linear range. If an interelement correction factor exists for a particular analyte which exceeds the linear range, the IEC may be inaccurately applied. Therefore, even if an over range analyte may not be required to be reported for a sample, if that analyte is an interferent for any requested analyte in that sample, the sample must be diluted. Acid strength must be maintained in the dilution of samples therefore samples must be diluted with reagent blank. For **North Carolina** samples, all the samples that exceed the highest calibration standard needs to be diluted.

11.1.4 Samples with visible particulates or cloudiness may require additional filtration through a 0.45um syringe filter to prevent the nebulizer from clogging.

11.1.5 After the sequence is entered it must be saved as [RunDate]A,B,C… etc and printed to be included in the data folder.

11.1.6 After the run is complete the data sequence is saved and printed in the Publisher application of the TEVA software using the "Vertical Table Report" and is included in the data package.

11.1.7 The complete data package must include:

11.3.7.1 The run sequence with analyst notes

11.3.7.2 Vertical Table Report

11.3.7.3 Prep batch sheets associated with the data

11.1.8 After analyst review, the completed data package is turned into the supervisor or qualified analyst for peer review.

12.0 Calculations

12.1 MS Recovery

$$\text{MS\% Recovery} = \frac{(A - B)}{C} \times 100\%$$

Where A = Spiked sample result; B = Non-Spiked Sample result; C = T.V. of Spike added

12.2 LCS Recovery

Where A= LCS result; B=T.V. Spiked added

$$\text{LCS \% Recovery} = \frac{A}{B} \times 100$$

12.3 Relative Percent Difference:

Where A= 1st result; B= 2nd result

$$\text{RPD} = \frac{(A - B)}{(A + B)/2} \times 100$$

12.4 Liquids

12.4.1 If 50 ml of sample is digested and the final volume of the digestate is 50mL, the result generated by the instrument in ug/L is reported without needing calculations.

12.4.2 If 50 ml of sample is digested and the final volume is 10 ml, the sample is concentrated by a factor of 5 (50 mL/10 ml = 5). In this case, correct the instrument readout by dividing it by the concentration factor of 5.

12.4.3 If 50 ml of sample is digested and the final volume is 100 ml, we have diluted the sample by a factor of 2. In this case, correct the instrument readout by multiplying it by the dilution factor of 2.

12.4.4 If the result generated by the instrument is in ug/L, simply divide that result by 1000 to yield the result in mg/L and use this value in the above calculation.

12.5 Reporting Silica from Silicon

Silicon x 2.14 = Silica

12.6 Reporting Total Hardness from Calcium and Magnesium

Total Hardness, mg equivalent CaCO3/L=2.497 [Ca,mg/L]+4.118 [Mg,mg/L]

13.0 Method Performance

13.1 Listed in Appendix A are typical single laboratory total recoverable reporting limits determined for the recommended wavelengths using simultaneous ICP-OES and the operating conditions given in Appendix A.

13.2 Method performance is monitored by:

13.2.1 Annual generation of MDL's

13.2.2 Proper laboratory control samples

13.2.3 Analysis of third party performance evaluation(PE).

14.0 Data Assessment and Acceptance Criteria for Quality Control Measure

14.1 Instrument conditions must be the same for all standards, samples, and QC

samples.

14.2 Each prepared batch may contain up to 20 environmental samples, a preparation blank (PB), a single laboratory control sample (LCS), and a matrix spike / matrix spike duplicate pair (MS/MSD). In the event that there is insufficient sample to perform an MS/MSD, an LCSD is prepared to demonstrate analytical precision.

14.3 Preparation Blank (PB) or LRB A blank matrix processed simultaneously with every batch, and under the same conditions as, the samples through all steps of the analytical procedure.

14.3.1 The PB matrix for aqueous samples is reagent (DI) water. For soil matrix, PTFE boiling chips are used.

14.3.2 Upon successful analyses of the PB no analytes of interest should be found in the PB above half of the designated RL. Samples associated with PBs that contain analyte concentrations greater than the RL shall be re-digested if the sample concentrations are not greater than 10X the PB value or below the RL.

14.3.3 If the PB is found to contain analytes above the MDL but less than the RL, associated sample concentrations above the MDL will be flagged with a (J) qualifier.

14.3.4 For dissolved samples that have not been digested, a CCB result is reported as the PB. The CCB run immediately prior to the start of the dissolved sample analyses must be used for this purpose. No more than 20 samples can be associated with one CCB

14.4 Initial Calibration Verification (ICV/ICB)

14.4.1 Immediately after the ICP has been calibrated, the accuracy of the initial calibration is verified by a second source QC standard (ICV) and documented for every analyte. The acceptance criteria for the (ICV) are ±10%. When measurements exceed the control limits, the analysis must be terminated, the problem corrected, and the calibration re-verified.

14.4.2 An ICB is analyzed immediately following the ICV to monitor low level accuracy and system cleanliness.

14.4.3 For 6010 method, the ICB result must be < RL and for 6010 D < ½ of RL.

14.4.4 If either the ICV or ICB fail to meet criteria, the analysis should be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified.

14.5 Low Level Check Standard (PQL)

14.5.1 In order to verify low level accuracy of the calibrated analytical system a low-level check standard (PQL) is performed at the beginning of every analytical run.

14.5.2 The PQL check standard is the lower part of the calibration.

14.5.3 The PQL check standard is considered in control if the analytes of interest recover within +/- 30% for 6010C and within +/- 35 % for 6010 D of the known true value.

14.5.4 If the PQL check standard fails to meet criteria and the associated sample concentrations are at or near the PQL level, the analyses should be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified through successful analyses of the PQL check standard. If associated sample target analyte concentrations are near or above the ICV/CCV levels than analysis may continue since the results are held in control by the ICV/CCV recoveries when the PQL check standard is out of control. The PQL sample is carried through the entire preparation and analytical procedure.

14.5.5 For PQL check standard levels, refer to Xenco LIMS.

14.6 Continuing Calibration Verification (CCV/CCB)

14.6.1 To ensure calibration accuracy during each analysis, a QC-check standard CCV must be analyzed for every analyte determined at a frequency of every 10 samples and at the end of the run. This standard must agree within ±10% of the true value. If the values deviate more than 10%, analysis must be terminated, the problem corrected and the samples between the last passing CCV and the nonconforming CCV must be reanalyzed.

14.6.2 A CCB is analyzed immediately following each CCV. The CCB result should be less than ½ of the reporting limit

14.6.3 Sample results may only be reported when bracketed by valid CCV/CCB pairs. If the associated sample concentrations, which are bracketed by a CCV that recovers
greater than 110%, are less than the RL the sample results may still be reported. If associated sample concentrations, that are bracketed by a CCB that shows analyte concentrations greater than the RL, are less than the RL or greater than 10X the CCB value the sample results may still be reported.

14.6.4 For CCV levels See Appendix A

14.7 Interference Check Analysis (ICSA/ICSAB)

14.7.1 The validity of the interelement correction factors is demonstrated through successful analysis of interference check solutions. The ICSA contains only the interfering analytes. The ICSAB contains the interfering analytes as well as all of the other analytes of interest. Custom multielement ICS solutions must be used. All analytes should be spiked into the ICSAB solution, therefore, if a nonroutine analyte is required than it should be manually spiked into the ICSAB solution using a high purity single element solution or a custom mix purchased from a reputable vender, Elements that are known to be interferents for a required analyte must be included in the ICP run when that analyte is determined. Aluminum, Iron,

Calcium, and Magnesium must always be included in all ICP runs.

14.7.2 The ICSA/ICSAB is analyzed at the beginning of the analyses.

14.7.3 The ICSAB results for all analytes must fall within 80-120% recovery

14.7.4 The ICSA results for the non-interfering must fall less than the reporting limit.

14.8 Laboratory Control Sample (LCS) A blank matrix spiked with a known amount of analyte, processed simultaneously with every batch, and under the same conditions as, the samples through all steps of the analytical procedure.

14.8.1 The LCS for aqueous samples consists of reagent (DI) water fortified with all analytes of interest. For soil matrix, PTFE boiling chips are used to matrix match.

14.8.2 For soil samples the LCS consists of reagent (DI) water fortified with all analytes of interest and glass beads.

14.8.3 The fortified analyte concentrations must recover within 20% of the known spiked value for both waters and soils for the sample digestion to be considered adequate. For samples analyzed, the LCS recovery criteria are +/- 20%.

14.8.4 If the LCS recovery for any analyte of interest is below the lower acceptance criteria all associated samples shall be re-digested. If the LCS recovers greater than the upper acceptance criteria and the sample concentrations are less than the RL the data may be reported.

14.9 Matrix Spike / Matrix Spike Duplicate Aliquots of a field sample to which a known amount of target analytes is added.

14.9.1 MS/MSDs do not count towards the 20 samples in an analytical batch.

14.9.2 MS/MSDs are processed simultaneously with every batch, and under the same conditions as, the samples through all steps of the analytical procedure.

14.9.2.1 One MS/MSD set is required for a batch of 20 samples.

14.9.3 For samples analyzed according to 6010 C, the MS/MSD recovery criteria are +/- 25% and 20% for relative percent difference

The relative percent different between spiked matrix duplicate or un spiked duplicate determinations is to be calculated as follows:

$$RPD = (A-B)/(A+B) *200$$

where:

RPD = relative percent difference.
A = Concentration of analyte in the original sample.
B = Concentration of analyte in the duplicate sample

14.10 Serial Dilution

14.10.1 A 1:4 (5X) dilution test is performed to determine whether significant physical or chemical interference exists due to the sample matrix.

14.10.2 The serial dilution is performed on a minimum of one sample per analytical batch. Samples identified as field blanks should not be used for dilution tests.

14.10.3 The serial dilution result shall agree within 10% of the undiluted sample result if the undiluted sample results are greater than 10X the RL. There are no criteria for sample results that are less than 10X the reporting limit. If the % difference of the serial dilution result is outside of the 10% criteria the associated sample results may still be reported. For 6010 D, the the dilution test should agree with in ± 20% of the original determination.

14.11 Post Digestion Spike (PDS)

If MS/MSD recoveries are unacceptable, the sample from which MS/MSD aliquots were prepared should also be spiked with a post digestion spike. The PDS should be recovered with in 80 % to 120% of the known value. If both the MS/MSD and the PDS fail, then the matrix interferences are confirmed. For 6010 D, the recovery of PDS should fall with in ± 25 %.

15.0 Calibration and Standardization

15.1 Standards for calibration are purchased from High Purity Standards. The standards are custom mix standards with catalog number SM-3847-012 solution A and B. Calibrate the instrument by using standard SM-3847-012 solution A and B. Prepare standards in 8% Nitric acid and 5% Hydrochloric acid

Table for the volume to be used for calibration standards

Calibration Name	Volume of Standard Used	Final Volume
Calibration Blank	N/A (8% HNO_3 and 5% HCl)	1000 ml
Calibration 1	0.1 ml	1000 ml
Calibration 2	0.2 ml	500 ml
Calibration 3	2.0 ml	500 ml
Calibration 4	20.0 ml	500 ml

16.0 Corrective Actions for Out-of-Control Data

16.1 If any QC criteria (Blank,ICV/CCV,PQL LCS, or Duplicates,MS, etc) are not met, that batch must be re-analyzed.

16.2 If the sample holding time expired prior to analysis, the client must be notified. If analysis is performed, the data will be flagged on the final report.

16.3 Any event that arises and does not conform to what is expected by the instrument or the QC generated must be documented. A Non- Conformance must be created in Xenco LIMS to document the corrective actions taken

17.0 Contingencies for Handling Out-of-Control or Unacceptable Data

17.1 For contingencies for handling out of control or unacceptable data, refer to Xenco Laboratories QAM, Corrective action SOP and/or Data Integrity SOP.

18.0 Pollution Prevention and Waste Management

18.1 It is the laboratory's practice to minimize the amount of solvents and reagents used to perform this method wherever technically sound, feasibly possible and within method requirements.

18.2 The laboratory complies with all Federal, State and local regulations governing waste management, particularly the hazardous waste identification rules and land disposal restrictions as specified in the laboratory Environment Health and Safety Manual

18.3 All non-hazardous aqueous waste is disposed of in the drain with copious amounts of tap water.

18.4 Waste management and disposal procedures are described in Xenco Laboratories SOP for Waste Disposal and Pollution Prevention.

19.0 References

19.1 EPA, Methods for Chemical Analysis of Water and Waste; U.S. EPA Office of Research and Development: Cincinnati, OH, March, 1983.

19.2 EPA, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, Method 6010B. Revision 2, December 1996

19.3 EPA, Test Methods for Evaluating Solid Waste, Physical and Chemical Methods, SW-846, Method 6010C. Revision 3, February 2007

19.4 EPA Method 6010 D, Inductively Coupled Plasma-Optical Emission Spectroscopy, SW-846, Revision 5, July 2018

19.5 SM 2340B," Total Hardness",APHA, et.al. Standard Methods for the Examination of Water and Wastewater, F2011

19.6 Code of Federal Regulations, 40CFR part 136, Appendix A.

19.7 Current TNI Standard.

19.8 Current Xenco Laboratories QA Manual.

19.9 Current Xenco Laboratories – Health & Safety and Chemical Hygiene Plan.

19.10 Current Xenco Laboratories Corrective Action SOP

19.11 Current Xenco Laboratories Data Integrity SOP

19.12 Current Xenco Laboratories Standards and Traceability SOP

19.13 Current Xenco Laboratories – Houston, Waste Disposal and Pollution Prevention

19.14 Current Xenco Laboratories-Houston Laboratory Initial calibration SOP.

19.15 5100 ICP OES, Agilent Technologies Inc.

19.16 ICP Expert Software User Guide,Agilent Technologies: Version:7.1.06821

20.0 Attachments, Tables, Diagrams, Flowcharts & Validation Data

20.1 Appendix A – ICP Standards and Solutions.Reporting limits for 6010 and wavelengths

Element (Water) 200.7/6010B/C/D	Reporting Limit mg/L	Wavelengths(nm)
Aluminum	0.2	396.152
Antimony	0.02	206.834
Arsenic	0.01	188.980
Barium	0.01	455.403
Beryllium	0.004	313.042
Bismuth	0.02	223.061
Boron	0.05	208.956
Cadmium	0.005	228.802
Calcium	0.2	315.887
Chromium	0.01	206.158
Cobalt	0.01	228.615
Copper	0.02	223.009
Iron	0.2	259.940
Lead	0.01	220.353
Lithium	0.04	610.365
Magnesium	0.2	279.078
Manganese	0.02	257.610
Molybdenum	0.01	202.032
Nickel	0.01	231.604
Phosphorus	0.04	177.434
Potassium	0.5	766.491
Selenium	0.03	196.026
Silica	1.07	288.158
Silicon	0.5	288.158
Silver	0.02	328.068
Sodium	0.5	589.592
Strontium	0.02	421.552
Sulfur	0.1	181.972
Thallium	0.02	190.794
Tin	0.02	189.925
Titanium	0.03	336.122
Vanadium	0.02	292.401
Zinc	0.03	213.857

Calibration Concentrations:

Column1	Column2	Column3	Column4	Column5
Elements	**CAL 1 (ppb)**	**CAL 2 (ppb)**	**CAL 3 (ppb)**	**CAL 4 (ppb)**
AG	20	80	800	8000
AL	200	800	8000	80000
AS	10	40	400	4000
B	50	200	2000	20000
BA	10	40	400	4000
BE	4	16	160	1600
BI	10	40	400	4000
CA	200	800	8000	80000
CD	5	20	200	2000
CO	10	40	400	4000
CR	10	40	400	4000
CU	20	80	800	8000
FE	200	800	8000	80000
K	500	2000	20000	200000
LI	40	80	800	8000
MG	200	800	8000	80000
MN	20	80	800	8000
MO	10	40	400	4000
NA	500	2000	20000	200000
NI	10	40	400	4000
P	10	40	400	4000
PB	10	40	400	4000
S	100	400	4000	40000
SB	20	80	800	8000
SE	30	120	1200	12000
SI	500	2000	20000	200000
SN	20	80	800	8000
SR	20	80	800	8000
TI	30	120	1200	12000
TL	20	80	800	8000
V	20	80	800	8000
ZN	30	120	1200	12000

LDNR 29B Parameters

Approvals (Signature/Date):

09/08/2022
Deepak Pandey — Date
Technical Manager

09/07/2022
Stephanie Coch — Date
Quality Assurance Manager

09/08/2022
Julian Martinez — Date
Laboratory Director

Copyright Information:
This documentation has been prepared by Eurofins Houston, solely for their own use and the use of their customers in evaluating their qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to Eurofins Houston upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use it for any purpose other than that for which it was specifically provided. The user also agrees not to give access to this document to any third parties including but not limited to consultants, unless such third parties specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS HOUSTON IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS HOUSTON IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES. IF PUBLICATION OF THIS WORK SHOULD OCCUR THE FOLLOWING NOTICE SHALL APPLY:

©COPYRIGHT 2022 EUROFINS HOUSTON LABORATORIES, INC. ALL RIGHTS RESERVED.

Facility Distribution No. 1 **Distributed To: Intranet**

1.0 Scope and Application

This SOP contains the procedures for the determination of various parameters by LA29B, SW-846 9081, and Methods of Phosphorus Analysis. These methods apply to most soils and solid wastes.

The following procedures are included in this SOP:

Preparation of Soils
Sample Preparation for Saturated Paste
Sodium Absorption Ratio (SAR)
Potassium Absorption Ratio (PAR)
Exchangeable Sodium Percentage (ESP)
Exchangeable Potassium Percentage (EPP)
Cation Exchange Capacity (CEC)
Total Barium
Leachate Test
Electrical Conductivity
pH
Water Soluble Phosphorus

2.0 Summary of Method

2.1 Preparation of Soils

For pH, CEC, EC, Soluble Cations, SAR, ESP, total Barium, the sample is homogenized and then dried at approximately 38 °C and ground prior to analyses. Oily waste material may require drying at temperatures up to 105°C.

2.2 Sample Preparation for Saturated Paste

The saturation point can be applied to soils and most solid wastes. It is used to determine the moisture concentration at which electrical conductivity must be reported. Water is added to a known amount of sample until the point where no more water can be absorbed and additional water would result in free water on the surface.

2.3 Sodium Absorption Ratio and Potassium Absorption Ratio

The SAR or PAR is determined from water, a 1:1 water extract of soil, or a saturated soil paste. Water is extracted from the paste by filtration or centrifuging. The extract is tested for the cations Sodium, Calcium, Potassium, and Magnesium by the ICP Method 6010B/C. The SAR or PAR is calculated from the cation concentrations. This may also be called “soluble cations”.

2.4 Exchangeable Sodium Percentage and Exchangeable Potassium Percentage

The exchangeable sodium percentage (ESP) and exchangeable potassium percentage (EPP) are calculations that measures the proportion of cation exchange sites occupied by Sodium or Potassium, respectively.

2.5 Cation Exchange Capacity

The sample is mixed with an excess of sodium acetate solution, resulting in an exchange of the added sodium cations for the matrix cations. Subsequently, the sample is washed with isopropyl alcohol. An ammonium acetate solution is then added, which replaces the adsorbed sodium with ammonium. The concentration of displaced sodium is then determined by ICP.

2.6 Total Barium

The sample is dried and pulverized to pass a 100-mesh sieve and digested in nitric acid. Atomic absorption or ICP emission spectroscopy is used to determine the barium concentration.

2.7 Leachate Test

A representative sample of treated waste is extracted by continuous contact with water at a 1:4 solid: solution ratio. Samples are reacted for 7 days at 25 C +/- 2 C with flask contents swirled on a daily basis to effect gentle, intermittent agitation. A suitable aliquot of the extract is analyzed for chlorides with the remainder of the sample partitioned for oil and grease by separatory funnel liquid-liquid extraction using methylene chloride (LAC 43:XIX.Subpart 1.Chapter 3) or total petroleum hydrocarbons by EPA Method SW-846 1664/SGT / SW-846 9071 (LAC 43:XIX.565.F).

2.8 Electrical Conductivity

The conductivity of a 1:1 aqueous extract is measured, and the reading is corrected to a conductivity at 25 ^{o}C at sample saturation. If the conductivity exceeds the regulatory limit the EC is determined on the paste extract.

2.9 pH

The dried and prepared sample (soil or solid waste) is mixed with Reagent Water. The pH of the solution is then measured with a pH meter.

2.10 Water Soluble Phosphorus

The dried and prepared sample (soil or solid waste) is mixed with Reagent Water. The Solution is shaken for 1 hour, centrifuged and filtered. The extract is acidified and analyzed 6010 or 6020 analysis.

3.0 Definitions

Refer to the Laboratory's Quality Assurance Manual (QAM) for the Glossary of Terms, Definitions and Acronyms except as follows.

4.0 Interferences

4.1 Procedural Interferences

Saturated Paste - Stirring the soil water mixture excessively while attempting to reach the saturation point results in over saturation of the sample. Generally, a saturation point greater than 80% indicates the sample has been over saturated.

Cation Exchange Capacity - Interferences can occur during analysis of the extract for sodium content. Thoroughly investigate the chosen analytical method for potential interferences.

Total Barium - Since barite (barium sulfate) is only sparingly soluble in acid, the analyst must strictly adhere to the size of the sample and the volume of acid that is specified in the protocol.

Exchangeable Cation - Sparingly soluble salts may give erroneously high cation distribution values. Samples that have a high pH may result in inadequate desorption

Oil and Grease Extraction - Caution must be taken to prevent sample particles from falling into the flask containing the solvent. The rate and time of extraction in the Soxhlet apparatus must be exactly as directed because of varying solubilities of the different greases. The length of time required for drying and cooling extracted material must be constant. A gradual increase in weight may result due to the absorption of oxygen; a gradual loss of weight may result due to volatilization.

pH - Samples with very low or very high pH may give incorrect readings on the meter.
For samples with a true pH of >10, the measured pH may be incorrectly low. This error can be minimized by using a low-sodium-error electrode. Strong acid solutions, with a true pH of <1, may give incorrect pH measurements.

Temperature fluctuation will cause measurement errors.

Errors will occur when the electrodes become coated. If an electrode becomes coated with an oily material that will not rinse free, the electrode can either (1) be cleaned with an ultrasonic bath, or (2) be washed with detergent, rinsed several times with water, placed in 1:10 HCL so that the lower third of the electrode is submerged, and then thoroughly rinsed with water.

Conductivity - Conductivity varies with temperature, therefore the conductivity must be temperature corrected to 25 C if it is not measured at this temperature.

4.2 Matrix Interferences

Leachate - Refer to applicable analytical methods for chlorides, oil and grease and total petroleum hydrocarbons for discussion of potential interferences that may be encountered during analysis. Naturally occurring organic matter (i.e. humic acids) may be co-extracted and impart a positive error to the Exploration and Production Waste leach test. Gas chromatographic analysis may be used to differentiate naturally occurring organic matter from Exploration and Production Waste products partitioned into the water extract.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve

hazardous material, operations, and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

All samples must be treated as if they are hazardous. The analyst must protect himself/herself from exposure to the sample matrix. Many of the samples that are tested for residue/solids may contain hazardous chemical compounds or biological organisms. The analyst must wear protective clothing (lab coat or apron), eye protection (glasses or face shield), and disposable gloves when handling these samples.

The toxicity or carcinogenicity of chemicals used in this method has not been precisely defined. Each chemical should be treated as a potential health hazard, and exposure to these chemicals should be minimized.

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

Hydrogen peroxide (H_2O_2) is a strong oxidizer and is corrosive. The digestion must be cooled sufficiently before the addition of H_2O_2 to avoid a reaction and possible violent effervescence or boiling over of the digestion. A splash/splatter hazard is possible, and a face shield should be worn.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure

Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Isopropyl Alcohol	Flammable	400 ppm-TWA	Flammable liquid and vapor. Harmful if swallowed or inhaled. Causes irritation to eyes and respiratory tract. Affects central nervous system. May be harmful if absorbed through skin. May cause irritation to skin.
Hydrogen Peroxide	Oxidizer Corrosive	1 ppm-TWA	Vapors are corrosive and irritating to the respiratory tract. Vapors are very corrosive and irritating to the eyes and skin.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

See attachments 1- 8 for listing of procedure specific Equipment and Supplies

6.1 Maintenance

Out of service or malfunctioning equipment must be clearly marked and stored in such a manner as to maximize laboratory workspace and minimize the possibility of inappropriate use of a malfunctioning piece of equipment.

7.0 Reagents and Standards

Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination

Expiration dates (time from initial use or receipt to final use) for standard and reagent materials must be set according to the guidance in this SOP. Note: These are maximum expiration dates and are not to be considered an absolute guarantee of standard or reagent quality. Sound judgment must be used when deciding whether to use a standard or reagent. If there is doubt about the quality of a standard or reagent material, a new material must be obtained or the standard or reagent material verified. Data quality must not be compromised to extend a standard's life.

The expiration date of any standard or reagent must not exceed the expiration date of the standard or reagent that was used to prepare it. Reagents must be prepared and documented in accordance with SOP QA-21-007: *Reagent and Standard Materials Procedures.*

See attachments 1- 8 for listing of procedure specific Reagents and Standards

8.0 Sample Collection, Preservation, Shipment and Storage

Samples can be collected in glass or plastic containers. At least 250 grams are needed for analysis and stored for 6 months. For CEC, the minimum sample volume needed is 20 grams.

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests.

9.0 Quality Control

9.1 Batch QC

A batch consists of up to 20 environmental samples and the associated QC items.

The instrument QC requirements for the analytical procedures associated with the procedures listed in this SOP are given in their respective analytical SOPs.

9.3 Corrective Action for Out-of-Control Data

When the quality control parameters do not meet the criteria set forth in this SOP, corrective action must be taken in accordance with SOP QA-21-001: *Preventive and Corrective Action Procedures.* SOP QA-21-001 provides contingencies for out-of-control data and gives guidance for exceptionally permitting departures from approved policies and procedures. Nonconformance Memos must be initiated to document all instances where QC criteria are not met and all departures from approved policies and procedures.

10.0 Procedure

10.1 QC Sample Preparation

See Attachments 1 – 8 for details on QC sample preparation.

10.2 Analysis

See Attachments 1 – 8 for details on sample analysis.

11.0 Calculations / Data Reduction

11.1 Data Reduction

Data must be evaluated in accordance with SOP QA-21-005: *Data Generation and Review*.

The data reduction procedures associated with the procedures in this SOP are given in the associated analytical SOP's.

11.1.1 Historical Data

Many of the laboratory's clients submit samples for repeat monitoring purposes. Prior to analysis, verify LIMS Worksheet Notes and/or use the Historical Data Tracker feature to determine if historical data is available for review.

11.1.2 Chemical Relationships

When available, the following chemical relationships must be evaluated for each sample. If these relationships are not met the Department Manager must be contacted immediately.

11.2 Calculations

See Attachments 1 – 8 for details on calculations.

12.0 Method Performance

Refer to the SOPs for each analytical procedure for performance data given.

12.1 Training Requirements

All training must be performed and documented in accordance with SOP QA-21-002: *Training Procedures*.

Note: The SOPs listed in the Reference/Cross-Reference Section are applicable to this procedure. All employees performing this procedure must also be trained on these SOPs, and/or have a general understanding of these procedures, as applicable.

13.0 Pollution Control

It is Eurofins Houston's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed.

15.0 References / Cross-References

- SOP QA-21-007: Reagent and Standard Materials Procedures
- SOP QA-21-006: Laboratory Support Equipment (Verification and Use)
- SOP QA-21-004: Data Generation and Review
- SOP QA-21-001: Preventive and Corrective Action Procedures
- SOP QA-21-002: Training Procedures
- SOP QA-21-005: Evaluation of Batch QC Data
- EX-QS-QAM: Eurofins Xenco Quality Assurance Manual
- Eurofins Environmental Health and Safety Manual (CW-E-M-001)

- Lab Manual LA 29B, Laboratory Procedures for Analysis of Exploration and Production Waste. Louisiana Department of Natural Resources Office of Conservation Injection and Mining Division. August 1988, revised 11/2011.
- LAC 43 XIX. Subpart 1
- SW-846 Method 9081 Cation Exchange Capacity of Soils, Revision 0 September 1986
- Methods of Phosphorus Analysis for Soils, Sediments, Residuals, and Waters: 2nd edition. June, 2009.

16.0 Method Modifications / Clarifications:

Not Applicable

17.0 Attachments

Attachment 1: Preparation of Soils
Attachment 2: Preparation of Saturated Paste
Attachment 3: Sodium Adsorption Ratio and Potassium Adsorption Ratio
Attachment 4: Cation Exchange Capacity
Attachment 5: True Total Barium
Attachment 6: Leachate Test
Attachment 7: pH
Attachment 8: Electrical Conductivity
Attachment 9: Water Soluble Phosphorus

18.0 Revision History

Historical File: Revision 0: 08/25/2022

Revision 0, 08/25/2022

- Initial release of SOP for all accredited LA29B Parameters in a single SOP to replace previous separate SOPs. Addition of water soluble phosphorus procedure. Previous SOPs decommissioned upon effective date of this SOP.
    - Previous: SAR-ESP SOP WC-17-002 Rev. 2017.1
    - Previous Exchangeable Cations SOP: WC-16-008 Rev. 2016.1
    - Previous Leachate Prep SOP: WC-16-007 Rev 2016.1
    - Previous Saturate Paste SOP: WC-16-007 Rev 2016.1
    - Previous Soluble Cation Extraction SOP: WC-16-005 Rev 2017.1
    - Previous LA29B Conductivity SOP: WC-16-004 Rev 2016.1
    - Previous LA29B pH SOP: WC-16-003 Rev 2016.1
    - Previous LA29B Sample Preparation SOP: WC-16-002 2016.1
    - Previous LA29B True Total Barium SOP: MET-16-002

Attachment 1:

Preparation of Soils
Method: LDNR Method LA29B

This method is used to prepare samples for analysis by the protocols listed below.

- Sodium Adsorption Ratio
- Exchangeable Sodium Percentage
- Cation Exchange Capacity
- pH

Equipment and Supplies

Oven capable of maintaining a temperature of (+/- 2) 38 °C and/or 105 °C (+/- 2)- if needed.

Grinding apparatus

Drying pans

Top loading balance, capable of accurately weighing to 0.01g verified daily or before use.

Preparation Procedure

Homogenize the sample thoroughly. Remove debris such as rocks and plant matter. Weigh a pan to the nearest tenth of a gram that is large enough to hold between 100 and 200 grams of sample. Add approximately 100 grams of sample to the pan and weigh the pan plus its contents to the nearest tenth of a gram. Place the pan and its contents in an oven at approximately 38 °C until a constant weight is achieved. Moisture content will be determined on this sample; however, additional material may need to be dried so that enough material is available for analysis. Cool the sample to room temperature and weigh the pan plus its contents. From this information calculate the moisture content. Grind the material so that it will pass a 2mm sieve. The sample is now ready for the appropriate analyses.

*Drying temperatures up to 105 °C may be necessary to prepare samples of oily / waste material for the analytical protocols listed above. Any increase in the drying temperature above 38 °C must be clearly explained on the analytical report of results. Increases in oven drying temperatures above 38 °C should only be used when necessary to condition a sample to a state suitable for performing the analysis listed in above to achieve the most reliable and accurate analytical results.

Preparation for Hydrophobic Material

Follow this procedure if the sample exhibits any of the following characteristics:

- Visible blobs of oil and grease
- The sample presses into a single damp looking mass when the sample is crushed with a mortar and pestle.
- The sample leaves an oily mark when pressed between two pieces of filter paper. The sample feels damp when pinched between the fingers.

Homogenize the sample thoroughly. Remove debris such as rocks and plant matter. Weigh a pan to the nearest tenth of a gram that is large enough to hold between 100 and 200 grams of sample. Add approximately 100 grams of sample to the pan and weigh the pan plus its contents to the nearest tenth of a gram. Place the pan and its contents in an oven at 105 °C until a constant weight is achieved. Moisture content will be determined on this sample; however, additional material may need to be dried so that enough material is available for analysis. Cool the sample to room temperature and weigh the pan plus its contents. Place the sample in a muffle furnace at 250 °C for 1 hour. Increase the temperature of the muffle furnace to 350 °C and ash the sample for an additional 7 hours. Cool the sample and grind it to pass a 2mm sieve. The sample is now ready for analysis

Attachment 2:

Preparation of Saturated Paste
Method: LDNR Method LA29B

Equipment and Supplies

Container – 250mL capacity or greater

Buchner funnel

Filter rack or flask

Filter paper

Vacuum Pump

Extract Containers such as test tubes or 1 oz bottles.

Reagents

Laboratory Reagent Water – ASTM Type I laboratory generated.

Preparation Procedure

Sample Preparation:

Prepare soils samples according to Attachment 1 of this SOP.

Paste Preparation:

Weigh to the nearest tenth of a gram at least 50 grams of sample from section prepared soil sample (Attachment 1). Transfer the sample to a beaker and prepare the saturated paste by adding reagent water to the sample with a minimum of stirring to prevent puddling of the sample (over saturation). The sample-water mixture is consolidated from time to time during the stirring process by tapping the container on the workbench.

At saturation, the paste glistens as it reflects light, flows slightly when the container is tipped, and the paste slides freely and cleanly off the spatula for all samples but those with a high clay content.

After mixing, the sample should be covered and allowed to stand for approximately one hour, and then the criteria for saturation should be rechecked. Free water should not collect on the sample surface, nor should the paste stiffen markedly or lose its glistening appearance on standing.
If the paste does stiffen or lose its glisten, remix with more water.

Because samples puddle most readily when worked at moisture contents near field capacity, sufficient water should be added immediately to bring the sample nearly to saturation. If the paste

is too wet, additional dry sample may be added. Special precautions must be taken with peat and muck soils and with samples of very fine and very coarse texture.

Let the paste stand for 12 to 24 hours before extracting to allow sparingly soluble salts to reach an equilibrium.

Take a subsample of the wet paste and weigh it. This weight is called the "wet weight (w)". Dry the paste at 105°C ± 5°C and re-weigh. This weight is called "dry weight, d". Use the two weights to determine the saturation percentage (amount of water added) as follows:

$$s = \frac{(w - d)}{d}$$

Where:

w = wet weight of sample
d = dry weight of sample

Transfer the saturated sample paste to the filter funnel with a pre-wet filter paper in place and apply vacuum. Collect the extract in a bottle or test tube.

If the initial filtrate is turbid, it can be re-filtered through the sample or discarded.

Vacuum extraction should be terminated when air begins to pass through the filter.

The extract may be analyzed for conductivity and soluble cations if the 1:1 extract method was not used.

Attachment 3:

Sodium Adsorption Ratio, Potassium Adsorption Ratio, Exchangeable Sodium Percentage, and Exchangeable Potassium Percentage
Method: LDNR Method LA29B

Equipment and Supplies

Top loading balance, capable of accurately weighing to 0.01g verified daily or before use.

Container – 250mL capacity or greater

Class A graduated cylinder

Mechanical Shaker

Centrifuge

Reagents

Laboratory Reagent Water – ASTM Type I laboratory generated.

Sample Preparation

Follow the sample preparation instructions in Attachment 1.

Sample Extraction

Place at least 100 grams of the ground and sieved sample (prepared in Attachment 1) and add to an equivalent amount of reagent water. Stopper and agitate in a mechanical shaker for at least 15 minutes. Allow the contents to stand for 12 to 24 hours. Agitate again for 5 minutes, centrifuge and filter the extract. Retain the supernatant for analysis.

Note: If a water sample is received, no preparation is performed. Filter the water and proceed to analysis.

Analysis and Calculations

Analyze the extracted samples by method 6010 or 6020 for Ca, Mg, and Na (Additionally analyze for K if PAR is requested). Refer to 6010/6020 SOP (MET-18-001 and MET-18-004, respectively) for Instrument QC preparation and criteria.
Determine the concentration of each cation on mg/L. Concentration data reported in milligrams per liter (mg/L) can be converted to milliequivalents per liter (meq/L), and vice versa. Use the following formula:

$$meq\ /\ L = \frac{mg\ /\ L}{equivalent\ weight}$$

Whereas equivalent weight is calculated by the equivalent weight of an element is its gram atomic weight divided by its valence (combining power).

Constituent	Atomic Weight	Valence	Equivalent weight
Sodium (Na^+)	22.990	1	~23
Calcium (Ca^{2+})	40.078	2	20
Magnesium (Mg^{2+})	24.305	2	~12
Potassium (K^+)	39.098	1	~39

SAR and PAR values are calculated by the following formulas:

$$\text{SAR} = \frac{Na^+}{\frac{\sqrt{Ca^{2+}+Mg^{2+}}}{2}} \qquad \text{PAR} = \frac{K^+}{\frac{\sqrt{Ca^{2+}+Mg^{2+}}}{2}}$$

Where Na^+, Ca^{2+}, K^+ , and Mg^{2+} refer to the concentration of designated cations expressed in milliequivalents per liter.

Exchangeable Sodium Percentage:

$$\text{Exchangeable-sodium-percentage (ESP)} = \frac{Exchangeable\ \ Na}{CEC} \times 100$$

Where CEC = cation exchange capacity (see attachment 3). The CEC and the exchangeable Na are expressed in meq/100g soil.

$$\text{Exchangeable-sodium percentage (ESP)} = \frac{100\times(-0.0126 \oplus 0.01475 \times SAR)}{1\oplus (-0.0126 \oplus 0.01475 \times SAR)}$$

$$\text{Exchangeable-Potassium-Percentage (EPP)} = \frac{100\times(-0.0126 \oplus 0.01475 \times PAR)}{1\oplus (-0.0126 \oplus 0.01475 \times PAR)}$$

Note: Soil having an SAR greater than 13 and/or ESP >15% are considered sodic.

This document is a CONTROLLED COPY and available on-line via the laboratory's computer intra network. This document becomes an UNCONTROLLED COPY when printed outside of the QA Dept.

Attachment 4:

Cation Exchange Capacity
Methods: LDNR Method LA29B / SW-846 Method 9081

Equipment and Supplies

Top loading balance, capable of accurately weighing to 0.01g verified daily or before use.

50mL centrifuge tubes / Digi tubes

Class A graduated cylinders

Class A volumetric flasks

Reagents and Standards

- Sodium Acetate Trihydrate ($CH_3COONa \cdot 3H_2O$), ACS grade Sigma Part#: 236500 or equivalent
    - To Prepare Sodium Acetate Solution, 1 N: Add 136 grams of Sodium Acetate into a 1 Liter Class A volumetric flask. Bring up to volume with reagent water, cap and invert several times to ensure Sodium Acetate is fully dissolved. The pH of this solution should be 8.2. If needed, add a few drops of acetic acid or NaOH solution to bring the reaction of the solution to pH 8.2.
- 99% Isopropyl Alcohol ($CH_3CHOHCH_3$), ACS grade VWR Part#: BDH1133 or equivalent
- Ammonium Acetate ($NH_4CH_3CO_2$), Crystalline ACS grade, Fisher Part #: A637 or equivalent
    - To Prepare Ammonium Acetate Solution, 1 N: Add 154 grams of Ammonium Acetate into 2 a Class A volumetric flask. Bring up to volume with reagent water, cap and invert several times to ensure Ammonium Acetate is fully dissolved.
- Laboratory Reagent Water – ASTM Type I laboratory generated.

Extraction Procedure

Weigh out and label samples

Evaluate sample grain size and document the review for each sample in the TALS prep batch. For Method 9081 Cation Exchange Capacity, weigh 4 +/- 1 grams of medium- or fine-textured soil or 6 +/- 1 grams of course-textured soil and transfer the sample to a 50-mL centrifuge tube.

Fine Soil: >50% particles less than or equal to 0.074mm
Medium Soil: >50% particles greater than or equal to 0.425mm

Coarse: >50% particles greater than or equal to 2mm

Record the soil weight used.

For LDNR 29-B Cation Exchange Capacity, prepare 5.0 ± 1 grams as described in Attachment 1 of this SOP.

Label one centrifuge tube as "method blank". This procedure requires one blank per 20 samples and one sample duplicate per 10 samples.

Sample preparation:

Add 30 mL of 1N sodium acetate to each centrifuge tube. Cap the tubes. Place on a shaker and shake for 5 minutes. Place the tubes in the centrifuge and spin for about 15 minutes at 2000 RPM or until the supernatant liquid is clear. Decant the liquid. (Do not save). Repeat step three more times.

Add 30 mL of 99% isopropyl alcohol to each centrifuge tube. Cap the tubes. Place on shaker and shake for 5 minutes. Place the tubes in the centrifuge and spin for about 15 minutes at 2000 RPM or until the supernatant liquid is clear. Decant the liquid. (Do not save). Repeat step two more times.

Add 30 mL ammonium acetate to each centrifuge tube. Cap the tubes. Place on shaker and shake for 5 minutes. Place the tubes in the centrifuge and spin for about 15 minutes at 2000 RPM or until the supernatant liquid is clear. Decant the 1 N ammonium acetate extract into a 100-mL volumetric flask. Repeat step two more times.

Dilute the combined washings (1N ammonium acetate) to the 100-mL mark with 1N ammonium acetate solution.

Analysis and Calculations

Analyze the batch for sodium (Na) using ICP Method 6010 or ICP-MS Method 6020. Refer to 6010/6020 SOP (MET-18-001 and MET-18-004, respectively). The data to be generated and recorded are the measured concentration values of sodium in units of mg/L. (Refer to attachment 2 for calculating equivalent weight)

$$\text{Meq/L (in the extract)} = \frac{Na\ mg/L}{23}$$

Where:
23 = equivalent weight of Na
Meq = milliequivalents

$$\text{CEC} = \frac{Meq\ Na \times 10}{sample\ wt\ \ in\ grams} = \text{Meq / 100g soil}$$

Attachment 5:

True Total Barium
Method: LDNR Method LA29B

Equipment and Supplies

Erlenmeyer flask (qualitative only), 500 mL

Mortar and Pestle, agate

100 mesh sieve

Class A Volumetric flask, 500 mL

Class A Graduated Cylinder, 500mL

Top loading balance, capable of accurately weighing to 0.01g verified daily or before use.

Reagents and Standards

Nitric acid, 3+7 (30% Nitric, 70% DI water) trace metal grade, Manufacturer or equivalent

Laboratory Reagent Water – ASTM Type I laboratory generated.

LCS/MS Spiking solution - High Purity standards custom spiking mixture, Catalog Number SM2636-003 A, B and C or equivalent. An intermediate standard is prepared as detailed below and this intermediate spiking mixture is to be used when preparing the MS/MSD, and LCS/LCSD. Spike 625uL of spiking solution into the digestion tubes when preparing the LCS, LCSD, MS and MSD. The stock and the intermediate standards are stored in a cool, dry ventilated storage area. The expiration date for the unopened stock standard is manufacturer's expiration date and for the opened standard is 1 year from the date opened. The expiration date for the intermediate stock standard is 3 months from the prepared date.

	SM 2636-003A	SM-2636-003B	SM-2636-003C	Nitric acid (ml)	Final Volume
ICP Standard A	50 ml			12.5	250 ml
ICP/ICP-MS Standard B		50 ml	50 ml	12.5	250 ml

Procedure

QC Preparation

Laboratory Control Spike / Laboratory Control Spike Duplicate:

Add 1.0g Teflon chips (the LCS sample should be weighed to the nearest 0.01g) and 625µL of LCS/MS Spike Solution into a digestion tube. Proceed to Digestion Procedure.

Method Blank:

Add 1.0g of Teflon chips. Proceed to Digestion Procedure.

Matrix Spike / Matrix Spike Duplicate:

If the sample is to be used as the matrix spike/matrix spike duplicate, prepare 2 additional 1.00g to 1.30g sample aliquots and record the exact weight to the nearest 0.01g. Add 625µL of LCS/MS Spike Solution to each digestion tube. Proceed to Digestion Procedure.

Digestion Procedure

Grind a 10 ± 0.01-gram sample to pass a 100-mesh sieve. Weigh to the nearest tenth of a milligram 100 mg of prepared sample**.** Place the weighed sample into a 500 ml flask and add 400 mL 3+7 nitric acid. Reflux on a hot plate until the volume is 300 mL Transfer to a 500mL volumetric flask and bring up the volume to the mark with Reagent water. Analyze sample by either method 6010 or 6020. Refer to 6010/6020 SOP (MET-18-001 and MET-18-004, respectively) Report the Barium content as parts per million (mg/Kg) on a dry weight basis.

Attachment 6:

Leachate Test
Method: LDNR Method LA29B

Equipment and Supplies

1000mL Erlenmeyer flask, rubber stoppers

Top loading balance, capable of accurately weighing to 0.01g verified daily or before use.

Weighing Beakers

Desiccator with Desiccant

Separatory funnel and filter apparatus

Reagents

Laboratory Reagent Water – ASTM Type I laboratory generated

Methylene Chloride

Anhydrous Sodium Sulfate

Sample Preparation

Non-Solidified soils are used as received and are homogenized to obtain a representative subsample.

Sample moisture level is determined on a separate subsample to correct for interstitial water in preparing the 1:4 solid: solution test matrix.

Extraction Procedure

Weigh 100 grams (dry weight basis) prepared sample into a 1000mL extraction flask.

Add Reagent water as required to adjust solution volume to 400mL. Stopper and swirl contents of flask to initiate 7-day leach test.

Contents are swirled on a daily basis to effect gentle agitation of the sample matrix.

The sample extract is separated from solids by filtration. An aliquot of the filtrate is analyzed for chloride using EPA 9056 (Refer to SOP WC-00-001).

For oil and grease, the extract is partitioned from the filtrate using methylene chloride (EPA 3510C). The extract is finally dried in a desiccator for gravimetric analysis of the oil and grease component. For sample analysis, EPA method 1664B / SW-846 9071 is used. Refer to SOPs (WC-07-001 and WC-16-001, respectively)

This document is a CONTROLLED COPY and available on-line via the laboratory's computer intra network. This document becomes an UNCONTROLLED COPY when printed outside of the QA Dept.

Attachment 7:

Electrical Conductivity
Method: LDNR Method LA29B

Equipment and Supplies

Conductivity meter (Thermo Orion VersaStar Pro or equivalent) with a minimum 1.0K conductivity cell, or equivalent, with an automatic temperature adjustment probe.

Vacuum filtration device

Reagents and Standards

Laboratory Reagent Water – ASTM Type I laboratory generated

Potassium Chloride (KCl) Conductivity Standard - commercially purchased. (See analytical SOP WC-22-004 for specifications)

Sample Preparation

Prepare sample by performing sample preparation procedure in Attachment 3.

Additionally, prepare saturated paste per procedure in Attachment 2.

Procedure

Calibrate the Conductivity meter and analyze Batch/Instrument QC per SOP: WC-22-004.

Rinse the cell with sample solution obtained from the preparation procedure in Attachment 3 and analyze the extract per the procedure in the analytical SOP (WC-22-004). Read the conductivity and record in millimhos per centimeter.

Use the saturation percentage determined in the saturation paste section of this SOP (attachment 2) to correct the 1:1 reading to a conductivity at saturation as follows:

$$\text{Electrical Conductivity at Saturation} = \frac{Ec}{S}$$

Where:

EC = Electrical Conductivity measured (extract produced from attachment 3)

S = The Saturation Percentage Expressed as a decimal (calculated in attachment 2)

i.e., 70mL required to achieve saturation of 100 grams of sample, S= .7

If the EC is above the regulatory limit or S is greater than 1.0, then determine the conductivity on the saturated paste extract.

Attachment 8:

pH
Method: LDNR Method LA29B

Equipment and Supplies

pH Meter (Thermo Orion VersaStar Pro or equivalent) with an automatic temperature adjustment probe. Calibrate each day of use in accordance with SOP WC-22-004

Class A Graduated Cylinder

Beaker, 50mL (Qualitative measurement only)

Reagents and Standards

Laboratory Reagent Water – ASTM Type I laboratory generated

pH Calibration/ QC standards (See analytical SOP WC-22-004 for specifications)

Sample Preparation

Follow the sample preparation instructions in Attachment 1.

Procedure

Calibrate the pH meter and analyze Batch/Instrument QC per SOP: WC-22-004.

To 20 g of prepared sample in a 50-ml beaker, add 20 ml of Reagent water and stir the suspension 3 times during the next 30 min.

Let the sampled suspension stand, covered, for 1 hr. to allow most of the suspended clay to settle out from the suspension.

Immerse the probe just below the suspension. Read the pH to the nearest tenth of a pH unit.

Report the results per analytical SOP (WC-22-004).

This document is a CONTROLLED COPY and available on-line via the laboratory's computer intra network. This document becomes an UNCONTROLLED COPY when printed outside of the QA Dept.

Attachment 9:

Water Soluble Phosphorus
Method: Methods for Phosphorus Analysis

Equipment and Supplies

Shaker, reciprocating or end over end

Centrifuge capable of spinning 6000rpm

Centrifuge Tubes

Filtration apparatus (0.45µm pore diameter membrane filter)

Class A – Volumetric Flasks and graduated cylinders, various sizes

Reagents and Standards

Laboratory Reagent Water – ASTM Type I laboratory generated

Concentrated HCl

Sample Preparation

Sieve an aliquot of sample (at least 5 grams) through a 2-mm mesh sieve and dry in an oven at approximately 60ºC for 48 hours.

Procedure

Weigh 2 grams of prepared soil into a centrifuge tube.

Add 20 mL of reagent water and shake for approximately 1 hour.

Centrifuge at 6000 rpm for 10 minutes.

Filter the solution through a 0.45µm membrane filter.

Acidify to pH 2 with HCl to prevent precipitation of phosphate compounds. If sample is not to be analyzed the same day, it must be frozen.

Analyze sample by either method 6010 or 6020. Refer to 6010/6020 SOP (MET-18-001 and MET-18-004, respectively).

This document is a CONTROLLED COPY and available on-line via the laboratory's computer intra network. This document becomes an UNCONTROLLED COPY when printed outside of the QA Dept.

Quality Assurance Manual Cover Page

Eurofins Xenco

Laboratory Locations:

Eurofins Xenco Corpus Christi 1733 North Padre Island Dr. Corpus Christi, TX 78408 361-289-2673	**Eurofins Xenco Dallas** 9701 Harry Hines Blvd. Dallas, TX 75220 214-902-0300	**Eurofins Xenco El Paso** 200 East Sunset Rd. El Paso, TX 79922 915-585-3443
Eurofins Xenco Stafford (Houston) 4147 Greenbriar Dr. Stafford, TX 77477 281-240-4200	**Eurofins Xenco Lubbock** 6701 Aberdeen Ave. Suite #8 Lubbock, TX 79424 806-794-1296	**Eurofins Xenco Midland** 1211 W. Florida Ave. Midland, TX 79701 432-704-5440

www.Eurofins.com

Copyright Information:

This documentation has been prepared by Eurofins Xenco and its affiliates, solely for their own use and the use of their customers in evaluating their qualifications and capabilities in connection with a particular project. The user of this document agrees by its acceptance to return it to Eurofins Xenco upon request and not to reproduce, copy, lend, or otherwise disclose its contents, directly or indirectly, and not to use it for any purpose other than that for which it was specifically provided. The user also agrees not to give access to this document to any third parties including but not limited to consultants, unless such third parties specifically agree to these conditions.

THIS DOCUMENT CONTAINS VALUABLE CONFIDENTIAL AND PROPRIETARY INFORMATION. DISCLOSURE, USE OR REPRODUCTION OF THESE MATERIALS WITHOUT THE WRITTEN AUTHORIZATION OF EUROFINS XENCO IS STRICTLY PROHIBITED. THIS UNPUBLISHED WORK BY EUROFINS XENCO IS PROTECTED BY STATE AND FEDERAL LAW OF THE UNITED STATES. IF PUBLICATION OF THIS WORK SHOULD OCCUR THE FOLLOWING NOTICE SHALL APPLY:

©COPYRIGHT 2021 EUROFINS XENCO ALL RIGHTS RESERVED.

Facility Distribution No. _____ **Distributed To:_____**

1.0 Title Page

Quality Assurance Manual

Approval Signatures

Houston and El Paso Business Unit Manager (BUMA) – Ruben Builes	12/01/2021 Date
Houston Laboratory Director – Julian Martinez	12/01/2021 Date
Houston Quality Assurance Manager – Stephanie Coch	12/01/2021 Date
Houston Technical Manager, **(Organics)** – Vicky Cuartas	12/01/2021 Date
Houston Technical Manager, **(Inorganics)** – Deepak Pandey	12/01/2021 Date
Corpus Christi Laboratory Director/BUMA – Christina Godines	12/01/2021 Date
Corpus Christi Quality Assurance Coordinator - Tiffany Fleming	12/01/2021 Date
Corpus Christi Technical Manager, **(Inorganics)** – Richard DeLeon	12/01/2021 Date

Corpus Christi Technical Manager, **(Organics)** – Gayland Fisher	12/01/2021 Date
Dallas Laboratory Director/BUMA/Technical Director– Dr. Carlos Castro	12/01/2021 Date
Dallas Quality Assurance Manager – Jose Londono	12/01/2021 Date
Dallas Operations Manager – Mike Kimmel	12/01/2021 Date
Midland Laboratory Director/BUMA/Technical Director – Allison Johnson	12/01/2021 Date
Midland Quality Assurance Manager – Linda Riviello	12/01/2021 Date

El Paso Laboratory Director & Technical Manager – Linda Riviello	12/01/2021 Date
El Paso Quality Assurance Manager – Stephanie Coch	12/01/2021 Date
Lubbock Laboratory Director/BUMA/Technical Director – Allison Johnson	12/01/2021 Date
Lubbock Quality Assurance Manager – Linda Riviello	12/01/2021 Date
Lubbock Operations Manager – Teddy Lee	12/01/2021 Date
Lubbock Technical Manger – Dr. Blair Leftwich	12/01/2021 Date
Eurofins Xenco President- Alex Montoya	12/01/2021 Date

2.0 TABLE OF CONTENTS

Contents

1.0 TITLE PAGE 2

2.0 TABLE OF CONTENTS 5

3.0 INTRODUCTION, SCOPE AND APPLICABILITY 10

3.1 INTRODUCTION AND COMPLIANCE REFERENCES 10
3.2 TERMS AND DEFINITIONS 10
3.3 SCOPE / FIELDS OF TESTING 10
3.4 MANAGEMENT OF THE MANUAL 11
3.4.1 Review Process 11

4.0 MANAGEMENT REQUIREMENTS 12

4.1 OVERVIEW 12
4.2 ROLES AND RESPONSIBILITIES 12
4.2.1 Vice President of Quality and Environmental Health and Safety (VP-QA/EHS) 12
4.2.2 Quality Directors 12
4.2.3 Quality Information Manager 13
4.2.4 Environmental Health and Safety (EH&S) Managers 13
4.2.5 Ethics and Compliance Officers (ECOs) 13
4.2.6 Laboratory Director 14
4.2.7 Quality Assurance (QA) Manager or Designee 14
4.2.8 Technical Manager or Designee 16
4.2.9 Operations Manager 16
4.2.10 Project Manager (PM) 17
4.2.11 Department Supervisors 17
4.2.12 Laboratory Analysts 18
4.3 BUSINESS CONTINUITY AND CONTINGENCY PLANS 18
FIGURE 4-1. LABORATORY ORGANIZATION CHARTS 20

5.0 PERSONNEL 20

5.1 OVERVIEW 21
5.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL 21
5.3 TRAINING 23
5.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM 24

6.0 ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS 25

6.1 OVERVIEW 25
6.2 ENVIRONMENT 25
6.3 WORK AREAS 26
6.4 RESPONDING TO EMERGENCIES 26
6.5 BUILDING SECURITY 27

7.0 QUALITY SYSTEM 28

7.1 QUALITY POLICY STATEMENT 28
7.2 ETHICS AND DATA INTEGRITY 28
7.3 QUALITY SYSTEM DOCUMENTATION 29
7.3.1 Order of Precedence 29
7.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA 30
7.4.1 Precision 30
7.4.2 Accuracy 30

7.4.3 Representativeness 31
7.4.4 Comparability 31
7.4.5 Completeness 31
7.4.6 Selectivity 31
7.4.7 Sensitivity 32
7.5 CRITERIA FOR QUALITY INDICATORS 32
7.6 STATISTICAL QUALITY CONTROL 32
7.6.1 QC Charts 32
7.7 QUALITY SYSTEM METRICS 32

8.0 DOCUMENT CONTROL 33

8.1 OVERVIEW 33
8.2 DOCUMENT APPROVAL AND ISSUE 33
8.3 PROCEDURES FOR DOCUMENT CONTROL POLICY 34
8.4 OBSOLETE DOCUMENTS 34

9.0 SERVICE TO THE CLIENT 35

9.1 OVERVIEW 35
9.2 REVIEW SEQUENCE AND KEY PERSONNEL 36
9.3 BALANCING LABORATORY CAPACITY AND WORKLOAD 36
9.4 DOCUMENTATION 37
9.4.1 Project-Specific Quality Planning 37
9.5 SPECIAL SERVICES 38
9.6 CLIENT COMMUNICATION 38
9.7 REPORTING 38
9.8 CLIENT FEEDBACK AND SURVEYS 38

10.0 SUBCONTRACTING OF TESTS 40

10.1 OVERVIEW 40
10.2 QUALIFYING AND MONITORING SUBCONTRACTORS 41
10.3 OVERSIGHT AND REPORTING 41
10.4 CONTINGENCY PLANNING 42
10.5 USE OF NELAP AND A2LA LOGO 42

11.0 PURCHASING SERVICES AND SUPPLIES 43

11.1 OVERVIEW 43
11.2 GLASSWARE 43
11.3 REAGENTS, STANDARDS & SUPPLIES 43
11.3.1 Purchasing 43
11.3.2 Receiving 43
11.3.3 Specifications 44
11.3.4 Storage 45
11.4 PURCHASE OF EQUIPMENT / INSTRUMENTS / SOFTWARE 45
11.5 SERVICES 45
11.6 SUPPLIERS 46
11.6.1 New Vendor Procedure 47

12.0 COMPLAINTS 48

12.1 OVERVIEW 48
12.2 EXTERNAL COMPLAINTS 48
12.3 INTERNAL COMPLAINTS 49
12.4 MANAGEMENT REVIEW 49

13.0 CONTROL OF NON-CONFORMING WORK 50

13.1 OVERVIEW 50

13.2 RESPONSIBILITIES AND AUTHORITIES 50
13.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN 51
13.4 PREVENTION OF NONCONFORMING WORK 51
13.5 METHOD SUSPENSION / RESTRICTION (STOP WORK PROCEDURES) 51

14.0 CORRECTIVE ACTION 53

14.1 OVERVIEW 53

14.2 GENERAL 53
14.2.1 Non-Conformance Memo (NCM) 53
NCMs are used to document the following types of corrective actions: 53
14.2.2 Corrective Actions Documented In the ICAT Database 53
14.3 CLOSED LOOP CORRECTIVE ACTION PROCESS 54
14.3.1 Cause Analysis 54
14.3.2 Selection and Implementation of Corrective Actions 54
14.3.3 Root Cause Analysis 54
14.3.4 Monitoring of the Corrective Actions 55
14.3.5 Follow-up Audits 55
14.4 TECHNICAL CORRECTIVE ACTIONS 55
14.5 BASIC CORRECTIONS 56
TABLE 14-1. EXAMPLE – GENERAL CORRECTIVE ACTION PROCEDURES 57

15.0 PREVENTIVE ACTION / IMPROVEMENT 59

15.1 OVERVIEW 59
15.2 MANAGEMENT OF CHANGE 60

16.0 CONTROL OF RECORDS 61

16.1 OVERVIEW 61
TABLE 16-1. RECORD INDEX 62
16.2 PROGRAMS WITH LONGER RETENTION REQUIREMENTS 63
TABLE 16-2. EXAMPLE: SPECIAL RECORD RETENTION REQUIREMENTS 63
16.3 TECHNICAL AND ANALYTICAL RECORDS 65
16.4 LABORATORY SUPPORT ACTIVITIES 66
16.4.1 Sample Handling Records 66
16.5 ADMINISTRATIVE RECORDS 66
16.6 RECORDS MANAGEMENT, STORAGE AND DISPOSAL 66
16.6.1 Transfer of Ownership 67
16.6.2 Records Disposal 67

17.0 AUDITS 68

17.1 INTERNAL AUDITS 68
TABLE 17-1. TYPES OF INTERNAL AUDITS AND FREQUENCY 68
17.1.1 Annual Quality Systems Audit 68
17.1.2 QA Technical Audits 69
17.1.3 SOP Method Compliance 69
17.1.4 Special Audits 69
17.1.5 Performance Testing 69
17.2 EXTERNAL AUDITS 69
17.2.1 Confidential Business Information (CBI) Considerations 70
17.3 AUDIT FINDINGS 70

18.0 MANAGEMENT REVIEWS 72

18.1 QUALITY ASSURANCE REPORT 72
18.2 ANNUAL MANAGEMENT REVIEW 72
18.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS 73

19.0 TEST METHODS AND METHOD VALIDATION 74

19.1 OVERVIEW 74
19.2 STANDARD OPERATING PROCEDURES (SOPS) 74
19.3 LABORATORY METHODS MANUAL 74
19.4 SELECTION OF METHODS 74
19.4.1 Sources of Methods 75
19.4.2 DEMONSTRATION OF CAPABILITY 76
19.4.3 Initial Demonstration of Capability (IDOC) Procedures 77
19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS 78
19.6 VALIDATION OF METHODS 78
19.6.1 Method Validation and Verification Activities for All New Methods 78
19.7 METHOD DETECTION LIMIT (MDL) / LIMITS OF DETECTION (LOD) 79
19.8 VERIFICATION OF DETECTION LIMITS 79
19.9 INSTRUMENT DETECTION LIMITS (IDL) 79
19.10 LIMIT OF QUANTITATION 80
19.11 RETENTION TIME WINDOWS 80
19.12 EVALUATION OF SELECTIVITY 80
19.13 ESTIMATION OF UNCERTAINTY OF MEASUREMENT 80
19.14 SAMPLE REANALYSIS GUIDELINES 81
19.15 CONTROL OF DATA 82
19.15.1 Computer and Electronic Data Related Requirements 82
19.15.2 Data Reduction 82
19.15.3 Logbook / Worksheet Use Guidelines 83
19.15.4 Review / Verification Procedures 83
19.15.5 Manual Integrations 85
FIGURE 19-1. EXAMPLE – WORK FLOW 86

20.0 EQUIPMENT AND CALIBRATIONS 87

20.1 OVERVIEW 87
20.2 PREVENTIVE MAINTENANCE 87
20.3 SUPPORT EQUIPMENT 88
20.3.1 Weights and Balances 88
20.3.2 pH, Conductivity, and Turbidity Meters 89
20.3.3 Thermometers 89
20.3.4 Refrigerators/Freezer Units, Water baths, Ovens and Incubators 89
20.3.5 Autopipettors, Dilutors, and Syringes 90
20.4 INSTRUMENT CALIBRATIONS 90
20.4.1 Calibration Standards 91
20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS 93
20.6 GC/MS TUNING 94
TABLE 20-1. EXAMPLE – INSTRUMENTATION LIST ..... **ERROR! BOOKMARK NOT DEFINED.**

21.0 MEASUREMENT TRACEABILITY 95

21.1 OVERVIEW 95
21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS 95
21.3 REFERENCE STANDARDS / MATERIALS 95
21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS 96

22.0 SAMPLING 99

22.1 OVERVIEW 99
22.2 SAMPLING CONTAINERS 99
22.2.1 Preservatives 99
22.3 DEFINITION OF HOLDING TIME 99
22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES 99
22.5 SAMPLE ALIQUOTS / SUBSAMPLING 99

23.0 HANDLING OF SAMPLES 101

23.1 CHAIN OF CUSTODY (COC) 101
23.1.1 Field Documentation 101
23.1.2 Legal / Evidentiary Chain-of-Custody 102
23.2 SAMPLE RECEIPT 102
23.2.1 Laboratory Receipt 102
23.3 SAMPLE ACCEPTANCE POLICY 102
23.4 SAMPLE STORAGE 103
23.5 HAZARDOUS SAMPLES AND FOREIGN SOILS 103
23.6 SAMPLE SHIPPING 103
23.7 SAMPLE DISPOSAL 104
FIGURE 23-1. EXAMPLE: SAMPLE ACCEPTANCE POLICY 106

24.0 ASSURING THE QUALITY OF TEST RESULTS 106

24.1 OVERVIEW 108
24.2 CONTROLS 108
24.3 NEGATIVE CONTROLS 108
TABLE 24-1. EXAMPLE – NEGATIVE CONTROLS 108
24.3.1 Negative Controls for Microbiological Methods 109
TABLE 24-2. NEGATIVE CONTROLS FOR MICROBIOLOGY 110
24.4 POSITIVE CONTROLS 110
24.4.1 Method Performance Control - Laboratory Control Sample (LCS) 110
24.5 SAMPLE MATRIX CONTROLS 112
24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS) 113
24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL 114

25.0 REPORTING RESULTS 116

25.1 OVERVIEW 116
25.2 TEST REPORTS 116
25.3 REPORTING LEVEL OR REPORT TYPE 118
25.4 ELECTRONIC DATA DELIVERABLES (EDDS) 118
25.5 SUPPLEMENTAL INFORMATION FOR TEST 118
25.6 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS 119
25.7 CLIENT CONFIDENTIALITY 119
25.8 FORMAT OF REPORTS 120
25.9 AMENDMENTS TO TEST REPORTS 120
25.10 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS 121
25.10.1 Policy on Data Omissions or Reporting Limit Increases 121
25.10.2 Multiple Reports 121
APPENDIX 1. LIST OF GOVERNING DOCUMENTS APPLICABLE TO THE QA MANUAL 122
APPENDIX 2. LIST OF LABORATORY CERTIFICATIONS, ACCREDITATIONS, VALIDATIONS 123
APPENDIX 3. REFERENCES USED TO PREPARE THE QA MANUAL 124
APPENDIX 4. QA MANUAL CROSSWALK WITH TNI AND ISO/IEC 17025 STANDARDS 125
APPENDIX 5. TERMS/GLOSSARY AND ACRONYMS (EL-V1M2 SEC. 3.1) 133
APPENDIX 6. ANALYTICAL METHOD REFERENCES 142

3.0 INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

The Quality Assurance (QA) Manual is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving the Eurofins Xenco QA Program. This QA Manual is applicable to the following Eurofins Xenco laboratories: Corpus Christi, Dallas, El Paso, Houston, Lubbock, and Midland. Governing SOPs are in place within the organization to ensure the proper execution of this QA Manual. This manual and referenced documents are required reading for all personnel.

The laboratory is a team of people who work together to serve the health and environmental needs of society through science and technology. We offer comprehensive expertise in environmental laboratory applications and client relations and maintain a national perspective in terms of quality.

As such, this QA Manual has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009 and 2016, and the ISO/IEC Guide 17025:2005 and 2017. Policies and procedures listed in Appendix 1 are compliant with the National Divisional Support Center (NDSC) Quality Management Plan (QMP) and the various accreditation and certification programs which are held by the laboratory to support environmental work (Appendix 2). The QA Manual provides a summary of Eurofins Xenco's quality and data integrity system. It contains requirements and general guidelines under which all Eurofins Xenco facilities shall conduct their operations.

Refer to Appendix 3 for a list of additional references for which this QA Manual is compliant; and Appendix 4 for the compliance crosswalk of this manual to the TNI and ISO/IEC Guide 17025 requirements.

3.2 Terms and Definitions

A QA Program is a system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the local management level through company goals, from guidance at the executive management level, and at the analytical level through Standard Operating Procedures (SOPs) and quality control.

Our program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization to better serve our clients.

Refer to Appendix 5 for a list of Terms and Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples. Sample matrices can include drinking water, non-potable water, hazardous waste, and soils. The QA Program contains specific procedures and methods to test samples of differing matrices for chemical, physical, and biological parameters. The QA Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are

thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States. The specific list of test methods used by the laboratories can be found in the methods listing housed in each the laboratory's information management system (i.e., LIMS). Our areas of expertise include Volatiles, Semivolatiles, Metals, Pesticides/PCBs/Herbicides, Petroleum Hydrocarbons, Waste Characterization, Non-Potable Water Testing, Drinking Water Testing, Soil and Surface Water Testing, Sediment and Tissue Testing, and Method Development.

Note: All current certificates and scopes of accreditation are available on the laboratory's website.

The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs), or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and/or Business Unit Manager, and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and/or Business Unit Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Eurofins National Divisional Support Center (NDSC) which houses the Quality Assurance leadership team for Eurofins Environment Testing America. NDSC QA will assure that the template remains in compliance with Section 3.1. This manual itself is reviewed every two years, at a minimum, by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by senior laboratory management staff. The QA Manual is updated and approved according to our document control and updating procedures.

4.0 MANAGEMENT REQUIREMENTS

4.1 Overview

Each Eurofins Xenco laboratory is a local operating unit of Eurofins Environment Testing America. The laboratories' operational and support staff have the day-to-day independent operational authority under the direction of the Laboratory President and Business Unit Managers and/or Laboratory Directors and are supported by the NDSC QA team. Laboratory management staff includes directors, managers and group leaders. The organizational charts of the associated laboratories are presented in Figure 4-1. Individual departmental staff lists are maintained in each laboratory's internal records.

4.2 Roles and Responsibilities

In order for the QA Program to function properly, all staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The responsibility for quality resides with every employee. All employees have access to the QA Manual, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks impartially and in a manner consistent with the goals and in accordance with the procedures in this manual and their laboratory's SOPs. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Vice President of Quality and Environmental Health and Safety (VP-QA/EHS)

The Vice President (VP) of QA/EHS reports directly to Eurofins Environment Testing America Chief Operating Officer (COO). With the aid of the NDSC Quality Team Members, Business Unit Managers, and Laboratory Directors, the VP-QA/EHS has the responsibility for the establishment, general overview, and maintenance of the Quality Assurance and EH&S Programs within Eurofins Environment Testing America. Additional responsibilities include:

- Review of QA/QC and EHS aspects of NDSC Official Documents, national projects and expansions or changes in services.
- Work with various organizations outside of the laboratory to further the development of quality standards and represent the laboratory at various trade meetings.
- Prepare monthly reports for quality and EH&S metrics across the environmental testing laboratories and a summary of any quality and EH&S related initiatives and issues.
- With the assistance of the Executive Management and the EHS Managers, maintenance and implementation of the Eurofins Environment Testing America Environmental, Health and Safety Program.

4.2.2 Quality Directors

Quality Directors within NDSC report directly to the VP-QA/EHS. These Quality Directors have oversight of the general overview and maintenance of the QA Program within the Eurofins Environment Testing America laboratories. Supported tasks include:

- Monitors laboratory internal audit findings;
- Identifies common laboratory weaknesses and monitors corrective action closures.
- Develops NDSC quality guidance documents and management tools for ensuring and improving compliance;

- Monitors and communicates DoD/DoE requirements;
- Monitors and communicates regulatory and certification requirements;
- Training and OnBoarding
- Laboratory assessments, mentoring, and interventions
- Track/drive root cause investigations and corrective action plans
- Builds knowledge base for preventive actions

4.2.3 Quality Information Manager

The Quality Information Manager works directly with the NDSC Quality Directors and EHS Managers; and reports directly to the VP-QA/EHS. The Quality Information Manager is responsible for the management of:

- NDSC Official Documents
- TALS/LIMS Certification Module Data
- Company's Intranet website
- Company's Regulatory Limits Database
- Subcontract laboratory and approved vendor information
- Internal and External client support for various company groups (e.g., Client Services, EH&S, Legal, IT, Sales) for both quality and operational functions
- Regulatory information communications

4.2.4 Environmental Health and Safety (EH&S) Managers

EH&S Managers within NDSC report directly to the VP-QA/EHS. These EH&S Managers have oversight of the general overview and maintenance of the EH&S Program within the Eurofins Environment Testing America laboratories. Supported tasks include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for Eurofins Environment Testing America locations.
- Coordination/preparation of the Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the coordination of employee exposure and medical monitoring programs to ensure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.5 Ethics and Compliance Officers (ECOs)

The NDSC VP-QA/EHS and Corporate Counsel are the designated Ethics and Compliance Officers (ECO). Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire executive management personnel and lab management staff.
The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the President, COO, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in

the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratory's regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.6 Laboratory Director/Business Unit Manager (BUMa)

The Laboratory Director and BUMa are responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their business unit President. The Laboratory Director and BUMa are also responsible for any service centers connected with their laboratory that perform analytical tests, such as short holding time analyses for pH. The Laboratory Director and BUMa provide the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.
Specific responsibilities may include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full-time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented. Works with Eurofins Environment Testing Human Resources for hiring of new personnel.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures company human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory. Assesses laboratory capacity and workload.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO/IEC 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Contributes to the continuous improvement of the laboratory operations.
- Maintains an awareness of technical developments and regulatory requirements.
- Captains the management team, consisting of the QA Manager, the Technical Manager(s), and the Operations Manager as direct reports.

4.2.7 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO/IEC 17025 and TNI at the laboratory where they work. The

QA Manager is also responsible for any service centers connected with their laboratory that perform analytical tests, such as short holding time analyses for pH.

The QA Manager reports directly to the Laboratory Director/BUMa and their NDSC Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. The NDSC QA Team may be used as a resource in dealing with regulatory requirements, certifications, and other quality assurance related items. The QA Manager directs the activities of the QA office to accomplish specific responsibilities, which may include, but are not limited to:

- Serving as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Having documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conduct internal audits on quality systems and the technical operation
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QA Manual or laboratory SOPs shall be investigated following procedures outlined in Section 14 and if deemed necessary may be temporarily suspended during the investigation.
- Maintaining and updating the QA Manual.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Maintaining records of all ethics-related training, including the type and proof of attendance.
- Maintaining, improving, and evaluating the corrective action database and the corrective and preventive action systems.
- Objectively monitoring standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Performing technical data audits and method audits to ensure consistency and compliance with regulatory requirements.
- Reviewing of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishing reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or NDSC QA Team.
- Developing of suggestions and recommendations to improve quality systems.
- Researching current state and federal requirements and guidelines.
- Participating in the vendor and supplier approval process, including subcontractors.
- Managing the QA team to enable communication and to distribute duties and responsibilities.
- Communicating to the relevant regulatory authorities when there are management or facility changes that impact the laboratory.
- Ensuring communication and monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.

- Evaluating of the thoroughness and effectiveness of training.
- Ensuring compliance with IEC/ISO 17025

4.2.8 Technical Manager or Designee

The Technical Manager reports directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025:2017 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercising day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of test methods, i.e., SOPs, with regard to quality, integrity, regulatory requirements, and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she ensures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, and the client's expectations.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, ensuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations and instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from "cradle to grave," ensuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.
- Compliance with ISO 17025.

4.2.9 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director. He/She assists the Technical Manager in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.

- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Manager and QA Manager and in compliance with regulatory requirements.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.10 Project Manager (PM)

Members of the laboratory Client Services/Project Management Group are responsible for organizing and managing client projects. Clients are assigned a project manager who serves as their primary contact at the laboratory. It is the PM's responsibility to act as the client advocate by communicating client requirements to laboratory personnel and ensuring that clients provide complete information needed by the laboratory to meet those requirements – including all verbal communications. Responsibilities include:

- Scheduling sample submissions, sample container order, and sample pick-up via the laboratory courier service.
- Confirming certification status
- Coordinating and communicating turnaround time (TAT) requirements for high priority samples/projects.
- Answering common technical questions, facilitating problem resolution, and coordinating technical details with the laboratory staff.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample status reports or results prior to receipt of the final report.
- Monitoring the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Informing clients of data package-related problems and resolving service issues.

4.2.11 Department Manager/Supervisor

Department Manager/Supervisors are responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training, development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Manager, Operations Manager, and/or QA Manager. Responsible for the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions, requiring formal corrective action, to the QA Manager, Technical Manager, Operations Manager, and/or BU / Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.12 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks, and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

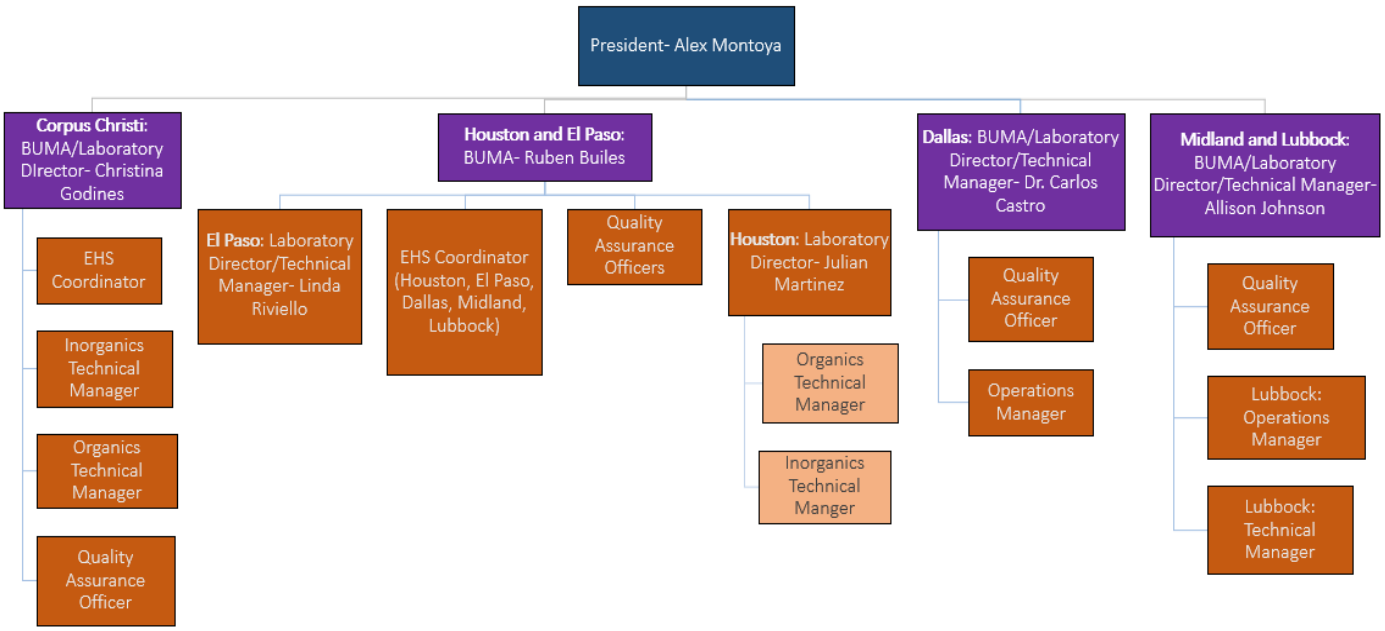
4.3 Business Continuity and Contingency Plans

Various policies and practices are in place to address continuity of business and contingency plans to ensure continued operations or minimal disruption in operations should unplanned events (natural disasters, unexpected management changes, etc.) occur. Deputies are identified for all key management personnel. Deputies would temporarily fill a role if the primary is absent for more than 15 consecutive calendar days. The deputies must meet the same qualifications as the primary person should they be required to take on the responsibilities. The QA Manager communicates to the relevant regulatory authorities when there are management or facility changes that impact the laboratory. Changes in the technical director must be communicated within a period of time and in the manner dictated by each regulatory authority.

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy
Laboratory Director	QA Manager
QA Manager	Laboratory Director
Department Manager	Laboratory Director
Technical Manager	Laboratory Director
EHS Coordinator	Laboratory Director

Figure 4-1. Laboratory Organization Charts



5.0 PERSONNEL

5.1 Overview

Laboratory management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience, and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for laboratory staff with respect to education, training, and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the laboratory staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

5.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staff that possess a college degree (e.g., AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for laboratory employees are outlined in job descriptions maintained by Eurofins Environment Testing America Human Resources.

Experience and specialized training are occasionally accepted in lieu of a college degree. Basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered.

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC)	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	Or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Manager (General)	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Manager (Wet Chem Only) (No advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

Specialty	Education	Experience
Technical Manager (Microbiology)	Bachelors degree in applied science with at least 16 semester hours in general microbiology and biology An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years of relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer, or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

5.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency.

Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics (Comprehensive)	60 days of hire	All
Data Integrity	60 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics (Comprehensive Refresher)	Annually	All
Initial Demonstration of Capability (IDOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills, and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to Demonstration of Capability in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood, and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques, or other relevant topics.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status and records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:
- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analyst knowledge to refer to QA Manual for quality issues.
- Analyst following SOPs, i.e., practice matches SOPs.
- Analyst regularly communicates to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

5.4 Data Integrity and Ethics Training Program

The laboratory's Ethics and Data Integrity Program is discussed in Section 6.2. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation.

Key topics include:
- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by the NDSC.

6.0 ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

6.1 Overview

Each laboratory is a secure facility with controlled access and is designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

Each laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

Each laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, microbiological sample analysis, and administrative functions, where applicable.

6.2 Environment

Laboratory accommodation, test areas, energy sources, and lighting are adequate to facilitate proper performance of tests. Each facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control, and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

When the laboratory performs laboratory activities at sites or facilities outside its permanent control, it shall ensure that the requirements related to facilities and environmental conditions of this document are met.

Specific requirements for facility and environmental conditions, as well as periodic monitoring of conditions, are given in the Environmental Health & Safety Manual plus each laboratory's Facility Addendum.

6.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Microbiological culture handling and sample incubation areas.
- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work space. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

Refer to the following documents and procedures for specific requirements for microbiological laboratory facility requirements.

- Standard Methods, 20th Ed., 9020B, Sec. 2
- TNI V1M5, 1.7.3.7.a

6.4 Responding to Emergencies

Employees must be aware of procedures to respond to all emergencies that might occur in the workplace. Employees must be familiar with the location and proper operation of all emergency equipment, evacuation routes, and designated assembly areas for all areas where they work. Refer to the NDSC EH&S Manual Document No. CW-E-M-001. Sec. 7 and the laboratory's local EH&S Addendum for complete details. These documents provide direction for situations where normal operations of the laboratory are not possible (e.g., electrical failures, heating/air conditioning failures, fire/building evacuation, computer failures, hazardous material spills, injury to employees, pandemic/flu, disruption of phone service, etc.)

In the event that the building or information technology (IT) systems would be severely challenged, a designated disaster recovery team, which includes Facility Management, Maintenance, Safety, Laboratory/Executive Management, Public Relations, IT, QA and other

applicable personnel depending on the scope of the disaster, would assemble at a designated area to assess the situation and formulate a plan.

6.5 Building Security

Each laboratory is considered a secure facility. All outside doors are locked, unless manned, during normal business hours to prevent unauthorized entry. Building keys and/or alarm codes are distributed to employees as necessary.

All visitors to the laboratory must sign in and out in a visitor's logbook that is located in the lobby. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. Both visitors and vendors must review and sign specific EH&S forms; and are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

7.0 QUALITY SYSTEM

7.1 Quality Policy Statement

The Quality Policy statement gives employees clear requirements for the production of analytical data. As an organization, all personnel are committed to high quality professional practice, testing and data, and service to our clients.

We strive to provide the highest quality data achievable by:

- Reading and understanding all of the quality documents applicable to each position and implementing the process in our work.
- Following all recordkeeping requirements; describing clearly and accurately all activities performed; recording "real time" as the task is carried out; understanding that it is never acceptable to "back date" entries and should additional information be required at a later date, the actual date and by whom the notation is made must be documented.
- Ensuring data integrity through the completeness, consistency, impartiality and accuracy of the data generated. Data is attributable, legible, contemporaneously recorded, original or a true copy, and accurate (ALCOA). This applies to manual paper documentation and electronic records.
- Providing accountability and traceability for each sample analyzed through proper sample handling, labeling, preparation, instrument calibration/qualification/validation, analysis, and reporting; establishing an audit trail that identifies date, time, analyst, instrument used, instrument conditions, quality control samples (where appropriate and/or required by the method), and associated standard material.
- Emphasizing a total quality management process which provides impartiality, accuracy, and strict compliance with agency regulations and client requirements, giving the highest degree of confidence; understanding that meeting the requirements of the next employee in the work flow process is just as important as meeting the needs of the external client.
- Providing thorough documentation and explanation to qualify reported data that may not meet all requirements and specifications, but is still of use to the client; understanding this occurs only after discussion with the client on the data limitations and acceptability of this approach.
- Responding immediately to indications of questionable data, out-of-specification occurrences, equipment malfunctions, and other types of laboratory problems, with investigation and applicable corrective action; documenting these activities completely, including the reasons for the decisions made.
- Providing a work environment that ensures accessibility to all levels of management and encourages questions and expression of concerns on quality issues to management. Eurofins recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff
- Continually improving systems and managing risk to support quality improvement efforts in laboratory, administrative and managerial activities

7.2 Ethics and Data Integrity

Eurofins Environment Testing America is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The laboratory operates our Ethics and Data Integrity program under the guidance of Eurofin's Key Guidance Document (KGD). The elements of the our program include:

- An Ethics Policy (NDSC Document No. CW-L-P-004) and Employee Ethics Statements.

- Ethics and Compliance Officer/s (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (NDSC Document No. CW-L-S-002).
- Procedures and guidance for re-issuing data if necessary (NDSC Document No. CW-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 17).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the ethical and quality standards of our industry.
- Provide procedures and guidance to ensure the impartiality and confidentiality of all data and customer information.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

7.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance (QA) Manual – The QA Manual defines the overall policies, organization objectives, and functional responsibilities for achieving the laboratory's QA Program.
- NDSC Official Documents – Each laboratory may use the Guidance (instructional use) documents at their discretion. Template documents are process documents that the laboratories need to implement locally by using the document as is or as an outline to define their internal practices that meet the minimum requirements of the template. Required documents need to be implemented as is and listed in the laboratory's document control list.
- Key Guidance Documents (KGDs) - Documents compiled at the Group Service Centre (GSC) level by Functional Leaders (document owners) aimed at providing specific Eurofins groups of employees with guidelines necessary for the good conduct of their respective work.
- Laboratory SOPs and Policies – General and Technical
- Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).

7.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- NDSC Guidance Documents
- KGDs

- Laboratory Quality Assurance Manual (QA Manual)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where one of these documents conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QA Manual shall take precedence in those cases.

7.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) is responsible for developing planned activities whose purpose is to provide assurance to all levels of management that a quality program is in place within the laboratory, and that it is functioning in an effective manner that is consistent with the requirements of NELAP and ISO/IEC 17025, and any other regulatory agencies (i.e., states) in which the laboratory maintains accreditation.

Quality Control (QC) is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. The client is responsible for developing the QAPP; however, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity, and sensitivity (PARCCSS). Each laboratory SOP defines the required QC indicators.

7.4.1 Precision

The objective is to meet the performance for precision demonstrated for the methods on similar samples and to meet DQOs of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

7.4.2 Accuracy

The objective is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet DQOs of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the

use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

7.4.3 Representativeness

The objective is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. Refer to laboratory SOPs for subsampling and homogenization techniques appropriate to the analytical method.

7.4.4 Comparability

The objective is to provide analytical data for which the accuracy, precision, representativeness, and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

Comparability is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision, and reporting limits with those of other laboratories.

7.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope, or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

7.4.6 Selectivity

Selectivity is defined as the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), and specific electrodes (separation and identification).

7.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (above the Method Detection Limit) or quantified (above the Reporting Limit).

7.5 Criteria for Quality Indicators

The laboratory maintains tables, housed in LIMS, that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated, and is managed by the laboratory's QA department.

Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 26.

7.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs. The laboratory routinely utilize statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts use the current limits entered into LIMS. The QA department maintains an archive of all limits used within the laboratory. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the laboratory develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 26. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

7.6.1 QC Charts

The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file.

7.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 18). These metrics are used to drive continuous improvement in the laboratory's Quality System.

8.0 DOCUMENT CONTROL

8.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance (QA) Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- NDSC Documents[1]
- KGDs[1]

[1]Includes locally implemented documents that are document controlled within the laboratory's document control system. The NDSC and/or KGD documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving NDSC Official Documents is found in Document No. CW-Q-S-001, *NDSC Document Control and Archiving*.

The laboratory's QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data, and final reports.

8.2 Document Approval and Issue

The pertinent elements of the document control system include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number, and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a responsible manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains that document as the official document on file. That document is then provided to all applicable operational units. Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.
Quality System policies and procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants.

8.3 Procedures for Document Control Policy

Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA Department. Electronic copies are stored on the Public server in the QA folder for the applicable revision.

Forms, worksheets, work instructions, and other pertinent information are organized by the QA Department.

8.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived.

9.0 SERVICE TO THE CLIENT

9.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily fit into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals, and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements.

Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another Eurofins facility on the same LIMS or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 10 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or Eurofins are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.
The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

9.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in NDSC Document No. CA-L-P-002**,** *Contract Compliance Policy*.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- Laboratory Project Manager
- Laboratory Directors and/or Technical Managers
- Account Executives
- Quality Managers
- Laboratory Environmental Health and Safety Managers/Directors

The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive, or Proposal Coordinator then submits the final proposal to the client.
In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

9.3 Balancing Laboratory Capacity and Workload

Evaluating laboratory capacity to perform specific projects is the responsibility of the BUMa, Laboratory Directors and Managers, and the Client Services Director. Many analysts are cross-trained to perform a variety of tests, and there is redundant equipment available in case of malfunctions. This minimizes the need to evaluate small and medium size projects against capacity available to complete them. Large and complex projects are reviewed against capacity estimates before bids are submitted to ensure that the client's analysis schedule is met. Meetings are held between laboratory management, PMs, Client Services, and QA personnel to review progress with current projects, as well as special requirements of new work scheduled for the laboratory. Laboratory capacity and backlog is tracked on a continuous basis using information from the Laboratory Sample Information System (LIMS) including turnaround time, and work in-house.

9.4 Documentation

The Contracts Department maintains copies of all signed contracts.

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

9.4.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA Department involvement may be needed to assist in the evaluation of custom QC requirements.

PMs are the primary client contact. They ensure resources are available to meet project requirements, and they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new project information to maximize production and client satisfaction, while maintaining quality. Project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

Any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document (e.g., letter, e-mail, variance, contract addendum), which has been signed by both parties.

Such changes are also communicated to the laboratory. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

9.5 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 17 and 25).

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assisting client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

When the client requests a statement of conformity to a specification or standard based on the analysis performed by the laboratory (e.g., pass/fail, in-tolerance/out-of-tolerance), the decision rule shall be clearly defined. Unless inherent in the requested specification or standard, the decision rule selected shall be communicated to the client. Associated reporting requirements are addressed in Section 25.2.18.

9.6 Client Communication

PMs are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers are available to discuss any technical questions or concerns that the client may have.

9.7 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

9.8 Client Feedback and Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. Eurofins Sales and Marketing teams periodically develop lab and client specific surveys to assess client satisfaction. Client satisfaction surveys are sent periodically.

When a complaint is received, we determine, to the best of our ability, the extent of the issue and what data is in question. The person receiving the complaint documents this information and promptly forwards it to the appropriate management personnel where the work in question was performed. If a data reporting error is discovered, the final report and/or data must be regenerated with the correct value(s).

The QA Department is responsible for entering client concerns into ICAT to address and document the situation. While an individual issue may not warrant a formal investigation, QA monitors these issues for potential trends and will issue a CAR if a trend is evident.

10.0 SUBCONTRACTING OF TESTS

The laboratory may subcontract tests to other laboratories if the requested testing is not routinely performed in our laboratory. To a lesser extent, samples may need to be subcontracted to an overflow laboratory to ensure hold times and/or turn-around-times (TAT) are met.

Testing is only subcontracted with the client's knowledge and approval. The laboratory must notify the client in writing when any of their requested analyses will be subcontracted to another lab. Client approval must be obtained in writing before samples are shipped.

Subcontract laboratories are selected based on their qualifications and accreditations. The subcontractor is requested to sign a Laboratory Analytical Services Subcontract. If projects require a specific agency certification (i.e. individual state agencies, NELAP, ISO 17025), only an appropriately accredited laboratory is used. The client may also have a list of laboratories to be used for subcontracting. In these cases, the evaluation of the subcontract laboratory is made by the client.

Data obtained from subcontract laboratories is clearly marked as such when reported by the laboratory. The data are submitted to the client in the format obtained from the subcontractor.

10.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the Eurofins Xenco laboratories and LIMS system (i.e., TALS). The phrase "work sharing" refers to internal transfers of samples between the Eurofins Xenco laboratories and any Eurofins laboratories on TALS. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity, or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to the NDSC Documents on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

PMs or other responsible Client Service members, for the export lab (i.e., the Eurofins Xenco laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be obtained and retained in the project folder. Standard Terms & Conditions include the flexibility to

subcontract samples within the Eurofins Xenco laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts require notification prior to placing such work.

10.2 Qualifying and Monitoring Subcontractors

Whenever a PM becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.
- Subcontractors reviewed by Eurofins Xenco – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

All Eurofins Xenco laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations and can adhere to the project/program requirements. Client approval is not necessary unless specifically required by the contract. In these cases, the client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (NDSC Document No. CA-C-S-001, *Work Sharing Process*).

10.2.1 When the potential subcontract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory. Refer to the NDSC Document No. CW-L-S-004, *Subcontracting Procedures*.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability. The documents are reviewed for completeness, and the information is forwarded to the Finance Department for formal signature and contracting with the laboratory.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. Eurofins Xenco does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

10.3 Oversight and Reporting

The status and performance of qualified subcontractors will be monitored and includes an annual review process. Any problems identified will be brought to the attention of the appropriate personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation, and

corrective action will be maintained in the subcontractor's file.

- Information shall be updated when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on Approved Subcontractor Listing.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it is current and scope-inclusive. The information is documented within the project records.

The laboratory's certifications can be viewed on the company's website.

10.3.1 All subcontracted samples must be accompanied by a Eurofins Xenco Chain of Custody (COC). A copy of the original COC sent by the client must be available in LIMS for all samples workshared within Eurofins Xenco. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratory's EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a Eurofins Xenco work sharing laboratory may be transferred electronically and the results reported by the Eurofins Xenco work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

10.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs. This decision and justification must be documented in the project files.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract agreement with Eurofins Xenco at this time.

10.5 Use of NELAP and A2LA Logo

It is not laboratory policy to use these logos on any company letterhead, including analytical reports.

11.0 PURCHASING SERVICES AND SUPPLIES

11.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Request for Proposals (RFPs) will be issued where more information is required from the potential vendors than just price. RFPs allow the laboratory to determine if a vendor is capable of meeting requirements such as supplying all of the laboratory facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

11.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

11.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are evaluated by reviewing the vendor's certificate of analysis (COA). A master list of the certificates of analysis for the materials is stored electronically and is available to employees.

11.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

11.3.2 Receiving

Once the ordered reagents or materials are received, the information on the label or packaging is compared to the original order to ensure that the purchase meets the quality level specified. This is documented through the addition of the received date and initials to the information present on the order log.

Lot numbers of received solvents and acids are verified against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is

acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared "public" folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) are available online via the intranet site. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

11.3.3 Specifications

Methods used in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method.

Chemicals/solvents should not be used past the manufacturer's or SOP expiration date unless verified as outlined below.

- An expiration date cannot be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded. In this case, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained on-file and available for review.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of samples, standards or reagents must have a specific conductivity of less than 1-µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at

25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified clean by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained on file. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

11.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the NDSC Environmental Health & Safety Manual, Document No. CW-E-M-001, the local laboratory EH&S manual addendum, and method SOPs or manufacturer instructions.

11.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Manager and/or the Laboratory Director. If they agree with the request, the procedures outlined in NDSC Document No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 20). For software, its operation must be deemed reliable and evidence of instrument verification must be retained. Software certificates supplied by the vendors are filed. The manufacturer's operation manual is retained.

11.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 22. The need for service is determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the laboratory.

Analytical balances are serviced and calibrated annually. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. Calibration certificates are filed for reference. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc., are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

11.6 Suppliers

The laboratory selects vendors through a competitive proposal / bid process, strategic business alliances, or negotiated vendor partnerships (contracts).

This process is defined in the NDSC Document No. CW-F-P-004, *Procurement & Contracts Policy*. The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on the laboratory's business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Purchasing Group.

The Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

Suppliers are subject to re-evaluation, as deemed appropriate, to determine corrective action necessary, or service improvements required by vendors.

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the purchasing system.

11.6.1 New Vendor Procedure

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with laboratory employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or Technical Management are consulted with vendor and product selection that have an impact on quality.

12.0 COMPLAINTS

12.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures client knowledge that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 14 (Corrective Actions) and is documented. A copy of this procedure will be made available to any interested party on request.

12.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and documenting complaints
- Acknowledging receipt of complaint, whenever possible
- Complaint investigation and service recovery
- Process improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

12.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 14. In addition, Executive Management, may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 14.

12.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the Laboratory Director and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Systems Review (Section 18).

13.0 CONTROL OF NON-CONFORMING WORK

13.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 14).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratory's corrective action system described in Section 14. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 21. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Manager and QA Manager, and fully documented.

13.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Technical Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the BUMa, Laboratory Director, Operations Manager, QA Manager, and the Technical Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an ECO (e.g., the VP-QA/EHS) and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The BUMa, Laboratory Director, QA Manager, ECOs, and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

13.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

NDSC Document No. CW-Q-S-005 is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

The NDSC Document entitled *Internal Investigations* (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in NDSC Document No. CW-Q-S-005.

13.4 Prevention of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

13.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target analyte which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 13.2, Paragraph 5.
Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 14 if one has not

already been started. A copy of any meeting notes and agreed upon steps should be e-mailed by the laboratory to their Quality Director. This e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc.). Clients will not generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, or determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (e.g., Laboratory Director, Technical Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete.

14.0 CORRECTIVE ACTION

14.1 Overview

A major component of the laboratory's (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. The laboratory employs two systems to manage non-conformances. Issues suspected of being systematic in nature and for which root cause analysis and a formal Corrective Action Report (CAR) are documented in the Incident Corrective Action Tracking (ICAT) database. Routine batch non-conformances, events that are understood to be isolated in nature, are documented in the LIMS non-conformance memo (NCM) system.

14.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

14.2.1 Non-Conformance Memo (NCM)

NCMs are used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips (Forms of documentation other than NCMs in LIMS are also acceptable)

14.2.2 Corrective Actions Documented In the ICAT Database include:

- Internal and external audit findings
- Failed or unacceptable PT results
- Identified poor process or method performance trends
- Systematic reporting / calculation errors
- Data recall investigations
- Questionable trends that are found in the review of NCMs.
- Client complaints
- Excessive revised reports

The ICAT database is used to document background information, track the results of corrective action investigations and root cause analysis, and to provide reports of corrective action plans.

14.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

14.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An entry into the ICAT system must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

14.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The ICAT record is used for this documentation.

14.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. NDSC Document No. CA-Q-S-009, *Root Cause Analysis*, provides guidance on this procedure.

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the root cause data from these incidents to identify root causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed and continue to plague the laboratory or operation.

14.3.4 Monitoring of the Corrective Actions

The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.

Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.

The QA Manager reviews monthly NCM and ICAT records for trends. Highlights are included in the QA monthly report (refer to Section 18). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.

Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the NDSC Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

14.3.5 Follow-up Audits

Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.

These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 17.1.4, Special Audits.)

14.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 13). The documentation of these procedures is through the use of an NCM or record in the ICAT system.

Table 14-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs.

Table 14-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in method SOPs, Work Instructions, and QA Manual Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager, and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the PM is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

14.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original uncorrected file must be maintained intact and a second, corrected file is created. This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated. When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Table 14-1. Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Instrument Blank *(Analyst)*	- Criteria in analytical SOP	- Prepare and analyze another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst)*	- Criteria in analytical SOP	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Initial Calibration Verification (Second Source ICV) *(Analyst)*	- Criteria within analytical SOP	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Verification (CCV) *(Analyst)*	- Criteria within analytical SOP	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst)*	- Criteria in LIMS MLGs	- If matrix interferences are present, evaluate the LCS. - If the LCS is within acceptable limits the batch is acceptable.
Laboratory Control Sample (LCS) *(Analyst)*	- Criteria in LIMS MLGs and SOP SA-QA-017	- Reanalyze LCS. - Batch must be re-prepared and/or re-analyzed.
Surrogates *(Analyst)*	- Criteria in LIMS MLGs	- Individual sample must be repeated, unless obvious matrix interference is noted.
Method Blank *(Analyst)*	<1/2RL	- Reanalyze blank. - Determine source of contamination. - Re-prepare/re-analyze batch.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager)*	- Criteria supplied by PT Supplier	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Client Complaints *(Project Managers, Lab Director, QA Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (QA Manager, Lab Director, Managers, *Technical Manager*)	- QAM, SOPs	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (EHS Officer, Lab Director, Managers, *Technical Manager*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

15.0 PREVENTIVE ACTION / IMPROVEMENT

15.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its QA Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:
- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, NDSC QA Team, and Executive Management. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lessons Learned, Technical Services audit report, Technical Best Practices, or as Executive or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

15.1.1 The following elements are part of a preventive action/process improvement system:
- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.

- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/process Improvement is incorporated into the monthly QA reports, corrective action process and management review.

15.1.2 Any preventive actions/process improvement undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

15.2 Management of Change

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: facility changes, major accreditation changes, addition or deletion to capabilities or instrumentation, key personnel changes, laboratory information management system (LIMS) changes. This process is discussed in further detail within the laboratory's SOPs.

16.0 CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.

16.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. More detailed information on retention of specific records is provided in NDSC Document Nos. CW-L-P-001, *Records Retention Policy* and CW-L-WI-001, *Records Retention/Storage Schedule*. Quality and technical records are maintained by the QA department and are backed up as part of the regular laboratory backup. Records are of two types: either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats).

Table 16-1. Record Index

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	- 5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Published Methods	- Indefinitely
QA Records	- Certifications - Method & Software Validation/Verification Data	- Indefinitely
QA Records	- Internal & External Audits/Responses - Corrective/Preventive Actions - Management Reviews - Data Investigation	- 5 Years from archival* - **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP & SAP - Lab Reports	- 5 Years from analytical report issue*
Administrative Records	Financial and Business Operations	Refer to CW-L-WI-001
	EH&S Manual and Permits	Indefinitely
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies	Indefinitely
	Technical Training Records	7 years
	Legal Records	Indefinitely
	HR Records	Refer to CW-L-WI-001
	IT Records	Refer to CW-L-WI-001
	Corporate Governance Records	Refer to CW-L-WI-001
	Sales & Marketing	5 years
	Real Estate	Indefinitely

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 16-2.

16.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log. Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Logs are maintained to note removal and return of records. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as NDSC and/or KGD Documents, QA, or administrative records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 16-2 have lengthier retention requirements and are subject to the requirements in Section 16.1.3.

16.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 16-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 16-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (lab reports and raw data) 10 years - Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
Ohio VAP	10 years and State contacted prior to disposal
OSHA	30 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

16.2.1 The laboratory has procedures to protect and back up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.15.1 for more information.

16.2.2 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.
- All information relating to the laboratory facilities' equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.
- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method. A copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench

sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.
- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.
- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.
- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned.
- Also refer to Section 19.15.1 ‘Computer and Electronic Data Related Requirements’**.**

16.3 Technical and Analytical Records

16.3.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for performance of each analysis and reviewing results.

16.3.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

16.3.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- Laboratory sample ID code;
- Date of analysis; time of analysis is also required if the holding time is 72 hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanups, volumes, weights, and reagents**;**
- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**

- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in LIMS and on specific analytical report formats**.**

16.3.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a periodic, documented supervisory or peer review.

16.4 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

16.4.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

16.5 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 16-1.

16.6 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hardcopy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued as needed, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Records are considered archived when noted as such in the records management system.

16.6.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of NDSC. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

16.6.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

17.0 AUDITS

17.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and, when requested, to Executive Management.

Audits are conducted and documented as described in the NDSC SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 17-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 17-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or NDSC QA	All areas of the laboratory annually
Method Audits / QA Technical Audits	Joint Responsibility: a) QA Manager or designee, b) Technical Manager or designee (Refer to SOP CW-Q-S-003)	QA Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint Responsibility: a) QA Manager or designee, b) Technical Manager or designee (Refer to SOP CW-Q-S-003)	SOP Compliance Review Frequency: - Every 2 years (non-DoD SOPs) Every year (Drinking Water SOPs) - 100% of SOPs annually (DoD/DOE SOPs)
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Proficiency Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

17.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, Eurofins Data Integrity and Ethics Policies (see Sec. 7.2), TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness and sustainability. The audit is divided into sections for each operating or support area of the lab, and each section

is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

17.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

17.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. (Annually for methods and administrative SOPs related to DW compliance methods.) It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

17.1.4 Special Audits
Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

17.1.5 Proficiency Testing

Single blind proficiency tests are employed for several reasons. One purpose is to provide corrective action for parameters judged to be unacceptable on external or internal proficiency tests. Periodic internal proficiency tests are also used to test parameters that are not routinely tested by external proficiency tests. Finally, single blind proficiency tests are employed to satisfy certain certification requirements, to satisfy auditors' specific requests for proficiency tests samples, or to provide additional evidence of data quality to clients with specific questions regarding laboratory performance.

The laboratory participates semi-annually in proficiency tests conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Non-Potable Water, and Soil.

These PT studies are performed approximately six months apart. The first study of the year is usually performed in January, and the second study is usually performed in July. The PT results are submitted to certification agencies directly from the PT Provider. Remedial PT studies can be performed, as required, for any analytes scored as unacceptable. Root cause

investigation into any unacceptable results must be initiated. Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

It is Eurofins policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written investigations for unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

Note: Proficiency tests can also be referred to as performance tests.

17.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is Eurofins policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response. Audit responses are due in the time allotted by the client or agency performing the audit.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

17.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 and 2016 TNI standards.

17.3 Audit Findings

Audit findings are documented using the corrective action process and database (see Section 14). The laboratory's corrective action responses may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24 hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

18.0 MANAGEMENT REVIEWS

18.1 Quality Assurance Report

The QA Department is responsible for preparing a comprehensive monthly metrics report to Management to keep them apprised of current quality issues. This report fosters communication, review, and refinement of the QA system to evaluate the suitability of policies and procedures to meet both regulatory and laboratory quality objectives.

The NDSC QA team compiles information from all of the Environment Testing laboratories monthly metrics reports for the Executive Management team. This report includes notable information and concerns regarding the laboratories' QA program and a listing of new regulations that may potentially impact the laboratories.

18.2 Annual Management Review

The senior management team conducts a review annually of its quality systems to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. NDSC personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to IT.

This management systems review (NDSC Document No. CW-Q-S-004 and Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.
- Evaluation of overall risk, including risks to impartiality, confidentiality, reporting statements of conformity, and nonconforming work.

A report is generated by the QA Manager and management. The report is distributed to the Laboratory Director, BUMa, and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review (e.g., an implementation schedule including assigned responsibilities for the changes).

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

18.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. The NDSC Document No. CW-L-S-002, Internal Investigations shall be followed. All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

The Eurofins Environment Testing America Presidents, Business Unit Managers, Laboratory Directors, and NDSC QA Team are informed of any current data integrity or data investigations via the monthly metrics report.

19.0 TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to NDSC Document No. CW-Q-S-002, *Writing a Standard Operating Procedure*.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the PM. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data. Refer to Appendix 6 for a list of the currently accepted USEPA analytical method references used by the laboratory.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.1.1 Client Supplied Methods

Most of the client-supplied method requirements presented to us involve achieving specific quality control criteria, limits of quantitation (LOQ), and/or method detection limits (MDL) using standard EPA methods. These requirements are communicated to the appropriate technical groups prior to the project start up. Each technical group evaluates the scope of work and the requirements to ensure the criteria can be met using the standard EPA method. The data is monitored to ensure the criteria are met throughout the project. The PM notifies the client if there is a more appropriate method available or if the client's criteria cannot be achieved on a certain sample matrix (i.e., due to matrix or dilutions).

Occasionally, we are asked to transfer a non-standardized method from a client into our lab or to develop a new method, when one is not available. In the case of a method transfer, we set

up the client's method and perform some initial evaluation. After the initial evaluation, we may make recommendations on how to improve method performance. If the method appears to be adequate, we determine linearity, specificity, precision, accuracy, MDL, and LOQ by performing calibrations, analyzing method blanks, and carrying out method detection limit and IDOC studies.

In the case of method development, we work with the client and/or data user to determine the level of validation required ensuring that the method meets its intended purpose. In addition to the elements above, we also determine standard and sample stability and robustness depending on the scope of the project. Typically, a standard operating procedure is written and submitted to the client with the results of the validation. These steps are completed prior to analysis of field samples. Data related to the setup of the method are archived.

19.4.1.2 Procedural Deviations

Analysts are required to follow a documented method for all tests performed; and any deviations from analytical methods must be documented, approved, and justified in an appropriate and consistent manner. We classify method deviations as either being a planned deviation or an unplanned deviation. In general, the following information is captured to document both types of situations:

- Description of the situation
- Reason or justification for the deviation
- Impact the deviation had on the testing
- Signature/date of analyst performing the test
- Signature/date of QA and Laboratory management approving the deviation
- Signature/date of client approval, if necessary

Deviations to written procedures are documented in raw data records or through the ICAT system. Both types of documentation require management and QA review and approval.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst has not performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All

associated documentation must be retained in accordance with the laboratory's archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (e.g., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

IDOCs are used as an initial assessment of analyst competency and must be performed prior to the analyst working unsupervised. Typically four laboratory QC samples spiked with all target analytes are used as the IDOC. Using the results of the four analyses, the average recovery and standard deviation for each parameter of interest is calculated. The resulting accuracy and precision is compared to the corresponding method limits, if available, or, if method acceptance limits are not specified, against current laboratory-generated acceptance limits.

If the average recovery and standard deviation for all parameters meet the acceptance criteria, the unsupervised analysis of actual client samples may begin. If any one of the parameters falls outside the acceptance range, the performance is unacceptable and the analysis must be repeated for that parameter until the analyst is able to *independently* demonstrate acceptable performance on another set of QC sample analyses.

IDOC documentation is maintained by the QA Department in the employee's training file, and must include the following information:

- Analyst(s) involved in preparation and/or analysis;
- Matrix;
- Analyte(s), class of analyte(s), or measured parameter(s)
- Identification of method(s) performed;
- Identification of laboratory-specific SOP used for analysis, including revision number
- Analysis date(s)

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods
While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

When changes are made to any validated methods, the influence of such changes shall be documented and, if appropriate, a new validation shall be performed.

19.6.1.1 Determination of Method Selectivity – Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity – Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Detection limit studies are conducted as described in Section 19.7. Where other protocols for estimations and/or demonstrations of sensitivity are required by regulation or client agreement, these shall be followed.
19.6.1.3 Relationship of Limit of Detection (LOD) to the Limit of Quantitation (LOQ) – An important characteristic of expression of sensitivity is the distinction between the LOD and the LOQ. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The LOQ is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias, equivalent to the laboratory's routine reporting limit (RL). For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the LOQ. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the LOQ, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be

reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences – A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range – Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision – Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method – The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance – Continued demonstration of method performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limit (MDL) / Limits of Detection (LOD)

The MDL is the minimum measured quantity of a substance that can be reported with 99% confidence that the concentration is distinguishable from method blank results, consistent with 40CFR Part 136 Appendix B, August, 2017. The MDL is equivalent to the TNI LOD or DL, and is also equivalent to the DoD/DOE Quality Systems Manual (QSM) DL. The working or final MDL is the higher of the MDL value determined from spikes (MDLs) and the MDL value determined from blanks (MDLb). An initial MDL study shall be performed during the method validation process and when the method is altered in a way that can reasonably be expected to change its sensitivity. On-going data are collected during each quarter in which samples are being analyzed. At least once every 13 months the MDLs and MDLb are re-calculated and re-evaluated using data collected during the preceding period. Details of the laboratory's procedure for conducting MDL studies are given in NDSC Document No. CA-Q-S-006.

19.8 Verification of Detection Limits

If it is found during the re-evaluation of detection limit results that more than 5% of the spiked samples do not return positive numeric results that meet all method qualitative identification criteria, then then spiking level shall be increased and the initial MDL study pre-performed at the new spiking concentration.

19.9 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDL or in some cases required by the analytical method or program requirements. IDLs are most commonly used in metals analyses but may be useful in demonstration of instrument performance in other areas. IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3x the absolute value of the standard deviation.

19.10 Limit of Quantitation

The LOQ shall be at a concentration equivalent to the lowest calibration standard concentration, with the exception of methods using a single-point calibration, and shall be greater than the MDL. The LOQ is verified by preparing and analyzing spikes at concentrations 1-2x the selected LOQ, employing the complete analytical process.

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit or by a DL check samples at or below the LOQ. The LOQ is verified annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.11 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specified in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept on-file and available for review. Complete details are available in the laboratory SOPs.

19.12 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, and chromatography retention time windows.

19.13 Estimation of Uncertainty of Measurement

19.13.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty" defined as the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.13.2 Uncertainty is not error. Error is a single value (i.e., the difference between the true result and the measured result). On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.13.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.13.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 +/- 0.5 mg/L.

19.13.5 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., EPA 524.2, EPA 525.2, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.14 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.
- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.
- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.
- Due to the potential for increased variability, reanalysis may not be applicable to non-homogenous, Encore, and sodium bisulfate preserved samples. See the Area Supervisor or Laboratory Director if unsure.

19.15 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.15.1 Computer and Electronic Data Related Requirements
The three basic objectives of our computer security procedures and policies are shown below. The laboratory is currently using the Eurofins LIMS system, which has been highly customized to meet the needs of the laboratory.

19.15.1.1 Maintain the Database Integrity – Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, documentation of system failures and corrective actions taken, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.15.1.2 Ensure Information Availability – Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.15.1.3 Maintain Confidentiality – Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.15.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged using NDSC Document No. CA-Q-S-002, *Acceptable Manual Integration Practices,* as the guideline.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff.

Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.15.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.15.2.2 In general, concentration results are reported in milligrams per liter (mg/L) or micrograms per liter (ug/L) for liquids and milligrams per kilogram (mg/Kg) or micrograms per kilogram (ug/Kg) for solids. For values greater than 10000mg/L, results can be reported in percent, i.e., 10000mg/L = 1**%.** Units are defined in each lab SOP.

19.15.2.3 If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures, where applicable. In general, results are reported to 2 significant figures on the final report.

19.15.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a formatter for significant figure criterion for each analyte.

19.15.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS, electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds.

19.15.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out ‘real time’ and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 14.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be “Z”-ed out, signed, and dated.
- Worksheets are created with the approval of the Technical Manager/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.15.4 Review / Verification Procedures

Review procedures are outlined in several SOPs to ensure that reported data are free from calculation and transcription errors, and that QC parameters have been reviewed and evaluated before data is reported. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.15.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.15.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.15.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.
Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.15.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.15.4.5 The results are then entered or directly transferred into the computer database and a pdf is printed for the client.

19.15.4.6 A check that can be performed prior to the release of the report, is a review of the results by the Project Manager for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that the COC is followed, narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships, such as the following:

- Total Results are > Dissolved results (e.g. metals)

- Total Solids (TS) > Total Dissolved Solids (TDS) or Total Suspended Solids (TSS)
- TKN > Ammonia
- Total Phosphorus > Orthophosphate
- COD > TOC
- Total Cyanide > Amenable Cyanide
- TDS > individual anions

19.15.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report.

19.15.4.8 A brief overview of sample flow through the laboratory, as well as data review and validation, is presented in Figure 19-1.

19.15.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using NDSC Document No. CA-Q-S-002, *Acceptable Manual Integration Practices.*

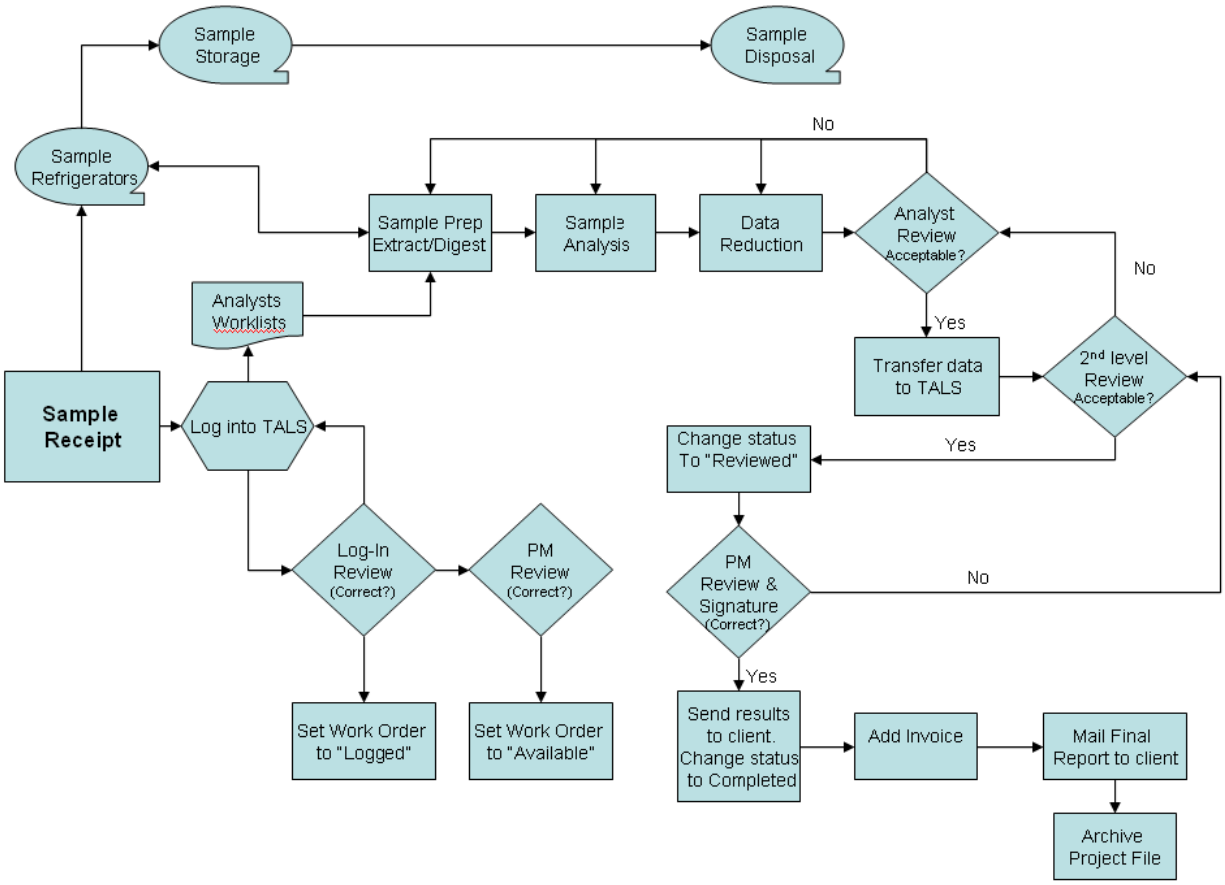
19.15.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.15.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.15.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.15.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on expanded scale “before” and “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented NDSC approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example – Work Flow



20.0 EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of available laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Scheduled routine maintenance is defined in each method SOP. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures are also outlined in analytical SOPs or instrument manuals. (Note: For some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed.

If an instrument requires repair (subjected to overloading or mishandling), gives suspect results, or otherwise has shown to be defective or outside of specified limits it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back-up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters used in the laboratory are capable or measuring conductivity with an error not exceeding 1% or one umhos/cm, whichever is greater. The meters are also calibrated before each use with a known standard.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH, Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

For laboratories performing drinking water analysis, IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4°C) and frozen (0°C to -5°C), per the Drinking Water Manual.

The NIST thermometer is recalibrated at least every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks or batch sheets.

20.3.4 Refrigerators/Freezer Units, Water baths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, water baths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.
Specific temperature settings/ranges for other refrigerators, ovens, water baths, and incubators can be found in method specific SOPs.

All of this information is documented in daily temperature logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

For those dispensers that are not used for measurements, a label shall be applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements.

20.3.6 Autoclaves

The performance of each autoclave shall be initially evaluated by establishing its functional properties and performance, for example heat distribution characteristics with respect to typical uses. Autoclaves shall meet specified temperature tolerances. Pressure cookers shall not be used for sterilization of growth media.

Demonstration of sterilization temperature shall be provided by use of continuous temperature recording device or by use of a maximum registering thermometer with every cycle. Appropriate biological indicators shall be used every run to determine effective sterilization. Temperature sensitive tape shall be used with contents of each autoclave run to indicate that the autoclave contents have been processed.

Records of autoclave operations shall be maintained for every cycle. Records shall include: date, contents, maximum temperature reached, time in sterilization mode, total run time (may be recorded as time in and time out) and analyst's initials.

Autoclave maintenance, by service contract, shall be performed annually or shall include a pressure check and calibration of temperature device. Records of the maintenance shall be maintained in equipment logs.

The autoclave mechanical timing device shall be checked monthly against a stopwatch and the actual time elapsed documented.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method,

instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, and type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 14).
Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.
The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules are ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 and 2016 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification (ICV) is with a

standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications (CCV) may use the same source standards as the calibration curve.
Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 and 2016 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.
Note: If an internal standard calibration is being used then bracketing calibration verification standards may not be are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).
Generally, the calibrations must be verified by an ICV analyzed immediately following initial calibration and before sample analysis. The ICV may be used as the first bracketing CCV, if criteria for both are met.

A continuing instrument calibration verification (CCV) is generally analyzed at the beginning of each 12-hour analytical shift during which samples are analyzed. The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12-hours of the beginning of the shift. For methods that have quantitation by external calibration models, a CCV is analyzed at the end of each analytical sequence. Some methods have more frequent CCV requirements. See specific SOPs. Most inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (e.g., GCMS) then bracketing standards are not required, only daily verifications are needed, except as specified by program or method requirements.

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed and documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable and reported based upon discussion and approval of the client under the following special conditions:

a) when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported case narrative comment explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b) when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.
Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.
Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.
- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

20.5 <u>Tentatively Identified Compounds (TICs) – GC/MS Analysis</u>

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or

narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

20.6 GC/MS Tuning

Prior to any GC/MS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.
Prior to tuning/auto-tuning the mass spectrometer, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally do not need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

21.0 MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperation – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia–Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique reagent ID and expiration date. All

documentation received with the reference standard is retained as a QC record and references the reagent ID.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the true value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory's Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company-wide purchase. Refer to NDSC Document No. CA-Q-S-001, *Solvent and Acid Lot Testing and Approval*.

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained electronically. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, refer to method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS, and are assigned a unique

identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst.

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended storage conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

22.0 SAMPLING

22.1 Overview

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory.

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in days (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in hours (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

23.0 HANDLING OF SAMPLES

It is the responsibility of the client to send us representative and/or homogeneous and properly preserved samples of the system from which they are drawn. The laboratory assumes that all multiple sample containers with the same designator/description and bottle type contain a homogeneous, representative sample.

The laboratory provides the appropriate sample containers, required preservative, chain-of-custody (COC) forms, shipping containers, labels, and custody seals. The laboratory also provides trip blanks and analyte-free water for field blanks. Preparation of methanol containers for field preservation of volatile soil samples is available.
Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible. This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to the laboratory personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a laboratory courier. When sampling personnel deliver the samples through a common carrier (FedEx, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by the laboratory when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal retain the shipping record with the COC, and initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on the Sample Receipt Checklist in LIMS and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

Sample Registration personnel can check and document preservation of non-volatile liquid samples after the samples have been entered into the LIMS and before they are released to the laboratory for testing or placed into storage. Preservation checks of non-volatile liquid samples can also be done at the bench level before analysis. Any checks of volatile samples and samples for oil and grease are performed and documented at the time of analysis.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-1) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers, or protected locations suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed at least every two weeks.
Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of Eurofins.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. If any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, the sample itself is clearly marked, stamped on the sample label reading “HAZARDOUS” and placed in a marked bag to easily identify the sample. All hazardous samples are either returned to the client or disposed of appropriately through a

hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory.

Upon receipt, foreign soil samples are marked as such prior to distributing to the analytical departments. Once the sample is received by the department, it is stored in a segregated area away from other samples. Non-hazardous foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility. RCRA hazardous foreign soil samples are heat treated at the laboratory. After heat treatment, normal disposal procedures are followed. Refer to the Environmental Health and Safety Manual Addendum for additional information on disposal of hazardous samples. If not classified as hazardous, foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a Eurofins courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The laboratory's Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures. All procedures in the laboratory's Environmental Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1. Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax, or e-mail ASAP after the receipt of the samples.

1) Samples must arrive in good condition with a Chain-of-Custody (COC) filled out completely and legibly. The following information must be captured:
   - Client name, address, and phone number
   - Project name and/or number
   - Sample identification
   - Date, time and location of sampling
   - Sample collector's name
   - Matrix type
   - Container type
   - Total number of each type of container
   - Preservatives used
   - Analysis requested
   - Any special instructions
   - Purchase Order number or billing information (e.g. quote number) if available.
   - Date and time each person received/relinquished the sample(s), including signed name.
   - Date and time of receipt between last person to relinquish samples and person who receives the samples in the lab.

The project manager will be notified if any sample is received in damaged condition.

2) Samples must be properly labeled and labels must be legible.
   - Use durable labels (labels provided by the laboratory are preferred)
   - Include a unique identification number
   - Include sampling date and time, and sampler ID
   - Include preservative used.
   - Use indelible ink
   - Information must be legible

3) Samples must be in proper containers with adequate volume for the analysis and any necessary sample-specific QC. Aqueous samples submitted for Volatiles analyses must be submitted without headspace. Samples must be dechlorinated, if needed, and submitted with proper chemical preservation (pH) as required by the analytical test method.

4) Most analytical methods require chilling samples to 4°C. These criteria are met if the samples are chilled to below 6°C and above freezing. Note: Samples hand-delivered to the laboratory immediately after collection are only considered acceptable if there is evidence that the chilling process has begun (i.e., arrival on ice). If sample analysis is begun within fifteen minutes of collection, thermal preservation is not required. Thermal preservation is not required in the field if the laboratory receives and refrigerates the sample within fifteen minutes of collection.

5) Samples must be prepared and analyzed with the holding times defined in the analytical test method.

Other Considerations:

- Chemical preservation (pH) will be verified prior to analysis and documented. The Project Manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- The laboratory will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (i.e., <48 hours) sample must be received with at least 48 hours (2 working days) remaining on the holding time to ensure analysis. Samples analyzed in the laboratory will be qualified on the final report with an 'H' to indicate holding time exceedance.

- Analyses that are designated as field analyses (e.g., Odor, pH, Dissolved Oxygen, and Residual Chlorine) should be analyzed as soon as possible by the field sampler prior to delivering to the lab (i.e., within 15 minutes of collection).

- All samples submitted for Volatiles analyses must have a Trip Blank submitted at the same time. The laboratory will supply a trip blank with the bottle order.

- Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any Eurofins facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

Recommendations for packing samples for shipment:

- Pack samples in ice rather than "blue" ice packs.
- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.
- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.
- Fill extra cooler space with bubble wrap.

24.0 ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include, but are not limited to, homogenization, solvent extraction, acid digestion, and evaporation/concentration. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Negative Controls

Control Type	Details
Method Blank (MB)	Used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	Prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.

Table 24-1. Negative Controls

Control Type	Details
Instrument Blanks	Blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blank [1]	Required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	Sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	Sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Holding Blanks	Referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.3.1 Negative Controls for Microbiological Methods

Microbiological Methods utilize a variety of negative controls throughout the process to ensure that false positive results are not obtained. These controls are critical to the validity of the microbiological analyses. Some of these negative controls are:

Table 24-2 Negative Controls for Microbiology

Control Type	Details
Sterility Checks (Media)	Analyzed for each lot of pre-prepared media, ready-to-use media and for each batch of medium prepared by the laboratory.
Filtration Blanks	Run at the beginning and end for each sterilized filtration unit used in a filtration series. For pre-sterilized single use funnels a sterility check is performed on at least one funnel per lot.
Sterility checks (Sample Containers)	Performed on at least one container per lot of purchased, pre-sterilized containers. If containers are prepared and sterilized by the laboratory, one container per sterilization batch is checked. Container sterility checks are performed using non-selective growth media.
Sterility Checks (Dilution Water)	Performed on each batch of dilution water prepared by the laboratory and on each batch of pre-prepared dilution water. All checks are performed using non-selective growth media.
Sterility Checks (Filters)	Performed on at least one filter from each new lot of membrane filters using non-selective growth media.

Negative culture controls demonstrate that a media does not support the growth of non-target organisms and ensures that there is not an atypical positive reaction from the target organisms. Prior to the first use of the media, each lot of pre-prepared selective media or batch of laboratory prepared selective media is analyzed with at least one known negative culture control as appropriate to the method.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is

spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process, a calibration verification standard is reported as the LCS.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, Toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB Aroclors, AR1016 and AR1260 are used for spiking as they cover the range of all of the Aroclors. Specific Aroclors may be used by request on a project specific basis.

24.4.1.1 Positive Controls for Microbiological Methods

- Each lot of pre-prepared media (including chromofluorogenic reagent) and each batch of laboratory prepared media is tested with a pure culture of known positive reaction.
- In addition, every analytical batch also contains a pure culture of known positive reaction.
- A pure culture of known negative reaction is also tested with each analytical batch to ensure specificity of the procedure.

24.5 Sample Matrix Controls

Table 24.5. Sample Matrix Controls

Control Type	Details	
Matrix Spikes (MS)	Use	Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	Essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.
[2] LCSDs are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS

and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).
- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.
- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.
- The maximum acceptable recovery limit will be 150%.
- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.
- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no effect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for

samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits.

Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.
- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.
- If there are an allowable number of Marginal Exceedances (ME):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken.

Though marginal exceedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, and if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 17).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 11 and 21.
- A discussion on selectivity of the test is included in Section 7.
- Constant and consistent test conditions are discussed in Section 6.
- The laboratories sample acceptance policy is included in Section 23.

25.0 REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 9.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g., Analytical Report)

25.2.2 The cover page shall include the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g., Job ID #) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc.)

25.2.11 Reporting Limit

25.2.12 Method Detection Limits (if requested)

25.2.13 Definition of data qualifiers and reporting acronyms (e.g. ND)

25.2.14 Sample results

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda.)

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory, except when information is provided by the client. When data is provided by the client there shall be a clear identification of it, and a disclaimer shall be put in the report when the client supplied data can affect the validity of the test.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue.

25.2.21 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-Eurofins subcontracted analysis, or any Eurofins analysis for laboratories not currently on TALS, results are provided as a separate report on the official letterhead of the subcontractor. All subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.27 A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the NDSC Document No. CA-I-P-002, *Electronic Reporting and Signature Policy*, for details on internally applying electronic signatures of approval.

25.2.28 Where the laboratory is responsible for the sampling stage, in addition to the requirements listed above, reports containing the results of sampling shall include the following, where necessary for the interpretation of test results:

- the date of sampling;
- unambiguous identification of the material sampled;
- the location of sampling plan and procedures, and deviations, addition to or exclusions from the sample procedures;
- a reference to the sampling plan and procedure, and deviations, additions to or exclusions from the sample procedures;
- details of any environmental conditions during sampling that affect the interpretation of test results;

- information required to evaluate measurement uncertainty for subsequent testing

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level 1 is a report with all of the elements outlined in Section 25.2 above, excluding Section 25.2.15 (QC data).
- Level II is a Level I report plus summary information, including results for the method blank, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in electronic format (see below). Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.4 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of the laboratory's services in addition to the test report as described in Section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. The laboratory offers a variety of EDD formats to accommodate varying client-specific requirements.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.5 Supplemental Information for Test

The laboratory identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as estimated.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

When, as requested by the client and agreed to by the laboratory, the report includes a statement of conformity to specification or standard (see Special Services, Section 7.4), the report shall clearly identify:

- to which results the statement applies,
- which specifications, standard or parts thereof are met or not, and
- the decision rule that was applied (unless the decision rule is inherent in the requested specification or standard, taking into account the level of risk (such as false accept and false reject and statistical assumptions) associated with the decision rule.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requiring responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.6 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the NDSC Document No. CW-L-S-004, *Subcontracting.*

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of Eurofins are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.7 Client Confidentiality

The laboratory will ensure the highest standards of quality and integrity of the data and services provided to our clients

The laboratory is responsible for maintaining in confidence all client information obtained or created. In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

The laboratory will not intentionally divulge to any person (other than the client or any other person designated by the client in writing) any information regarding the services provided by the laboratory or any information disclosed to the laboratory by the client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Information about the client obtained from sources other than the client (e.g., complainant, regulators) shall be confidential between client and the laboratory. The source of this information shall be confidential to the laboratory and shall not be shared with the client, unless agreed by the source.

Note: This shall not apply to the extent that the information is required to be disclosed by the laboratory under the compulsion of legal process. The laboratory will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.7.1 Report deliverable formats are discussed with each new client. If a client requests that reports be e-mailed, the reports are to meet all requirements of this document.

25.8 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.9 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system.

The revised report is retained in the LIMS, as is the original report. The revised report is stored in the Project files under the sample number followed by "Rev#" where "#" refers to the number of the report revision.

When the report is re-issued, a revision number is placed on the cover/signature page of the report or at the top of the narrative page. A brief explanation of the reason for the re-issue and a reference back to the last final report generated may be included.

25.10 Policies on Client Requests for Amendments

25.10.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists EPA Method 8315 but client wanted EPA Method 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.10.2 Multiple Reports

The laboratory does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. List of Eurofins NDSC Governing Documents Applicable to the QA Manual

NDSC Doc. No.	Title
CA-C-S-001	Work Sharing Process
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CA-Q-M-002	Quality Management Plan
CA-Q-QM-001	Guidance on Tentatively Identified Compounds (TICs) – GC/MS Analysis
CA-Q-S-001	Acid and Solvent-Lot Testing and Approval Program
CA-Q-S-002	Manual Integrations
CA-Q-S-006	Detection and Quantitation Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Fixed Asset Acquisition, Retention and Safeguarding
CW-I-M-001	IT Change Control Procedure Manual
CW-L-P-001	Records Retention Policy
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-L-S-004	Subcontracting
CW-Q-S-001	Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CW-Q-S-001	Document Control and Archiving

Appendix 2. List of Laboratory Certifications, Accreditations, Validations

The laboratory maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/ certification/licensing with the following organizations:

Eurofins Xenco Corpus Christi Louisiana DEQ Texas CEQ Oklahoma DEQ USDA	**Eurofins Xenco Dallas** Florida DOH Texas CEQ	**Eurofins Xenco El Paso** Texas CEQ
Eurofins Xenco Stafford (Houston) Arkansas DEQ Florida DOH Louisiana DEQ Texas CEQ Oklahoma DEQ USDA	**Eurofins Xenco Lubbock** Texas CEQ	**Eurofins Xenco Midland** Texas CEQ

Appendix 3. References Used to Prepare the QA Manual

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- APHA, *Standard Methods for* the Examination of Water and Wastewater, 18th Edition, 19th, 20th, 21st, 22nd and on-line Editions.

Appendix 4. QA Manual Crosswalk with TNI and ISO/IEC 17025 Standards

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
-	QUALITY ASSURANCE MANUAL COVER PAGE	V1M2 Sec. 4.2.8.3		
1.0	Title Page			
2.0	Table of Contents	V1M2 Secs. 4.2.8.3-4.2.8.4		8.1.2, 8.2.1
3.0	Introduction, Scope and Applicability	V1M2 Sec. 4.2.8.4		
3.1	Introduction and Compliance References	V1M2 Secs. 1.1; 1.2; 2.0; 3.2; 4.1.2; 4.2.4	4.1.2; 4.2.4	5.3; 5.4; 8.2.4; 8.3.1
3.2	Terms and Definitions	V1M2 Secs. 3.0; 4.2.4	4.2.4	
3.3	Scope /Field of Testing	V1M2 Secs. 1.2; 4.2.4	4.1.2; 4.2.4	5.3; 5.4; 8.2.1; 8.2.4
3.4	Management of The Manual	V1M2 Secs. 4.2.1; 4.2.7; 4.3.3.2; 4.3.3.3	4.2.1; 4.2.7; 4.3.3.2; 4.3.3.3	5.3
4.0	Management and Responsibilities	V1M2 Sec. 4		8.2.4; 8.2.5
4.1	Overview	V1M2 Secs. 4.1.1, 4.1.3; 4.1.5	4.1.1; 4.1.3; 4.1.5; 4.2.6	5.1; 5.2; 5.5; 5.6 ; 6.2.1; 6.2.4
4.2	Roles and Responsibilities	V1M2 Secs. 4.1.4; 4.1.5; 4.1.6; 4.2.1; 4.2.6; 5.2.4	4.1.3; 4.1.5; 4.1.6; 4.2.1; 4.2.6; 5.2.4	4.1.1 to 4.1.3; 4.1.5; 5.5; 5.6; 6.2.1; 6.2.4; 6.2.6 8.2.2;
4.3	Business Continuity and Contingency Plan *(Prev. Deputies)*	V1M2 Secs. 4.1.5; 4.1.7.2; 4.2.7	4.1.5; 4.2.7	
5.0	PERSONNEL	V1M2 Secs. 5.2; 5.2.1	5.2.1	6.1; 6.2.3
5.1	Overview	V1M2 Secs. 5.2.2; 5.2.3; 5.2.5	5.2.2; 5.2.3; 5.2.5	6.2.2
5.2	Education and Experience Requirements for Technical Staff	V1M2 Secs. 5.2.1; 5.2.3; 5.2.4	5.2.1; 5.2.3; 5.2.4	6.2.2 to 6.2.4
5.3	Training	V1M2 Sec. 5.2.5	5.2.5	4.2.1; 6.2.2; 6.2.4; 6.2.5
5.4	Data Integrity and Ethics Training Program	V1M2 Sec. 4.2.8.1; 5.2.7		4.1.1
6.0	ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS	V1M2 Sec. 5.3		6.1; 6.3.1
6.1	Overview	V1M2 Secs. 5.3.1; 5.3.3; 5.3.4; 5.3.5	5.3.1; 5.3.3; 5.3.4; 5.3.5	6.3.1
6.2	Environment	V1M2 Secs. 5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5	5.3.1; 5.3.2; 5.3.3; 5.3.4; 5.3.5	6.3.1 to 6.3.5
6.3	Work Area	V1M2 Secs. 5.3.3; 5.3.4; 5.3.5	5.3.3; 5.3.4; 5.3.5	6.3.1
6.4	Responding to Emergencies			
6.5	Building Security	V1M2 Sec. 5.3.4	5.3.4	6.3.4
7.0	QUALITY SYSTEM			6.1; 8.2.4

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
7.1	Quality Policy	V1M2 Secs. 4.1.5; 4.2.2; 4.2.3; 4.2.8.3	4.1.5; 4.2.2; 4.2.3	8.2.3; 8.6.1
7.2	Ethics and Data Integrity	V1M2 Secs. 4.1.5; 4.16; 4.2.2; 4.2.8.1; 5.2.7	4.1.5; 4.2.2	4.1.1 to 4.1.3; 4.2.1; 6.2.1; 8.2.2; 8.2.3
7.3	Quality System Documentation	V1M2 Secs. 4.1.5; 4.2.2; 4.2.5	4.2.2; 4.2.5	8.2.4
7.4	QA/QC Objectives for the Measurement of Data	V1M2 Sec. 4.2.2	4.1.5; 4.2.2	6.2.4
7.5	Criteria for Quality Indicators			
7.6	Statistical Quality Control			
7.7	Quality System Metrics			
8.0	Document Control	V1M2 Secs. 4.2.7; 4.3.1; 4.3.2.2 ; 4.3.3.3; 4.3.3.4	4.2.7; 4.3.1; 4.3.2.2; 4.3.3.3; 4.3.3.4	8.2.4; 8.3.1
8.1	Overview			8.2.5; 8.3.1; 8.3.2
8.2	Document Approval and Issue	V1M2 Secs. 4.3.2; 4.3.2.1-4.3.2.3; 4.3.3.1	4.3.2.1; 4.3.2.2; 4.3.2.3; 4.3.3.1	8.2.5; 8.3.2
8.3	Procedures for Document Control Policy	V1M2 Secs. 4.3.2.1–4.3.2.2; 4.3.3.1	4.3.2.1; 4.3.2.2; 4.3.3.1	8.2.5; 8.3.2
8.4	Obsolete Documents	V1M2 Secs. 4.3.2.1–4.3.2.2	4.3.2.1; 4.3.2.2	8.2.5; 8.3.2
9.0	SERVICE TO THE CLIENT	V1M2 Secs. 4.4.1 - 4.4.4	4.4.1; 4.4.2; 4.4.3; 4.4.4	7.1.1; 7.1.1.4; 7.1.1.5; 7.1.1.8; 7.1.2.1
9.1	Overview	V1M2 Secs. 4.4.5; 4.5.5; 5.7.1	4.4.5; 5.7.1	
9.2	Review Sequence and Key Personnel	V1M2 Sec. 4.4.5	4.4.5	7.1.1.6
9.3	Balancing Laboratory Work Load and Capacity			
9.4	Documentation	V1M2 Sec. 5.7.1	5.7.1	
9.5	Special Services	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.3; 7.1.1.7
9.6	Client Communication	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7
9.7	Reporting	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7
9.8	Client Feedback and Surveys	V1M2 Secs. 4.7.1-4.7.2	4.7.1; 4.7.2	7.1.1.7; 8.6.2
10.0	SUBCONTRACTING OF TESTS	V1M2 Secs. 4.4.3; 4.5.4	4.4.3; 4.5.4	
10.1	Overview	V1M2 Secs. 4.5.1 - 4.5.3; 4.5.5; 5.3.1	4.5.1; 4.5.2; 4.5.3; 5.3.1	6.6.1; 7.1.2.1; 7.1.2.2
10.2	Qualifying and Monitoring Subcontractors	V1M2 Secs. 4.5.1; 4.5.2; 4.5.3; 4.5.5	4.5.1; 4.5.2; 4.5.3	6.6.1; 7.1.2.1; 7.1.2.2
10.3	Oversight and Reporting	V1M2 Sec. 4.5.5		
10.4	Contingency Planning			
10.5	Use of NELAP and A2LA Logo			

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
11.0	PURCHASING SERVICES AND SUPPLIES	V1M2 Sec. 4.6.1	4.6.1	
11.1	Overview	V1M2 Secs. 4.6.2; 4.6.3; 4.6.4	4.6.2; 4.6.3; 4.6.4	6.6.1; 6.6.2
11.2	Glassware	V1M2 Sec. 5.5.13.1		
11.3	Reagents, Standards & Supplies	V1M2 Secs. 4.6.2; 4.6.3; 4.6.4 2016 V1M4 1.7.2.5	4.6.2; 4.6.3; 4.6.4	6.6.1 to 6.6.3
11.4	Purchase of Equipment / Instruments / Software			
11.5	Services			
11.6	Suppliers			
12.0	COMPLAINTS	V1M2 Sec. 4.8	4.8	8.6.1; 8.6.2
12.1	Overview			7.9.1 to 7.9.3 8.6.1; 8.6.2;
12.2	External Complaints			7.9.2 to 7.9.7 8.6.1; 8.6.2;
12.3	Internal Complaints			8.6.1; 8.6.2
12.4	Management Review			8.6.1; 8.6.2
13.0	CONTROL OF NON-CONFORMING WORK	V1M2 Secs. 4.9.1; 5.10.5	4.9.1; 5.10.5	7.10.1
13.1	Overview	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5	4.9.1; 4.11.3; 4.11.5	7.10.1
13.2	Responsibilities and Authorities	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5; 5.2.7	4.9.1; 4.11.3; 4.11.5	7.10.1
13.3	Evaluation of Significance and Action Taken	V1M2 Secs. 4.9.1; 4.11.3; 4.11.5	4.9.1; 4.11.3; 4.11.5	4.1.5; 7.10.1; 7.10.2; 8.5.3
13.4	Prevention of Non-Conforming Work	V1M2 Secs. 4.9.4; 4.11.2	4.9.2; 4.11.2	7.10.2; 7.10.3; 8.5.3
13.5	Method Suspension / Restriction (Stop Work Procedures)	V1M2 Secs. 4.9.1; 4.9.2; 4.11.5	4.9.1; 4.9.2; 4.11.5	7.10.1; 7.10.2
14.0	CORRECTIVE ACTION	V1M2 Sec. 4.11		4.1.4; 4.1.5
14.1	Overview	V1M2 Secs. 4.9.2; 4.11.1; 4.11.2	4.9.2; 4.11.1; 4.11.2; 8.7.1; 8.7.3	7.10.2 8.7.1; 8.7.3;
14.2	General	V1M2 Sec. 4.11.2; 4.11.3	4.11.2; 4.11.3	7.7.2; 8.5.3; 8.7.1;
14.3	Closed Loop Correction Action Process	V1M2 Sec. 4.11.2; 4.11.3; 4.11.4; 4.11.6; 4.11.7; 4.12.2	4.11.2; 4.11.3; 4.11.4; 4.12.2	8.5.3; 8.6.1; 8.7.2
14.4	Technical Corrective Actions	V1M2 Sec. 4.11.6		8.7.1
14.5	Basic Corrections	V1M2 Secs. 4.11.1; 4.13.2.3	4.11.1; 4.13.2.3	7.5.2; 8.7.1
15.0	PREVENTIVE ACTION / IMPROVEMENT	V1M2 Secs. 4.10; 4.12.1; 4.12.2	4.10; 4.12.1; 4.12.2	4.1.4
15.1	Overview	V1M2 Secs. 4.15.1; 4.15.2	4.15.1; 4.15.2	8.6.2
15.2	Management of Change			
16.0	CONTROL OF RECORDS	V1M2 Secs. 4.2.7; 4.13.1.1; 4.13.3	4.2.7; 4.13.1.1	8.4.2

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
16.1	Overview	V1M2 Secs. 4.13.1.1 - 4.13.1.4; 4.13.2.1- 4.13.2.3; 4.13.3	4.13.1.1 - 4.13.1.4; 4.13.2.1- 4.13.2.3	8.4.1; 8.4.2
16.2	Programs with Longer Retention Requirements			
16.3	Technical and Analytical Records	V1M2 Sec. 4.13.2.2 - 4.13.2.3	4.13.2.2; 4.13.2.3	7.5.1; 8.4.2
16.4	Laboratory Support Activities			7.5.2; 8.4.2
16.5	Administrative Records			8.4.2
16.6	Records Management, Storage and Disposal	V1M2 Sec. 4.13.3		4.2.1; 8.4.2
17.0	AUDITS			
17.1	Internal Audits	V1M2 Sec. 4.2.8.1; 4.14; 4.14.1; 4.14.2 ; 4.14.3; 4.14.5; 5.9.1; 5.9.2	4.14.1; 4.14.2; 4.14.3; 5.9.1; 5.9.2	8.6.1; 8.8.1; 8.8.2
17.2	External Audits	V1M2 Secs.4.14.2; 4.14.3	4.14.2; 4.14.3; 4.14.4	4.2.1; 8.6.1
17.3	Audit Findings	V1M2 Secs. 4.14.2; 4.14.3; 4.14.5		8.6.1
18.0	MANAGEMENT REVIEWS	V1M2 Sec. 4.1.6; 4.15; 4.15.1; 4.15.2	4.1.6; 4.15.1; 4.15.2	4.1.4; 8.5.1; 8.6.1; 8.9.1; 8.9.2
18.1	Quality Assurance Report			8.5.1
18.2	Annual Management Review	V1M2 Sec. 4.2.2; 4.15.3	4.2.2	4.1.1, 4.1.4; 4.2.1; 7.1.1.3; 8.2.2; 8.5.1 to 8.5.3; 8.6.1; 8.9.3
18.3	Potential Integrity Related Managerial Reviews			4.1.5; 8.5.1; 8.6.1
19.0	TEST METHODS AND METHOD VALIDATION	V1M2 Sec. 5.4.1	5.4.1	7.2.1.1; 8.2.5
19.1	Overview	V1M2 Sec. 5.4.1	5.4.1; 5.4.5.1	6.2.3; 7.2.1.1 to 7.2.1.3
19.2	Standard Operating Procedures (SOPs)	V1M2 Secs. 4.2.8.5; 4.3.3.1; 5.4.2	4.3.3.1; 5.4.2	7.2.1.4
19.3	Laboratory Methods Manual	V1M2 Sec. 4.2.8.5 (2019 5.4.4.2)		6.2.3
19.4	Selection of Methods	V1M2 Secs. 4.13.3; 5.4.1; 5.4.2; 5.4.3. (2019 5.4.4) V1M4 Secs. 1.4; 1.5.1; 1.6.1; 1.6.2; 1.6.2.1; 1.6.2.2	5.4.1; 5.4.2; 5.4.3; 5.4.4; 5.4.5.1; 5.4.5.2; 5.4.5.3	7.1.1.2; 7.2; 7.2.1.2; 7.2.1.3; 7.1.2.4 to 7.2.1.7; 7.2.2.1 to 7.2.1.7; 7.2.2.1

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
19.5	Laboratory Developed Methods and Non-Standard Methods	V1M2 Sec. 5.4.2. (2019 5.4.4.1, 5.4.4.2) V1M4 Sec. 1.5.1	5.4.2; 5.4.4; 5.4.5.2; 5.4.5.3	7.1.1.2; 7.2.1.4 to 7.2.1.7 7.2.2.1; 7.2.2.3; 8.2.5
19.6	Validation of Methods	V1M2 Sec. 5.4.2. (2019 5.4.5.4) V1M4 Secs. 1.5.1; 1.5.2; 1.5.2.1; 1.5.2.2; 1.5.3	5.4.2; 5.4.4; 5.4.5.2; 5.4.5.3	7.1.1.2; 7.1.2.4; 7.2.1.6; 7.2.2.1 to 7.2.2.4
19.7	Method Detection Limits (MDLs) / Limit of Detection (LOD)	V1M2 Sec. 5.9.3. V1M4 Secs. 1.5.2; 1.5.2.1; 1.5.2.2	5.4.5.3	7.2.2.3
19.8	Verification of Detection Limits	V1M2 Sec. 5.9.3		
19.9	Instrument Detection Limits (IDLs)	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.2.1		
19.10	Limit of Quantitation	V1M2 Sec. 5.9.3		
19.11	Retention Windows	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.4; (2009 1.7.3.6) (2016 1.7.2.6)		
19.12	Evaluation of Selectivity	V1M2 Sec. 5.9.3. V1M4 Sec. 1.5.4; (2009 1.7.3.6) (2016 1.7.2.6)		
19.13	Estimation of Uncertainty of Measurement	V1M2 Sec. 5.1.1; 5.1.2; 5.4.6	5.1.1; 5.1.2; 5.4.6.1; 5.4.6.2; 5.4.6.3	7.6.1; 7.6.2; 7.6.3
19.14	Sample Reanalysis Guidelines	V1M2 Sec 5.9.1	5.9.1	
19.15	Control of Data	V1M2 Secs. 5.4.7.1; 5.4.7.2; 5.9.1	5.4.7.1; 5.4.7.2; 5.9.1	7.11.1 to 7.11.6
20.0	EQUIPMENT AND CALIBRATIONS	V1M2 Secs. 5.5.4; 5.5.5; 5.5.6	5.5.4; 5.5.5; 5.5.6; 5.6.1	6.1; 6.4.3; 6.4.6; 6.4.9
20.1	Overview	V1M2 Secs. 5.5.1; 5.5.2; 5.5.3; 5.5.5; 5.5.10	5.5.1; 5.5.2; 5.5.3; 5.5.5; 5.5.10; 5.6.1	6.4.1; 6.4.4 to 6.4.6; 6.4.9; 6.4.11
20.2	Preventive Maintenance	V1M2 Secs. 5.5.1; 5.5.3; 5.5.7; 5.5.9	5.5.1; 5.5.3; 5.5.7; 5.5.9; 5.6.1	6.4.1 to 6.4.3; 6.4.6; 6.4.10
20.3	Support Equipment	V1M2 Secs. 5.5.10; 5.5.11; 5.5.13.1	5.5.10; 5.5.11; 5.6.2.1.2; 5.6.2.2.1; 5.6.2.2.2	6.4.11; 6.4.12; 6.5.1; 6.5.2; 6.5.3
20.4	Instrument Calibrations	V1M2 Secs. 5.5.8; 5.5.10; 5.6.3.1. V1M4 Sec. 1.7.1.1; (2009 1.7.2) (2016 1.7.1.2)	5.5.8; 5.5.9; 5.5.10; 5.6.1; 5.6.2; 5.6.3.1	6.4.2; 6.4.3; 6.4.6 to 6.4.8; 6.4.11; 6.4.13; 6.4.14; 6.5.1; 6.5.2
20.5	Tentatively Identified Compounds (TICs) – GC/MS Analysis			
20.6	GC/MS Tuning			
21.0	MEASUREMENT OF TRACEABILITY			

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
21.1	Overview	V1M2 Sec. 5.6.3.1	5.6.2.1.2; 5.6.2.2.2; 5.6.3.1	6.4.14; 6.5.1; 6.5.2; 6.5.3
21.2	NIST-Traceable Weights and Thermometers	V1M2 Secs. 5.5.13.1; 5.6.3.1; 5.6.3.2	5.6.3.1; 5.6.3.2	6.4.14
21.3	Reference Standards / Materials	V1M2 Secs. 5.6.3.1; 5.6.3.2; 5.6.3.3; 5.6.3.4; 5.6.4.1; 5.6.4.2; 5.9.1; 5.9.3	5.6.3.1; 5.6.3.2; 5.6.3.3; 5.6.3.4; 5.9.1	6.4.14
21.4	Documentation and Labeling of Standards, Reagents, and Reference Materials	V1M2 Secs. 5.6.4.2; 5.9.3		
22.0	SAMPLING			
22.1	Overview	V1M2 Secs. 5.7.1; 5.7.3	5.7.1; 5.7.3	7.3.1; 7.3.2; 7.3.3
22.2	Sampling Containers			
22.3	Definition of Holding Time			
22.4	Sampling Containers, Preservation Requirements, Holding Times			
22.5	Sample Aliquots / Subsampling	V1M2 Sec. 5.7.1	5.7.1	7.3.1; 7.3.2
23.0	HANDLING OF SAMPLES	V1M2 Sec. 5.8.1	5.8.1	7.4.1
23.1	Chain of Custody (CoC)	V1M2 Secs. 5.7.2; 5.7.4; 5.8.4; 5.8.7.5; 5.8.8; 5.9.1	5.7.2; 5.8.4; 5.9.1	7.1.1.6; 7.4.1
23.2	Sample Receipt	V1M2 Secs. 5.8.1; 5.8.2; 5.8.3; 5.8.5; 5.8.7.3; 5.8.7.4; 5.8.7.5	5.8.2; 5.8.3	7.4.3
23.3	Sample Acceptance Policy	V1M2 Secs. 5.8.6; 5.8.7.2		
23.4	Sample Storage	V1M2 Secs. 5.7.4; 5.8.4	5.8.4	7.4.1; 7.4.4
23.5	Hazardous Samples and Foreign Solids			
23.6	Sample Shipping	V1M2 Sec. 5.8.2	5.8.2	7.4.2
23.7	Sample Disposal			
24.0	ASSURING THE QUALITY OF TEST RESULTS			
24.1	Overview	V1M2 Secs. 5.9.2; 5.9.3	5.9.2	7.7.2 to 7.7.3
24.2	Controls	V1M2 Secs. 5.9.2; 5.9.3	5.9.2	7.7.1; 7.7.3
24.3	Negative Controls	V1M2 Secs. 5.9.2; 5.9.3 V1M4 Secs. (2019 1.7.3; 1.7.3.1; 1.7.4.1) (2016 1.7.2, 1.7.2.1, 1.7.3.1)	5.9.2	7.7.1; 7.7.3

Sec. No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
24.4	Positive Controls	V1M2 Secs 5.9.2; 5.9.3. V1M4 Secs.(2009 1.7.3; 1.7.3.2; 1.7.3.2.1; 1.7.3.2.2; 1.7.3.2.3) (2016 1.7.2, 1.7.2.2, 1.7.3.2)	5.9.2	7.7.1; 7.7.3
24.5	Sample Matrix Controls	V1M2 Secs. 5.9.2; 5.9.3. V1M4 Secs. (2009 1.7.3 ; 1.7.3.3; 1.7.3.3.1; 1.7.3.3.2; 1.7.3.3.3) (2016 1.7.2, 1.7.2.3, 1.7.3.3)	5.9.2	7.7.1; 7.7.3
24.6	Acceptance Criteria (Control Limits)	V1M2 Sec. 5.9.3. V1M4 Secs. 1.7.4.2; 1.7.4.3		7.7.1; 7.7.3
24.7	Additional Procedures to Assure Quality Control	V1M2 Sec. 5.9.3. V1M4 Sec. (2009 1.7.3.4), (2016 1.7.2.4)		7.7.1; 7.7.3
25.0	REPORTING RESULTS			
25.1	Overview	V1M2 Secs. 5.10.1; 5.10.2; 5.10.8	5.10.1; 5.10.2; 5.10.8	7.8.1 to 7.8.2
25.2	Test Reports	V1M2 Secs. 5.10.1; 5.10.2; 5.10.3.1; 5.10.3.2; 5.10.5; 5.10.6; 5.10.7; 5.10.8; 5.10.10; 5.10.11	5.10.1; 5.10.2; 5.10.3.1; 5.10.3.2; 5.10.5; 5.10.6; 5.10.7; 5.10.8	7.8.2.1; 7.8.2.2; 7.8.3; 7.8.5
25.3	Reporting Level or Report Type	V1M2 Secs. 5.10.1; 5.10.7; 5.10.8	5.10.1; 5.10.7; 5.10.8	
25.4	Electronic Data Deliverables (EDDs)			
25.5	Supplemental Information for Test	V1M2 Secs. 5.10.1; 5.10.3.1; 5.10.5	5.10.1; 5.10.3.1; 5.10.5	7.1.1.3; 7.8.6.1; 7.8.6.2; 7.8.7.1 to 7.8.7.3
25.6	Environmental Testing Obtained from Subcontractors	V1M2 Secs. 4.5.5; 5.10.1; 5.10.6	5.10.1; 5.10.6	
25.7	Client Confidentiality	V1M2 Secs. 4.1.5; 5.10.7	4.1.5; 5.10.7	4.2.1 to 4.2.4
25.8	Format of Reports	V1M2 Sec. 5.10.8	5.10.8	
25.9	Amendments to Reports	V1M2 Sec. 5.10.9	5.10.1; 5.10.9	7.8.8.1 to 7.8.8.3
25.10	Policies on Client Requests for Amendments	V1M2 Secs. 5.9.1; 5.10.9	5.9.1; 5.10.1; 5.10.5; 5.10.9	

LIST OF TABLES

Table No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005 (E) Reference	ISO/IEC 17025:2017(E) Reference
14-1	General Corrective Action Procedures	V1M2 Sec. 4.11.6. V1M4 Sec. (2009 1.7.4.1) (2016 1.7.1.2, 1.7.2.1, 1.7.2.3, 1.7.3.1)	4.11.2	
16-1	Record Index		4.13.1.1	
16-2	Special Record Retention Requirements			
17-1	Type of Internal Audits and Frequency		4.14.1	
24-1	Negative Controls			
24-2	Negative Controls for Microbiology			
24-5	Sample Matrix Controls			

LIST OF FIGURES

Figure No.	Title	2009 and 2016 TNI Standard Reference	ISO/IEC 17025:2005(E) Reference	ISO/IEC 17025:2017(E) Reference
4-1	Laboratory Organization Charts	V1M2 Sec. 4.1.5	4.1.3; 4.1.5; 4.2.6	
19-1	Work Flow			
23-2	Sample Acceptance Policy	V1M2 Sec. 5.8.6; 5.8.7.1 V1M4 Sec. (2009 1.7.5) (2016 1.7.4)		

Appendix 5. Terms/Glossary and Acronyms (EL-V1M2 Sec. 3.1)

Terms/Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the

usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).
2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguard identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Integrity: The condition that exists when data are sound, correct, and complete, and accurately reflect activities and requirements. (TNI)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.
An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: The MDL is the minimum measured quantity of a substance that can be reported with 99% confidence that the concentration is distinguishable from method blank results, consistent with 40CFR Part 136 Appendix B, August, 2017.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: See Limit of Detection (LOD)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an

agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.
Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC – Gas Chromatography
GC/MS – Gas Chromatography/Mass Spectrometry
HPLC – High Performance Liquid Chromatography
ICP – Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 6. Analytical Method References

Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; August 28, 2017.*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

FIELD STANDARD OPERATING PROCEDURES

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

The controlled version of this document is the electronic version viewed on-line only. If this is a printed copy of the document, it is an uncontrolled version and may or may not be the version currently in use.

This document contains direction developed solely to provide guidance to U.S. Environmental Protection Agency (EPA) personnel. EPA retains the discretion to adopt approaches that differ from these procedures on a case-by-case basis. The procedures set forth do not create any rights, substantive or procedural, enforceable at law by party to litigation with EPA or the United States.

Prepared by:_____ _____
(Robert Reinhart, Quality Assurance Unit) Date

Approved by:_____ _____
(John Smaldone, Quality Assurance Unit) Date

Revision Page

Date	**Rev #**	**Summary of changes**	**Sections**
7/30/96	1	Finalized	
01/19/10	2	Updated	All sections
3/23/17	3	Updated	All sections
9/20/17	4	Updated	Section 7.0

Table of Contents

1.0 USE OF TERMS 4
2.0 SCOPE & APPLICATION 5
3.0 BACKGROUND FOR IMPLEMENTATION 6
4.0 HEALTH & SAFETY 7
5.0 CAUTIONS 7
6.0 PERSONNEL QUALIFICATIONS 9
7.0 EQUIPMENT AND SUPPLIES 9
8.0 EQUIPMENT/INSTRUMENT CALIBRATION 13
9.0 PRELIMINARY SITE ACTIVITIES (as applicable) 13
10.0 PURGING AND SAMPLING PROCEDURE 14
11.0 DECONTAMINATION 19
12.0 FIELD QUALITY CONTROL 21
13.0 FIELD LOGBOOK 21
14.0 DATA REPORT 22
15.0 REFERENCES 22
APPENDIX A 24
PERISTALTIC PUMPS 24
APPENDIX B 25
SUMMARY OF SAMPLING INSTRUCTIONS 25
Low-Flow Setup Diagram 29
APPENDIX C 30
WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM 30

1.0 USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Potentiometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the “Monitoring Indicator Field Parameters” section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

2.0 SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase

liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.

3.0 BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection

may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

4.0 HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

5.0 CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in

the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convection cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

6.0 PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

7.0 EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or polytetrafluoroethylene (PTFE, i.e. Teflon®) are preferred. PTFE, however, should not be used when sampling for per- and polyfluoroalkyl substances (PFAS) as it is likely to contain these substances.

Note: If extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

PTFE (Teflon®) or PTFE-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. As discussed in the previous section, PTFE tubing should not be used when sampling for PFAS. In this case, a suitable alternative such as high-density polyethylene tubing should be used.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

Note: If tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic ”tape”, pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume

cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

8.0 EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

9.0 PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed, lay out a sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

10.0 PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the

minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be

changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging, emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and

continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). Throughout the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods

(e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 µm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

11.0 DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well, and then following sampling of each subsequent well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

12.0 FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

13.0 FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

14.0 DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

15.0 REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, *DNAPL Site Evaluation*; C.K. Smoley (CRC Press), Boca Raton, Florida.

Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

U.S. Environmental Protection Agency, 1987, *A Compendium of Superfund Field Operations Methods*; Washington, DC (EPA/540/P-87/001).

U.S Environmental Protection Agency, Region 1, *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity),* March 23, 2017 or latest version.

U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A

PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases, (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could affect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or discolored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or discolored water is usually from the well-being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to

the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take a while (pump may be removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note:

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note: at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

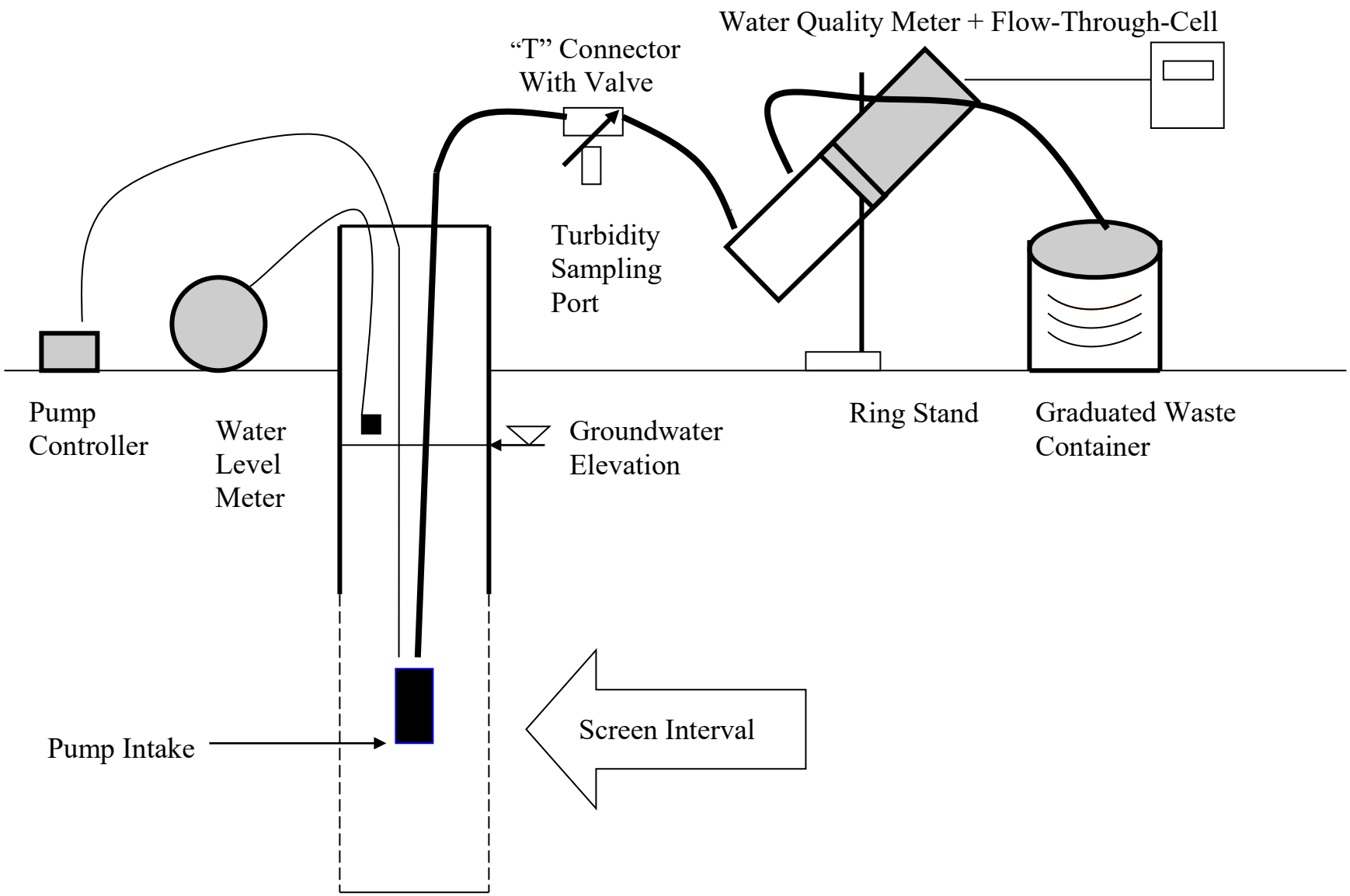
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____
Well Number_____ Date_____
Field Personnel_____
Sampling Organization_____
Identify MP_____

Depth to _____/_____ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_____
Purging Device; (pump type)_____
Total Volume Purged _____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. "C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Tur-bidity NTU	Comments
Stabilization Criteria					3%	3%	±0.1	±10 mv	10%	10%	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)

SURFACE WATER SAMPLING

CONTENTS

1.0 SCOPE AND APPLICATION

2.0 METHOD SUMMARY*

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

5.0 EQUIPMENT/APPARATUS*

6.0 REAGENTS

7.0 PROCEDURES

7.1 Preparation
7.2 Representative Sampling Considerations

7.2.1 Sampler Composition

7.3 Sample Collection

7.3.1 Kemmerer Bottle*
7.3.2 Van Doren Sampler*
7.3.3 Bacon Bomb Sampler*
7.3.4 Dip Sampler
7.3.5 Direct Method

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL*

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY

12.0 REFERENCES*

CONTENTS (cont)

13.0 APPENDICES*

A - Figures*

* These sections affected by Revision 0.0.

SUPERSEDES: SOP #2013; Revision 0.0; 11/17/94; U.S. EPA Contract EP-W-09-031.

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) is applicable to the collection of representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling situations vary widely; therefore, no universal sampling procedure can be recommended. However, surface water sampling is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle
- Van Doren sampler
- Bacon bomb sampler
- Dip sampler
- Direct method

These samplers and sampling techniques will result in the collection of representative samples from the majority of surface waters and impoundments encountered.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, the following procedures should be followed:

1. Transfer the sample(s) into suitable, labeled sample containers specific for the analyses to be performed.

2. Preserve the sample, if appropriate, or use pre-preserved sample bottles. Do not overfill bottles if they are pre-preserved.

3. Cap the container securely, place in a resealable plastic bag, and cool to $4^{o}C$.

4. Record all pertinent data in the site logbook and/or on field data sheets.

5. Complete the Chain of Custody record.

6. Attach custody seals to cooler prior to shipment.

7. Decontaminate all non-dedicated sampling equipment prior to the collection of additional samples.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with surface water sampling. These include cross contamination of samples and improper sample collection.

1. Cross contamination problems can be eliminated or minimized through the use of dedicated or disposable sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*.

2. Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed or non-representative area.

Following proper decontamination procedures, minimizing disturbance of the sample site, and careful selection of sampling locations will eliminate these problems. Proper timing for the collection of samples must be taken into consideration due to tidal influences and low or fast-flowing streams or rivers.

5.0 EQUIPMENT/APPARATUS

Equipment needed for collection of surface water samples may include (depending on technique chosen):

- Kemmerer bottles
- Van Doren sampler
- Bacon bomb sampler
- Dip sampler
- Line and messengers
- Peristalic pump
- Tygon tubing
- 0.45 micron (µm) filters
- Sample bottles/preservatives
- pH paper
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of Custody records, custody seals
- Field data sheets
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Compass
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera and film

- Logbook/waterproof pen
- Sample bottle labels
- Paper towels
- Disposable pipets
- Hydrolab

6.0 REAGENTS

Reagents will be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed and are summarized in ERT/SERAS SOP #2003, *Sample Storage, Preservation and Handling*. Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination.*

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain the necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry, in accordance with the site specific Health and Safety Plan (HASP).

6. Use stakes, flags, or buoys to identify and mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and obstructions.

7.2 Representative Sampling Considerations

In order to collect a representative sample, the hydrology and morphometrics of a stream, river, pond, lake or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths.

Water quality data should be collected in ponds, lakes and impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, conductivity, oxidation-potential, temperature and turbidity can indicate if strata exist that would affect analytical results. Measurements should be collected at one-meter intervals from the surface to the bottom using the appropriate instrument (i.e., a Hydrolab or equivalent). These water quality measurements can assist in the interpretation of analytical data, and the selection of sampling sites and depths when

surface water samples are collected.

Factors that contribute to the selection of a sampling device used for sampling surface waters in streams, rivers, lakes, ponds, lagoons, and surface impoundments are:

- Width, depth, flow and accessibility of the location being sampled
- Whether the sample will be collected onshore or offshore

7.2.1 Sampler Composition

The appropriate sampling device must be of a proper composition. Selection of samplers constructed of glass, stainless steel, polyvinyl chloride (PVC) or PFTE (Teflon) should be based upon the suspected contaminants and the analyses to be performed.

7.3 Sample Collection

7.3.1 Kemmerer Bottle

A Kemmerer bottle (Figure 1, Appendix A) may be used in most situations where site access is from a boat or structure, such as a bridge or pier, and where samples at specific depths are required. Sampling procedures are as follows:

1. Use a properly decontaminated Kemmerer bottle. Set the sampling device so that the upper and lower stoppers are pulled away from the body, allowing the surface water to enter tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.

3. When the Kemmerer bottle is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.

4. Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.2 Van Doren Sampler

A Van Doren sampler (Figure 2, Appendix A) is used to collect surface water from a very specific sampling depth or from a shallow water body. Since the sampler is suspended horizontally, the depth interval sampled is the diameter of the sampling tube. The sampling procedure is as follows:

1. Use a properly decontaminated Van Doren sampler. Set the device so that the end stoppers are pulled away from the body allowing surface water to enter the

tube.

2. Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.

3. When the Van Doren is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.

4. Retrieve the sampler and discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.3 Bacon Bomb Sampler

A bacon bomb sampler (Figure 3, Appendix A) may be used in situations similar to those outlined for the Kemmerer bottle. Sampling procedures are as follows:

1. Lower the bacon bomb sampler carefully to the desired depth, allowing the line for the trigger to remain slack at all times. When the desired depth is reached, pull the trigger line until taut. This will allow the sampler to fill.

2. Release the trigger line and retrieve the sampler.

3. Discharge the first 10-20 milliliters (mL) from the drain to clear potential contamination from the valve. This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

7.3.4 Dip Sampler

A dip sampler (Figure 4, Appendix A) is useful in situations where a sample is to be recovered from an outfall pipe or along a lagoon bank where direct access is limited. The long handle on such a device allows access from a discrete location. Sampling procedures are as follows:

1. Assemble the device in accordance with the manufacturer's instructions.

2. Extend the device to the sample location and collect the sample by dipping the sampler into the water.

3. Retrieve the sampler and transfer the sample to the appropriate sample container(s).

7.3.5 Direct Method

For streams, rivers, lakes, and other surface waters, the direct method may be utilized to collect water samples directly into the sample container(s). Health and safety considerations must be addressed when sampling lagoons or other impoundments where specific conditions may exist that warrant the use of additional safety equipment. These issues must be addressed in the site-specific HASP.

Using adequate protective clothing, access the sampling station by appropriate means. For shallow stream stations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface while avoiding surface debris and the boat wake.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following general QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

3. To avoid the incidental inclusion of disturbed sediment in the sample, surface water should be collected from a downstream to upstream direction and upstream of any activity that may disturb the sediment (i.e., wading).

4. While collecting surface water using the direct method, the sample container should be held below the surface to avoid the collection of floating debris.

5. Water quality data should be collected to detect the presence of stratified layers or other site-specific characteristics that would affect the sample.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Health and Safety (OSHA) and corporate health and safety procedures.

More specifically, when sampling lagoons or surface impoundments containing known or suspected hazardous substances, adequate health and safety and boating precautions must be taken to ensure the safety of sampling personnel.

12.0 REFERENCES

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo. 1998. National Field Manual for the Collection of Water-Quality Data - Selection of Equipment for Water Sampling. U.S. Geological Survey Techniques of Water - Resources Investigations, Book 9, Chap. A2, variously paged.

http://water.usgs.gov/owq/FieldManual/index.htmland
http://water.usgs.gov/owq/FieldManual/mastererrat.html

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SOP #2013
February 2002

FIGURE 1. Kemmerer Bottle

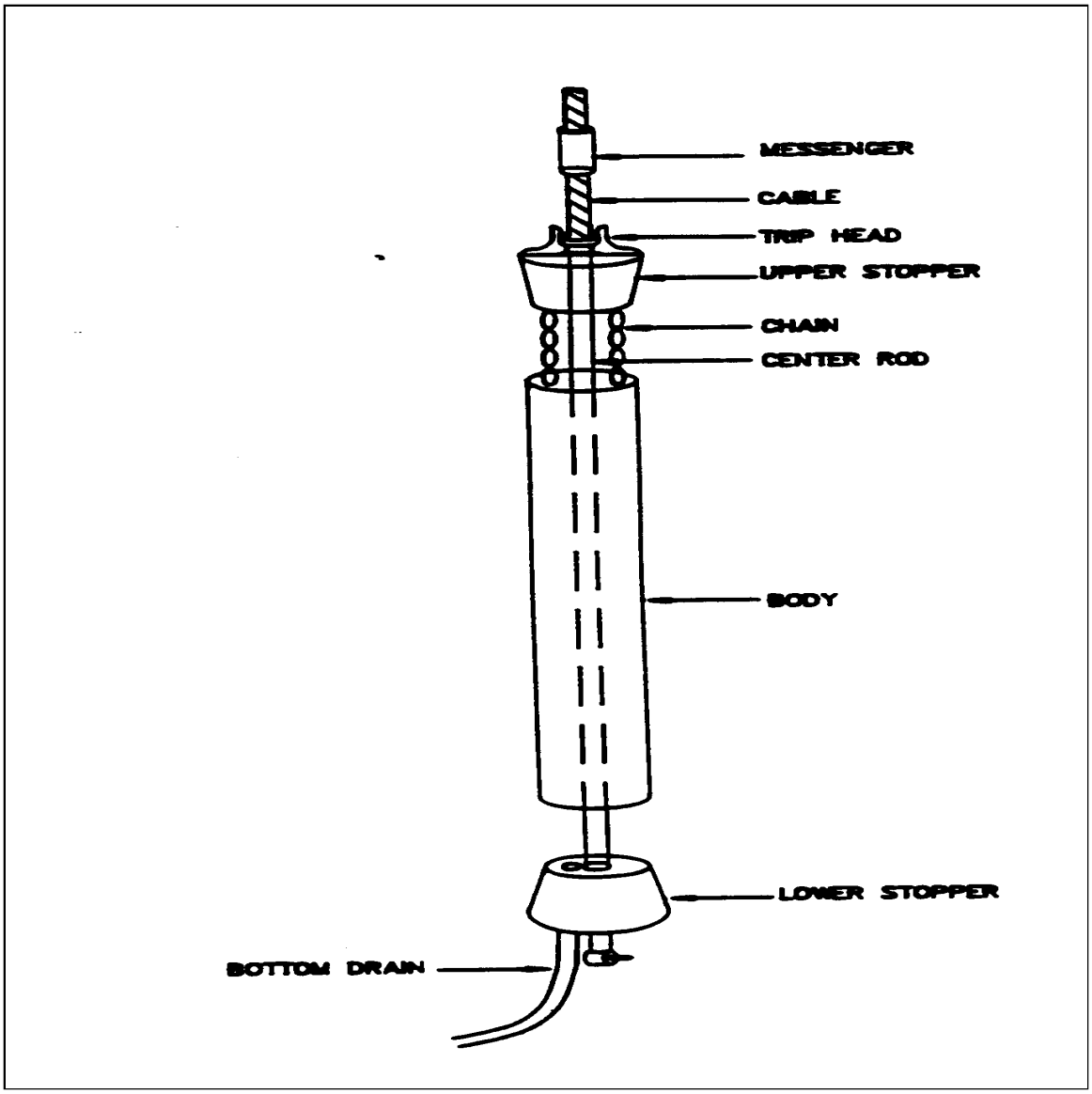


FIGURE 2. Van Doren Sampler

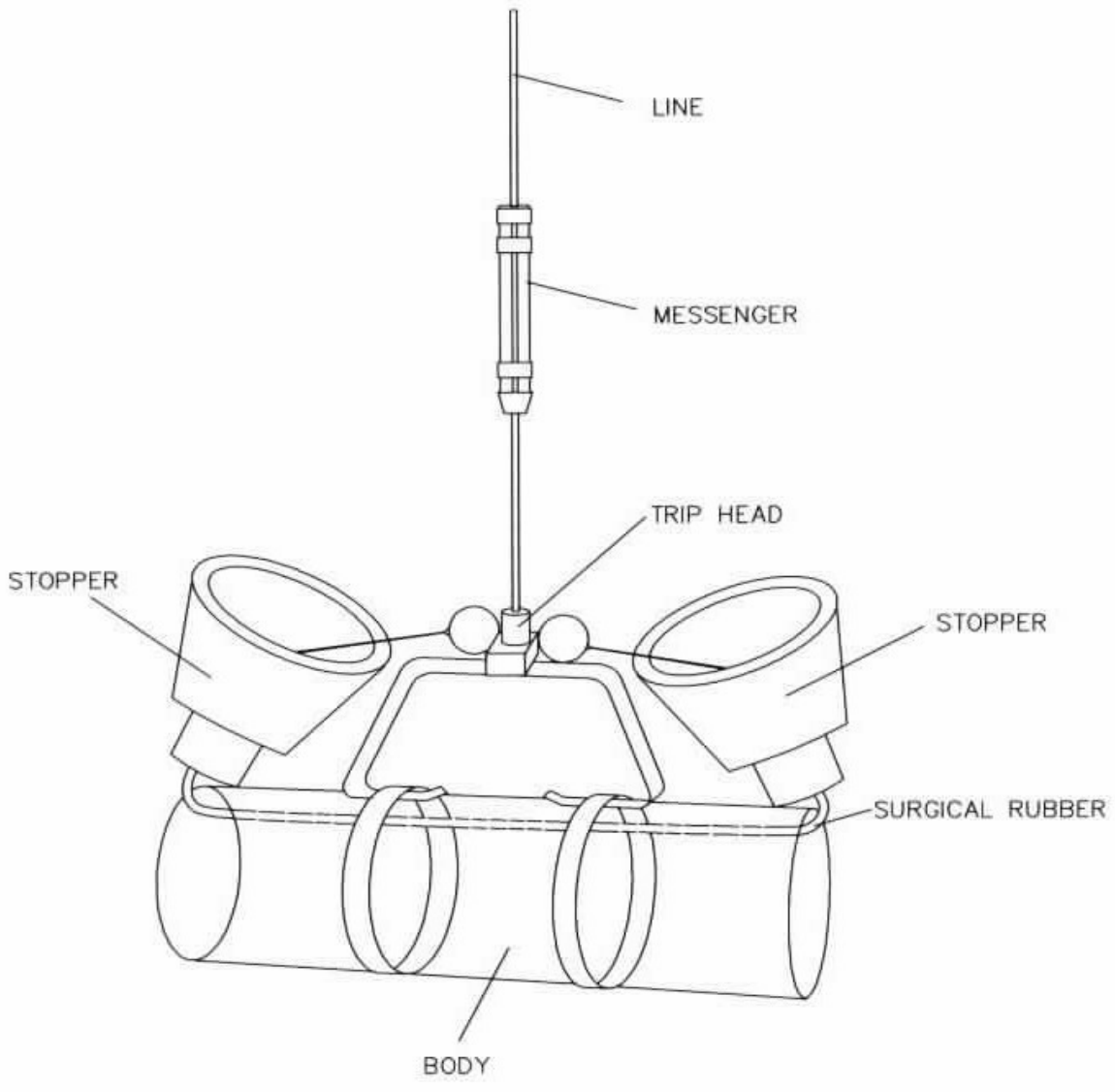


FIGURE 3. Bacon Bomb Sampler

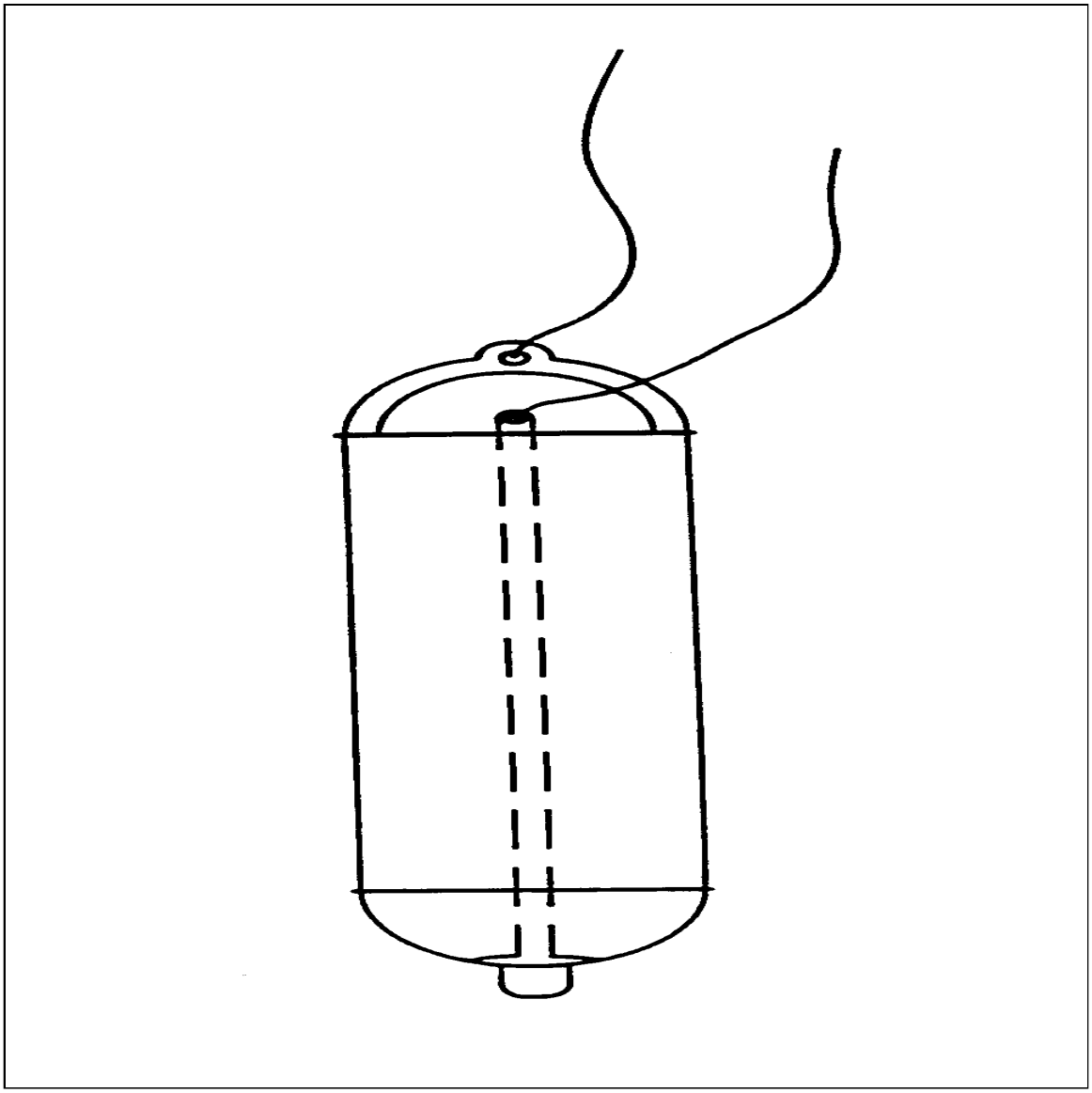
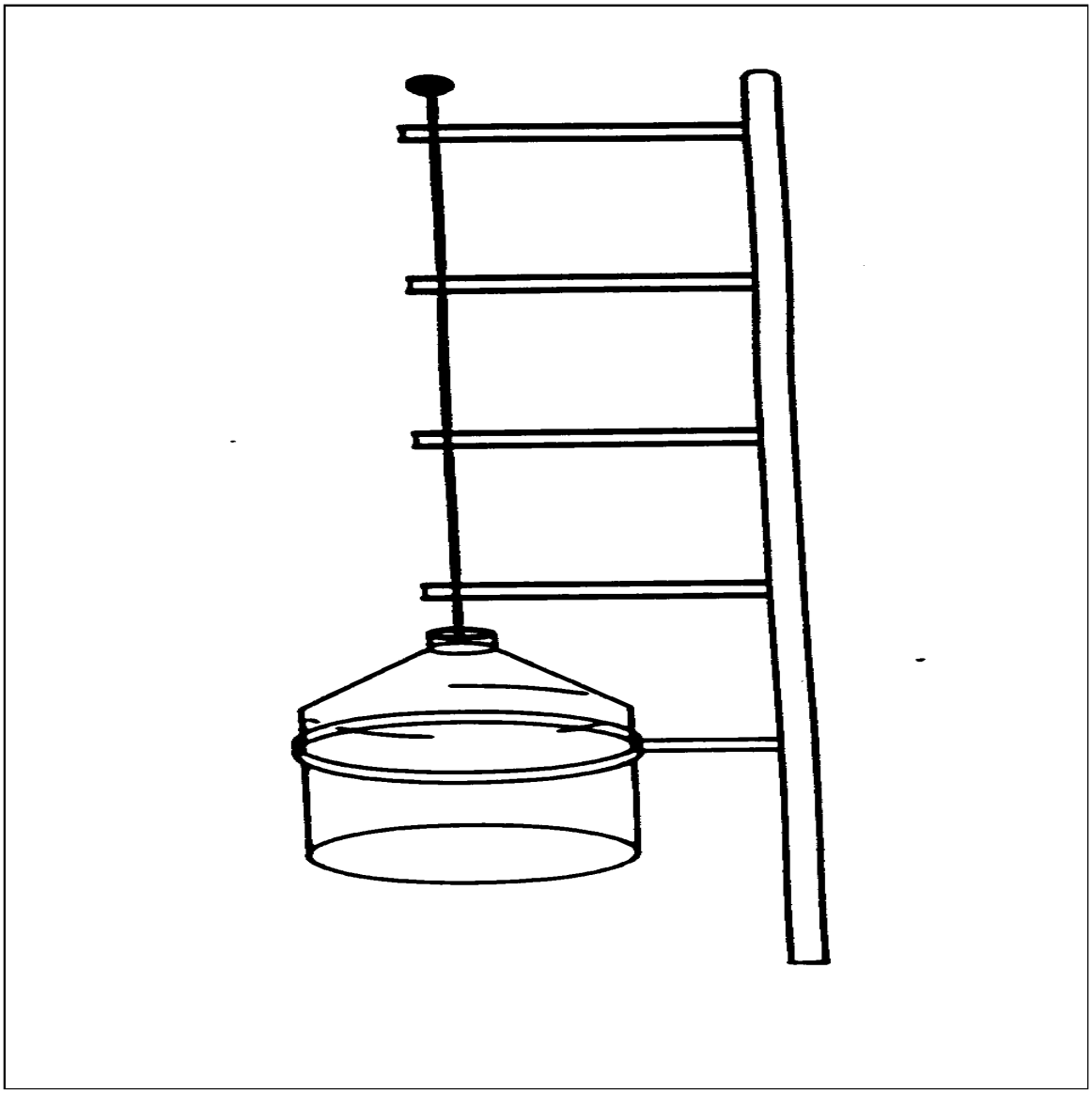


FIGURE 4. Dip Sampler



MONITORING WELL DEVELOPMENT

CONTENTS

DISCLAIMERS

1.0 SCOPE AND APPLICATION

2.0 METHOD SUMMARY

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

5.0 EQUIPMENT/APPARATUS

6.0 REAGENTS

7.0 PROCEDURES

- 7.1 Preparation
- 7.2 Operation
- 7.3 Post-Operation

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY

12.0 REFERENCES

13.0 APPENDICES

The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide an overview of monitoring well development practices. The development of a monitoring well (herein development) removes fine-grained material and/or drilling fluids from the well screen and filter pack. This activity is necessary to restore the formation properties disturbed during the drilling process, to improve the hydraulic characteristics of the filter pack, and to recondition hydraulic communication between the well and the hydrologic unit adjacent to the well screen because fine-grained materials or fluids may interfere with water quality analyses [American Society for Testing and Materials (ASTM) D5092M-16 (Reapproved 2016)].

Development allows groundwater to flow freely from the geological formation (herein formation) into the monitoring well and also reduces the turbidity of the groundwater during sampling. There are several factors to be considered when choosing a development method. These factors include but are not limited to: well construction; aquifer characteristics and hydraulic conductivity of the formation surrounding the well screen; groundwater quality of the water-bearing zone being monitored; consequences of introducing foreign fluids into the well and aquifer; drilling method used during borehole installation; depth to static water level and water column height in the well; type and portability of available equipment; time available for development; and cost effectiveness of the method (ASTM D5521M-13). The most common well development methods are surging, hydraulic jetting, over-pumping, bailing and air lifting.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must also be documented in the final deliverable.

2.0 METHOD SUMMARY

The chosen development method should not interfere with the setting of the monitoring well seal. After construction, a well should not be disturbed for up to 48 hours to allow grout/concrete to cure. This is especially important, if a vigorous development method (i.e. hydraulic surging) is being used. If a less vigorous method is used (i.e. bailing), it may be initiated shortly after installation.

Several activities must take place prior to development. First, open the monitoring well, take initial measurements (i.e., headspace air monitoring readings, groundwater level, total depth of the well, etc.), and record results in a site logbook and/or field data sheet. Develop the well by the appropriate method to accommodate site conditions and project objectives. The most common development methods are surging, hydraulic jetting, over-pumping, bailing and air lifting. These methods are described below:

- **Surging** involves raising and lowering a surge block or surge plunger inside the monitoring well. The resulting surging motion forces water into the formation and loosens sediment, pulled from the formation into the well. Occasionally, sediments must be removed from the well with a sand bailer to prevent sand locking of the surge block. This method may cause the sandpack around the screen to be displaced to a degree that damages its value as a filtering medium. Channels or voids may form near the screen if the filter pack sloughs away during surging (Keel and Boating, 1987).

- **Hydraulic jetting** involves lowering a small diameter pipe into the monitoring well and injecting a high velocity horizontal stream of water or air through the pipe into the screen openings. This method is especially effective at breaking down filter cakes developed during mud-rotary drilling. Simultaneous air lift pumping is usually used to remove fine particles.

- **Over-pumping** involves pumping at a high rate to increase drawdown as low as possible and then allowing the well to recharge to near the original level before repeating the process until the purge water is sediment-free.

- **Bailing** includes the use of a simple manually operated check-valve bailer to remove groundwater from the monitoring well. The bailing method, like many other methods, should be repeated until the purge water is sediment-free. Bailing may be the method of choice in a shallow monitoring well or on a monitoring well that recharges slowly.

- **Air lifting** is done by injecting a sudden charge of compressed air into the well with an air-line in a way that water is forced through the monitoring well screen, or extracted from the well using air as the lifting medium (air-lift pumping). The air injection is cycled allowing the water column to rapidly rise and fall repeatedly in the well pipe. Periodically, the airline is pulled up into a pipe string known as the eductor pipe. The air injection cycling is repeated until the purge water is sediment-free. Method variations include leaving the air line in the pipe string at all times or using the monitoring well casing as the eductor pipe.

Once a monitoring well is developed (i.e., purge water is sediment free), record readings (e.g., pH, temperature, and specific conductivity) in a site logbook and/or field data sheet. Containerize all purge water from the monitoring well with known or suspected contamination. Label containers with the location where purge waters will be stored. Decontaminate monitoring well development equipment prior to use in the next well.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The following problems are often encountered during development activities:

- Over-pumping is not as vigorous as surging and hydraulic jetting, even though it is the most desirable development method.

- Surging and jetting development methods have the potential of distorting the monitoring well filter pack.

- Introduction of other source (s) water or air by jetting may alter the hydrochemistry of the aquifer.

- Air lifting may produce “air locking” in some formations, preventing water from flowing into the well.

- The use of surge blocks in clay-rich formations may plug/smear the well screen.

- Small (two-inch nominal diameter) submersible pumps that fit in two-inch diameter well casings are especially susceptible to clogging if used in well development applications.

- Improper decontamination of drilling equipment may cause cross-contamination in monitoring well.

5.0 EQUIPMENT/APPARATUS

The type of equipment used for development is dependent on the well diameter and the development method. For example, the diameter of most submersible pumps is too large to fit into a two-inch inner diameter (ID) monitoring well; thus other development methods should be used. Obtaining the highest possible yield is not usually an objective in developing monitoring wells and vigorous development is not always necessary. Many monitoring wells are constructed in fine-grained formations that would not normally be considered aquifers. Specifications for the drilling contract should include the necessary monitoring well development equipment (e.g., air compressors, pumps, air lines, surge blocks, generators, etc.).

6.0 REAGENTS

Chemicals [e.g., polyphosphates (a dispersing agent), acids, or disinfectants] are often used in development, but should be avoided for monitoring wells in which groundwater quality is most important. Polyphosphates should not be used in thinly bedded sequences of sands and clays. The use of decontamination solutions may also be necessary. If decontamination of equipment is required at a monitoring well, refer to the Environmental Response Team (ERT) SOP, *Sampling Equipment Decontamination* and the site-specific UFP-QAPP.

7.0 PROCEDURES

7.1 Preparation

1. Coordinate site access and obtain keys to access monitoring well.

2. Obtain information on each well to be developed [i.e., drilling method, well diameter, well depth, screened interval, presence of contaminants; (if any)].

3. Obtain a water level meter, a depth sounder, air monitoring instruments, materials for decontamination, and water quality instrumentation. The water quality instrumentation needs to be capable of measuring, at a minimum, pH, specific conductivity, temperature, turbidity, dissolved oxygen (DO) and oxidation-reduction potential. Choose a development method and proceed (Refer to Section 2.0 *Method Summary*).

4. Assemble and label containers for temporary storage of water produced during development. Containers must be structurally sound, compatible with suspected contaminants, and easy to manage in the field. The use of truck-mounted or roll-off tanks may be necessary in some cases; alternately, a portable water treatment unit (i.e.: granulated activated carbon) may be used to treat purge water.

7.2 Operation

Development should be performed as soon as it is practical after the monitoring well is installed, but at least 48 hours after monitoring well installation to allow grout/cement to cure.

1. Assemble necessary equipment on a plastic sheet surrounding the monitoring well.

2. Record pertinent information in a site logbook and/or field data sheet (personnel, time, location ID, etc.).

3. Open monitoring well, wait at least three to five seconds and take air monitor readings at the top of casing and in the breathing zone (BZ), as appropriate.

4. Measure depth to groundwater and the total depth of the monitoring well. Calculate the water column volume of the monitoring well (Equation 1, Section 8.0).

5. Begin development and measure/record the initial pH, temperature, turbidity, specific conductivity, DO and oxidation-reduction potential of the groundwater. Note the initial color, clarity, and odor of the groundwater.

6. Continue to develop the well and periodically measure the water quality parameters indicated in step 5. Depending on project objectives and available time, development should proceed until the water color and clarity are transparent or near transparent and all silt to sand purged from the well. The development water should reach a turbidity of less than 50 nephelometric turbidity units (NTUs). Most important is to confirm that sand from the surrounding sandpack is not entering the wells.

   Note: In practice, well development should continue until water quality parameters stabilize; however, this is not always possible. The addition of drilling fluids (e.g., mud, foam, or lost-circulation additives (LCA)) may require the sandpack to be flushed for an extended period under ambient flow conditions. Wells installed in bedrock commonly intersect isolated water bearing fractures and may require some time to re-establish equilibrium.

7. All water produced by development of contaminated or suspected contaminated wells must be containerized or treated. Each container must be clearly labeled with the location ID, date collected, and sampling contractor. Determination of the appropriate disposal method will be based on the analytical results from each well.

8. No water will be added to the well to assist development without prior approval by the ERT Work Assignment Manager (WAM). In some cases, small amounts of potable water may be added to help develop a poor yielding well. It is essential that at least five times the amount of water injected must be recovered from the well in order to assure that all injected water is removed from the formation.

9. Note the final water quality parameters along with the following data:

- Well designation (location ID)
- Date(s) of monitoring well installation
- Date(s) and time of development
- Static water level before and after development
- Quantity of groundwater removed; and initial and completion time
- Type and capacity of pump or bailer used
- Description of development techniques

7.3 Post-Operation

1. Decontaminate all equipment used. Refer to the site-specific UFP-QAPP and ERT SOP, *Sampling Equipment Decontamination.*

2. Secure holding tanks or containers of purge water.

3. Review analytical results and determine the appropriate water disposal method. Actual disposal of the purge water is generally carried out by the US EPA On-Scene Coordinator (OSC); however, at times ERT contractor personnel may be requested to contract someone to dispose of this material.

8.0 CALCULATIONS

To calculate the volume of water in the monitoring well, the following equation is used:

$$Well\ volume(V) = \pi r^2 h(cf)$$ **Equation 1**

Where:

π = Pi (3.14)
r = Radius of monitoring well in feet (ft)
h = Height of the water column in ft. (This may be determined by subtracting the depth to groundwater from the total depth of the well as measured from the same reference point)
cf = Conversion factor in gallons per cubic foot (in Equation 1, 7.48 gal/ft^3 is the conversion factor)

Monitoring well diameters are typically two, three, four, or six inches. A number of standard conversion factors can be used to simplify the above equation using the diameter of the monitoring well. The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:

$$V\ (gal/\ ft) = \pi r^2 h(cf)$$ **Equation 2**

Where:

π = Pi (3.14)
r = Radius of monitoring well (feet)
cf = Conversion factor (7.48 gal/ft^3)

For example, a two-inch diameter monitoring well, the volume per linear foot can be calculated as follows:

$$V\ (gal/\ ft) = \pi\, r^2\, h\,(cf)$$

$V = 3.14\ (1/12\ ft)^2\ 7.48\ gal/ft^3$

$V = 0.1631\ gal/ft$

NOTE: The diameter must be converted to the radius in feet as follows:

Well Diameter (in inches) x 0.5 = Well Radius (feet)

The volume in gallons/feet for the common size monitoring wells is as follows:

Well diameter (inches):	2	3	4	6
Volume (gal/ft):	0.1631	0.3670	0.6524	1.4680

If the volumes for the common size wells above-mentioned are used, **Equation 1** is modified as follows:

Well volume = (h)(f)

Where:

h = height of water column (feet)
f = the volume in gal/ft calculated from **Equation 2**

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific Quality Assurance/Quality Control (QA/QC) activities that apply to the implementation of these procedures will be listed in the QAPP prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All well development data, including the items listed in Section 7.2, step 9, must be documented in site logbooks or on field data sheets.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer or instrument-specific SOPs, unless otherwise specified in the UFP-QAPP. Equipment checkout and calibration is necessary prior to purging and sampling and must be done according to the instruction manuals supplied by the manufacturer.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to location information, water quality parameter measurements, development techniques, water levels, quantity of groundwater removed, date of monitor well installation, and date and time of development. These data are essential to providing an accurate and complete final deliverable. The ERT contractor's Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

12.0 REFERENCES

ASTM International. 2013. Standard Guide for Development of Groundwater Monitoring Wells in Granular Aquifers. Designation: D-5521M-13.

ASTM International. 2016. Standard Practice for Design and Installation of Groundwater Monitoring Wells. Designation: D-5092M-16.

Driscoll, F. G. 1986. "Development of Water Wells." In: *Groundwater and Wells.* Second Edition. Chapter 15. Johnson Filtration Division, St. Paul, Minnesota. p. 497-533.

Freeze, Allan R. and John A. Cherry. 1979. *Groundwater*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Keel, J.F. and Kwasi Boating. 1987. "Monitoring Well Installation, Purging, and Sampling Techniques - Part 1: Conceptualizations".*Groundwater,* 25(3):300-313.

Keel, J.F. and Kwasi Boating. 1987. "Monitoring Well Installation, Purging, and Sampling Techniques - Part 2: Case Histories". *Groundwater*, 25(4):427-439.

Ohio EPA, 2009. Monitoring Well Development, Maintenance, and Redevelopment, Chapter 8, *Technical Guidance Manual for Ground Water Investigations.* Division of Drinking and Ground Waters. State of Ohio Environmental Protection Agency. February 2009 (rev. 2).

13.0 APPENDICES

This section is not applicable to this SOP.

CONTENTS

DISCLAIMERS

1.0 SCOPE AND APPLICATION

2.0 METHOD SUMMARY

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

5.0 EQUIPMENT/APPARATUS

6.0 REAGENTS

7.0 PROCEDURES

7.1 Texture
7.2 Secondary and Minor Components
7.3 Color
7.4 Soil Moisture
7.5 Soil Odor
7.6 Grading
7.7 Grain shape
7.8 Other Components
7.9 Photoionization/Flame Ionization Detectors)
7.10 Hydrochloric Acid Reaction
7.11 Soil Consistency
7.12 Recording Soil Descriptions by the Use of the Modified Burmister Soil Identification System
7.13 Recording Soil Descriptions by the Use of the United Soil Classification System
7.14 Soil Cores Descriptions

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY

12.0 REFERENCES

13.0 APPENDICES

A – Tables
B – Figures

The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

1.0 SCOPE AND APPLICATION

The objective of this Standard Operating Procedure (SOP) is to describe the procedures for field description of soil and sediment borings during site investigations. Conventions used by the Modified Burmister Soil Identification (Burmister) System and the Unified Soil Classification System (USCS) are included in this SOP.

For the purpose of site investigations, soil and sediment are considered to be any unconsolidated material composed of grains and/or organic matter with pore spaces. Soil is considered to be subaerial, whereas sediment is from beneath a water body or wetland. These definitions differ from the formal geological definitions. According to this usage, soil may include formal geologic units and material that would traditionally be classified as sediment.

Soil is typically described from core samples or drill cuttings during drilling activities or test pits during excavating activities. The Burmister and the USCS conventions were developed for engineering purposes. Both of the engineering conventions require laboratory measurements; therefore, field descriptions depend on estimates based on the professional judgment of the geologist.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations, or limitations imposed by the procedure or other procedure limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the Quality Assurance Project Plan (QAPP). These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Major attributes of a representative soil or sediment sample to be identified in the field include soil type or lithology (sand, silt, clay), color, texture as determined by major and minor particle sizes and sorting. Other characteristics that may be recorded include structure, cementation, moisture content, density, the presence of accessory minerals, foreign material, odor and hydrochloric acid (HCl) reaction. Other critical parameters of the sample collected include method of collection, location, and depth.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

This section is not applicable to this SOP.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Because field description of soil or sediment is a learned skill, results may vary due to experience, weather conditions, and type of sampling. Determining if a sample is representative of native soil may also present difficulties. During borehole investigations, “fallback” of material in the hole is common, particularly in loose sediment, and thus it may be difficult to identify native soil. Sampling or drilling methods other than coring may segregate size fractions so that finer-grained portions of the samples may be lost or not recognized. Soils containing large gravel or cobbles may be difficult to core consistently.

5.0 EQUIPMENT/APPARATUS

The primary equipment and materials required for field description of soil and sediment:

- Pocket knife
- Core cutter
- Small spatulas, spoons, and trowels
- Tape measure
- Grain size charts
- Munsell Soil Color Charts
- Field logbook/soil boring log sheets
- Pens
- Permanent markers
- Nitrile gloves
- Work gloves
- Monitoring instruments equipped with photoionization detector (PID) and/or flame ionization detector (FID)
- Folding table
- Camera

6.0 REAGENTS

- Dilute 10 percent (%) hydrochloric acid (HCl), as required
- Water; city, non-potable or any other natural source

7.0 PROCEDURES

The primary descriptors are texture (grain size), color, sorting, moisture content, foreign material, odor, consistency and reaction with acid.

7.1 Texture

Soil and sediment are described based on grain size, which is referred to as soil texture in the engineering systems. The grain size classes typically encountered during environmental investigations are gravel, sand, silt and clay. The presence of cobbles and boulders are noted but are excluded from the primary texture description. The grain size classes with diameters in millimeters (mm) for the Wentworth phi scale, the USCS and Burmister system are in Table 1, Appendix A.

Burmister (1970) uses one of the four classes or, in the case when the secondary component exceeds % of the sample, the secondary class is added following “and”. For example, the primary class is sand and the secondary component is silt “Sand and Silt.” For USCS (ASTM 2009), a secondary component exceeding 30% is added by creating an adjective out of the one of the four classes (e.g., Silty sand). The percentages of the classes are approximated to within 5%. The USCS group names and group symbols are defined in Table 2, Appendix A.

Texture is generally determined tactually. Sand and gravel are gritty with the difference determined visually. Silt is too fine to be felt but smudges across the fingers. Clay generally contains sufficient clay-minerals to be cohesive and rolled like dough. Grain size can further be defined as fine, medium or coarse, or as a range, such as fine to medium. The engineering systems do not differentiate between very fine sand, silt and clay based on grain size, but rather on mineralogy, which is judged by either laboratory or field tests of plasticity. Table 3, Appendix A is the field method provided by Burmister (1970) for approximating plasticity and the relative proportions of silt and clay.

7.2 Minor Components

Minor components are grain sizes less than 35% for the Burmister system and less than 30% for the USCS. Burmister uses some, little, and trace for amounts of minor components defined as follows:

Some	=	20 to 35%
Little	=	10 to 20%
Trace	=	<10%

The percentages are from Burmister (1970). The USCS adds a minor component using "with", and percentage is approximated within 5%. In the USCS system, trace is defined as less than 5%. The minor components are identified using the same methods as identifying the primary components.

7.3 Color

In addition to generic color descriptions, the Munsell® Soil Color Charts can be used. The specific soil color is determined in a standardized manner by comparing the soil to colors in the charts. This system encompasses three color aspects: hue, value and chroma represented as "hue value/chroma." The hue is denoted as the letter abbreviation of the color (R for red, Y for Yellow, YR for yellow-red). The color is modified by a preceding number to indicate the proportions of yellow and red. The value is rated on a scale from 0/ to 10/, with 0/ being absolute black, and 10/ for absolute white. Thus, a value of 5/ represents visually half-way between black and white, while 6/ is slightly less dark than 5/, and 7/ is lighter. The chroma notation consists of numbers signifying the range of neutral grays ranging from /0 to /20. For example, 5YR 5/6 has a hue of 5YR with a value of five and a chroma of six, which is a dark orange. In addition, half values can be used for colors falling between the value and the chroma, for example, 5YR 5.5/6 is darker than the above example. For the Munsell Soil Color Charts, value ranges between 2 and 8, and the chroma ranges between 1 and 8.

The color charts for gley soil provides the hue at the bottom of the page and includes neutral (N), green (G), blue (B) and purple (P). As in the other charts the values are indicated on the left side of the charts. The chroma for gley soil is 1 except for neutral and 5G, which are 0 and 1 or 2, respectively.

To use the Munsell Soil Color Charts, hold an undisturbed soil sample under the page that appears to have the correct color range. Move the sample beneath the page until a match is found through the holes that are between the color chips. If no match is found, attempt to find the match on another page. Once a match is found, read the hue from the upper right corner, the value from the left margin and chroma from the bottom margin. The gley pages are as indicated above. The left page also indicates the generic names for the colors.

Soil and sediment should be inspected for the presence of mottles, which are areas of color that differ from the matrix color. The color or colors of the mottles are described as above. The size, shape, contrast and amount of mottles should also be described.

7.4 Soil Moisture

Moisture content is described as dry, moist or wet. Dry refers to the absence of moisture, dusty, dry to the touch. Moist is damp with no visible water. Wet has visible free water, which is common when the soil is from below the water table and is wet in the case of sediment.

7.5 Soil Odor

Soil odor is typically described as organic or chemical. Some organic soil may exhibit sulfur or decaying vegetable odors, whereas contaminated soil may have a petroleum or chemical odor. A sulfur odor indicates anoxic conditions and is more likely in sediments. Odors should never be inhaled directly if contaminants are suspected.

7.6 Grading

Grading is the engineering term for amount of sorting of grain sizes. A poorly graded soil or sediment would have particles which are all a similar size, and well graded indicates grain sizes spanning a wide range. USCS uses W for well graded and P for poorly graded. Sorting is the geological term and ranges from very poorly sorted to very well sorted. Figure 1, Appendix B shows degrees of sorting where grading is the ranges in the opposite direction.

7.7 Grain Shape

Grain shape is the degree the grains are angular and how similar the grains are to a sphere. Figure 1, Appendix B shows terminology and range for angularity and sphericity.

7.8 Other Components

Identify other components if present such as:

- Roots and root mass;
- Vegetation, peat, organic matter content, humus;
- Shells or fossils;
- Accessory minerals such as mica;
- Rock fragments; and
- Indication of fill including slag, cinders or charcoal, rubbish, brick, glass, and other foreign material.

7.9 Photoionization/Flame Ionization Detectors

PIDs and FIDs are used to identify potential areas of contamination. Both detectors measure organic vapors and gases. PIDs respond to functional groups; whereas, FIDs respond to carbon chain lengths. Weather conditions, temperature, and moisture content of the sample may affect the readings. The use of a PID and/or FID depends on the expected contaminants as indicated in the site-specific Health and Safety Plan (HASP).

PID and FID measurements are made at discrete points in the core. These locations are chosen based on visual changes in the core or regular intervals when the core is uniform. The core is disturbed to release any vapors by using a sampling spoon or similar tool. The PID and/or FID are held close to the soil to analyze any vapors emanating for the soil. Refer to the manufacturers' manuals or the appropriate SERAS SOP for details.

7.10 Hydrochloric Acid Reaction

Reaction to a drop or two of dilute HCl is noted as strong, weak, or none. Strong refers to a lively effervescence, with bubbles forming immediately. Weak is some reaction, with the slow formation of bubbles. None is defined as "no visible reaction". This test indicates the presence of carbonates, either in cement or in the soil matrix. Caution must be exercised when handling acids, refer to the site-specific HASP for reagents.

7.11 Consistency

The resistance to penetration is determined by evaluating how easily a finger can be pushed into a sample. The descriptions range from very soft through very hard as described in Table 4, Appendix A.

Another measure of consistency is the standard penetration resistance indicated by the number of blows required to drive a standard two-inch outer diameter (OD) split-spoon sampler six inches into the soil using a 140-pound hammer falling freely through 30 inches. The sampler is driven through 4 six-inch intervals for a total of 24 inches. The number of blows is recorded for each 6-inch interval. The number of blows required to drive the last twelve inches is denoted as the "N" value. This test indicates the compactness of granular soil and the consistency of cohesive silt and clay rich soil on a shearing strength basis.

Sample recovery in cores or split spoons can also indicate consistency through the degree that the sample compacts into the core. Soil recovery is the length of core retrieved measured to 0.01 of a foot. The percent recovery is the ratio of total recovery to possible recovery based on the length of the sampler.

7.12 Recording Soil Descriptions by the Use of the Modified Burmister Soil Identification System

- If the major component comprises more than 50 % of the soil, then fully capitalize the major component descriptor (i.e., SAND);
- If the major component comprises less than 50% of the soil, capitalize the descriptor (i.e., Sand);
- Place a comma after the major and minor component descriptors;
- Place size qualifiers such as coarse, medium, or fine before the major component descriptors (refer to Table 1, Appendix A);

- Describe the minor component with the first letter capitalized, preceded by the size descriptor (i.e., fine Sand)

- Describe the minor fractions using:
  And = 35 to 50%
  Some = 20 to 35%
  Little = 10 to 20%
  Trace (tr) = <10%

- Record the formal or informal geological names when probable identification can be made.

An example of a Modified Burmister Soil Identification System description is: Gray medium to fine GRAVEL and coarse to fine Sand, trace silt; and 2.5 5/4 reddish brown coarse to medium SAND, loose, wet, no odor.

7.13 Recording Soil Descriptions by the Use of the United Soil Classification System

- Indicate the major component for fine-grained soil and major and secondary components for coarse-grain soil when appropriate. Indicate grain size class percentages with the group name and include group symbol in brackets using the codes indicated in Table 2, Appendix A.

- Indicate grading for coarse-grain soil.

- When appropriate, use dual symbols separated by a hyphen, for example, GP-GM. Borderline symbols may be used and are separated by a slash indicating the soil has been identified as having properties of two groups. For example, CL/CH.

An example of USCS soil description is: Well-Graded Gravel with Sand (GW), fine to coarse, hard subangular gravel; about 25% fine to coarse, hard, subangular sand, trace of fines; maximum size 75 mm, brown, no reaction with HCl.

7.14 Soil Cores Descriptions

Soil logs present the information recorded during field investigations. Soil descriptions may be based on the Burmister, the USCS or neither provided that all the relevant information is recorded.

The following information should be recorded in a core log:

- Date boring was advanced;

- Boring, monitoring well, or test pit identification designation;

- Soil sampling technique, for example: hand-auger, direct push, etc;

- Soil recovery;

- Soil color;

- Depth range of sample;

- Soil description;
- Depth to groundwater;
- Elevations shown in the boring logs are ground surface elevations at the time of the soil investigation; and,
- Photographic documentation: Photograph the soil sample in natural light, correlated to the boring and depth range by an identification number of the photograph. A photographic log provides a permanent visual record of the soil conditions and a graphic record of structural features exposed in the soil.

All soil cores must be described in the site-specific field logbooks. Refer to Figures 2 and 3 included in Appendix B for examples of soil logs.

8.0 CALCULATIONS

This section not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

1. All data must be documented on soil boring logs or in site logbooks.
2. Records must be maintained, documenting the training of the operators that use instrumentation and equipment for the collection of environmental information.

10.0 DATA VALIDATION

If additional analyses (e.g., sieve analyses or other engineering tests) are required by a laboratory, the results will be reviewed prior to release. All soil boring logs will become part of a final deliverable package and will be reviewed in accordance with standard peer review practices.

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: date boring was advanced, identification of boring, soil color, soil description, photographic documentation, etc., etc. These data are essential to providing an accurate and complete final deliverable. The Contractor's Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's Environmental Response Team (ERT) should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

12.0 REFERENCES

ASTM International. 2009. *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, Designation: D2488 – 09a.

ASTM International. 1970. *Suggested Methods of Test for Identification of Soils*. STP-479 EB/Jun.1970. Burmister, D.M. 13 pp.

ASTM International. 2011. Standard *Practice for Classification of Soils for Engineering Purposes (United Soil Classification System)*. D2487-11. 12 pp.

Boggs, S. 1987. *Principles of Sedimentology and Stratigraphy*. Macmillan Publishing. New York.

http://tasaclips.com/illustrations/Detrital_rock_sorting.jpg

The Munsell Soil Color Charts, Macbeth Division of Kollmorgen Instruments Corporation, 405 Little Britain Road, New Windsor, NY 12553.

13.0 APPENDICES

A - Tables
B - Figures

APPENDIX A
Tables
SOP: ERT-PROC-2074-20
May 2020

TABLE 1. Grain Size Classes in Millimeters for Three Systems

Component	*Wentworth*[1]	*USCS*[2]	*Burmister*[3]
Boulders	> 256	> 300	—
Cobbles	64 - 256	75 - 300	—
Very Coarse Gravel	32 - 64	—	—
Coarse Gravel	16 - 32	19-75	25.4 – 76.2
Medium Gravel	8 - 16	—	4.525 – 25.4
Fine Gravel	4 - 8	4.75-19	2.0 – 4.525
Very Fine Gravel	2 -4	—	—
Very Coarse Sand	1 - 2	—	—
Coarse Sand	0.5 – 1 (1/2 - 1)	2.0 - 4.75	0.590 – 2.0
Medium Sand	0.25 – 0.5 (1/4 – 1/2)	0.425 – 2.0	0.250 – 0.590
Fine Sand	0.125 - 0.25 (1/8 – 1/4)	0.075 - 0.425	0.074 – 0.250
Very Fine Sand	6.25×10^{-2} – 12.5×10^{-2} (1/16 – 1/8)	—	—
Silt	3.90625×10^{-3} – 6.25×10^{-3} (1/256 – 1/16)	< 0.075 (non-plastic)	0.02 – 0.074
Fine Silt	—	—	< 0.02
Clay	< 3.90625×10^{-3} (< 1/256)	< 0.075 (plastic)	< 0.074 (plastic)

[1]Boggs, 1987
[2]ASTM, 2009
[3]Burmister, 1970

> = greater than
> = less than

TABLE 2. Grain Size and Type Definitions for the USCS

Major divisions			***Group symbol***	***Group name***
Coarse grained soil more than 50% retained on No.200 (0.075 mm) sieve	Gravel > 50% of coarse fraction retained on No. 4 (4.75 mm) sieve	clean Gravel <5% smaller than #200 Sieve	**GW**	Well-graded gravel, fine to coarse gravel
			GP	Poorly graded gravel
		Gravel with >12% fines	**GM**	Silty gravel
			GC	Clayey gravel
	Sand ≥ 50% of coarse fraction passes No.4 sieve	clean Sand	**SW**	Well-graded sand, fine to coarse sand
			SP	Poorly graded sand
		Sand with >12% fines	**SM**	Silty sand
			SC	Clayey sand
Fine grained soil more than 50% passes No.200 sieve	Silt and Clay liquid limit < 50	inorganic	**ML**	Silt
			CL	Clay
		organic	**OL**	Organic silt, organic clay
	Silt and Clay liquid limit ≥ 50	inorganic	**MH**	Silt of high plasticity, Elastic silt
			CH	Clay of high plasticity, Fat clay
		organic	**OH**	Organic clay, Organic silt
Highly organic soils			**Pt**	Peat

Notes: mm = millimeters, < = less than, ≥ = greater than or equal to.

TABLE 3. Field Identification of Silt and Clay Component Ratio

Component	*Smallest Diameter of Rolled Thread*	*Plasticity Index*	*Plasticity*
Silt	none	0	Non-plastic
Clayey silt	thread crumbles at1/4"	1 to 5	Slight
Silt and Clay	thread crumbles at 1/8"	5 to 10	Low
Clay and Silt	thread crumbles at 1/16"	10 to 20	Medium
Silty clay	thread crumbles at 1/32"	20 to 40	High
Clay	thread crumbles at 1/64"	>40	Very high

Notes: “ = inches, > = greater than.

TABLE 4. Criteria for Describing Consistency

Description	*Criteria*
Very Soft	Thumb will penetrate soil more than 1 in. (25 mm).
Soft	Thumb will penetrate soil about 1 in. (25 mm).
Firm	Thumb will indent soil about 1⁄4 in. (6 mm)
Hard	Thumb will not indent soil but readily indented with thumbnail.
Very hard	Thumbnail will not indent soil.

Notes: in = inches, mm = millimeters

APPENDIX B
Figures
SOP: ERT-PROC-2074-2
May 2020

FIGURE 1. Soil Sorting and Grain Shape Diagrams (www.tasaclips.com)

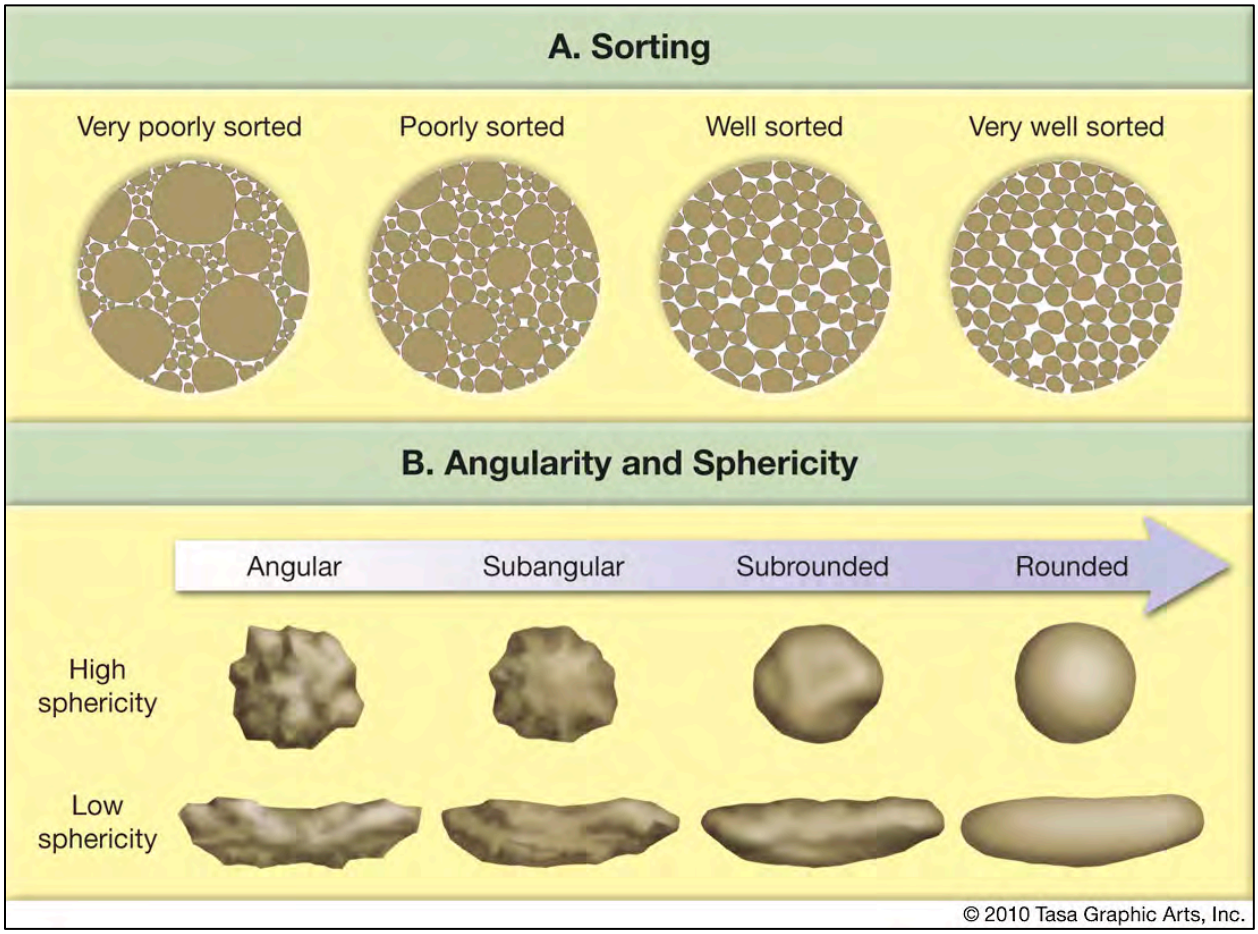


FIGURE 2. Example of Soil Boring Log for Burmister

Project No: XXXX

Log of Borehole AA-01 a

Project: XXXX

Client: ERT-EPA

Location: Anywhere, NJ **Geologist: XXXX** **Date: XX-XX-XXXX**

SUBSURFACE PROFILE				SAMPLE		
Depth	Symbol	Description	Depth	Recovery	Well Completion Details	VOC Concentration
0		Ground Surface	0.0			
		SAND Gray (5/2 10 YR) cf subrounded SAND, moist, no odor, loose	0.0			
1			-1.0 / 1.0			
		SAND Dark gray-brown (4/3 10 YR) to gray (4/1 10 YR) c subrounded SAND, tr. subangular f Gravel, wet, TPH odor, loose				
2						
3						
4			-4.4			
		SAND Gray (4/1 10 YR) cm subrounded SAND, wet, slight TPH odor, loose	4.4 / -5.0 / 5.0			
5						
		GRAVELLY SAND Gray (5/1 10 YR) grading to light gray (6/1 10 YR) cf subrounded SAND and f subangular Gravel, wet, no odor, loose				
6						
7						
8						
9						
10						

Drill Method: Direct Push

Hole Size: 2 inches

Lockheed Martin/SERAS
2890 Woodbridge Avenue
Edison, NJ 08520

Datum: grade

Checked by: XX

Sheet: 1 of 1

FIGURE 3. Example of Soil Boring Log for USCS

Project No: XXXX

Log of Borehole AA-00

Project: XXXX

Client: ERT-EPA

Location: Anywhere, NJ **Geologist: XXXX** **Date: XX-XX-XXXX**

SUBSURFACE PROFILE				SAMPLE		
Depth	Symbol	Description	Depth	Recovery	Well Completion Details	VOC Concentration
		Ground Surface	0.0			
0		***SAND*** Gray (5/2 10 YR) poorly graded fine to medium SAND (SP), wet, no odor, subrounded, loose	0.0			
1			-1.0 / 1.0			
2		***SAND*** Dark gray-brown (4/3 10 YR) to gray (4/1 10 YR) poorly graded coarse subangular SAND (SP), tr. fine to coarse subangular poorly graded Gravel (GP), wet, no odor, loose		3.5		
3						
4			-4.4			
		SAND Gray (4/1 10 YR) medium to coarse SAND (SM), wet, no odor, loose	4.4 / -5.0			
5			5.0			
		GRAVELLY SAND Gray (5/1 10 YR) grading to light gray (6/1 10 YR) fine to coarse well graded SAND and fine subangular Gravel (SW), moist, slight TPH odor, loose				
6						
7				2.5		
8						
9						
10						

Drill Method: Direct Push

Hole Size: 2 inches

Lockheed Martin/SERAS
2890 Woodbridge Avenue
Edison, NJ 08520

Datum: grade

Checked by: XX

Sheet: 1 of 1

SOIL SAMPLING

CONTENTS

1.0 SCOPE AND APPLICATION*

2.0 METHOD SUMMARY*

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE*

4.0 INTERFERENCES AND POTENTIAL PROBLEMS*

5.0 EQUIPMENT/APPARATUS*

6.0 REAGENTS

7.0 PROCEDURES

- 7.1 Preparation*
- 7.2 Sample Collection
  - 7.2.1 Surface Soil Samples*
  - 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers*
  - 7.2.3 Sampling at Depth with a Trier*
  - 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler*
  - 7.2.5 Test Pit/Trench Excavation*
  - 7.2.6 Sampling for VOCs in Soil Using an Encore® Sampler

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL*

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY*

12.0 REFERENCES*

13.0 APPENDICES

A - Figures

*These sections affected by Revision 1.0.

SUPERCEDES: SOP #2012; Revision 0.0; 2/18/00; U.S. EPA Contract 68-C99-223.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4°C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

5.0 EQUIPMENT/APPARATUS

Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
  - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)

- Backhoe (as required)
- En Core® samplers

* Not used when sampling for semivolatile compounds.

6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.

2. Obtain the necessary sampling and air monitoring equipment.

3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.

4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.

5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.

6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

7.2 Sample Collection

7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.

3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in

a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.

2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.

5. Remove auger tip from the extension rods and replace with a tube sampler. Install the

proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler and unscrew the extension rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.

10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.

12. Abandon the hole according to applicable state regulations.

7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree (0° to 45°) angle from the soil surface plane. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the

homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, *"Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"*.

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler at a 90 degree (90°) angle to the sample material.

3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.

5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the hole according to applicable state regulations.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.

4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the pit or excavation according to applicable state regulations.

7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.

2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.

3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.

4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.

5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

   Sampler's name and affiliation with project
   Sample number
   Sample location
   Sample depth
   Approximate volume of sample collected
   Type of analyses to be performed
   Sample description
   Date and time of sample collection
   Weather conditions at time of sampling
   Method of sample collection
   Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.

3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1989. *Soil Sampling Quality Assurance User's Guide*. EPA-600/8-89-046.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II.* Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.

APPENDIX A
Figures
SOP #2012
July 2001

FIGURE 1. Sampling Augers

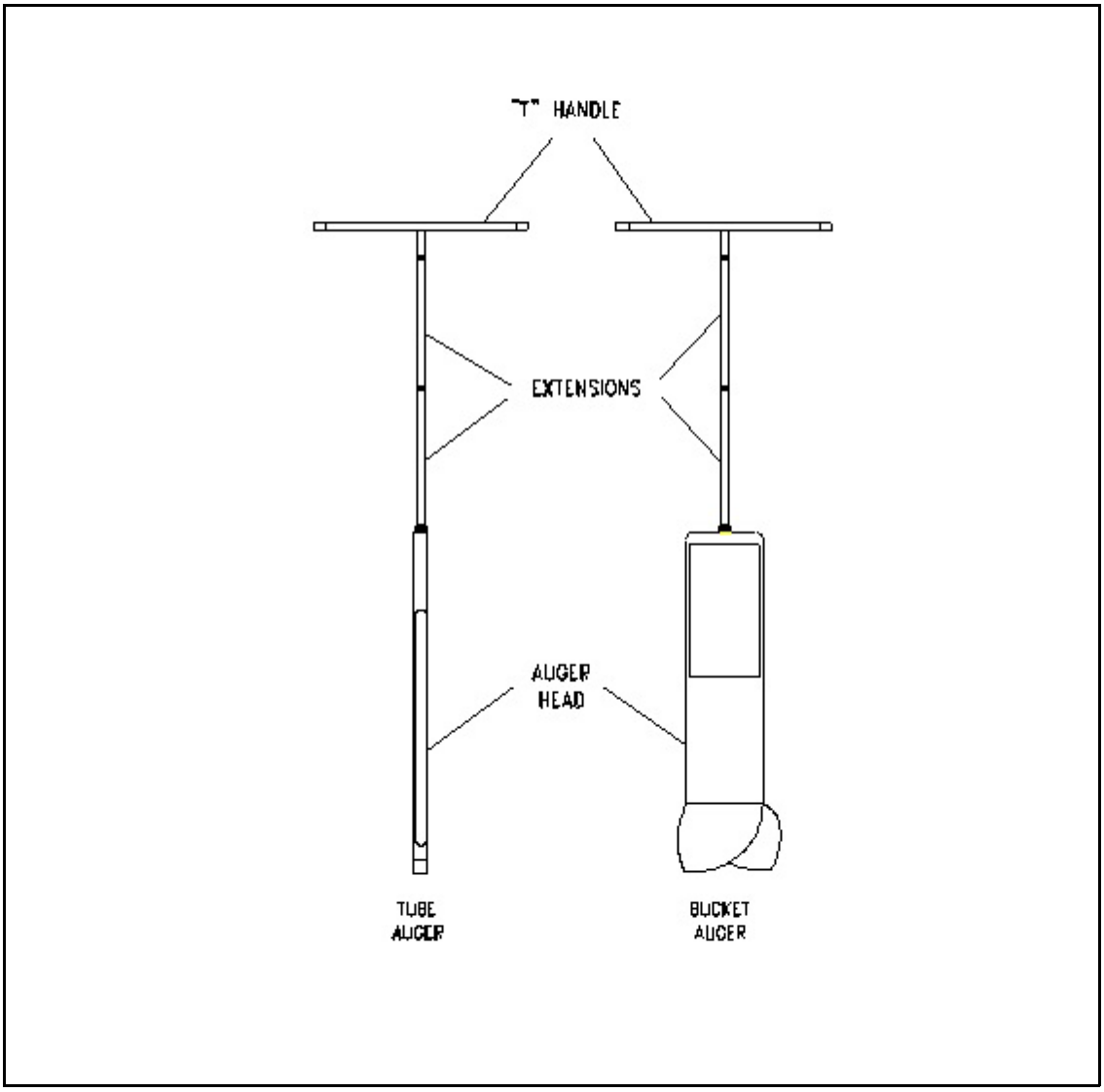
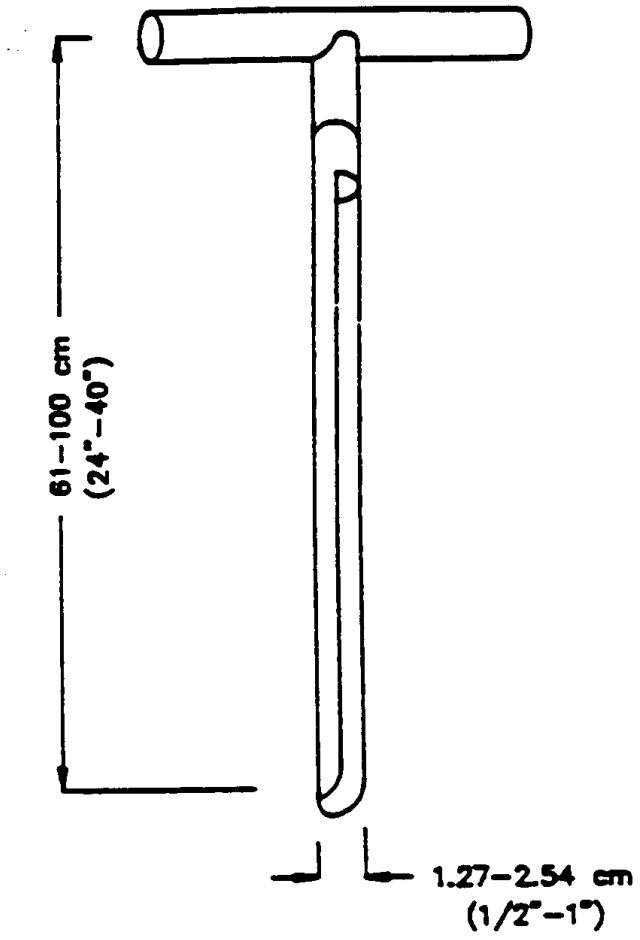


FIGURE 2. Sampling Trier


61–100 cm
(24"–40")
1.27–2.54 cm
(1/2"–1")

SEDIMENT SAMPLING

CONTENTS

1.0 SCOPE AND APPLICATION*

2.0 METHOD SUMMARY*

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE*

4.0 INTERFERENCES AND POTENTIAL PROBLEMS*

5.0 EQUIPMENT/APPARATUS*

6.0 REAGENTS

7.0 PROCEDURES

7.1 Preparation*
7.2 Sample Collection*

7.2.1 Sampling Surface Sediment with a Trowel or Scoop from Beneath a Shallow Aqueous Layer*
7.2.2 Sampling Surface Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer*
7.2.3 Sampling Deep Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer*
7.2.4 Sampling Surface Sediment with an Ekman or Ponar Dredge from Beneath a Shallow Aqueous Layer or in Deep Water*
7.2.5 Sampling Subsurface Sediment with a Coring Device from Beneath a Shallow Aqueous Layer*
7.2.6 VibraCore*

7.2.6.1 Intrusion
7.2.6.2 Extraction
7.2.6.3 Core Sampling
7.2.6.4 Packaging

7.2.7 Diver-Assisted Core Sampling (using S.C.U.B.A. or surface-supplied air)*

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL*

CONTENTS (cont)

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY*

12.0 REFERENCES

13.0 APPENDICES

A - Figures*

* These sections are affected by Revision 0.0.

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the collection of representative sediment samples. Analysis of sediment may be biological, chemical, or physical in nature and may be used to determine the following:

- toxicity;
- biological availability and effects of contaminants;
- benthic biota;
- extent and magnitude of contamination;
- contaminant migration pathways and source;
- fate of contaminants;
- grain size distribution;
- deposition environment;
- sediment type.

For the purpose of this procedure, sediment is the mineral and/or organic material situated beneath an aqueous layer. The aqueous layer may be either static, as in lakes, ponds, and impoundments or flowing, as in rivers and streams. The methodologies discussed in this SOP are applicable to the sampling of sediment in both flowing and standing water.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sediment samples may be collected using a variety of methods and equipment, depending on the depth of the aqueous layer, the portion of the sediment profile required (surface vs. subsurface), the type of sample required (disturbed vs. undisturbed), contaminants present, sediment type, and analyses required.

Sediment is collected from beneath an aqueous layer either directly, using a hand-held device such as a shovel, trowel, or auger, or indirectly, using a remotely activated device such as an Ekman or Ponar dredge. Following collection, sediment is transferred from the sampling device to a sample containers of appropriate size and construction for the analysis (es) requested. If composite sampling techniques are employed, multiple grabs are placed into a container constructed of an inert material (e.g. stainless steel), homogenized, and transferred to the sample container(s) appropriate for the analysis (es) requested. The homogenization procedure should not be used if the sample analysis includes volatile organic compounds (VOCs). In this case,

sediment, or multiple grabs of sediment, should be transferred directly from the sample collection device or homogenization container to the sample container. Cores may also be collected directly into an acetate sleeve that serves as the sample container for undisturbed samples.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

1. Chemical preservation of solids is generally not recommended. Cooling to 4 degrees Celsius (^{O}C) is usually the best approach, supplemented by the appropriate holding time for the analyses requested.

2. Wide-mouth glass containers with Teflon lined caps are utilized for sediment samples. The sample volume is a function of the analytical requirements and will be specified in the Work Plan or Sampling and Analysis Plan.

3. If analysis of sediment from a discrete depth or location is desired, sediment is transferred directly from the sampling device to a labeled sample container(s) of appropriate size and construction for the analysis (es) requested. Transfer is accomplished with a stainless steel or plastic lab spoon or equivalent.

4. If composite sampling techniques or multiple grabs are employed, equal portions of sediment from each location or collocation are deposited into a decontaminated stainless steel, plastic, or other appropriate container (e.g., Teflon). The sediment is homogenized thoroughly to obtain a mixture representative of the area sampled. The composite sediment sample is transferred to a labeled container(s) of appropriate size and construction for the analysis(es) requested. Transfer of sediment is accomplished with a stainless steel or plastic lab spoon or equivalent. Samples for VOC analysis must be transferred directly from the sample collection device or pooled from multiple areas in the homogenization container prior to mixing. This is done to minimize the loss of contaminant due to volatilization during homogenization.

5. All sampling devices should be decontaminated, then wrapped in aluminum foil. The sampling device should remain wrapped until needed. Dedicated sampling devices should be used for each sample. Disposable sampling devices for sediment are generally impractical due to cost and the large number of sediment samples which may be required. Sampling devices should be cleaned in the field using the decontamination procedure described in Environmental Response Team/Scientific, Engineering Response and Analytical Services (ERT/SERAS) SOP #2006, *Sampling Equipment Decontamination*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Substrate particle size and organic matter content are a direct consequence of the physical characteristics of a water body and the watershed. Contaminants are more likely to be concentrated in sediment typified by fine particle size and high organic matter. This type of sediment is most likely to be collected from depositional zones. In contrast, coarse sediment with low organic matter does not typically concentrate contaminants and are generally found in

erosional zones. The selection of a sampling location can, therefore, greatly influence the analytical results and should be justified and discussed in the Work Plan or Sampling and Analysis Plan.

5.0 EQUIPMENT/APPARATUS

Equipment needed for collection of sediment samples may include:

- Maps/plot plan
- Safety equipment
- Compass
- Global positioning system (GPS)
- Tape measure
- Survey stakes, flags, or buoys and anchors
- Camera and film
- Stainless steel, plastic, or other appropriate composition bucket
- 4-oz., 8-oz., and one-quart wide mouth jars w/Teflon lined lids
- Ziploc plastic bags
- Logbook
- Sample jar labels
- Chain of Custody records, field data sheets
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Spade or shovel
- Spatula
- Scoop
- Trowel (plastic or stainless steel)
- Bucket auger
- Tube auger
- Extension rods and pipe wrenches
- "T" handle
- Sediment coring device (tube, drive head, eggshell check value, nosecone, acetate tube, extension rods)
- Ponar dredge
- Ekman dredge
- Nylon rope or steel cable
- Messenger device
- VibraCore
- Power drill
- S.C.U.B.A. and/or other appropriate dive gear

6.0 REAGENTS

Reagents are not used for preservation of sediment samples. Decontamination solutions are specified in ERT/REAC SOP #2006, *Sampling Equipment Decontamination*.

7.0 PROCEDURES

7.1 Preparation

1. Determine the objective(s) and extent of the sampling effort. The sampling methods to be employed, and the types and amounts of equipment and supplies required will be a function of site characteristics and objectives of the study.

2. Obtain the necessary sampling and monitoring equipment.

3. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.

4. Decontaminate or preclean equipment, and ensure that it is in working order.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan (HASP).

6. Use stakes, flags, or buoys to identify and mark all sampling locations. Site specific factors including flow regime, basin morphology, sediment characteristics, depth of overlying aqueous layer, contaminant source, and extent and nature of contamination should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.2 Sample Collection

Selection of a sampling device is most often contingent upon: (1) the depth of water at the sampling location, (2) the physical characteristics of the sediment to be sampled, (3) the type of sample required and (4) the parameters being analyzed.

7.2.1 Sampling Surface Sediment with a Trowel or Scoop from Beneath a Shallow Aqueous Layer

For the purpose of this procedure, surface sediment is considered to range from 0 to 6 inches in depth and a shallow aqueous layer is considered to range from 0 to 12 inches in depth. Collection of surface sediment from beneath a shallow aqueous layer can be accomplished with tools such as spades, shovels, trowels, and scoops. Although this method can be used to collect both unconsolidated and/or consolidated sediment, it is limited somewhat by the depth and movement of the aqueous layer. Deep and rapidly flowing water render this method less

accurate than others discussed below. However, representative samples can be collected with this procedure in shallow sluggish water provided care is demonstrated by the sampler. A stainless steel or plastic sampling implement will suffice in most applications. Care should be exercised to avoid the use of devices plated with chrome or other materials; plating is particularly common with garden trowels.

The following procedure will be used to collect sediment with a scoop, shovel, or trowel:

1. Using a decontaminated sampling implement, remove the desired thickness and volume of sediment from the sampling area carefully to minimize movement between sample sediment and water.

2. Transfer the sample into an appropriate sample or homogenization container. Ensure that non-dedicated containers have been adequately decontaminated.

3. Surface water should be decanted from the sample or homogenization container prior to sealing or transfer; care should be taken to retain the fine sediment fraction during this procedure.

7.2.2 Sampling Surface Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer

For the purpose of this procedure, surface sediment is considered to range from 0 to 6 inches in depth and a shallow aqueous layer from 0 to 24 inches in depth. Collection of surface sediment from beneath a shallow aqueous layer can be accomplished with a system consisting of a bucket or tube auger, a series of extensions, and a "T" handle (Figure 1, Appendix A). The use of additional extensions in conjunction with a bucket auger can increase the depth of water from which sediment can be collected from 24 inches to 10 feet or more. However, sample handling and manipulation increases in difficulty with increasing depth of water. The bucket or tube auger is driven into the sediment and used to extract a core. The various depths represented by the core are homogenized or a subsample of the core is taken from the appropriate depth.

The following procedure will be used to collect sediment samples with a bucket or tube auger:

1. If the study objectives and characteristics of the sediment or water body warrant, an acetate core may be inserted into the bucket or tube auger prior to sampling, By using this technique, an intact core can be extracted.

2. Attach the auger head to the required length of extensions, then attach the "T" handle to the upper extension.

3. If possible, clear the area to be sampled of any rocks or surface debris.

4. Insert the bucket or tube auger into the sediment at a 0 degrees (^{o}) to 20° angle from vertical. This orientation minimizes spillage of the sample from the sampler upon extraction from the sediment and water.

5. Rotate the auger to cut a core of sediment.

6. Slowly withdraw the auger; if using a tube auger, make sure that the open slot is facing upward.

7. Transfer the sediment into an appropriate sample or homogenization container. Ensure that non-dedicated containers have been adequately decontaminated.

7.2.3 Sampling Deep Sediment with a Bucket Auger or Tube Auger from Beneath a Shallow Aqueous Layer

For the purpose of this procedure, deep sediment is considered to range from 6 to greater than 18 inches in depth and a shallow aqueous layer from 0 to 24 inches. Collection of deep sediment from beneath a shallow aqueous layer can be accomplished with a system consisting of a bucket auger, a tube auger, a series of extensions and a "T" handle (Figure 1, Appendix A). The use of additional extensions can increase the depth from which sediment can be collected from 24 inches to 5 feet or more. However, water clarity must be high enough to permit the sampler to directly observe the sampling operation. In addition, sample handling and manipulation increases in difficulty with increasing depth of water. The bucket auger is used to bore a hole to the upper range of the desired sampling depth and then withdrawn. The tube auger is then lowered down the borehole, and driven into the sediment to the lower range of the desired sampling depth. The tube is then withdrawn and the sample recovered from the tube. This method can be used to collect firmly consolidated sediments, but is somewhat limited by the depth of the aqueous layer, and the integrity of the initial borehole.

The following procedure will be used to collect deep sediment samples with a bucket auger and a tube auger:

1. Attach the bucket auger to the required lengths of extensions, then attach the "T" handle to the upper extension.

2. If possible, clear the area to be sampled of any rocks or surface debris.

3. Begin augering, periodically removing any accumulated sediment (i.e., cuttings) from the auger bucket. Cuttings should be disposed of far enough from the sampling area to minimize cross contamination of various depths.

4. After reaching the upper range of the desired depth, slowly and carefully remove bucket auger from the boring.

5. Attach the tube auger to the required lengths of extensions, then attach the "T" handle to the upper extension.

6. Carefully lower the tube auger down the borehole using care to avoid making contact with the borehole sides, and cross-contaminating the sample. Gradually force the tube auger into the sediment, to the desired sampling depth. Hammering of the tube auger to facilitate coring should be avoided as the vibrations may cause the boring walls to collapse.

7. Remove the tube auger from the borehole, again taking care to avoid making contact with the borehole sides and cross contaminating the sample.

8. Discard the top of core (approximately 1 inch); this represents material collected by the tube auger before penetration to the layer of concern.

9. Transfer the sediment into an appropriate sample or homogenization container. Ensure that non-dedicated containers have been properly decontaminated.

7.2.4 Sampling Surface Sediment with an Ekman or Ponar Dredge from Beneath a Shallow Aqueous Layer or in Deep Water

For the purpose of this procedure, surface sediment is considered to range from 0 to 6 inches in depth. Collection of surface sediment can be accomplished with a system consisting of a remotely activated device (dredge) and a deployment system. This technique consists of lowering a sampling device (dredge) to the surface of the sediment by use of a rope, cable, or extended handle. The mechanism is activated, and the device entraps sediment in spring loaded or lever operated jaws.

An Ekman dredge is a lightweight sediment sampling device with spring activated jaws. It is used to collect moderately consolidated, fine textured sediment. The following procedure will be used for collecting sediment with an Ekman dredge (Figure 2, Appendix A):

1. Attach a sturdy nylon rope or stainless steel cable through the hole on the

top of the bracket, or secure the extension handle to the bracket with machine bolts.

2. Fix the jaws so that they are in the open position by placing trip cables over the release studs. Ensure that the hinged doors on the dredge top are free to open.

3. Lower the sampler to a point 4 to 6 inches above the sediment surface.

4. Drop the sampler to the sediment.

5. Trigger the jaw release mechanism by lowering the messenger weight down the line, or by depressing the button on the upper end of the extension handle.

6. Raise the sampler and slowly decant any free liquid through the top of the sampler. Care should be taken to retain the fine sediment fraction during this procedure.

7. Open the dredge jaws and transfer the sediment into an appropriate container. Ensure that non-dedicated containers have been properly decontaminated.

A Ponar dredge is a heavyweight sediment sampling device with weighted jaws that are lever activated. It is used to collect consolidated fine to coarse textured sediment. The following procedure will be used for collecting sediment with a Ponar dredge (Figure 3, Appendix A):

1. Attach a sturdy nylon rope or steel cable to the ring provided on top of the dredge.

2. Arrange the Ponar dredge with the jaws in the open position, setting the trip bar so the sampler remains open when lifted from the top. If the dredge is so equipped, place the spring loaded pin into the aligned holes in the trip bar.

3. Slowly lower the sampler to a point approximately 2 inches above the sediment.

4. Drop the sampler to the sediment. Slack on the line will release the trip bar or spring loaded pin; pull up sharply on the line closing the dredge.

5. Raise the dredge to the surface and slowly decant any free liquid through the screens on top of the dredge. Care should be taken to retain the fine sediment fraction during this operation.

6. Open the dredge and transfer the sediment to an appropriate container. Ensure that non-dedicated containers have been properly decontaminated.

7.2.5 Sampling Subsurface Sediment with a Coring Device from Beneath a Shallow Aqueous Layer

For purposes of this procedure, subsurface sediment is considered to range from 6 to 18 inches in depth and a shallow aqueous layer is considered to range from 0 to 24 inches in depth. Collection of subsurface sediment from beneath a shallow aqueous layer can be accomplished with a system consisting of a tube sampler, acetate sleeve, eggshell check valve, nosecone, extensions, and "T" handle or drivehead. The use of additional extensions can increase the depth of water from which sediment can be collected from 24 inches to 10 feet or more. This sampler may be used with either a drive hammer for firm sediment, or a "T" handle for soft sediment. However, sample handling and manipulation increases in difficulty with increasing depth of water.

The following procedure describes the use of a sample coring device (Figure 4, Appendix A) used to collect subsurface sediments.

1. Assemble the coring device by inserting the acetate sleeve into the sampling tube.

2. Insert the "egg-shell" check valve into the lower end of the sampling tube with the convex surface positioned inside the acetate sleeve.

3. Screw the nosecone onto the lower end of the sampling tube, securing the acetate sleeve and egg-shell check valve. Screw the bracket to the top of the sampling tube.

4. Attach the sampling device to the required length of extensions; then attach the “T” handle or the drive hammer onto the upper extension.

5. Place the sampler in a perpendicular position on the sediment to be sampled.

6. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. After the desired depth is reached, slowly withdraw the sampler from the sediment and proceed to Step 10.

7. If the drive hammer is selected, drive the sampler into the sediment to the desired depth.

8. Record the length of the tube that penetrated the sediment, and the number of blows required to obtain this depth.

9. Sharply pull the drive hammer upwards and dislodge the sampler from the sediment. Slowly withdraw the sampler from the sediment.

10. Carefully remove the coring device from the water.

11. Unscrew the nosecone and remove the eggshell check valve.

12. Slide the acetate sleeve out of the sampler tube. Decant surface water, using care to retain the fine sediment fraction. The sample may be used in this fashion, or the contents transferred to a sample or homogenization container.

13. If head space is present in the upper end, a hacksaw may be used to shear the acetate tube off at the sediment surface. The acetate core may then be capped at both ends. Indicate on the acetate tube the appropriate orientation of the sediment core using a waterproof marker.

14. The sediment may be extracted from the acetate sleeve and manipulated in the typical fashion. Extrude the sample from or open the acetate tube and transfer the sediment to an appropriate homogenization or sample container. Ensure that non-dedicated containers have been adequately decontaminated.

7.2.6 VibraCore

Sampling with a vibratory corer is divided into four steps: intrusion, extraction, core sampling, and packaging. The following procedure describes the use of a VibraCore to collect subsurface sediments.

7.2.6.1 Intrusion

The vibrator head should be attached near the top of the unsharpened end of the core barrel prior to initiating the coring procedure. After a coring location has been determined, the core pipe will be vertically positioned. The core barrel will initially sink into the sediment by its own weight, giving the barrel stability. Once the vibrator head engine is started, the pipe will rapidly penetrate into the sediment. Tying a teather line (rope) to the core barrel and pulling down by adding weight will aid in getting the pipe through resistant subsurfaces.

7.2.6.2 Extraction

After removing the vibrator head, the remaining pipe is cut off with a hacksaw approximately 2 feet above the ground surface. The distance to the sediment surface inside and outside of the pipe is measured to determine the amount of compaction. The pipe is then filled with water and a gas-main sealer plug is inserted and tightened to prevent loss of sediment from the core pipe when it is removed.

A tripod is assembled and placed over the intruded pipe. Two come-alongs are fastened to the eyeballs on the tripod head and to a rope securely fastened to the core pipe. The core is guided through the core pipe slot in the tripod head and then rested against the tripod head to prevent falling over during extraction. When the core is completely out of the sediment, the come-alongs are removed and the core pipe slot is opened by pulling on the cord that moves the spring-loaded slot gate. The core barrel is gently placed horizontally, to prevent disturbance of the core, and examined.

7.2.6.3 Core Sampling

Sediment samples can be removed from the core either by splitting the core lengthwise and removing the sample or by drilling holes in the core liner. Splitting the core lengthwise is preferred since it allows direct observation of the sediment structure, bedding, lithologies and other features. Samples can be collected from one half of the core and the other half can be preserved for future studies or sampling. Alternatively, a power drill fitted with a 1.5- to 2-inch saw can be used to make holes in the liner. Samples can then be removed with a spoon and the hole closed by replacing the cutout disk and sealing with duct or plastic electrical tape. Spacing of approximately 1 foot is recommended to ensure that the samples are representative of the lithologies in the cores.

7.2.6.4 Packaging

If the core is to be homogenized at the laboratory, the extracted core is cut in the field using a hacksaw. Aluminum foil, plastic caps, or wooden plugs held securely with duct tape may be used to cap the core liner. Each core section must be carefully labeled, indicating the top and bottom, with a waterproof marker.

7.2.7 Diver-Assisted Core Sampling (using S.C.U.B.A. or surface-supplied air)

For the purposes of this procedure, surface sediment is considered to range from 6 to 72 inches in depth and the overhead water column is between 4 and 120 feet. Collection can be accomplished by the diver using an acetate sleeve cut to the desired sampling depth, two plastic end

caps, and a metal cap and hammer. The diver may either push the core to the desired depth in soft sediment or use the metal cap and hammer to drive the core into firmer sediment. This method can be applicable in chemically and biologically hazardous environments, if the divers are properly trained, equipped, and following appropriate precautions.

The following procedure describes the use of a diver-assisted core sampling device to collect subsurface sediments.

1. The diver is supplied with one acetate sampling tube, two plastic end caps, duct tape, a hammer, and metal hammering cap that fits over one end of the tube to receive the hammer blows. The hammering should not damage the acetate sleeve.

2. Once the sampling location is reached, the diver notes the time, depth, and any other conditions to be transferred into the appropriate logbook or sample data sheet. If on surface-supplied air, the diver communicates this information directly to the surface control.

3. The sleeve is inserted vertically into the soft sediment until the desired depth is reached. If the desired depth cannot be achieved, a metal hammer cap is assembled on top of the vertical sleeve. The diver delivers blows to the cap with a hammer until the sleeve reaches the desired depth.

4. The hammer cap is removed without disturbing the sleeve that remains at the desired depth. One plastic end cap is placed over the exposed end of the sleeve, and when possible, duct taped to secure the cap to the sleeve.

5. With the single end cap firmly in place, the sleeve is slowly removed from the sediment. In firmer sediments, a twisting or rotating motion is used to extract the sleeve.

6. While maintaining the tube vertically, a second end cap will be placed over the other end of the core to minimize any loss of material from the sleeve. Again, when possible, the cap is duct taped to secure the cap to the sleeve.

7. With both caps in place, the core is transported vertically to the surface. The diver will place their hands over the “bottom” end of the core to secure the sleeve.

8. The core will be transferred to surface personnel to maintain

custody.

9. The acetate sleeve may be cut with a hacksaw at the sediment surface if headspace is present in the core. It is then recapped for shipping and storage. The sample location must be marked on each tube. The sample may be used as is, or the contents homogenized and transferred to another container.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or in site logbooks.

2. All instrumentation and equipment must be operated in accordance with the operating instructions supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout activities must occur prior to sampling/operation, and must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, Occupational Safety and Health Act (OSHA), and Corporate health and safety procedures.

More specifically, when sampling sediment from water bodies, physical hazards must be identified and adequate precautions must be taken to ensure the safety of the sampling team. The team member collecting the sample should not get too close to the edge of the water body, where bank failure may cause loss of balance. As a preventive measure, the person performing the sampling should be on a lifeline, and be wearing adequate protective equipment. This may include a personal flotation device (PFD), if necessary. If sampling from a vessel, appropriate protective measures including a PFD must be implemented.

12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. *Soil Sampling Quality Assurance User's Guide*. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual, Available Sampling Methods*. 2nd Ed. Vol. II. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams.* EPA-600/2-80-018.

13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SOP #2016
November 2001

FIGURE 1. Sampling Auger

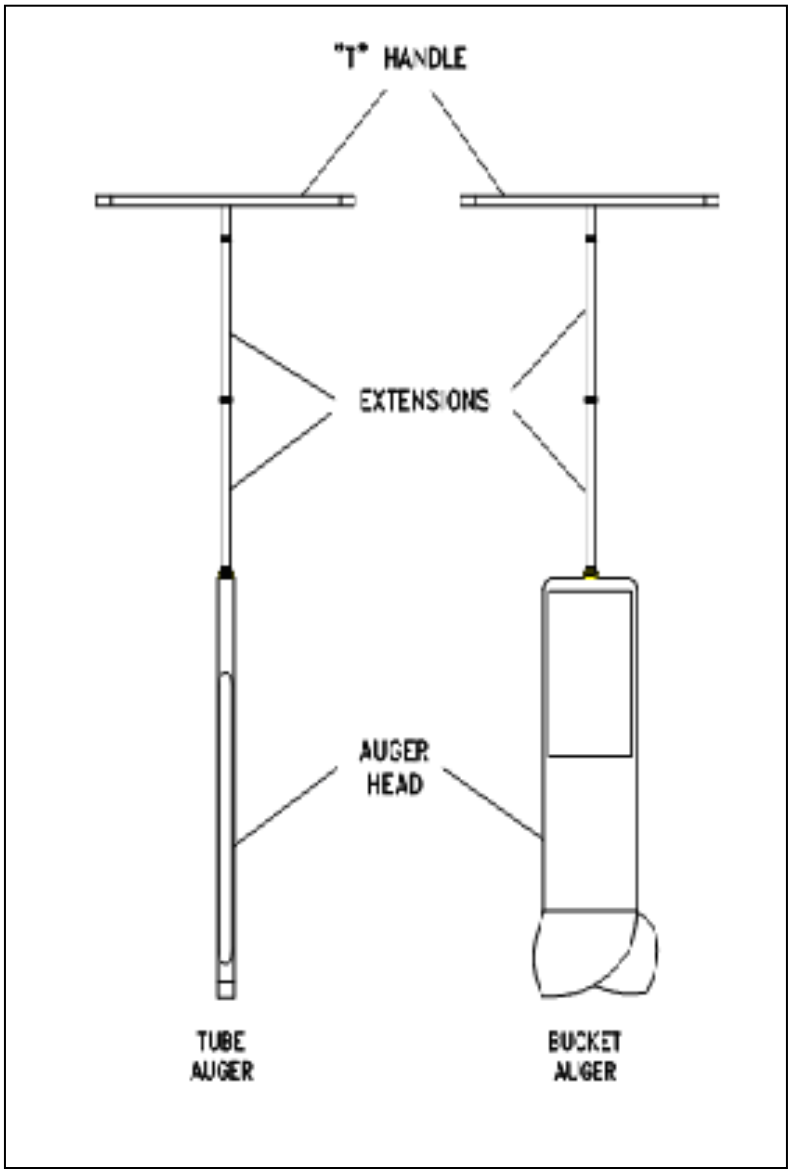


FIGURE 2. Ekman Dredge

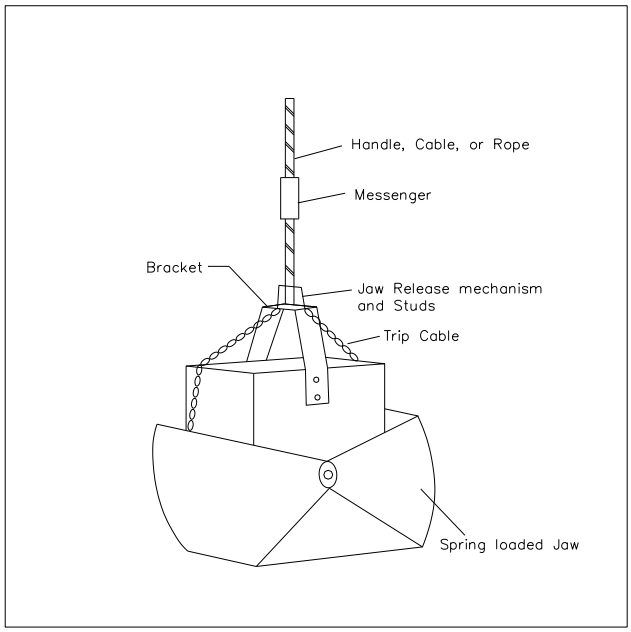


FIGURE 3. Ponar Dredge

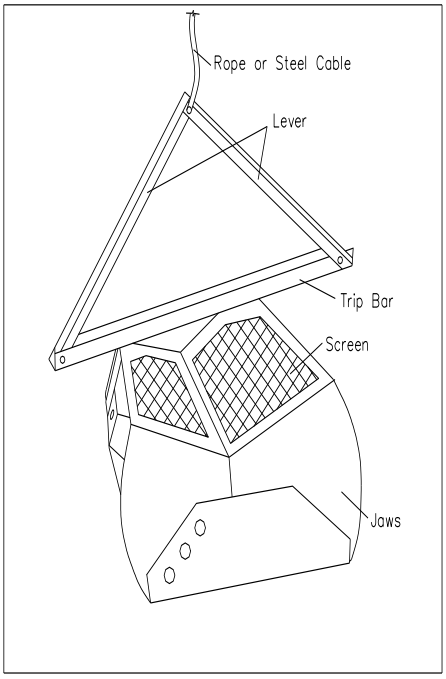
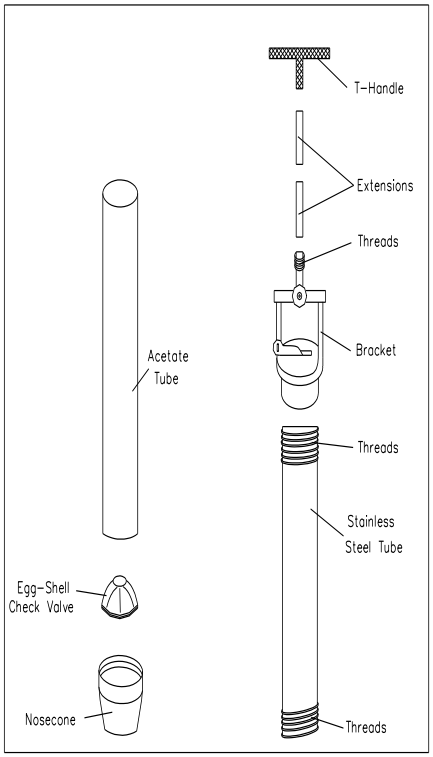


FIGURE 4. Sampling Coring Device



GROUNDWATER MONITORING WELL INSTALLATION

CONTENTS

DISCLAIMERS

1.0 SCOPE AND APPLICATION

2.0 METHOD SUMMARY

2.1 Hollow-Stem Augering
2.2 Cable Tool Drilling
2.3 Rotary Drilling

2.3.1 Mud Rotary Method
2.3.2 Air Rotary Method

2.4 Sonic Drilling

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

4.1 Auger Drilling
4.2 Cable Tool Drilling
4.3 Rotary Drilling

4.3.1 Mud Rotary Drilling
4.3.2 Air Rotary Drilling

4.4 Sonic Drilling

5.0 EQUIPMENT/APPARATUS

6.0 REAGENTS

7.0 PROCEDURES
7.1 Preparation
7.2 Field Preparation
7.3 Well Construction

7.3.1 Bedrock Wells
7.3.2 Overburden Well Construction

7.4 Well Development
7.5 Investigation-Derived Waste Management

8.0 CALCULATIONS

9.0 QUALITY ASSURANCE/QUALITY CONTROL

CONTENTS (cont'd)

10.0 DATA VALIDATION

11.0 HEALTH AND SAFETY

12.0 REFERENCES

13.0 APPENDICES

A - Figures

The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide an overview of the methods used for the installation of conventional groundwater monitoring wells. Groundwater monitoring well installation creates a permanent access for the collection of samples to assess groundwater quality and the hydrogeologic properties of the aquifer in which contaminants may exist. Such wells should not alter the medium that is being monitored.

The most commonly used drilling methods are hollow-stem auger, cable tool, hydraulic rotary and sonic. Rotary drilling can utilize mud rotary or air rotary methods.

Additional technical guidance and information pertaining to drilling, subsurface sampling, and design-installation of monitoring wells can be found in the following: American Society for Testing and Materials (ASTM), 2010; Environmental Protection Agency (EPA), 2013; and Ohio EPA, 2007 and 2008.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be modified, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, changes in the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

There is no ideal monitoring well installation method for all conditions; therefore, hydrogeologic conditions at the site, as well as project objectives, must be considered before deciding which drilling method is the most appropriate. Boreholes should be drilled and constructed to allow the proper construction of a monitoring well and must allow for the proper placement of a well screen so that chemical and physical parameters can be monitored.

2.1 Hollow-Stem Auguring

Successive 5-foot flights of hollow-stem augers, with outside diameters (O.D.) of 6.25 inches to 22 inches and corresponding inner diameters (I.D.) ranging from 2.25 inches to 13 inches are rotated into the ground to create a borehole. Auger lengths of 10 or 20 feet may be used for deeper holes drilled with machines capable of handling the extended lengths. Formation samples can be taken in a number of ways, depending on the accuracy required. Cuttings are brought to the surface by the rotation of the auger flights and may suffice for shallow depths but become less representative with depth, particularly below the water table. The most accurate samples are obtained with various coring devices, such as split spoons or Shelby tubes, which can be attached to center rods inside the augers. Cores may also be taken with a thin-walled tube sampler that is inserted into the lowest auger and locked in place. The tube is retracted with a wire line and hoist after the hole has been advanced the length of the auger. A bottom plug in the cutting head or bit prevents cuttings from entering the augers until the first core sample is taken and the plug is knocked out.

In unconsolidated material, the augers serve as a temporary casing. Filter-packed wells can be constructed inside the augers as the augers are retrieved from the borehole. Well development is usually less difficult than with wells drilled by the mud rotary method because a bentonite drilling

fluid is not typically used.

2.2 Cable Tool Drilling

Cable tool drilling is a percussion method in which a bit, attached to a weighted drilling string, is alternately lifted and dropped. The drilling string, consists (bottom to top) of the drill bit, drill stem, drilling jars, socket, and wire cable. A walking beam on the drilling rig provides the lifting and dropping motion to the wire cable and hence to the drilling string. The repeated action breaks or loosens the formation material, which mixes with formation water, or water can be added to the borehole by the operator, forming a slurry mixture. The slurry facilitates the removal of the cuttings, which are periodically removed from the borehole with a bailer. In unconsolidated formations, steel casing must be driven or pushed into the ground as the drilling progresses to maintain the wall of the borehole and prevent collapse. A hardened steel drive shoe on the bottom end of the casing prevents damage during drilling. A well may then be constructed inside the steel casing before the casing is pulled back. In consolidated formations, the casing may be driven through the weathered zone and seated in solid rock. The hole below the casing may remain open or may be fitted with a smaller diameter inner casing and screen, depending on the sampling requirements. Depending on formation material, extensive well development may often not be necessary.

2.3 Rotary Drilling

2.3.1 Mud Rotary Method

In the mud rotary method, the drill bit is rotated rapidly to cut the formation material and advance the borehole. The drill bit is attached to hollow drilling rods, which transfer power from the rig to the bit. In conventional mud rotary drilling, cuttings are removed by pumping drilling fluid (water, or water mixed with bentonite or other additives) down through the drill rods and bit, and up the annulus between the borehole and the drill rods. The drilling fluid flows into a mud pit where the cuttings settle out, and the “fluid” is pumped back down the drilling rods. The drilling fluid cools and lubricates the bit and prevents the borehole from collapsing in unconsolidated formations.

Sampling may be done from the cuttings, but these types of samples are generally mixed and the amount of fine material may not be accurately represented. Coring may be done through the drill rods and bit, if a coring bit (with a center opening big enough to allow passage of the coring tube) is used. When drilling unconsolidated formations, a temporary surface or shallow casing may have to be installed to prevent cross-contamination, borehole collapse, or wall erosion by the drilling fluid. Casing (riser pipe), screen, and filter pack are usually installed in the open hole or through the surface casing. Once the well is constructed, extensive well development may be necessary to remove drilling fluid from the formation.

2.3.2 Air Rotary Method

In the conventional air rotary method, the drill string operates in a manner similar to that described for the mud rotary system. In a "hammer" air rotary method, the bit is pneumatically driven rapidly against the rock in short strokes while the drilling string slowly rotates and uses air as the drilling fluid. Air is forced down the drill rods by an air compressor, escapes out of the bit and returns to the surface in the annular space between

the borehole wall and the drill string. Cuttings are moved out of the borehole by the ascending air and collect around the rig. Cuttings are mixed and may not always be representative of the depth currently being drilled. Air rotary methods are generally limited to consolidated and semi-consolidated formations. Casing is often used in semi-consolidated formations and through the weathered portion of consolidated formations to prevent borehole collapse or "caving in". In environmental investigations, the air supply must be filtered to prevent introduction of any contamination into the borehole.

2.4 Sonic Drilling

A sonic drill is a rotary-vibratory drill capable of high drilling speeds as well as continuous coring that uses an adjustable high-frequency mechanical vibration to take continuous core samples of overburden soils and most hard rocks. The drill rig looks very much like a conventional air or mud rotary drill rig. The biggest difference is in the drill head, which is slightly larger than a standard rotary head. The head contains the mechanism necessary for rotary motion, as well as an oscillator, which causes an adjustable high frequency force to be superimposed on the drill string. The drill bit is physically vibrated up and down in addition to being pushed down and rotated. The amount of power applied is also adjustable in order to achieve optimal drilling conditions.

In overburden, the vibratory action causes the surrounding soil to fluidize. In rock, the drill bit causes fractures at the rock face, creating rock dust and small rock particles, which facilitates advancement of the drill bit. In many instances the drilling and coring of rock can be accomplished without the use of a drilling fluid.

Soil sampling can be performed using a 10-foot long core barrel that is rotated, advanced, and retrieved within the inner casing. Cores are then resonated from the core barrel into plastic sleeves, which are placed on aluminum trays. The cores are generally less disturbed than those obtained using a split-spoon sampler.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Often, a primary objective of the drilling program is to obtain representative lithologic or environmental samples. The most common techniques for retrieving samples are:

In unconsolidated formations:

- Shelby tube sampling, when an undisturbed sample is required from clay or silt soils, especially for geotechnical evaluation or chemical analysis
- Split spoon sampling when a reasonably undisturbed sample is required for geotechnical evaluation or chemical analysis
- Cutting collection, when a general lithologic description and approximate depths are sufficient

In consolidated formations:

- Rock coring at continuous or discrete intervals
- Cutting collection, when a general lithologic description and approximate depths are sufficient

Samples should, however, be cooled to less than or equal to (≤) 6 degrees Celsius (°C) and protected from sunlight to minimize degradation and any potential reaction due to the light sensitivity of the sample. The amount of sample to be collected, the proper sample container (i.e. glass, plastic), chemical preservation, and

storage requirements are dependent on the matrix being sampled and the parameter(s) of interest which are discussed in Environmental Response Team (ERT) SOP, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The advantages and disadvantages of the various drilling methods are listed and summarized below:

4.1 Auger Drilling

The advantages of auger drilling are:

- Relatively fast and inexpensive
- Because augers act as temporary casing, drilling fluids are not used, resulting in reduced well development
- Allows collection of split spoon samples

The disadvantages of auger drilling are:

- Very slow or impossible to use in coarse materials such as cobble or boulders
- Cannot be used in unweathered consolidated formations and is generally limited to depths of approximately 100 feet below ground surface in order to be efficient

4.2 Cable Tool Drilling

The advantages of cable tool drilling are:

- Relatively inexpensive with minimum labor requirements
- Water table and water bearing zones are easily identified
- Driven casing stabilizes the open borehole and minimizes potential for cross-contamination
- Especially successful in caving formations or formations containing boulders (unconsolidated and consolidated medium hard to hard rock)
- Accurate formation samples can usually be obtained from cuttings

The disadvantages of cable tool drilling are:

- Extremely slow rate of drilling
- Necessity to drive casing may limit depth in large diameter holes

4.3 Rotary Drilling

4.3.1 Mud Rotary Drilling

The advantages of mud rotary drilling are:

- Fast, typically more than 100 feet of borehole advancement per day
- Provides an open borehole, necessary for some types of geophysical logging and other tests

The disadvantages of mud rotary drilling are:

- Potential for cross-contamination of water-bearing zones
- Drill cuttings may be mixed and not accurately represent lithologies at a given drilling depth
- Drilling mud may alter the groundwater chemistry/geochemistry
- Water levels can only be determined by constructing wells

- Drilling mud may change local permeability of the formation and may not be entirely removed during well development
- Disposal of large volumes of drilling fluid and cuttings may be necessary if they are contaminated

4.3.2 Air Rotary Drilling

The advantages of air rotary drilling are:

- Very fast, typically more than 100 feet of borehole advancement a day
- Preliminary estimates of well yields and water levels are often possible
- No drilling mud to plug the borehole
- Economical for deep water wells

The disadvantages of air rotary drilling are:

- Generally cannot be used in unconsolidated formations
- In contaminated zones, the use of high-pressure air may pose a significant hazard to the drill crew because of transport of contaminated material up the hole
- Introduction of air to the groundwater could reduce concentration of volatile organic compounds (VOCs)

4.4 Sonic Drilling

The advantages of sonic drilling are:

- Very fast drilling, more than 100 feet of borehole advancement a day
- Drilling can be done in almost all types of lithology
- Generally, no need to use a drilling fluid other than potable water

The disadvantages of sonic drilling are:

- Expensive method

5.0 EQUIPMENT/APPARATUS

The following equipment is necessary for the site geologist/hydrogeologist:

- Metal clipboard box case
- Ruler
- Depth sounder
- Water level indicator
- Water/phase probe indicator
- Bailer
- Rope
- Knife (with locking blade)
- Personal Protective Equipment (PPE)
- Sample collection jars (i.e. glass, plastic, etc.)
- Aluminum trays
- Soil description aids such as Munsell® color and grain-size charts
- Field Logbook or Field Data Sheets

Drilling equipment, tools, and construction materials required for well installation are usually provided by

the drilling contractor.

6.0 REAGENTS

Reagents are generally not required for preservation of soil samples. Decontamination solutions are specified in the ERT SOP, *Sampling Equipment Decontamination*, and the site-specific UFP-QAPP.

7.0 PROCEDURES

7.1 Preparation

All drilling and monitoring well installation programs must be planned and supervised by a licensed professional geologist/hydrogeologist.

The planning, selection and implementation of any monitoring well installation program should include the following:

- Review of existing data on site geology and hydrogeology including publications, aerial photographs, water quality data, and existing maps. These may be obtained from local, state and federal agencies.
- Ensure the drilling subcontractor has obtained all local, state, and federal licenses and/or permits required to drill and install monitoring wells.
- Assess the site to determine potential access problems (i.e. overhead obstructions) for drill rig, locate water supply sources, establish equipment storage area, and observe outcrops.
- Perform utilities check, note location of underground and aboveground utility lines and obstructions.
- Prepare a site-specific Health and Safety Plan (HASP).
- Select drilling, sampling and well development methods.
- Determine the well construction specifications (i.e., casing and screen materials; casing and screen diameter; screen length and screen interval; filter pack and screen slot size; etc.).
- Determine the need for containing drill cuttings and fluids and their method of disposal.
- Prepare the site-specific UFP-QAPP including all of the above.
- Prepare and execute the drilling contract as written.

7.2 Field Preparation

Prior to mobilization, the drill rig and all associated equipment must be thoroughly decontaminated by a steam/pressure washer to remove all soil and residue materials. Prior to drilling each boring, all drilling equipment is required to be steam cleaned and rinsed with potable water to prevent cross-contamination. It is required that all drilling equipment be steam-cleaned at completion of the

project to ensure that no contamination is transported from the site.

7.3 Well Construction

The well casing material must not interact with the groundwater. Well casing for environmental projects is usually constructed of polyvinyl chloride (PVC) or stainless steel. Details of the construction methods are given in Sections 7.3.1 and 7.3.2.

7.3.1 Bedrock Well Construction

Wells installed in bedrock will be drilled using the air or mud rotary or sonic methods. Crystalline rock wells are usually drilled most efficiently with the air rotary method while consolidated sedimentary formations are drilled using either the air rotary or mud rotary method. The compressed air supply will be filtered prior to introduction into the borehole to remove oil or other contaminants. Bedrock wells may be completed as an open-hole, providing that borehole "cave-in" is not a possibility.

Bedrock wells will be advanced with air or mud rotary methods until a minimum of 5 feet of competent rock has been drilled. The minimum borehole diameter will be at least 2 inches greater than the well diameter. The drill string will then be pulled from the borehole followed by insertion of an appropriate diameter Schedule 40 or Schedule 80 PVC casing. Portland cement/bentonite grout will be pumped through a tremie pipe (placed at the bottom of the borehole) into the annular space outside the casing. After the cement grout has cured (minimum of 24 hours), it will be drilled-out (if needed) and then the borehole will be advanced to the final desired depth. Figure 1, Appendix A depicts typical construction details for an open-hole bedrock well.

The preferred method of well completion for the bedrock wells will be open-hole. However, if the open borehole is subject to "cave-in", the well will be completed as a screened and cased filter-packed well. For completion details, see Section 7.3.2.

7.3.2 Overburden Well Construction

Any of the drilling methods discussed in this SOP can be used to drill or set a well in the overburden. Hollow-stem auguring method is the preferred choice for shallow (less than [<] 100 feet total depth) overburden wells because the well can be constructed inside of the augers. Details of the well construction are provided below and are shown in Figure 2, Appendix A.

1. The screen slot size will be determined by the site geologist/hydrogeologist, based on the filter-pack size. The length of screen used will be site-dependent. Casing sections will be flush-threaded. Screw-threaded bottom plugs will be used. To prevent introduction of contaminants into the well, no glue-connected fittings will be used. Each piece of PVC pipe, screen, and the bottom plug will be steam-cleaned or certified-clean by the manufacturer before lowering into the borehole. The site geologist/hydrogeologist is responsible for supervising all steam cleaning procedures.

2. The annular space between the well screen and the borehole wall will be filled with a uniform gravel/sand to serve as a filter pack. For wells deeper than 50 feet or when

recommended by the site geologist, the filter pack will be emplaced using a tremie pipe. A sand-slurry composed of sand and potable water will be pumped through the tremie pipe into the annulus throughout the entire screened interval, and over the top of the screen. Allowance must be made for settlement of the sand pack. This may be accomplished by gently surging the filter pack prior to installing the annular seal. Additional sand may need to be added to compensate for settlement.

3. Depth to the top of the sand will be determined using the tremie pipe and a weighted measuring tape, thus verifying the thickness of the sand pack. Additional sand will be added to bring the top of the sand pack to approximately 2 to 3 feet above the top of the well screen.

   Under no circumstances should the sand pack extend into any aquifer other than the one to be monitored. In most cases, the well design can be modified to allow for a sufficient sand pack without a threat of cross-flow between producing zones through the filter pack.

4. For materials that will not maintain an open borehole, the temporary or outer casing will be withdrawn gradually during placement of the filter pack/grout. For example, after filling 2 feet with sand pack, the outer casing should be withdrawn 2 feet. The procedure of placing more sand and withdrawing the outer casing should be repeated until the level of the sand pack is approximately 3 feet above the top of the well screen. This ensures there is no locking of the inner casing within the outer casing.

5. A bentonite seal of a minimum 2-foot vertical thickness will be placed in the annular space above the sand pack to separate the sand pack from the cement surface seal. The bentonite will be placed through a tremie pipe or poured directly into the annular space, depending upon the depth and site conditions. The bentonite will be pourable pellets. The geologist/hydrogeologist will record the start and stop times of the bentonite seal emplacement, the interval of the seal, the amount of bentonite used, and any problems that arise. The type of bentonite and the supplier will also be recorded.

   A cap placed over the top of the well casing, before pouring the bentonite pellets, will prevent pellets from entering the well casing.

6. If a slurry mixture of bentonite is used as an annular seal, it is prepared by mixing powdered or granular bentonite with potable water. The slurry must be of sufficiently high specific gravity and viscosity to prevent its displacement by the grout to be emplaced above it. As a precaution (regardless of depth) and depending on fluid viscosity, a few handfuls of bentonite pellets may be added to solidify the bentonite slurry surface.

7. Cement and/or bentonite grout is placed from the top of the bentonite seal to the ground surface.

   Only Type I (normal) or II (sulfate resistant) cement without accelerator additives should be used. An approved source of potable water must be used for mixing grout materials. The following mixes are acceptable:

- Neat cement, a maximum of 6 gallons of water per 94 pound bag of cement
- Granular bentonite, 1.5 pounds of bentonite per 1 gallon of water
- Cement-bentonite, 5 pounds of pure bentonite per 94 pound bag of cement with 7-8 gallons of water
- Cement-bentonite, 6 to 8 pounds of pure bentonite per 94 pound bag of cement with 8-10 gallons of water, if water mixed
- Non-expandable cement, mixed at 7.5 gallons of water to ½ teaspoon of Aluminum Hydroxide, 94 pounds of cement (Type I) and 4 pounds of bentonite
- Non-expandable cement, mixed at 7 gallons of water to ½ teaspoon of Aluminum Hydroxide, and 94 pounds of cement (Type I and Type II)

8. Grout is pumped through a tremie pipe (usually a 1.25-inch PVC or steel pipe) to the bottom of the annulus until undiluted grout flows from the annulus at the ground surface.

9. In materials that will not maintain an open hole, the temporary steel casing should be withdrawn in a manner that prevents the level of grout from dropping below the bottom of the casing.

10. Additional grout may be added to compensate for the removal of the temporary casing and the tremie pipe to ensure that the top of the grout is at or above ground surface. After the grout has set (about 24 hours), any depression due to settlement is filled with a grout mix similar to the one described above.

11. The protective casing should be set at this time. The casing may be a 5-foot minimum length of black iron or galvanized pipe extending about 1.5 to 3 feet above the ground surface, and set in concrete or cement grout. The protective casing diameter should be at least 2 inches greater than the well casing. A 0.5-inch drain hole may be installed near ground level. A flush-mount protective casing may also be used in areas of high traffic or where access to other areas would be limited by a well stick-up.

12. A protective steel cap, secured to the protective casing by a padlock, should be installed.

13. Steel guard posts should be installed around the protective casing in areas where vehicle traffic may be a safety hazard. Posts should have a minimum diameter of 3 inches and be a minimum of 4 feet high.

14. All monitoring wells must be labeled and dated with permanent paint or steel tags.

7.4 Well Development

Well development is the process by which the aquifer's hydraulic conductivity is restored by removing drilling fluids, and fine-grained formation material from newly installed wells. Two methods of well development that are commonly used are surging and bailing, and over-pumping. A well is considered developed when the pH and conductivity of the groundwater stabilizes and the measured turbidity is <50 nephelometric turbidity units (NTUs).

Surging and bailing will be performed as follows:

1. Measure the total depth (TD) of the well and depth to water (DTW).

2. Using an appropriately-sized surge block, surge 5-foot sections of well screen, using 10-20 up/down cycles per section. Periodically remove the surge block and bail accumulated sediment from the well, as required.

3. For open-hole wells, a 6-inch surge block will be used inside the cased portion of the well. Sediments will be bailed periodically, as required. Over-pumping may be used in combination with surging and bailing for development of bedrock wells. The method (s) used will be based on field conditions encountered, and will be determined by the site geologist/hydrogeologist. However, sediment will initially be removed from the wells by bailing to minimize the volume of development water generated.

The pump used must be rated to achieve the desired yield at a given depth. The pump system should include the following:

- A check valve to prevent water from running back into the well when the pump is shut off
- Flexible discharge hose
- Safety cable or rope to remove the pump from the well
- Flow meter (measuring bucket or inline flow meter)
- Generator
- Amp meter to measure electrical current (load)

The amp meter is used to monitor pump performance. If the pump becomes clogged, the amperage will increase due to stress on the pump. If the water level drops below the intake ports, the current will drop due to decreased resistance on the pump. Please refer to ERT SOP, *Monitoring Well Development* for more details.

7.5 Investigation-Derived Waste Management

The drilling and development of groundwater monitoring wells will generate solid and liquid investigation-derived waste (IDW). The IDW will need to be contained, properly stored, and adequately characterized, and transported by a licensed hauler for disposal. Manifests documenting the ultimate disposition of the IDW should be retained by the responsible party installing the groundwater monitoring wells.

8.0 CALCULATIONS

To maintain an open borehole during rotary drilling, the drilling fluid must exert a pressure greater than the formation pore pressure. Typical pore pressures for unconfined and confined aquifers are 0.433 pounds per square inch per foot (psi/ft) and 0.465 psi/ft, respectively.

The relationship for determining the hydrostatic pressure of the drilling fluid is:

$$\textit{Hydrostatic Pressure}\ (psi) = \textit{Fluid Density}\ (lb/gal) \times \textit{Height of Fluid Column}\ (ft) \times 0.052 \quad \textbf{(Equation 1)}$$

The minimum grout volume necessary to grout a well can be calculated using:

Grout Volume **(ft^3) =** ***Volume of Borehole*** **(ft^3) -** ***Volume of Casing*** **(ft^3) = $\pi L\ (r_B^2 - r_C^2)$ (Equation 2)**

Where,

L = length of borehole to be grouted (ft)
r_B = radius of boring (ft)
r_C = radius of casing (ft)

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance activities that apply to the implementation of these procedures. However, the following general Quality Assurance (QA) procedures apply:

1. All data must be documented on standard well completion forms, field data sheets or within field/site logbooks.

2. All instrumentation must be operated in accordance with the operating instructions as provided by the manufacturer, unless otherwise specified in the UFP-QAPP. Equipment checkout and calibration activities must occur prior to sampling/operation and must be documented.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to well identification; identifications of driller installing the well and geologist supervising the construction; top of casing elevation and horizontal coordinates; depth and diameter of boring; protective wellhead completion (vault or monument); diameter and type of surface and isolation casing, if present; well cap type; screen type, slot size, and interval; annular materials such as sand pack, choke sand, and grout type; and dates the well construction started and ended. These data are essential to providing an accurate and complete final deliverable. The contractor's Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

12.0 REFERENCES

American Society for Testing and Materials (ASTM). 2010. Standard Practice for Design and Installation of Ground Water Monitoring Wells. ASTM D5092-04 (Reapproved 2010).

U.S. Environmental Protection Agency (EPA) - Region 4. 2013. Guidance Document: Design and Installation of Monitoring Wells. Document # SESDGUID-101-R1. Science and Ecosystem Support Division, Athens, Georgia. January 22, 2013. http://www.epa.gov/region4/sesd/fbqstp/

State of Ohio Environmental Protection Agency (OhioEPA). 2007. Drilling and Subsurface Sampling. Technical Guidance Manual for Ground Water Investigations (Chapter 6). Division of Drinking and Ground Waters. April 2007.

State of Ohio Environmental Protection Agency (OhioEPA). 2008. Monitoring Well Design and Installation. Technical Guidance Manual for Ground Water Investigations (Chapter 7). Division of Drinking and Ground Waters. February 2008.

13.0 APPENDICES

A - Figures

APPENDIX A
Figures
SOP: ERT-PROC-2048-20
April 2020

FIGURE 1. Typical Bedrock Well Construction

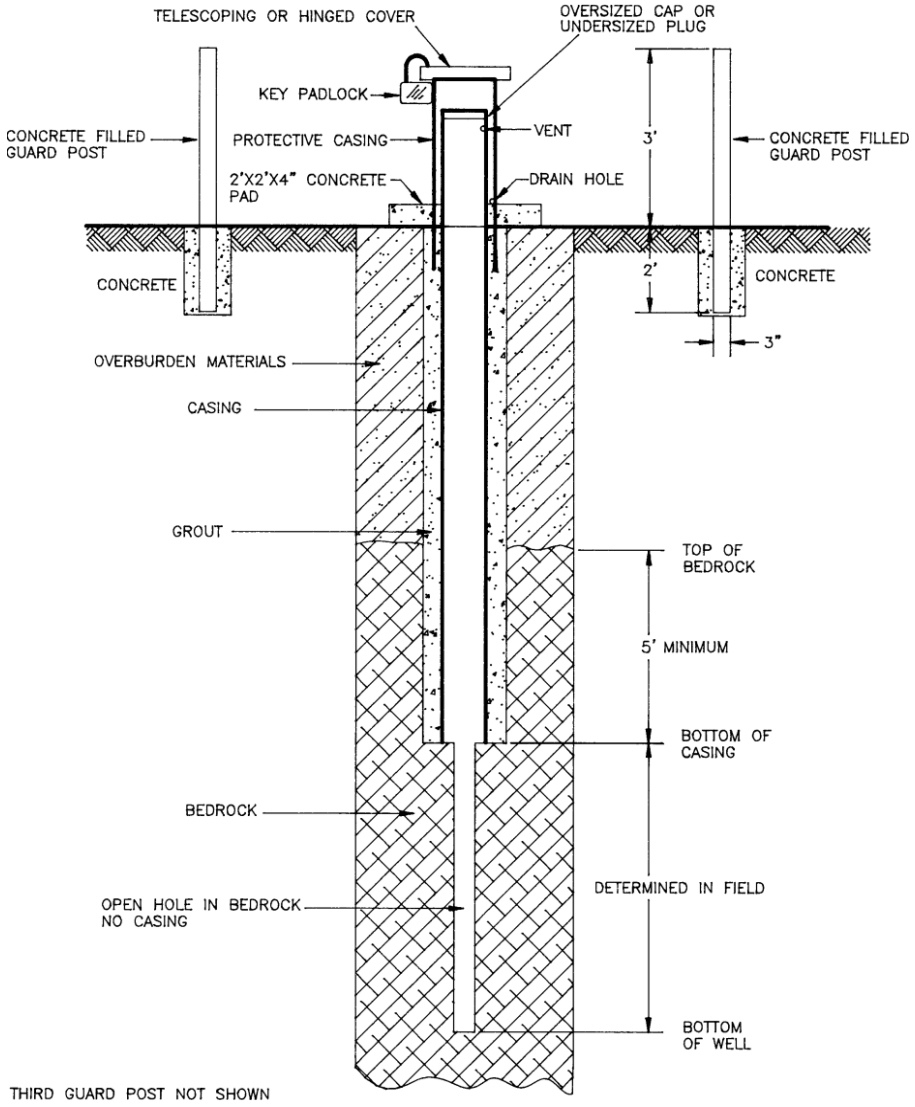
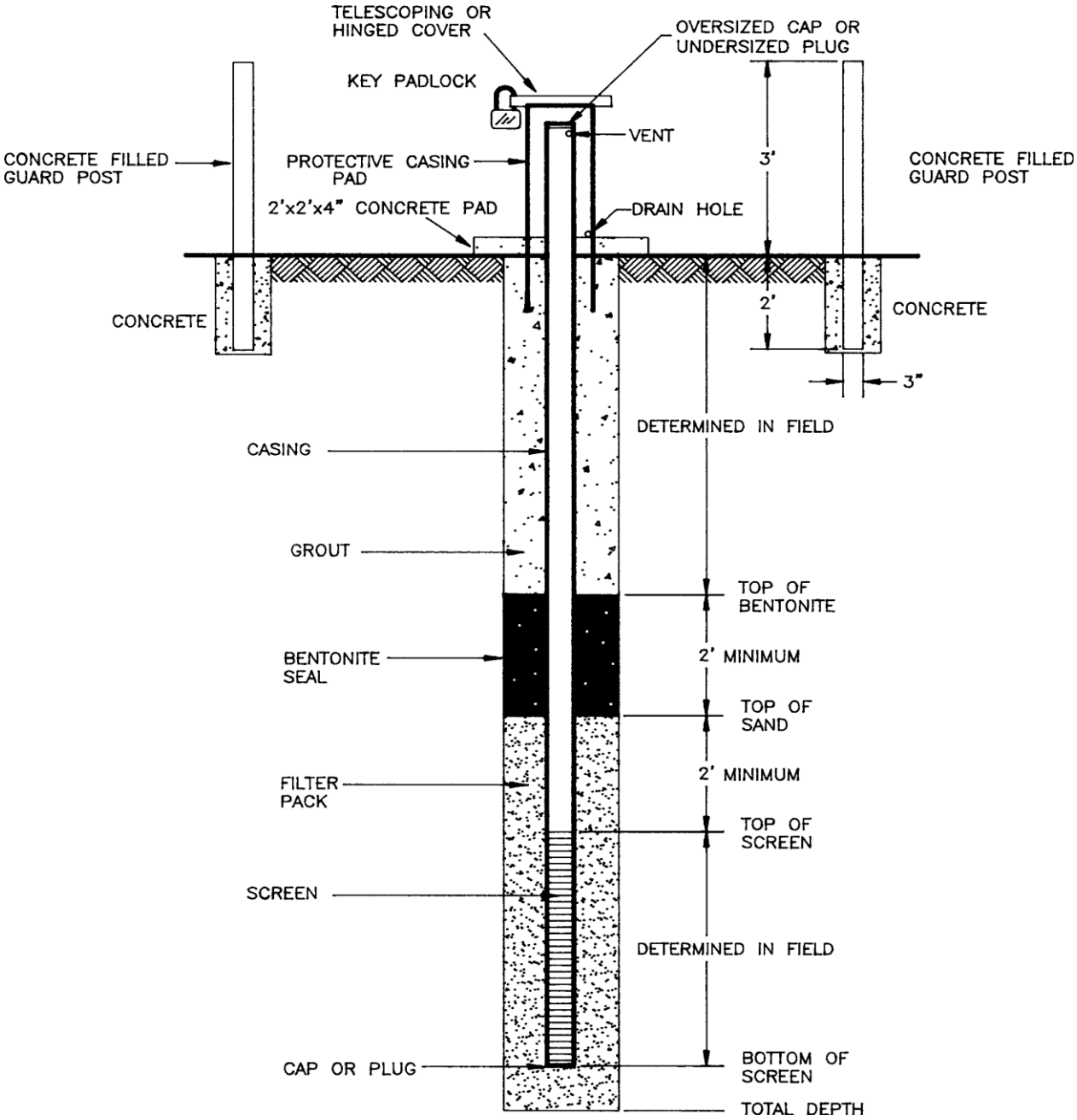


FIGURE 2. Typical Overburden Well Construction



APPENDIX E

QUALITY CONTROL FORMS

INITIAL PHASE CHECKLIST

		SPEC SECTION	DATE
CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

PROCEDURE COMPLIANCE

IDENTIFIY FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY. COORDINATE PLANS, SPECIFICATIONS, AND SUBMITTALS.

COMMENTS: _____

PRELIMINARY WORK

ENSURE PRELIMINARY WORK IS COMPLETE AND CORRECT. IF NOT, WHAT ACTION IS TAKEN?

WORKMANSHIP

ESTABLISH LEVEL OF WORKMANSHIP.

WHERE IS WORK LOCATE _____

IS SAMPLE PANEL REQUIRED? YES ☐ NO ☐

WILL THE INIITAL WORK BE CONSIDERED AS A SAMPLE? YES ☐ NO ☐

(IF YES, MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE AND DESCRIBE LOCATION OF SAMPLE)

RESOLUTION

RESOLVE ANY DIFFERENCES.

COMMENTS: _____

CHECK SAFETY

REVIEW JOB CONDITIONS USING EM 385-1-1 AND JOB HAZARD ANALYSIS

COMMENTS: _____

OTHER

OTHER ITEMS OR REMARKS

_____

QC MANAGER DATE

PREPARATORY PHASE CHECKLIST

(CONTINUED ON SECOND PAGE)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SPEC SECTION	DATE
		SCHEDULE ACT NO.	INDEX #

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTE _____

ARE ALL MATERIALS ON HAND? YES ☐ NO ☐

IF NO, WHAT ITEMS ARE MISSING? _____

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES.)

COMMENTS: _____

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF NO, WHAT ACTION IS TAKEN? _____

SPECIFICATIONS

REVIEW EACH PARAGRAPH OF SPECIFICATIONS.

DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK.

CLARIFY ANY DIFFERENCES.

PRELIMINARY WORK & PERMITS

ENSURE PRELIMINARY WORK IS CORRECT AND PERMITS ARE ON FILE.

IF NOT, WHAT ACTION IS TAKEN? _____

PREPARATORY PHASE CHECKLIST

(CONTINUED FROM FIRST PAGE)

		SPEC SECTION	DATE
CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #

TESTING

IDENTIFY TEST TO BE PERFORMED, FREQUENCY, AND BY WHOM.

WHEN REQUIRED?

WHERE REQUIRED?

REVIEW TESTING PLAN.

HAS TEST FACILITIES BEEN APPROVED?

SAFETY

ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐

REVIEW APPLICABLE PORTION OF EM 385-1-1.

MEETING COMMENTS

NAVY/ROICC COMMENTS DURING MEETING.

OTHER ITEMS OR REMARKS

OTHER ITEMS OR REMARKS:

QC MANAGER DATE

CONTRACTOR PRODUCTION REPORT

(CONTINUATION SHEET)

		DATE
CONTRACT NO	TITLE AND LOCATION	REPORT NO

WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

Schedule Activity No.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (INDICATE SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER.

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (incl Make and Model)	Hours Used

Schedule Activity No.	REMARKS

INCLUDE ALL PERSONNEL WORK HOURS IN THE WORK PERFORMED SECTION ON THIS SHEET
INTO THE FRONT CONTRACTOR PRODUCTION REPORT

CONTRACTOR QUALITY CONTROL REPORT

(CONTINUATION SHEET)

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

REPORT NO.

PHASE	CONTRACT NO	CONTRACT TITLE

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

FOLLOW-UP

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REMARKS (Also Explain Any Checklist Item From Above That Was Answered "NO"), Manuf. Rep. On-Site, etc.

Schedule Activity No.	Description

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

REPORT NO

PHASE	CONTRACT NO	CONTRACT TITLE

PREPARATORY

WAS PREPARATORY PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

INITIAL

WAS INITIAL PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL INITIAL PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

Schedule Activity No.	Description

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

Schedule Activity No.	Description

REMARKS (Also Explain Any Follow-Up Phase Checklist Item From Above That Was Answered "NO"), Manuf. Rep On-Site, etc.

Schedule Activity No.	Description

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

CONTRACTORS QUALITY CONTROL REPORT (QCR)

DAILY LOG OF ACTIVITIES (ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE: 12/12/2019

REPORT #: QCR-001

PAGE 1 OF 1

PROJECT TITLE:	Former Naval Air Station AOC-1 Former Dumping Station						CONTRACT #:	W912WJ-19-D-008
LOCATION:	Cape May, NJ USGS TRACENCM						CONTRACTOR:	Sovereign Consulting Inc
WEATHER:	TEMP (°F)	MAX	37	MIN	25	HUMIDITY(%)	+/- 50	PRECIP: ☐ YES ☑ NO
	WIND (mph)	MAX	7	MIN	0	DIRECTION:	N - NE	WEATHER CAUSED DELAYS
AM:	Sunny and clear			PM:	Sunny and clear			(if "yes" detail in remarks) ☐ YES ☑ NO

WORK PERFORMED TODAY

NAME	WORK LOCATION AND DESCRIPTION	EMPLOYER	LABOR CLASS/TRADE	HRS
Philip Villeneuve	AOC-1 Geophysical Drone Survey	SOVCON	Geologist	8
Drew Clemons	AOC-1 Geophysical Drone Survey	USACE	Geologist	8
Jon Belmont	AOC-1 Geophysical Drone Survey	USACE	Chief of Staff	8
Alex Ross	AOC-1 Geophysical Drone Survey	Maser	Geophysicist	8
Joe Vallo	AOC-1 Geophysical Drone Survey	Maser	Geophysicist	8
Pat Van Haverbeke	AOC-1 Geophysical Drone Survey	Maser	Drone Pilot	8
Jay Ambrust	AOC-1 Geophysical Drone Survey	Maser	Drone Ops	8
Brian Willig	AOC-1 Geophysical Drone Survey	Maser	Drone Ops	8
Tom Meyers	AOC-1 Geophysical Drone Survey	SOVCON	Geologist	8

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? ☑ YES ☐ NO
(If YES attach copy of the meeting minutes)

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? ☐ YES ☑ NO
(If YES attach copy of completed OSHA report)

WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELEC/HIGH WORK/ HAZMAT WORK DONE? ☐ YES ☑ NO
(If YES attach statement or checklist showing inspection performed.)

WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? ☐ YES ☑ NO
(If YES attach description of incident and proposed action.)

TOTAL WORK HOURS ON JOB SITE, THIS DATE, INCL CON'T SHEETS	72
CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT	
TOTAL WORK HOURS FROM START OF PROJECT	72

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

☑ SAFETY REQUIREMENTS HAVE BEEN MET.

Daily Tailgate meeting held, reviewed SSHP and APP
Discussed USGC requirements with site rep (Chris)
Reviewed EC1110-1-109 for UAS operations

QC NARRATIVES
WORK PERFORMED:
Conducted UAS aerial drone survey using Magnetometer, LiDAR, and photographic data
Maser setup a temporary remote base station for magnetic background and GPS data
Photos taken of low tide conditions within the area of concern

QC REQUIREMENTS:
NA - No CQM meetings required for scope of work

EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AS APPLICABLE

Description of Equipment Used Today (incl Make and Model)	Number	Contractor	Hours Used
AeroVironment Vapor 55 drone	1	Maser	6
Gem Sys GSMP-35U Magnetometer sensor	1	Maser	4
Riegl VUX-1 LiDAR Scanner	1	Maser	2
Falcon 8+ Octocopter with 36 Megapixel Sony A7R camera	1	Maser	2
Geometrics G858 Cesium Vapor Magnetometer base station	1	Maser	8
Trimble R8s Reciever and Trimble TSC3 Data Collector	1	Maser	8

ADDITIONAL REMARKS

On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

CONTRACTOR SITE REPRESENTATIVE DATE

REWORK ITEMS LIST

Contract No. and Title: _____

Contractor: _____

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

Computer Generated

SHEET OF

TESTING PLAN AND LOG

CONTRACT NUMBER	PROJECT TITLE AND LOCATION	CONTRACTOR

SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		DATE COMPLETED	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE			

Computer Generated

APPENDIX F

FIELD DOCUMENTATION FORMS

Sovereign Consulting Inc.

Science. Service. Solutions

www.sovcon.com

Test Pit ID: _____

Sheet of

Client: _____
Project: _____
Project Number: _____
Location: _____

Excavation Co.: _____
Excavation Method: _____
Machine: _____
Foreman: _____
SCI Inspector: _____
Start Date: _____
Completion Date: _____

Test Pit Details

Width: Orientation:

Length: Orientation:

Surface Elevation:

Depth	Sample Information: Sample ID	Interval (Ft.)	PID (ppmv)	Sample Type	Water Detected	Sample Description	Notes	Stratum Change (ft.)
2								
4								
6								
8								
10								

Notes: 1)

2)

3)

4)

1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings were completed at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a photoionization detector with a 10.6 Ev lamp and set to a reference factor of _____ (for _____).
3) Sample is designated as either "C" for composite or "G" for a discrete grab sample.
▼= Approximate water table NA=Not Applicable bgs=below ground surface ags=above ground surface SAA= Same As Above

Sediment/Surficial Soil Sample Log

Sovereign Consulting Inc.

Science. Service. Solutions.

www.sovcon.com

Project Name: _____ Date: _____

Project Location: _____ Project #: _____

Personnel: _____

IDENTIFICATION: _____

Sampling Details

Depth Collected: _____ feet **PID TOVs:** _____ (ppmv)

Water Depth: _____ feet

Low Tide Time: _____

Type of Sample: Grab
Composite

Equipment Used for Collection: _____
_____

Collection Method: Wading NA
Shoreline
Boat
Other:_____

Description (sand, silt, muck, mud, etc.) _____
_____
_____

N: _____ **E:** _____

Location of GPS coordinates measured in the field

(NAD83, State Plane Coordinate System)

Sketch or additional comments/notes:

Sampled By (print):		**Sampler(s) Signature:**
Duplicate: Y N	**MS/MSD: Y N**	**Sample Time:**

NOTES: _____
_____
_____

Sovereign Consulting Inc.

Science. Service. Solutions.

www.sovcon.com

Boring/Well ID

_____

Sheet 1 of 4

Client:	_____
Project:	_____
Project Number:	_____
Location:	_____

Drilling Co.:	_____
Drill Rig:	_____
Drill Method:	_____
Foreman:	_____
SCI Inspector:	_____
Start Date:	_____
Completion Date:	_____

Drilling Method Details

	Bit	Casing	Soil Sampler	Rock Core
Type:	____	____	_____	_____
Size:	____	____	_____	_____

SPT: Hammer- lbs Fall - _____in

Monitoring Well Details

Well Type:	_____	Diameter:	_____
Well Head:	_____	Casing:	_____
Latitude:	_____	Surface Elev:	_____
Longitude:	_____	Casing Elev:	_____

Sample Information

Depth (Feet)	Sample ID	Pen./Rec. (in.)	Interval (Ft.)	SPT - Blow/6"	Rock coring time minsec/1'	Field Testing PID (ppmv)	Water Table	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
											PVC Riser Stickup +__'ags
2											Cement __' - __' bgs
4											
6											Drilling Cuttings ___-___' Native backfill/collapse __' - __' bgs
8											
10											2" Schedule 40 PVC Riser __' - __' bgs
12											
14											Bentonite __' - __' bgs
16											
18											#2 Morie Sand __' - __' bgs
20											2" Schedule 40 PVC Wellscreen - 0.01" slot __' - __' bgs
22											
24											

Notes: 1)
2)
3)

NA= Not Applicable bgs= below ground surface HSA= Hollow Stem Auger
NR= No Recovery ags= above ground surface D&W= Drive and Wash
WOH= weight of hammer SAA= Same as Above DPT= Direct Push Technology

Key:
Bedrock
Steel Casing
Grout
Open bedrock
Cement
Drill Cuttings/Native Soils
Bentonite
Sand
Screen
Riser

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings were completed at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a Ion Science photoionization detector (PID) with a 10.6 Ev lamp and set to a reference factor of 1.0.
▼= Approximated water table, water content is considered sautrated below this point unless noted differently. Actual sample water content may vary.

Sovereign Consulting Inc.

Science. Service. Solutions

www.sovcon.com

Boring/Well ID

_____

Sheet 2 of 4

Client: _____
Project: _____
Project Number: _____
Location: _____

Drilling Co.: _____
Drill Rig: _____
Drill Method: _____
Foreman: _____
SCI Inspector: _____
Start Date: _____
Completion Date: _____

Drilling Method Details

	Bit	Casing	Soil Sampler	Rock Core
Type:	____	____	_____	_____
Size:	____	____	_____	_____

SPT: Hammer- lbs Fall - _____in

Monitoring Well Details

Well Type: _____ Diameter: _____
Well Head: _____ Casing: _____
Latitude: _____ Surface Elev: _____
Longitude: _____ Casing Elev: _____

Depth	Sample ID	Pen./Rec. (in.)	Interval (Ft.)	SPT - Blow/6"	Rock coring time minsec/1'	Field Testing PID (ppmv)	Water Table	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
26											
28											
30											
32											
34											
36											
38											
40											
42											
44											
46											
48											

Notes: 1)
2)
3)

NA= Not Applicable bgs= below ground surface HSA= Hollow Stem Auger
NR= No Recovery ags= above ground surface D&W= Drive and Wash
WOH= weight of hammer SAA= Same as Above DPT= Direct Push Technology

Key: Bedrock, Steel Casing, Grout, Open bedrock, Cement, Drill Cuttings/Native Soils, Bentonite, Sand, Screen, Riser

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings were completed at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a Ion Science photoionization detector (PID) with a 10.6 Ev lamp and set to a reference factor of 1.0.
▼= Approximated water table, water content is considered sautrated below this point unless noted differently. Actual sample water content may vary.

Sovereign Consulting Inc.

Science. Service. Solutions

www.sovcon.com

Boring/Well ID

_____

Client: _____

Project: _____

Project Number: _____

Location: _____

Drilling Co.: _____

Drill Rig: _____

Drill Method: _____

Foreman: _____

SCI Inspector: _____

Start Date: _____

Completion Date: _____

Drilling Method Details

	Bit	Casing	Soil Sampler	Rock Core
Type:	____	____	_____	_____
Size:	____	____	_____	_____

SPT: Hammer- lbs Fall - _____in

Monitoring Well Details

Well Type: _____ Diameter: _____

Well Head: _____ Casing: _____

Latitude: _____ Surface Elev: _____

Longitude: _____ Casing Elev: _____

Depth	Sample ID	Pen./Rec. (in.)	Interval (Ft.)	SPT - Blow/6"	Rock coring time minsec/1'	Field Testing PID (ppmv)	Water Table	Sample Description	Stratum Change (ft.)	Notes	Test Boring/ Monitoring Well Construction
52											
54											
56											
58											
60											
62											
64											
66											
68											
70											
72											
74											

Notes: 1)
2)
3)

NA= Not Applicable bgs= below ground surface HSA= Hollow Stem Auger

NR= No Recovery ags= above ground surface D&W= Drive and Wash

WOH= weight of hammer SAA= Same as Above DPT= Direct Push Technology

Key: Bedrock, Steel Casing, Grout, Open bedrock, Cement, Drill Cuttings/Native Soils, Bentonite, Sand, Screen, Riser

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings were completed at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a Ion Science photoionization detector (PID) with a 10.6 Ev lamp and set to a reference factor of 1.0.

▼= Approximated water table, water content is considered sautrated below this point unless noted differently. Actual sample water content may vary.

Sovereign Consulting Inc.

Science. Service. Solutions

www.sovcon.com

Boring/Well ID

_____

Sheet 4 of 4

Client: _____

Project: _____

Project Number: _____

Location: _____

_____

Drilling Co.: _____

Drill Rig: _____

Drill Method: _____

Foreman: _____

SCI Inspector: _____

Start Date: _____

Completion Date: _____

Drilling Method Details

	Bit	Casing	Soil Sampler	Rock Core
Type:	____	____	_____	_____
Size:	____	____	_____	_____

SPT: Hammer- lbs Fall - _____in

Monitoring Well Details

Well Type:	_____	Diameter:	_____
Well Head:	_____	Casing:	_____
Latitude:	_____	Surface Elev:	_____
Longitude:	_____	Casing Elev:	_____

Sample Information

Depth	Sample ID	Pen./Rec. (in.)	Interval (Ft.)	SPT - Blow/6"	Rock coring time minsec/1'	Field Testing PID (ppmv)	Water Table
76							
78							
80							
82							
84							
86							
88							
90							
92							
94							
96							
98							

Sample Description	Stratum Change (ft.)	Not	Test Boring/ Monitoring Well Construction

Notes: 1)
2)
3)

NA= Not Applicable bgs= below ground surface HSA= Hollow Stem Auger
NR= No Recovery ags= above ground surface D&W= Drive and Wash
WOH= weight of hammer SAA= Same as Above DPT= Direct Push Technology

Key:
Bedrock
Steel Casing
Grout
Open bedrock
Cement
Drill Cuttings/Native Soils
Bentonite
Sand
Screen
Riser

Remarks: 1) Stratification lines represent approximate boundaries between soil types and the transition may be gradual. Water level readings were completed at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.
2) Field testing values represent total volatile organic vapors (referenced to an isobutylene standard) measured in the headspace of a sealed soil sample with a Ion Science photoionization detector (PID) with a 10.6 Ev lamp and set to a reference factor of 1.0.
▼= Approximated water table, water content is considered sautrated below this point unless noted differently. Actual sample water content may vary.

Project Name: _____

Location: _____

Project #: _____

Date: _____

Sovereign Consulting Inc.

Science. Service. Solutions.

www.sovcon.com

Field Instrument Calibration Record

Instrument (MAKE/MODEL#) _____

Instrument # _____

Parameter:

Gas/Vapor -

- ☐ LEL (±3%)
- ☐ CO (±3%)
- ☐ (VOC) Isobutylene (±3%)
- ☐ H_2S (±3%)
- ☐ CO_2 (±3%)
- ☐ O_2 (±3%)
- ☐ CH_4 (±3%)

Aqueous -

- ☐ Conductivity (±0.5%)
- ☐ Salinity
- ☐ pH (±0.2 units)
- ☐ Turbidity (±5%)
- ☐ ORP (±20 mV)
- ☐ DO (±2%)

Standards:

Standard A _____

Standard B _____

Standard C _____

Standard D _____

Standard E _____

Standard F _____

Standard G _____

Standard H _____

Standard I _____

Date	Time	STD (A,B,C)	STD Value	Instrument Response	% Dev	Calibrated (Y/N)	Type (Init., Cont.)	Sampler

MONITORING WELL SAMPLING LOG

Low Flow Sampling

Sovereign Consulting Inc.
Science. Service. Solutions
www.sovcon.com

PROJECT NAME:	PROJECT LOCATION:	DATE:	WELL ID:

PROJECT NUMBER:	WELL DIAMETER: (inches)	DEPTH TO WATER: (feet)	DEPTH TO BOTTOM: (feet)	PID READING: (ppmv)

PURGING DATA

TUBING DIAMETER (inches):	TUBING MATERIAL CODE: (see below)	PURGE PUMP TYPE:	PUMP EQUIPMENT MODEL & SERIAL #s:

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY	GALLONS:	LITERS:

WELL CAPACITY (Gallons Per Foot): 0.75" = 0.02; 1" = 0.04; 1.25" = 0.06; 2" = 0.16; 3" = 0.37; 4" = 0.65; 5" = 1.02; 6" = 1.47; 12" = 5.88	1 GALLON = 3.785 LITERS	TOTAL VOLUME PURGED:

WELL SCREEN INTERVAL DEPTH (feet):	INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	GALLONS: / LITERS:

WATER LEVEL STABLIZATION	DEPTH TO WATER WITH PUMP: (feet)	

TIME INTERVAL (min)	FLOW RATE (mL/min)	PUMP SETTINGS	DEPTH TO WATER (feet) START	DEPTH TO WATER (feet) END	Water Level Stable (Yes or No)	VOLUME PURGED DURING INTERVAL (mL)

TIME	FLOW RATE (mL/min)	DEPTH TO WATER (feet)	TURBIDITY (NTU)	DISSOLVED OXYGEN (mg/L)	pH	TEMP (°C)	SPECIFIC CONDUCTIVITY (µS/cm)	ORP (mV)	COLOR (describe)	ODOR (describe)
(3-5 minutes)*	(100-500 mL/min)*	(+/- 0.3')*	(+/- 10%)*	(+/- 10%)*	(+/- 0.1)*	(+/- 3%)*	(+/- 3%)*	(+/- 10mV)*	-	-

* EPA stabilization parameters from EPA/540/S-95/504 April 1996

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURES:	SAMPLING INITIATED AT:	SAMPLING ENDED AT:

PUMP OR TUBING DEPTH IN WELL (feet):	SAMPLE PUMP FLOW RATE (mL per minute):	FIELD PARAMETER MONITORING EQUIPMENT MODEL & SERIAL #s:

FIELD DECONTAMINATION: Y N	FIELD-FILTERED: Y N FILTER SIZE: _____ µm Filtration Equipment Type:	DUPLICATE: Y N

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

WELL CONDITION CHECKLIST (circle appropriate item(s), cross out if not applicable)

Type: Flush Mount / Stand Pipe General Condition: Good / Needs Repair Well Caps: Good / Broken / None Lock: Good / Broken / None

Evidence of Rain Water Between Steel & PVC? Y / N Is Well Plumb?: Y / N PVC Riser: Good / Damaged / None

Evendence of Ponding Around Welll? Y / N Concrete Collar: Good / Cracked / Leaking / None

REMARKS:

WELL DEVELOPMENT DATA FORM

Sovereign Consulting Inc.
Science. Service. Solutions.
www.sovcon.com

WELL ID:

SITE: DATE:

PROJECT NO.: TIME:

PUMP TYPE & MODEL: WEATHER:

1. INITIAL READINGS

START TIME:

WELL DIAMETER (INCHES)	PID WELL HEAD (PPM)	DEPTH TO WATER (FEET)	DEPTH TO BOTTOM (FEET)	DEPTH TO PRODUCT (FEET)	PRODUCT THICKNESS (FEET)	DEPTH TO SCREEN (FEET)	PUMP DEPTH (FEET)	WELL VOLUME (Gallons) (Milliliters)

2. DEVELOPMENT READINGS

TIME (MINUTES)	RATE (gal/min) (ml/min)	DEPTH TO WATER (FEET)	ORP (mV)	D.O. (mg/L)	pH (S.U.)	TEMP (degrees C)	SP. COND. (uS/cm)	Turb (NTU)	Volume (gal) (ml)	Appearance (Silty) (Clear)

3. POST-DEVELOPMENT

END TIME:

TOTAL TIME (MINUTES)	TOTAL VOL (gallons) (millilietrs)	DEPTH TO WATER (FEET)	DEPTH TO BOTTOM (FEET)

ADDITIONAL NOTES:

APPENDIX G

ECOLOGICAL SCREENING LEVELS

Appendix G-1
Ecological Screening Levels for Surface Water

Analytes of Concern and Methods	CAS Number	EPA NRALC - Freshwater Chronic:	EPA NRALC - Saltwater Chronic:	Region 3 BTAG - Freshwater	Region 3 BTAG- Marine	Region 4 Freshwater Surface Water	Region 4 Marine/Estuarine Surface Water
TCL SVOC in Water – EPA Method 8270D (µg/L)							
1,1'-Biphenyl	92-52-4	--	--	14	--	6.5	49
2,2'-oxybis(1-Chloropropane)	108-60-1	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	--	--	12	1.9	12
2,4,6-Trichlorophenol	88-06-2	--	--	4.9	61	4.9	6.5
2,4-Dichlorophenol	120-83-2	--	--	11		11	790
2,4-Dimethylphenol	105-67-9	--	--	--	--	15	193
2,4-Dinitrophenol	51-28-5	--	--	--	48.5	71	14
2,4-Dinitrotoluene	121-14-2	--	--	44		44	9.1
2,6-Dinitrotoluene	606-20-2	--	--	81	--	81	36
2-Chloronaphthalene	91-58-7	--	--	--	--	--	--
2-Chlorophenol	95-57-8	--	--	24	265	18	400
2-Methylphenol	95-48-7	--	--	13	1020	67	995
2-Nitroaniline	88-74-4	--	--	--	--	17	17
2-Nitrophenol	88-75-5	--	--	1920	2940	73	900
3,3'-Dichlorobenzidine	91-94-1	--	--	4.5	73	4.5	13
3-Nitroaniline	99-09-2	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	--	--	--	--	--	--
4-Bromophenyl-phenylether	101-55-3	--	--	1.5	--	1.5	2
4-Chloro-3-methylphenol	59-50-7	--	--	--	--	1	241
4-Chloroaniline	106-47-8	232	--	--	--	0.80	0.80
4-Chlorophenyl-phenylether	7005-72-3	--	--	--	--	--	--
4-Methylphenol	106-44-5	--	--	543	--	53	405
4-Nitroaniline	100-01-6	--	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	60	71.7	58	600
Acetophenone	98-86-2	--	--	--	--	--	--
Atrazine	1912-24-9	--	--	1.8		0.03	--
Benzaldehyde	100-52-7	--	--	--	--	143	143
bis(2-Chloroethoxy)methane	111-91-1	--	--	--	--	--	--
bis(2-Chloroethyl)ether	111-44-4	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	117-81-7	--	--	16		8	6
Butylbenzylphthalate	85-68-7	--	--	19	29.4	23	18
Caprolactam	105-60-2	--	--	--	--	--	--
Carbazole	86-74-8	--	--	--	--	4	112
Di-n-butylphthalate	84-74-2	--	--	19	3.4	19	27
Di-n-octylphthalate	117-84-0	--	--	22	--	215	215
Dibenzofuran	132-64-9	--	--	3.7	65	4	61
Diethylphthalate	84-66-2	--	--	210	75.9	220	59

Appendix G-1
Ecological Screening Levels for Surface Water

Analytes of Concern and Methods	CAS Number	EPA NRALC - Freshwater Chronic:	EPA NRALC - Saltwater Chronic:	Region 3 BTAG - Freshwater	Region 3 BTAG- Marine	Region 4 Freshwater Surface Water	Region 4 Marine/Estuarine Surface Water
Dimethylphthalate	131-11-3	--	--	--	580	1100	3295
Hexachlorobenzene	118-74-1	--	--	0.0003	--	0.15	0.15
Hexachlorobutadiene	87-68-3	--	--	1.3	0.3	1	0.3
Hexachlorocyclopentadiene	77-47-4	--	--	--	0.07	0.45	0.07
Hexachloroethane	67-72-1	--	--	12	9.4	12	33
Isophorone	78-59-1	--	--	--	129	920	996
N-Nitroso-di-n-propylamine	621-64-7	--	--	--	120	--	--
N-Nitrosodiphenylamine	86-30-6	--	--	210	33000	25	48
Nitrobenzene	98-95-3	--	--	--	66.8	230	1046
Pentachlorophenol	87-86-5	15	7.9	0.5	7.9	15	7.9
Phenol	108-95-2	--	--	4	58	160	58
PAHs							
2-Methylnaphthalene	91-57-6	--	--	4.7	4.2	4.7	52
Acenaphthene	83-32-9	--	--	5.8	6.6	15	15
Acenaphthylene	208-96-8	--	--	--	--	13	28
Anthracene	120-12-7	--	--	0.012	0.18	0.02	0.43
Benzo(a)anthracene	56-55-3	--	--	0.018	--	4.7	0.35
Benzo(a)pyrene	50-32-8	--	--	0.015	--	0.06	0.02
Benzo(b)fluoranthene	205-99-2	--	--	--	--	2.6	0.06
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	0.012	0.012
Benzo(k)fluoranthene	207-08-9	--	--	--	--	0.06	0.06
Chrysene	218-01-9	--	--	--	--	4.7	0.35
Dibenz(a,h)anthracene	53-70-3	--	--	--	--	0.012	0.010
Fluoranthene	206-44-0	--	--	0.04	1.6	0.8	0.82
Fluorene	86-73-7	--	--	3	2.5	19	24
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	--	--	0.012	0.012
Naphthalene	91-20-3	--	--	1.1	1.4	21	1.4
Phenanthrene	85-01-8	--	--	0.4	1.5	2.3	4.6
Pyrene	129-00-0	--	--	0.025	0.24	4.6	0.11
PAH-SIM in Water – EPA Method 8270D							
1-Methylnaphthalene	90-12-0	--	--	2.1	--	6.1	52
2-Methylnaphthalene	91-57-6	--	--	4.7	4.2	4.7	52
Acenaphthene	83-32-9	--	--	5.8	6.6	15	15
Acenaphthylene	208-96-8	--	--	--	--	13	28
Anthracene	120-12-7	--	--	0.012	0.18	0.02	0.43
Benzo(a)anthracene	56-55-3	--	--	0.018	--	4.7	0.35
Benzo(a)pyrene	50-32-8	--	--	0.015	--	0.06	0.02
Benzo(b)fluoranthene	205-99-2	--	--	--	--	2.6	0.06
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	0.012	0.012
Benzo(k)fluoranthene	207-08-9	--	--	--	--	0.06	0.06
Chrysene	218-01-9	--	--	--	--	4.7	0.35
Dibenz(a,h)anthracene	53-70-3	--	--	--	--	0.012	0.010
Fluoranthene	206-44-0	--	--	0.04	1.6	0.80	0.82

Appendix G-1
Ecological Screening Levels for Surface Water

Analytes of Concern and Methods	CAS Number	EPA NRALC - Freshwater Chronic:	EPA NRALC - Saltwater Chronic:	Region 3 BTAG - Freshwater	Region 3 BTAG- Marine	Region 4 Freshwater Surface Water	Region 4 Marine/Estuarine Surface Water
Fluorene	86-73-7	--	--	3	2.5	19	24
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	--	--	0.012	0.012
Naphthalene	91-20-3	--	--	1.1	1.4	21	1.4
Phenanthrene	85-01-8	--	--	0.4	1.5	2.3	4.6
Pyrene	129-00-0	--	--	0.025	0.24	4.6	0.11
Explosives in Water – EPA Method 8330B							
1,3,5-Trinitrobenzene	99-35-4	--	--	--	--	11	11
1,3-Dinitrobenzene	99-65-0	--	--	--	--	22	20
2,4,6-Trinitrotoluene	118-96-7	--	--	100	100	13	54
2,4-Diamino-6-nitrotoluene	6629-29-4	--	--	--	--	--	--
2,4-Dinitrotoluene	121-14-2	--	--	44		44	9.1
2,6-Diamino-4-nitrotoluene	59229-75-3	--	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	--	--	81	--	81	36
2-Amino-4,6-Dinitrotoluene	35572-78-2	--	--	1480	--	18	20
2-Nitrotoluene	88-72-2	--	--	--	--	71	1185
3-Nitrotoluene	99-08-1	--	--	750	--	42	1384
4-Amino-2,6-Dinitrotoluene	19406-51-0	--	--	--	--	11	27
4-Nitrotoluene	99-99-0	--	--	1900	--	46	1438
HMX	2691-41-0	--	--	150	--	220	330
Nitrobenzene	98-95-3	--	--		66.8	230	1046
Nitroglycerin	55-63-0	--	--	138	--	18	239
PETN	78-11-5	--	--	85000	--	--	--
RDX	121-82-4	--	--	360	--	79	190
Tetryl	479-45-8	--	--	--	--	--	--
Pesticides in Water – EPA Method 8081B							
Aldrin	309-00-2	3 CMC	1.3 CMC	3	0.13	0.04	0.0001
Alpha BHC	319-84-6	--	--	2.2 (BHC, nonlindane)	25	0.01	0.046
Alpha Chlordane	5103-71-9	0.0043	0.0040	0.0022	--	0.004	0.004
Beta BHC	319-85-7	--	--	2.2 (BHC, nonlindane)	--	0.01	0.046
Delta BHC	319-86-8	--	--	2.2 (BHC, nonlindane)	--	--	--
Dieldrin	60-57-1	0.056	0.0019	0.056	0.11	0.06	0.002
Endosulfan I	959-98-8	0.056	0.0087	0.051	--	0.06	0.009
Endosulfan II	33213-65-9	0.056	0.0087	0.051	--	0.06	0.009
Endosulfan Sulfate	1031-07-8	--	--	--	0.009	0.06	0.009
Endrin	72-20-8	0.036	0.0023	0.036	0.01	0.04	0.002
Endrin Aldehyde	7421-93-4	--	--	--	--	--	--
Endrin Ketone	53494-70-5	--	--	--	--	--	--
Gamma BHC - Lindane	58-89-9	0.95 CMC	0.16 CMC	0.01	0.016	0.11	0.02
Gamma Chlordane	5103-74-2	0.0043	0.004	0.0022	--	0.004	0.004
Heptachlor	76-44-8	0.0038	0.0036	0.0019	--	0.004	0.004
Heptachlor Epoxide	1024-57-3	0.0038	0.0036	0.0019	--	0.004	0.004
Methoxychlor	72-43-5	0.03	0.03	0.019	0.03	0.03	0.03
p,p-DDD	72-54-8	--	--	0.011	0.025	0.01	0.084

Appendix G-1
Ecological Screening Levels for Surface Water

Analytes of Concern and Methods	CAS Number	EPA NRALC - Freshwater Chronic:	EPA NRALC - Saltwater Chronic:	Region 3 BTAG - Freshwater	Region 3 BTAG- Marine	Region 4 Freshwater Surface Water	Region 4 Marine/Estuarine Surface Water
p,p-DDE	72-55-9	--	--	--	0.14	0.3	0.14
p,p-DDT	50-29-3	0.001	0.001	0.0005	0.0065	0.001	0.01
Toxaphene	8001-35-2	0.0002	0.0002	0.0002	0.21	0.0002	0.0002
Metals in Water – EPA Method 6020B/3010A							
Aluminum	7429-90-5	--	--	87	--	87	1,500
Antimony	7440-36-0	--	--	30	500	190	4,300
Arsenic	7440-38-2	150	36	5	12.5	150	36
Barium	7440-39-3	--	--	4	--	220	4
Beryllium	7440-41-7	--	--	0.66	--	11	0.13
Cadmium	7440-43-9	0.72	7.9	0.25	0.12	0.45	7.9
Calcium	7440-70-2	--	--	116000	--	116,000	--
Chromium	7440-47-3	74 (trivalent)	--	74 (trivalent)	56 (trivalent)	42 (trivalent)	103 (trivalent)
Hexavalent Chromium	18540-29-9	11	50	11	1.5	11	50
Cobalt	7440-48-4	--	--	23		19	--
Copper	7440-50-8	--	3.1	9	3.1	4.95	3.1
Iron	7439-89-6	1000		300	--	1,000	300
Lead	7439-92-1	2.5	8.1	2.5	8.1	1.25	8.1
Magnesium	7439-95-4	--	--	--	--	82,000	--
Manganese	7439-96-5	--	--	120	--	93	100
Mercury	7439-97-6	0.77	0.94	0.026	0.016	0.77	0.94
Nickel	7440-02-0	52	8.2	52	8.2	28.9	8.2
Potassium	9/7/7440			--	--	53,000	--
Selenium	7782-49-2	--	71	1	71	5	71
Silver	7440-22-4	3.2 CMC	1.9 CMC	3.2	0.23	0.06	0.10
Sodium	7440-23-5	--	--	--	--	680,000	--
Thallium	7440-28-0	--	--	0.8	21.3	6	6.3
Vanadium	7440-62-2	--	--	20	--	27	--
Zinc	7440-66-6	120	81	120	81	66	81

Shading indicates ECO PAL selection based on hierarchy.

Sources:

Ecological PAL is based off the following hierarchy of sources:

a) EPA National Recommended Water Quality Criteria - Aquatic Life Criteria (NRALC) Table, minimum value of freshwater or saltwater chronic (as accessed on April 2020 at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table)

b) EPA Region III Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmarks. August 2006. (https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values).

c) EPA Region 4 Minimum of Freshwater and Marine/Estuarine Surface Water Screening Values (SWSV) for Hazardous Waste Sites (March 2018), aquatic life values. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

All units in micrograms per liter (µg/L).

CMC = Criterion Maximum Concentration

NRALC = National Recommended Aquatic Life Criteria

BTAG = Biological Technical Assistance Group

Appendix G-2
Ecological Screening Levels for Soil

Analytes of Concern and Methods	CAS Number	EPA Ecological Soil Screening Levels (mg/kg)	EPA Region 4 Ecological Screening Value for Soil (mg/kg)	LANL ECORISK V4.1 Database Mminimum No Effect Level for Soil (mg/kg)
TCL SVOC in Soil – EPA Method 8270D				
1,1'-Biphenyl	92-52-4	--	0.2	--
2,2'-oxybis(1-Chloropropane)	108-60-1	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	4	--
2,4,6-Trichlorophenol	88-06-2	--	9.94	--
2,4-Dichlorophenol	120-83-2	--	0.05	--
2,4-Dimethylphenol	105-67-9	--	0.04	--
2,4-Dinitrophenol	51-28-5	--	0.061	--
2,4-Dinitrotoluene	121-14-2	--	6	6
2,6-Dinitrotoluene	606-20-2	--	4	4
2-Chloronaphthalene	91-58-7	--	--	--
2-Chlorophenol	95-57-8	--	0.06	0.39
2-Methylphenol	95-48-7	--	0.1	0.67
2-Nitroaniline	88-74-4	--	0.02	5.3
2-Nitrophenol	88-75-5	--	--	--
3,3'-Dichlorobenzidine	91-94-1	--	0.03	--
3-Nitroaniline	99-09-2	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	--	--	--
4-Bromophenyl-phenylether	101-55-3	--	--	--
4-Chloro-3-methylphenol	59-50-7	--	--	--
4-Chloroaniline	106-47-8	--	1	--
4-Chlorophenyl-phenylether	7005-72-3	--	--	--
4-Methylphenol	106-44-5	--	0.08	0.69 (3-methylphenol)
4-Nitroaniline	100-01-6	--	--	--
4-Nitrophenol	100-02-7	--	5.12	--
Acetophenone	98-86-2	--	--	--
Atrazine	1912-24-9	--	0.00005	--
Benzaldehyde	100-52-7	--	--	--
bis(2-Chloroethoxy)methane	111-91-1	--	--	--
bis(2-Chloroethyl)ether	111-44-4	--	--	--
bis(2-Ethylhexyl)phthalate	117-81-7	--	0.02	0.02
Butylbenzylphthalate	85-68-7	--	0.59	90
Caprolactam	105-60-2	--	--	--
Carbazole	86-74-8	--	0.07	79
Di-n-butylphthalate	84-74-2	--	0.011	0.011
Di-n-octylphthalate	117-84-0	--	0.91	0.91
Dibenzofuran	132-64-9	--	0.15	6.1
Diethylphthalate	84-66-2	--	0.25	100
Dimethylphthalate	131-11-3	--	0.35	10
Hexachlorobenzene	118-74-1	--	0.079	0.079
Hexachlorobutadiene	87-68-3	--	0.009	--
Hexachlorocyclopentadiene	77-47-4	--	0.001	--
Hexachloroethane	67-72-1	--	0.024	--

Appendix G-2
Ecological Screening Levels for Soil

Analytes of Concern and Methods	CAS Number	EPA Ecological Soil Screening Levels (mg/kg)	EPA Region 4 Ecological Screening Value for Soil (mg/kg)	LANL ECORISK V4.1 Database Mminimum No Effect Level for Soil (mg/kg)
Isophorone	78-59-1	--	--	--
N-Nitroso-di-n-propylamine	621-64-7	--	--	--
N-Nitrosodiphenylamine	86-30-6	--	0.545	--
Nitrobenzene	98-95-3	--	2.2	2.2
Pentachlorophenol	87-86-5	2.1	2.1	0.36
Phenol	108-95-2	--	0.79	0.79
PAHs				
2-Methylnaphthalene	91-57-6	29 LMW sum	29 LMW sum	16
Acenaphthene	83-32-9	29 LMW sum	29 LMW sum	0.25
Acenaphthylene	208-96-8	29 LMW sum	29 LMW sum	120
Anthracene	120-12-7	29 LMW sum	29 LMW sum	6.8
Benzo(a)anthracene	56-55-3	1.1 HMW sum	1.1 HMW sum	0.73
Benzo(a)pyrene	50-32-8	1.1 HMW sum	1.1 HMW sum	62
Benzo(b)fluoranthene	205-99-2	1.1 HMW sum	1.1 HMW sum	18
Benzo(g,h,i)perylene	191-24-2	1.1 HMW sum	1.1 HMW sum	25
Benzo(k)fluoranthene	207-08-9	1.1 HMW sum	1.1 HMW sum	71
Chrysene	218-01-9	1.1 HMW sum	1.1 HMW sum	3.1
Dibenz(a,h)anthracene	53-70-3	1.1 HMW sum	1.1 HMW sum	14
Fluoranthene	206-44-0	1.1 HMW sum	1.1 HMW sum	10
Fluorene	86-73-7	29 LMW sum	29 LMW sum	3.7
Indeno(1,2,3-cd)pyrene	193-39-5	1.1 HMW sum	1.1 HMW sum	71
Naphthalene	91-20-3	29 LMW sum	29 LMW sum	1
Phenanthrene	85-01-8	29 LMW sum	29 LMW sum	5.5
Pyrene	129-00-0	1.1 HMW sum	1.1 HMW sum	10
PAH-SIM in Soil – EPA Method 8270D				
1-Methylnaphthalene	90-12-0	29 LMW sum	29 LMW sum	--
2-Methylnaphthalene	91-57-6	29 LMW sum	29 LMW sum	16
Acenaphthene	83-32-9	29 LMW sum	29 LMW sum	0.25
Acenaphthylene	208-96-8	29 LMW sum	29 LMW sum	120
Anthracene	120-12-7	29 LMW sum	29 LMW sum	6.8
Benzo(a)anthracene	56-55-3	1.1 HMW sum	1.1 HMW sum	0.73
Benzo(a)pyrene	50-32-8	1.1 HMW sum	1.1 HMW sum	62
Benzo(b)fluoranthene	205-99-2	1.1 HMW sum	1.1 HMW sum	18
Benzo(g,h,i)perylene	191-24-2	1.1 HMW sum	1.1 HMW sum	25
Benzo(k)fluoranthene	207-08-9	1.1 HMW sum	1.1 HMW sum	71
Chrysene	218-01-9	1.1 HMW sum	1.1 HMW sum	3.1
Dibenz(a,h)anthracene	53-70-3	1.1 HMW sum	1.1 HMW sum	14
Fluoranthene	206-44-0	1.1 HMW sum	1.1 HMW sum	10
Fluorene	86-73-7	29 LMW sum	29 LMW sum	3.7
Indeno(1,2,3-cd)pyrene	193-39-5	1.1 HMW sum	1.1 HMW sum	71
Naphthalene	91-20-3	29 LMW sum	29 LMW sum	1
Phenanthrene	85-01-8	29 LMW sum	29 LMW sum	5.5
Pyrene	129-00-0	1.1 HMW sum	1.1 HMW sum	10

Appendix G-2
Ecological Screening Levels for Soil

Analytes of Concern and Methods	CAS Number	EPA Ecological Soil Screening Levels (mg/kg)	EPA Region 4 Ecological Screening Value for Soil (mg/kg)	LANL ECORISK V4.1 Database Mminimum No Effect Level for Soil (mg/kg)
Explosives in Soil – EPA Method 8330B				
1,3,5-Trinitrobenzene	99-35-4	--	0.3	10
1,3-Dinitrobenzene	99-65-0	--	0.034	0.072
2,4,6-Trinitrotoluene	118-96-7	--	7.5	7.5
2,4-Diamino-6-nitrotoluene	6629-29-4	--	--	--
2,4-Dinitrotoluene	121-14-2	--	6	6
2,6-Diamino-4-nitrotoluene	59229-75-3	--	--	--
2,6-Dinitrotoluene	606-20-2	--	4	4
2-Amino-4,6-Dinitrotoluene	35572-78-2	--	14	14
2-Nitrotoluene	88-72-2	--	0.19	9.8
3-Nitrotoluene	99-08-1	--	0.13	12
4-Amino-2,6-Dinitrotoluene	19406-51-0	--	12	12
4-Nitrotoluene	99-99-0	--	0.14	21
HMX	2691-41-0	--	16	16
Nitrobenzene	98-95-3	--	2.2	2.2
Nitroglycerin	55-63-0	--	13	13
PETN	78-11-5	--	2.2	100
RDX	121-82-4	--	2.3	2.3
Tetryl	479-45-8	--	0.018	1.5
Pesticides in Soil – EPA Method 8081B/3540				
Aldrin	309-00-2	--	0.03	0.037
Alpha BHC	319-84-6	--	0.0003	59
Alpha Chlordane	5103-71-9	--	0.0029	0.27
Beta BHC	319-85-7	--	0.0003	0.27
Delta BHC	319-86-8	--	--	--
Dieldrin	60-57-1	0.0049	0.0029	0.0045
Endosulfan I	959-98-8	--	0.0009	0.64
Endosulfan II	33213-65-9	--	0.0009	--
Endosulfan Sulfate	1031-07-8	--	0.0065	--
Endrin	72-20-8	--	0.0019	0.0014
Endrin Aldehyde	7421-93-4	--	--	--
Endrin Ketone	53494-70-5	--	--	--
Gamma BHC - Lindane	58-89-9	--	0.0031	0.0095
Gamma Chlordane	5103-74-2	--	0.02	2.2
Heptachlor	76-44-8	--	0.0016	0.059
Heptachlor Epoxide	1024-57-3	--	0.00015	--
Methoxychlor	72-43-5	--	0.0021	5.1
p,p-DDD	72-54-8	0.021 (sum of	0.021	0.0063
p,p-DDE	72-55-9	0.021 (sum of	0.021	0.11
p,p-DDT	50-29-3	0.021 (sum of	0.021	0.044
Toxaphene	8001-35-2	--	0.00015	4.1

Appendix G-2
Ecological Screening Levels for Soil

Analytes of Concern and Methods	CAS Number	EPA Ecological Soil Screening Levels (mg/kg)	EPA Region 4 Ecological Screening Value for Soil (mg/kg)	LANL ECORISK V4.1 Database Mminimum No Effect Level for Soil (mg/kg)
Metals in Soil – EPA Methods 6010D and 7471B				
Aluminum	7429-90-5	--	--	--
Antimony	7440-36-0	0.27	0.27	2.3
Arsenic	7440-38-2	18	18	6.8
Barium	7440-39-3	330	330	110
Beryllium	7440-41-7	21	2.5	2.5
Cadmium	7440-43-9	0.36	0.36	0.27
Calcium	7440-70-2	--	--	--
Chromium	7440-47-3	26	26	23
Hexavalent Chromium	18540-29-9	130	0.34	0.34
Cobalt	7440-48-4	13	13	13
Copper	7440-50-8	28	28	14
Iron	7439-89-6	--	--	--
Lead	7439-92-1	11	11	11
Magnesium	7439-95-4	--	--	--
Manganese	7439-96-5	220	220	220
Mercury	7439-97-6	--	0.013	0.013
Nickel	7440-02-0	38	38	10
Potassium	9/7/7440	--	--	--
Selenium	7782-49-2	0.52	0.52	0.52
Silver	7440-22-4	4.2	4.2	2.6
Sodium	7440-23-5	--	--	--
Thallium	7440-28-0	--	0.05	0.05
Vanadium	7440-62-2	7.8	7.8	4.7
Zinc	7440-66-6	46	46	47

Shading indicates ECO PAL selection based on hierarchy.

Sources:

Ecological PAL is based off the following hierarchy of sources:

a) EPA EcoSSLs (various dates) (https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents), minimum value for plants, soil invertebrates, bird and mammals.

b) R4 = EPA Region 4 Ecological Risk Assessment Supplemental Guidance (2018) – Soil Screening Values for Hazardous Waste Sites (https://www.epa.gov/sites/production/files/201803/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf), Table 3 Screening Level.

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for soil.

All units in milligrams per kilogram (mg/kg).

HMW = high molecular weight

LMW = low molecular weight

Appendix G-3
Ecological Screening Levels for Sediment

Analytes of Concern and Methods	CAS Number	EPA Region 3 BTAG - Freshwater Sediment	EPA Region 3 BTAG- Marine Sediment	EPA Region 4 ESV for Freshwater Sediment	EPA Region 4 ESV for Marine/Estuarine Sediment	LANL No Effect Level for Sediment Aquatic Organisms
TCL SVOC in Sediment – EPA Method 8270D (µg/kg)						
1,1'-Biphenyl	92-52-4	1,220	--	198	--	--
2,2'-oxybis(1-Chloropropane)	108-60-1	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	819	34	217	--
2,4,6-Trichlorophenol	88-06-2	--	--	89	117	--
2,4-Dichlorophenol	120-83-2	117	--	57	1,886	--
2,4-Dimethylphenol	105-67-9	29	--	39	29	--
2,4-Dinitrophenol	51-28-5	--	--	223	45	--
2,4-Dinitrotoluene	121-14-2	41.6	--	290	29	290
2,6-Dinitrotoluene	606-20-2	--	--	296	--	8,600
2-Chloronaphthalene	91-58-7	--	--	--	--	--
2-Chlorophenol	95-57-8	31.2	344	55	885	55
2-Methylphenol	95-48-7	--	--	119	63	1,700,000
2-Nitroaniline	88-74-4	--	--	--	--	7,300
2-Nitrophenol	88-75-5	--	--	168	2,070	--
3,3'-Dichlorobenzidine	91-94-1	127	2,060	31	--	--
3-Nitroaniline	99-09-2	--	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	--	--	1,477	1,477	--
4-Bromophenyl-phenylether	101-55-3	1,230	--	47	--	--
4-Chloro-3-methylphenol	59-50-7	--	--	5	1,257	--
4-Chloroaniline	106-47-8	--	--	0.9	0.9	--
4-Chlorophenyl-phenylether	7005-72-3	--	--	--	--	--
4-Methylphenol	106-44-5	670	--	93	670	--
4-Nitroaniline	100-01-6	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	153	1,579	--
Acetophenone	98-86-2	--	--	--	--	--
Atrazine	1912-24-9	6.62	--	0.3	--	--
Benzaldehyde	100-52-7	--	--	59	59	--
bis(2-Chloroethoxy)methane	111-91-1	--	--	--	--	--
bis(2-Chloroethyl)ether	111-44-4	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	117-81-7	180	182	180	182	26
Butylbenzylphthalate	85-68-7	10,900	16,800	100	--	100
Caprolactam	105-60-2	--	--	--	--	--
Carbazole	86-74-8	--	--	69	1,928	130,000
Di-n-butylphthalate	84-74-2	6,470	1,160	11	--	11
Di-n-octylphthalate	117-84-0	--	--	39	580	1,000
Dibenzofuran	132-64-9	415	7,300	510	--	510
Diethylphthalate	84-66-2	603	218	630	80	4,000,000
Dimethylphthalate	131-11-3	--	--	678	530	90,000
Hexachlorobenzene	118-74-1	20	--	20	10	100
Hexachlorobutadiene	87-68-3	--	--	--	--	--
Hexachlorocyclopentadiene	77-47-4	--	139	6.5	1	--

Appendix G-3
Ecological Screening Levels for Sediment

Analytes of Concern and Methods	CAS Number	EPA Region 3 BTAG - Freshwater Sediment	EPA Region 3 BTAG- Marine Sediment	EPA Region 4 ESV for Freshwater Sediment	EPA Region 4 ESV for Marine/Estuarine Sediment	LANL No Effect Level for Sediment Aquatic Organisms
Hexachloroethane	67-72-1	1,027	804	27	--	--
Isophorone	78-59-1	--	--	876	--	--
N-Nitroso-di-n-propylamine	621-64-7	--	--	--	--	--
N-Nitrosodiphenylamine	86-30-6	2,680	422,000	110	211	--
Nitrobenzene	98-95-3	--	--	407	1,853	24,000
Pentachlorophenol	87-86-5	504	7,970	10	360	10
Phenol	108-95-2	420	--	175	63	750,000
PAHs (µg/kg)						
2-Methylnaphthalene	91-57-6	20.2	20.2	20.2	20.2	76
Acenaphthene	83-32-9	6.7	6.7	6.7	6.7	76
Acenaphthylene	208-96-8	5.9	5.9	5.9	5.9	76
Anthracene	120-12-7	57.2	47	57	47	57
Benzo(a)anthracene	56-55-3	108	75	108	75	100
Benzo(a)pyrene	50-32-8	150	89	150	89	150
Benzo(b)fluoranthene	205-99-2	--	--	190	--	190
Benzo(g,h,i)perylene	191-24-2	170	--	170	310	170
Benzo(k)fluoranthene	207-08-9	240	--	240	--	240
Chrysene	218-01-9	166	108	166	108	160
Dibenz(a,h)anthracene	53-70-3	33	6.2	33	6.2	33
Fluoranthene	206-44-0	423	113	423	113	420
Fluorene	86-73-7	77	21	77	21	77
Indeno(1,2,3-cd)pyrene	193-39-5	17	--	200	340	200
Naphthalene	91-20-3	176	35	176	35	170
Phenanthrene	85-01-8	204	87	--	--	200
Pyrene	129-00-0	195	153	195	153	190
PAH-SIM in Sediment – EPA Method 8270D (µg/kg)						
1-Methylnaphthalene	90-12-0	--	--	141	--	--
2-Methylnaphthalene	91-57-6	20.2	20.2	20.2	20.2	76
Acenaphthene	83-32-9	6.7	6.7	6.7	6.7	76
Acenaphthylene	208-96-8	5.9	5.9	5.9	5.9	76
Anthracene	120-12-7	57.2	47	57	47	57
Benzo(a)anthracene	56-55-3	108	75	108	75	100
Benzo(a)pyrene	50-32-8	150	89	150	89	150
Benzo(b)fluoranthene	205-99-2	--	--	190	--	190
Benzo(g,h,i)perylene	191-24-2	170	--	170	310	170
Benzo(k)fluoranthene	207-08-9	240	--	240	--	240
Chrysene	218-01-9	166	108	166	108	160
Dibenz(a,h)anthracene	53-70-3	33	6.2	33	6.2	33
Fluoranthene	206-44-0	423	113	423	113	420

Appendix G-3
Ecological Screening Levels for Sediment

Analytes of Concern and Methods	CAS Number	EPA Region 3 BTAG - Freshwater Sediment	EPA Region 3 BTAG- Marine Sediment	EPA Region 4 ESV for Freshwater Sediment	EPA Region 4 ESV for Marine/Estuarine Sediment	LANL No Effect Level for Sediment Aquatic Organisms
Fluorene	86-73-7	77.4	21	77	21	77
Indeno(1,2,3-cd)pyrene	193-39-5	17	--	200	340	200
Naphthalene	91-20-3	176	35	176	35	170
Phenanthrene	85-01-8	204	87	--	--	200
Pyrene	129-00-0	195	153	195	153	190
Explosives in Sediment – EPA Method 8330B (µg/kg)						
1,3,5-Trinitrobenzene	99-35-4	--	--	15	15	1,100
1,3-Dinitrobenzene	99-65-0	--	--	40	37	1,100
2,4,6-Trinitrotoluene	118-96-7	92	--	27	--	25,000
2,4-Diamino-6-nitrotoluene	6629-29-4	--	--	--	--	--
2,4-Dinitrotoluene	121-14-2	41.6	--	290	29	290
2,6-Diamino-4-nitrotoluene	59229-75-3	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	--	--	296	--	8,600
2-Amino-4,6-Dinitrotoluene	35572-78-2	--	--	47	52	17,000
2-Nitrotoluene	88-72-2	--	--	207	3,448	25,000
3-Nitrotoluene	99-08-1	--	--	145	4,787	21,000
4-Amino-2,6-Dinitrotoluene	19406-51-0	--	--	28	--	14,000
4-Nitrotoluene	99-99-0	4,060	--	145	4,534	46,000
HMX	2691-41-0	--	--	108	162	130,000
Nitrobenzene	98-95-3	--	--	407	1,853	24,000
Nitroglycerin	55-63-0	--	--	10	133	1,500,000
PETN	78-11-5	--	--	--	--	1,300,000
RDX	121-82-4	13	--	65	155	3,200
Tetryl	479-45-8	--	--	--	--	91,000
Pesticides in Sediment – EPA Method 8081B (µg/kg)						
Aldrin	309-00-2	2.0	--	29	0.1	42
Alpha BHC	319-84-6	6.0	1,360	0.3	1.3	66,000
Alpha Chlordane	5103-71-9	3.2	2.26	--	--	3.2
Beta BHC	319-85-7	5.0	--	5	--	5
Delta BHC	319-86-8	6,400	--	--	--	--
Dieldrin	60-57-1	1.9	0.72	1.9	0.1	1.9
Endosulfan I	959-98-8	2.9	--	--	--	0.01
Endosulfan II	33213-65-9	14	--	0.9	0.14	0.01
Endosulfan Sulfate	1031-07-8	5.4	0.36	0.7	0.11	--
Endrin	72-20-8	2.22	2.7	2.2	0.12	1.8
Endrin Aldehyde	7421-93-4	2.22	2.7	--	--	--
Endrin Ketone	53494-70-5	2.22	2.7	--	--	--
Gamma BHC - Lindane	58-89-9	2.37	0.32	2.4	0.6	2.3
Gamma Chlordane	5103-74-2	3.2	2.26	--	--	3.2
Heptachlor	76-44-8	68	--	0.6	1.5	2.4

Appendix G-3
Ecological Screening Levels for Sediment

Analytes of Concern and Methods	CAS Number	EPA Region 3 BTAG - Freshwater Sediment	EPA Region 3 BTAG- Marine Sediment	EPA Region 4 ESV for Freshwater Sediment	EPA Region 4 ESV for Marine/Estuarine Sediment	LANL No Effect Level for Sediment Aquatic Organisms
Heptachlor Epoxide	1024-57-3	2.47	0.6	2.5	0.14	--
Methoxychlor	72-43-5	18.7	30	30	2.1	30
p,p-DDD	72-54-8	4.88	1.2	3.5	1.2	8.2
p,p-DDE	72-55-9	3.16	2.07	1.4	2.1	3.1
p,p-DDT	50-29-3	4.16	1.19	1	--	4.1
Toxaphene	8001-35-2	0.10	536	0.1	0.15	0.1
Metals in Sediment – EPA Methods 6010D and 7471B (mg/kg)						
Aluminum	7429-90-5	--	--	25,000	--	25,000
Antimony	7440-36-0	2.0	--	2.0	2.0	45
Arsenic	7440-38-2	10	7.24	10	7.2	10
Barium	7440-39-3	--	--	20	--	150
Beryllium	7440-41-7	--	--	--	--	66
Cadmium	7440-43-9	0.99	0.68	1.0	0.7	0.3
Calcium	7440-70-2	--	--	--	--	--
Chromium	7440-47-3	43.4	52	43	52	43
Hexavalent Chromium	18540-29-9	--	--	--	--	660
Cobalt	7440-48-4	50	--	50	--	220
Copper	7440-50-8	32	18.7	32	19	23
Iron	7439-89-6	20,000	--	20,000	--	20,000
Lead	7439-92-1	36	30.2	36	30	26
Magnesium	7439-95-4	--	--	--	--	--
Manganese	7439-96-5	460	--	460	--	460
Mercury	7439-97-6	0.18	0.13	0.18	0.13	0.017
Nickel	7440-02-0	23	15.9	23	16	12
Potassium	9/7/7440	--	--	--	--	--
Selenium	7782-49-2	2.0	--	0.72	--	0.72
Silver	7440-22-4	1.0	0.73	1.00	0.73	0.50
Sodium	7440-23-5	--	--	--	--	--
Thallium	7440-28-0	--	--	--	--	0.73
Vanadium	7440-62-2	--	--	--	--	29
Zinc	7440-66-6	121	124	121	124	63

Shading indicates ECO PAL selection based on hierarchy.

Sources:

Ecological PAL is based off the following hierarchy of sources:

a) EPA Region III Biological Technical Assistance Group (BTAG) minimum of Freshwater and Saltwater Sediment Benchmarks https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values.

b) EPA Region 4 Ecological Screening Value (ESV), Tables 2a and 2b, minimum ESV for freshwater and marine/estuarine. https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

c) LANL. September 2017. ECORISK Database (Release 4.1), LA-UR-17-26376, Los Alamos National Laboratory, Los Alamos, New Mexico. Minimum no effect level for sediment aquatic organisms.

APPENDIX H

ANALYTES OF CONCERN WITH LOQ > PAL

Appendix H-1
Water Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
Metals in Water – EPA Method 6020B				
Antimony	X	X	X	
Arsenic	X	X	X	
Cadmium	X	X	X	
Hexavalent Chromium		R4 Acute saltwater ESL (1100 ug/L) > LOQ		
Mercury	X	X	X	
Silver	X	R4 Acute saltwater ESL (1.9 ug/L) > LOQ	X	
Thallium	PPRTV Appendix screening level toxicity value	X	X	
Pesticides in Water – EPA Method 8081B				
Aldrin		X		
Alpha BHC		X		
Alpha Chlordane	X	R4 Acute saltwater ESL (0.09 ug/L) > LOQ		
Dieldrin		R4 Acute saltwater ESL (0.71 ug/L) > LOQ		
Endosulfan I		R4 Acute saltwater ESL (0.03 ug/L) > LOQ		X
Endosulfan II		R4 Acute saltwater ESL (0.03 ug/L) > LOQ		X
Endosulfan Sulfate	X	R4 Acute saltwater ESL (0.03 ug/L) > LOQ		X
Endrin	X	R4 Acute saltwater ESL (0.04 ug/L) > LOQ		
Endrin Aldehyde		R4 Acute saltwater ESL (0.04 ug/L) = LOD (endrin)		
Endrin Ketone		R4 Acute saltwater ESL (0.04 ug/L) > LOQ (endrin)		
Gamma Chlordane	X	R4 Acute saltwater ESL (0.09 ug/L) > LOQ		

Appendix H-1
Water Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
Heptachlor		R4 Acute saltwater ESL (0.05 ug/L) > LOQ		
Heptachlor Epoxide		R4 Acute saltwater ESL (0.05 ug/L) > LOQ		
Methoxychlor	X	R4 Acute freshwater ESL (0.7 ug/L) > LOQ		
p,p-DDD		R4 Acute saltwater ESL (0.35 ug/L) > LOQ	X	
p,p-DDT	X	R4 Acute saltwater ESL (0.15 ug/L) > LOQ	X	
Toxaphene				X
PAH-SIM in Water – EPA Method 8270E				
Anthracene		R4 chronic saltwater ESL (0.43 ug/L) > LOQ	X	
Benzo(a)anthracene	X	R4 chronic saltwater ESL (0.35 ug/L) > LOQ	X	
Benzo(a)pyrene		R4 Acute saltwater ESL (0.64 ug/L) > LOQ	X	
Benzo(k)fluoranthene		R4 Acute saltwater ESL (1.3 ug/L) > LOQ	X	
Dibenz(a,h)anthracene	X	R4 Acute saltwater ESL (0.28 ug/L) > LOQ	X	
Fluoranthene		R4 chronic saltwater ESL (0.82 ug/L) > LOQ	X	
Pyrene	X	R4 chronic saltwater ESL (0.11 ug/L) > LOQ	X	
TCL SVOC in Water – EPA Method 8270E				
1,1'-Biphenyl		X		X
2,4,6-Trichlorophenol	X	X		X
2,4-Dinitrophenol	X	X		X
2,4-Dinitrotoluene	X	X	X	
2,6-Dinitrotoluene	X	X	X	
2-Nitrophenol	X	X		X

Appendix H-1
Water Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
3,3'-Dichlorobenzidine	X	R4 Acute saltwater ESL (505 ug/L) > LOQ		X
3-Nitroaniline	X	R4 chronic saltwater ESL (17 ug/L) > LOQ (2-nitroaniline)		X
4,6-Dinitro-2-methylphenol				X
4-Bromophenyl-phenylether		R4 Acute saltwater ESL (12 ug/L) > LOQ		x
4-Chloro-3-methylphenol	X	EcoPAL = LOD		X
4-Chloroaniline		R4 Acute saltwater ESL (24 ug/L) > LOQ		X
4-Nitrophenol	X	R4 Chronic saltwater ESL (600 ug/L) > LOQ		X
Atrazine	X			X
bis(2-Chloroethoxy)methane	X			
bis(2-Chloroethyl)ether		R4 Acute saltwater ESL (8,163 ug/L) > LOQ		X
bis(2-Ethylhexyl)phthalate	X	X		X
Di-n-butylphthalate	X	R4 Acute saltwater ESL (102 ug/L) > LOQ		X
Dibenzofuran	X	X		X
Hexachlorobenzene	MCL (1 ug/L) > LOQ	R4 Acute saltwater ESL (2.8 ug/L) > LOQ		X
Hexachlorobutadiene	X	R4 Acute saltwater ESL (1.6 ug/L) > LOD		X
Hexachlorocyclopentadiene	MCL (50 ug/L) > LOQ			X
Hexachloroethane	X	X	X	
N-Nitroso-di-n-propylamine				X
Nitrobenzene	X	X	X	
Pentachlorophenol		X		X
Explosives in Water – EPA Method 8330B				
3-Nitrotoluene	X	X	X	
4-Nitrotoluene	X	X	X	

Appendix H-1
Water Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
Nitroglycerin	X	X	X	
Tetryl	X	X	X	
1,3,5-Trinitrobenzene	X	X	X	
1,3-Dinitrobenzene	X	X	X	
2,4,6-Trinitrotoluene	X	X	X	
2,4-Dinitrotoluene	X	X	X	
2,6-Dinitrotoluene	X	X	X	
2-Nitrotoluene	X	X	X	
3-Nitrotoluene	X	X	X	
Nitrobenzene	X	X	X	
Nitroglycerin		X	X	X
PETN	X	X	X	
RDX	X	X	X	

a Use and manfacturing information obtained from PubChem https://pubchem.ncbi.nlm.nih.gov/

Appendix H-2
Soil Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within risk range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/ Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
Hexavalent Chromium in Soil –EPA Method 7196A				
Hexavalent Chromium	X	LANL Low effect ESL (3.4 mg/kg) >LOQ		
Explosives in Soil – EPA Method 8330B				
1,3-Dinitrobenzene	X	LANL Low effect ESL (160 ug/kg) >LOQ	X	
3-Nitrotoluene	X	LANL No effect ESL (12000 ug/kg) >LOQ	X	
4-Nitrotoluene	X	LANL No effect ESL (21000 ug/kg) >LOQ	X	
Nitroglycerin	X	LANL No effect ESL (13000 ug/kg) >LOQ	X	
PETN	X	LANL No effect ESL (100000 ug/kg) >LOQ	X	
Tetryl	X	LANL No effect ESL (1800 ug/kg) >LOQ	X	
Pesticides in Soil – EPA Method 8081B				
Alpha BHC	X	LANL No effect ESL (59000 ug/kg) >LOQ		
Beta BHC	X	LANL No effect ESL (270 ug/kg) >LOQ		
Delta BHC		LANL No effect ESL (270 ug/kg) >LOQ (beta BHC)		
Endosulfan II		LANL No effect ESL (640 ug/kg) >LOQ		
Endrin Aldehyde		LANL Low effect ESL (14 ug/kg) >LOQ (endrin)		X
Endrin Ketone		LANL Low effect ESL (14 ug/kg) >LOQ (endrin)		X

Appendix H-2
Soil Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within risk range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/ Common Laboratory Chemical/Manufacturing Intermediate/Research/Preservative[a]
Heptachlor Epoxide	X	LANL No effect ESL (59 ug/kg) > LOQ (heptachlor)		
Methoxychlor	X	LANL No effect ESL (5100 ug/kg) > LOQ		
Toxaphene	X	LANL No effect ESL (4100 ug/kg) > LOQ		X
TCL SVOC in Soil – EPA Method 8270E				
2,4-Dimethylphenol	X			X
2,4-Dinitrophenol	X			X
2-Chloronaphthalene	X			
2-Nitroaniline	X	LANL No effect ESL (5300 ug/kg) > LOQ		X
2-Nitrophenol				X
3,3'-Dichlorobenzidine	X			X
3-Nitroaniline		LANL No effect ESL (5300 ug/kg) > LOQ (2-nitroaniline)		X
4-Nitroaniline	X	LANL No effect ESL (5300 ug/kg) > LOQ (2-nitroaniline)		X
Atrazine	X			X
bis(2-Ethylhexyl)phthalate	X	LANL Low effect ESL (200 ug/kg) > LOQ		X
carbazole	X	X	X	
Di-n-butylphthalate	X			X
Hexachlorobutadiene	X			X
Hexachlorocyclopentadiene	X			X
Hexachloroethane	X		X	

a Use and manfacturing information obtained from PubChem https://pubchem.ncbi.nlm.nih.gov/

Appendix H-3
Sediment Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Preservative[a]
Hexavalent Chromium in Soil –EPA Method 7196A				
Hexavalent Chromium	X	X		
Pesticides in Sediment – EPA Method 8081B				
Dieldrin	X	R4 RSV (4.3 ug/kg) > LOQ		
Endosulfan Sulfate	X			X
Gamma BHC - Lindane	X	R4 RSV (0.99 ug/kg) > LOQ		
Heptachlor Epoxide	X	R4 RSV (15 ug/kg) > LOQ		
p,p-DDD	X	R4 RSV (8 ug/kg) > LOQ	X	
p,p-DDT	X	R4 RSV (5 ug/kg) > LOQ	X	
Toxaphene	X	R4 RSV (32 ug/kg) > LOQ		X
Explosives in Sediment – EPA Method 8330B				
1,3,5-Trinitrobenzene	X	R4 RSV (116 ug/kg) > LOD	X	
1,3-Dinitrobenzene	X	R4 RSV (105 ug/kg) >LOD	X	
2,4,6-Trinitrotoluene	X		X	
2,4-Diamino-6-nitrotoluene	X		X	
2,4-Dinitrotoluene	X	R4 RSV(114 ug/kg)>LOD	X	
2,6-Diamino-4-nitrotoluene	X		X	
2-Amino-4,6-Dinitrotoluene	X		X	
3-Nitrotoluene	X	R4 RSV (5995 ug/kg) >LOQ	X	
4-Amino-2,6-Dinitrotoluene	X		X	
HMX	X	R4 RSV (64709 ug/kg) >LOQ	X	
Nitroglycerin	X	R4 RSV (12704 ug/kg) >LOQ	X	
RDX	X	R4 RSV (312 ug/kg) >LOQ	X	
TCL SVOC in Sediment – EPA Method 8270E				
2,4-Dimethylphenol	X	R4 RSV (504 ug/kg) >LOQ		X
2,4-Dinitrophenol	X	R4 RSV (2961 ug/kg) >LOQ		X
2,4-Dinitrotoluene	X	R4 RSV (114 ug/kg) >DL	X	
2-Chlorophenol	X	R4 RSV (550 ug/kg) >LOQ		X
2-Methylphenol	X	R4 RSV (1773 ug/kg) >LOQ		

Appendix H-3
Sediment Analytes of Concern with LOQ > PAL

Analytes of Concern and Methods	Within Risk Range (TR 1E-06 to 1E-04; THQ 0.1 to 1)	Meets Eco PAL or Refinement Ecological Screening Level (ESL)	Potential DoD-Related/Site-Related	Agricultural Use/Common Laboratory Chemical/Manufacturing Intermediate/Preservative[a]
3,3'-Dichlorobenzidine	X			X
4-Chloro-3-methylphenol	X			X
4-Chloroaniline	X			X
4-Nitrophenol	X	R4 RSV (4105 ug/kg) >LOQ		X
Atrazine	X			X
Benzaldehyde	X			X
Carbazole	X		X	
Di-n-octylphthalate	X	R4 RSV (1100 ug/kg) >:LOQ)		X
Hexachlorocyclopentadiene	X			X

a Use and manfacturing information obtained from PubChem https://pubchem.ncbi.nlm.nih.gov/