FINAL

SHEPLEY'S HILL LANDFILL SUPPLEMENTAL GROUNDWATER AND LANDFILL CAP ASSESSMENT FOR LONG-TERM MONITORING AND MAINTENANCE – ADDENDUM REPORT

SHEPLEY'S HILL LANDFILL

FORMER FORT DEVENS ARMY INSTALLATION, DEVENS, MA

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BOOK 4 OF 4

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Concord, Massachusetts

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Attachment H

INTRODUCTION

This data validation report covers five water samples (including 2 rinsate blanks and 1 field duplicate) collected on May 19 and May 20, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 20, 2010 and assigned sample delivery group (SDG) numbers L1007542, L1007543, and L1007544 upon receipt. Alpha analyzed the samples for total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO3-F. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007542-01/L1007543-01/ L1007544-01	5/19/2010	GP-10-07-039-U/F	
L1007542-02/L1007543-02/ L1007544-02	5/20/2010	GP-10-07-049-U/F	MS/MSD
L1007542-03/L1007543-03/ L1007544-03	5/20/2010	GPDUP-052010-U/F	Field Duplicate of GP-10-07-049-U
L1007543-04, L1007544-04	5/19/2010	RB-051910-U	Rinsate Blank
L1007543-05, L1007544-05	5/20/2010	RB-052010-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Three sample coolers were received on 05/20/2010 at temperatures of 3.4, 2.2, and 4.4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007542 L1007543 L1007544

INTRODUCTION

This data validation report covers 19 water samples (including 3 rinsate blanks and 2 field duplicates) collected between May 24 and May 26, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 25 and May 26, 2010 and assigned sample delivery group (SDG) number L1007788 upon receipt. Alpha analyzed the samples for total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO3-F and SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007788-01/08	5/24/2010	GP-10-06-024-U/F	
L1007788-02/09	5/24/2010	GP-10-06-034-U/F	MS/MSD
L1007788-03/10	5/24/2010	GP-10-06-044-U/F	
L1007788-04/11	5/24/2010	GP-10-06A-034-U/F	
L1007788-05/12	5/24/2010	GP-10-06A-044-U/F	
L1007788-06/13	5/24/2010	GP-10-06A-054-U/F	
L1007788-14	5/24/2010	RB-052410-U	Rinsate Blank
L1007788-07/15	5/25/2010	GP-10-06A-064-U/F	
L1007788-16	5/25/2010	GDUP-052510-F	Field Duplicate of GP-10-06A-064-F
L1007788-17/21	5/25/2010	GP-10-06A-074-F/U	
L1007788-18/22	5/25/2010	GP-10-06A-084-F/U	
L1007788-19/29	5/25/2010	GP-10-06A-094-F/U	
L1007788-20	5/25/2010	RB-052510-U	Rinsate Blank
L1007788-23	5/25/2010	GP-10-06A-104-F	
L1007788-24	5/25/2010	GP-10-06A-110-F	
L1007788-25	5/26/2010	GP-10-06-054-F	
L1007788-26	5/26/2010	GP-10-06-064-F	
L1007788-27	5/26/2010	GDUP-052610-F	Field Duplicate of GP-10-06-054-F
L1007788-28	5/26/2010	RB-052610-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Five sample coolers were received on 05/25/2010 and 05/26/2010 at temperatures of 4.5, 3.8, 2.2, 5, and 2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007788

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) $r^2 \geq 0.995$, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Dissolved manganese (0.15 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Dissolved calcium (23 µg/L) and dissolved manganese (0.24 µg/L) were detected in rinsate RB-052410-U. Dissolved calcium (26.2 µg/L) and dissolved manganese (0.55 µg/L) were detected in rinsate RB-052510-U. Dissolved calcium (13 µg/L) and dissolved manganese (0.28 µg/L) were detected in rinsate RB-052610-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples.		
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

August 10, 2010 Total and Dissolved Metals by USEPA Method 6020A, Other Inorganics by USEPA 2320B/300.0/ 410.4 and SM 4500NH3-BH/4500NO3-F /4500NO2-B
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-052510-F was collected as the field duplicate of sample GP-10-06-064-F. Sample GDUP-052610-F was collected as the field duplicate of sample GP-10-06-054-F. RPDs were within acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	The RPD for dissolved iron (67%) between the MS and MSD performed on sample GP-10-06-034-F was above acceptance criteria.	AMEC J qualified the detected iron result from sample GP-10-06-034-F with a Q (RPD was not within control limits) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved Iron (60%MS) recovery in the MS/MSD performed on sample GP-10-06-034-F was outside the QAPP specified limits. Dissolved calcium (131%) and dissolved iron (126%) recoveries in the MS performed on sample GP-10-06A-104-F were outside QAPP-specified limits.	Dissolved iron (14400 µg/L) concentration in sample GP-10-06-034-F and dissolved calcium (97900 µg/L) and dissolved iron (5950 µg/L) were more than 4 times the spike concentrations of 10000 and 1000 µg/L. respectively. Therefore, data usability is not adversely affected.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits, except for dissolved sodium (18%) in the SD performed on sample GP-10-06-034-F and total arsenic (12%) in the SD performed on sample GP-10-06-034-U.	The detected sodium concentration was <50 times the LOQ. Data usability is not adversely affected. AMEC J qualified the detected arsenic result from sample GP-10-06-034-U with an A (SD %difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: GP-10-06A-034-F (arsenic), GP-10-06A-044-F (magnesium), RB-052410-U (calcium and manganese), RB-052510-U (manganese and calcium), GP-10-06A-110-F (arsenic), and RB-052610-U (manganese and calcium).	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	$r \geq 0.995$ for alkalinity linear calibration Analytes with low r flag detected results "J" and nondetected results "UJ"	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 85-115% a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in the rinsate or preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

August 10, 2010 Total and Dissolved Metals by USEPA Method 6020A, Other Inorganics by USEPA 2320B/300.0/
Region I Data Review Worksheet 410.4 and SM 4500NH3-BH/4500NO3-F/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Samples GP-10-06-034-F and GP-10-06A-104-F were analyzed in duplicate for total alkalinity. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052510-F was collected as the field duplicate of sample GP-10-06-064-F. Sample GDUP-052610-F was collected as the field duplicate of sample GP-10-06-054-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs/MSDs were performed on samples GP-10-06-034-F and GP-10-06A-104-F. % recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours. preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements for chloride and sulfate. All samples from this SDG were analyzed for nitrate past the holding time.	AMEC J qualified the detected nitrate results from all samples from this SDG with an H (hold time exceeded) reason code.	Unknown
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate. linear calibration Analytes with low r ≤0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

August 10, 2010 Total and Dissolved Metals by USEPA Method 6020A, Other Inorganics by USEPA 2320B/300.0/ 410.4 and SM 4500NH3-BH/4500NO3-F/4500NO2-B
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.29 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate results from samples GP-10-06A-074-F, GP-10-06-064-F, GDUP-052610-F, and GP-10-06-024-F because the sample concentrations were less than 10x the MB concentration. A B (contamination detected in preparation blank) reason code was applied.	High
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-052510-F was collected as the field duplicate of sample GP-10-06-064-F. RPDs were within acceptance criteria. Sample GDUP-052610-F was collected as the field duplicate of sample GP-10-06-054-F. Nitrate (44.1%) and sulfate (31.6%) RPDs were above acceptance criteria.	AMEC J qualified the detected nitrate and sulfate results from sample GP-10-06-054-F and its field duplicate GDUP-052610-F with an E (duplicate poor agreement) reason code.	Estimation
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-06-034-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GP-10-06-024-F, GP-10-06A-034-F, GP-10-06A-044-F, and GP-10-06A-054-F, chloride from sample GP-10-06-024-F, and sulfate from sample GP-10-06-064-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO3-F and 4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia and nitrite were not detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-06-034-F was analyzed in duplicate for ammonia. Sample GP-10-06A-110-F was analyzed in duplicate for nitrite. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-052510-F was collected as the field duplicate of sample GP-10-06-064-F. Sample GDUP-052610-F was collected as the field duplicate of sample GP-10-06-054-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-06-034-F for ammonia and on sample GDUP-052610-F for nitrite. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite results from samples GP-10-06-044-F, GP-10-06A-074-F, and GP-10-06A-094-F and ammonia from samples GP-10-06-024-F and GP-10-06A-034-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite and ammonia results from these samples with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-06-034-F was analyzed in duplicate by the laboratory. Both results were reported as not detected.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052510-F was collected as the field duplicate of sample GP-10-06-064-F. RPD was within acceptance criteria. Sample GDUP-052610-F was collected as the field duplicate of sample GP-10-06-054-F. The RPD at 40% was outside acceptance criteria, but the COD result from sample GDUP-052610-F at 18 mg/L was below the QL of 20 mg/L.	No qualification warranted.	
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-06-034-F. The recovery was within acceptance criteria at 111%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified COD results detected between the LOD and the LOQ. The affected samples are: GP-10-06A-074-F, GP-10-06A-084-F, GP-10-06A-094-F, GP-10-06A-104-F, and GDUP-052610-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise King
Environmental Chemist

August 10, 2010 Target Analyte List Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet Total Organic Carbon by SM 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers four soil samples (including 1 field duplicate) and one water sample (rinsate blank) collected on May 21, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 21, 2010 and assigned sample delivery group (SDG) number L1007633 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A and total organic carbon (TOC) using SM 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Table 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007633-01	5/21/2010	SP-10-07-029	MS/MSD
L1007633-02	5/21/2010	SP-10-07-041	
L1007633-03	5/21/2010	SP-10-07-053	
L1007633-04	5/21/2010	SDup-052110	Field Duplicate of SP-10-07-029
L1007633-05	5/21/2010	RB-052110-0	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 05/21/2010 at a temperature of 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007633

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was 3°C. Rinsate sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7471A) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

August 10, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Target Analyte List Metals by USEPA Method 6010B/7471A
Total Organic Carbon by SM 9060

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total calcium at a concentration of 35 µg/L was detected in rinsate blank RB-052110-0 associated with samples SP-10-07-029, SP-10-07-041, SP-10-07-053, and SDUP-052110. Total Lead at a concentration of 0.076 mg/kg was detected in the preparation blank associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples.		
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results <10 x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP-052110-0 was collected as the field duplicate of sample SP-10-07-029. RPDs were within the acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	The RPDs for total calcium (21%) and total magnesium (27%) between MS and MSD performed on sample SP-10-07-029 were above acceptance criteria.	AMEC J qualified these analytes from samples SP-10-07-029 and its field duplicate SDUP-052110-0 with a Q (RPD was not within control limits) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Total antimony (77%/77%), total iron (0%/0%), and total magnesium (63% MSD) recoveries in the MS/MSD performed on sample SP-10-07-029 were outside the QAPP specified limits.	Total iron (4400 mg/kg) was more than 4 times the spike concentration of 48.2 mg/kg. Therefore, data usability is not adversely affected. AMEC J qualified the detected total magnesium and UJ qualified the nondetected total antimony from sample SP-10-07-029 and its field duplicate SDUP-052110 with a Q (MS/MSD recovery not within control) reason code.	None Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for silver at 73% in sample SP-10-07-029.	AMEC UJ qualified the nondetected silver result from sample SP-10-07-029 and its field duplicate SDUP-052110 with a P (PDS recovery not within control limits) reason code.	Low
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %D for the SD performed was within acceptance limits, except total iron (11%) and total magnesium (11%) in the SD performed on sample SP-10-07-029.	AMEC J qualified the detected total iron and magnesium from sample SP-10-07-029 and its field duplicate SDUP-052110 with an A (ICP SD % difference was not within control limits) reason code.	High

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Sample SP-10-07-053 has elevated detection limits for all analytes, with the exception of Mercury, due to the dilution required by target analyte spectral interferences encountered during analysis. The laboratory J qualified metal results detected between the LOD and the LOQ. The affected analytes and samples are: SP-10-07-029 (sodium and beryllium), SP-10-07-041 (antimony, selenium, and cadmium), SP-10-07-053 (selenium, beryllium, and sodium), SDUP-052110 (beryllium and sodium), and RB-052110-0 (calcium).	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by SM 9060(M)

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		

August 10, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Target Analyte List Metals by USEPA Method 6010B/7471A
Total Organic Carbon by SM 9060

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) K-factor within ± 0.15% from mean value for carbon 2) r ≥ 0.995	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was not detected in associated preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD. RPD >25% flag detected results "J" and nondetected results "UJ"	Sample SP-10-07-029 was analyzed in duplicate by the laboratory. % RPD was within control limit.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	Sample SDUP-052110 was collected as the field duplicate of sample SP-10-07-029. % RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SP-10-07-029. The recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported at or slightly above the LOQ.		

August 10, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Target Analyte List Metals by USEPA Method 6010B/7471A
Total Organic Carbon by SM 9060

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise King
Environmental Chemist

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 4±2°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) $r^2 \geq 0.995$, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total calcium (13.5 µg/L), dissolved arsenic (0.14 µg/L), and dissolved manganese (0.26 µg/L) were detected in the method blanks associated with samples GP-10-07-039-U, GP-10-07-039-F, GP-10-07-049-U, GP-10-07-049-F, and GPDUP-052010-U. Dissolved calcium (32.7 µg/L) and dissolved manganese (0.28 µg/L) were detected in rinsate RB-051910-U associated with sample GP-10-07-039-F. Dissolved calcium (55.9 µg/L) and dissolved manganese (0.22 µg/L) were detected in rinsate blank RB-052010-U associated with samples GP-10-07-049-F and GPDUP-052010-F.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples.		
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GPDUP-052010-U was collected as the field duplicate of sample GP-10-07-049-U. RPDs were within the acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	The RPDs for dissolved calcium (44%), dissolved iron (183%), dissolved manganese (56%), and dissolved potassium (21%) between MS and MSD performed on sample GP-10-07-049-F were above acceptance criteria.	AMEC J qualified these analytes from samples GP-10-07-049-F and its field duplicate GPDUP-052010-F with a Q (RPD was not within control limits) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Total iron (0%/700%), total magnesium (121%MSD), and total manganese (66%MS) recoveries in the MS/MSD performed on sample GP-10-07-049-U were outside the QAPP specified limits. Dissolved Calcium (143%MS), dissolved iron (230%/10%), and dissolved manganese (156%MS) recoveries in the MS/MSD performed on sample GP-10-07-049-F were outside QAPP-specified limits.	Total iron (251000 µg/L), total magnesium (99900 µg/L), and total manganese (9139 µg/L) concentrations in sample GP-10-07-049-U and dissolved calcium (65100 µg/L), dissolved iron (27800 µg/L), and dissolved manganese (5330 µg/L) were more than 4 times the spike concentrations. Therefore, data usability is not adversely affected.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SD performed was within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR) a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Arsenic, iron, calcium, magnesium, manganese, and sodium were detected and reported in associated samples above the associated LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	$r \geq 0.995$ for alkalinity linear calibration Analytes with low r flag detected results "J" and nondetected results "UJ"	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 85-115% a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in the rinsate or preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-07-049-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GPDUP-052010-F was collected as the field duplicate of sample GP-10-07-049-F. % RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-07-049-F. % recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements, except for samples GP-10-07-039-F (4.3 hours) and RB-051910-U (1.9 hours) that were analyzed for nitrate past the holding time.	AMEC UJ qualified the nondetected nitrate results for samples GP-10-07-039-F and RB-051910-U with H (hold time exceeded) reason code.	Unknown
Initial Calibration	1) $r \geq 0.99$ for chloride, sulfate and nitrate, linear calibration Analytes with low $r < 0.99$ flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.13 mg/L was detected in rinsate blank RB-051910-U associated with sample GP-10-07-039-F. Sulfate at a concentration of 0.47 mg/L was detected in the method blank associated with samples GP-10-07-039-F, GP-10-07-049-F and GPDUP-052010-F. Nitrate at a concentration of 0.01 mg/L was detected in rinsate blank RB-052010-U associated with samples GP-10-07-049-F and GPDUP-052010-F.	AMEC U qualified the detected nitrate and sulfate results from these samples because the sample concentrations were less than 10x the RB and MB concentrations. An F(contamination detected in rinsate blank) and/or B (contamination detected in preparation blank) reason code was applied.	High
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GPDUP-052010-F was collected as the field duplicate of sample GP-10-07-049-F. % RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-07-049-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GP-10-07-049-F and GPDUP-052010-F, and sulfate from sample GP-10-07-039-F were detected and reported between the LOD and the LOD. These results were J qualified by the laboratory.	AMEC J qualified the nitrate and sulfate results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO3-F

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ for 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia was detected in rinsate blanks RB-051910-U (0.0339 mg/L) and RB-052010-U (0.0223 mg/L).	The detected ammonia results were greater than 10x the RBs concentrations. Data usability is not affected.	None
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-07-049-F was analyzed in duplicate for nitrite and ammonia. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GPDUP-052010-F was collected as the field duplicate of sample GP-10-07-049-F. % RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-07-049-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite results from samples GP-10-07-039-F and GPDUP-052010-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite results from samples GP-10-07-039-F and GPDUP-052010-F with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated rinsate or preparation blanks		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-07-049-F was analyzed in duplicate by the laboratory. Both results were below the LOQ.	No qualification warranted.	
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GPDUP-052010-F was collected as the field duplicate of sample GP-10-07-049-F. % RPD was within acceptance criteria.		

August 10, 2010 — **Total and Dissolved Metals by USEPA Method 6020A**

Region I Data Review Worksheet — **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO3-F**

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-07-049-F. The recovery was within acceptance criteria at 111%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified COD results detected between the LOD and the LOQ. The affected samples are: GP-10-07-049-F and GPDUP-052010-F.	AMEC J qualified the COD results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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INTRODUCTION

This data validation report covers 9 water samples (including 1 rinsate blank and 1 field duplicate) collected on May 26 and May 27, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 27, 2010 and assigned sample delivery group (SDG) number L1007928 upon receipt. Alpha analyzed the samples for total or dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007928-01	5/27/2010	GP-10-01-009-F	MS/MSD
L1007928-02	5/27/2010	GP-10-01-019-F	
L1007928-03	5/27/2010	GP-10-01-029-F	
L1007928-04	5/27/2010	GP-10-01-039-F	
L1007928-05	5/27/2010	GP-10-01-049-F	
L1007928-06	5/27/2010	GDUP-052710-F	Field Duplicate of GP-10-01-019-F
L1007928-07	5/27/2010	RB-052710-U	Rinsate Blank
L1007928-08	5/26/2010	GP-10-06-074-F	
L1007928-09	5/26/2010	GP-10-06-079-F	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Three sample coolers were received on 05/27/2010 at temperatures of 4, 4, and 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007928

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved sodium (26.6 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Dissolved calcium (12.7 µg/L) and dissolved sodium (41.1 µg/L) were detected in rinsate RB-052710-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	Calcium (0.1043 mg/L) and sodium (0.03428 mg/L) were detected in the ICB and CCBs associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10x the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ"	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-052710-F was collected as the field duplicate of sample GP-10-01-019-F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	RPDs were within acceptance limits.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD was performed on sample GP-10-01-019-F. Recoveries were within acceptance criteria.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed were within acceptance limits, except for dissolved manganese (13%) in the SD performed on sample GP-10-01-009-F.	AMEC J qualified the detected manganese result from sample GP-10-01-009-F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: arsenic from samples GP-10-01-009-F, GP-10-01-019-F, GP-10-01-029-F, and GDUP-052710-F; calcium and sodium from sample RB-052710-U.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	$r \geq 0.995$ for alkalinity linear calibration Analytes with low r flag detected results "J" and nondetected results "UJ"	Initial calibration criteria were met.		

August 10, 2010 Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
ICV/CCV	No qualification if recovery between 85-115% a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in the preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-01-009-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052710-F was collected as the field duplicate of sample GP-10-01-019-F. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-01-009-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥ 10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.27 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate result from sample GP-10-06A-074-F, because the sample concentration was less than 10x the MB concentration A B (contamination detected in preparation blank) reason code was applied.	High
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-052710-F was collected as the field duplicate of sample GP-10-01-019-F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-01-009-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample GP-10-06-074-F was detected and reported between the LOD and the LOQ. This result was J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia and nitrite were not detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-01-009-F was analyzed in duplicate. %RPDs were within acceptance criteria		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-052710-1 was collected as the field duplicate of sample GP-10-01-019-F. Ammonia RPD was high at 124%.	AMEC J qualified the detected ammonia results from sample GP-10-01-019-F and its field duplicate GDUP-0527-01-F with an E (duplicate poor agreement) reason code.	Unknown
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite); 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-01-009-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-01-039-F and ammonia results from samples GP-10-01-019-F and GP-10-01-029-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite and ammonia results from these samples with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	COD was not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		

August 10, 2010 — **Total and Dissolved Metals by USEPA Method 6020A**

Region I Data Review Worksheet — **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-01-009-F was analyzed in duplicate by the laboratory. Both results were reported as not detected.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052710-F was collected as the field duplicate of sample GP-10-01-019-F. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-01-009-F. The recovery was within acceptance criteria at 107%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified COD results detected between the LOD and the LOQ. The affected samples are: GP-10-01-039-F and GP-10-06-079-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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INTRODUCTION

This data validation report covers 7 water samples (including 1 rinsate blank and 1 field duplicate) collected on May 27 and May 28, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 28, 2010 and assigned sample delivery group (SDG) number L1007997 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007997-01	5/27/2010	GP-10-01-059-F	
L1007997-02	5/27/2010	GP-10-01-069-F	
L1007997-03	5/27/2010	GP-10-01-075-F	
L1007997-04	5/28/2010	GP-10-09-021-F	MS/MSD
L1007997-05	5/28/2010	GP-10-09-031-F	
L1007997-06	5/28/2010	GDUP-052910-F	Field Duplicate of GP-10-09-031-F
L1007997-07	5/28/2010	RB-052810-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 05/28/2010 at temperatures of 3.5 and 3.6°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007997

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero. are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

August 11, 2010 — Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved sodium (26.6 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Dissolved calcium (16.1 µg/L), dissolved manganese (0.19 µg/L), and dissolved sodium (21.8 µg/L) were detected in rinsate RB-052810-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples, except calcium ranging from 35 to 104 mg/L in all CCBs and ICB.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-052810-F was collected as the field duplicate of sample GP-10-09-031-F. RPDs were within acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD were performed on sample GP-10-09-021-F with acceptable recoveries.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits, except for dissolved magnesium (12%), dissolved manganese (14%), and dissolved potassium (13%) in the SD performed on sample GP-10-09-021-F.	The detected magnesium, manganese, and potassium concentrations were <50 times the LOQ. Data usability is not adversely affected.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: arsenic from samples GP-10-01-069-F, GP-10-01-075-F, GP-10-09-021-F, GP-10-09-031-F, and GDUP-052810-F; and calcium, sodium and manganese from sample RB-052810-U.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Metal results from samples GP-10-01-059-F, GP-10-01-069-F, and GP-10-01-075-F have elevated detection limits due to dilutions required by the high concentration target analytes. The requested reporting limits were not achieved.	Not warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for alkalinity linear calibration Analytes with low r flag detected results "J" and nondetected results "UJ"	Initial calibration criteria were met		
ICV/CCV	No qualification if recovery between 85-115% a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in the preparation blank.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Samples GP-10-09-021-F was analyzed in duplicate for total alkalinity. RPD was high at 8%.	AMEC J qualified the detected total alkalinity result from sample GP-10-09-021-F with an E (duplicate poor agreement) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052810-F was collected as the field duplicate of sample GP-10-09-031-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-09-021-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

August 11, 2010 Dissolved Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days: preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours: preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R 90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Chloride, nitrate, and sulfate were not detected in the method blanks associated with samples from this SDG.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-052810-F was collected as the field duplicate of sample GP-10-09-031-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-09-021-F. The recoveries were within acceptance criteria, except for nitrate MSD at 71%.	AMEC J qualified the detected nitrate result from sample GP-10-09-021-F with a Q (MS/MSD recovery not within control) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No chloride , nitrate, or sulfate results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Nitrate results from samples GP-10-01-069-F, GP-10-01-075-F, GP-10-09-021-F, GP-10-09-031-F and GDUP-052810-F and chloride result from sample GP-10-01-075-F have elevated detection limits due to dilutions required to quantitate the results within the calibration range.	Not warranted.	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		

August 11, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		
Blanks (Method, Field. Equipment. Rinsate. etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia and nitrite were not detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-09-021-F was analyzed in duplicate. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-052810-F was collected as the field duplicate of sample GP-10-09-031-F. The nitrite RPD was within acceptance criteria. The ammonia RPD at 77.3%.was outside acceptance criteria. but the ammonia results from both samples were below the QL of 20 mg/L.	No qualification warranted.	None
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-09-021-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-01-075-F and ammonia from samples GP-10-09-021-F, GP-10-09-031-F, and GDUP-052810-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite and ammonia results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements		
Initial Calibration	$r \geq 0.995$ for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-09-021-F was analyzed in duplicate by the laboratory. Both results were reported as not detected.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-052810-F was collected as the field duplicate of sample GP-10-09-031-F. The RPD at 200% was outside acceptance criteria, but the COD result from sample GP-10-09-031-F at 9 mg/L was below the QL of 20 mg/L.	No qualification warranted.	None
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-09-021-F. The recovery was within acceptance criteria at 106%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified COD results detected between the LOD and the LOQ. The affected samples are: GP-10-01-059-F and GDUP-052810-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation

August 11, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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Environmental Chemist

REVIEWED BY:

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Environmental Chemist

INTRODUCTION

This data validation report covers 3 water samples (including 1 rinsate blank and 1 field duplicate) collected on May 27, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on May 28, 2010 and assigned sample delivery group (SDG) number L1007999 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; hardness by USEPA Method 6010B; total alkalinity using SM 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total organic carbon (TOC) using SM 5310C; ammonia using standard method (SM) 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1007999-01/02	5/27/2010	SHM-10-07-052710-U/F	MS/MSD
L1007999-03/04	5/27/2010	DUP-052710-F/U	Field Duplicate of SHM-10-07-052710-U/F
L1007999-05	5/27/2010	RB2-052710-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 05/28/2010 at a temperature of 4°C	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1007999

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

August 11, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total aluminum (2.31 µg/L), total calcium (14.4 µg/L), total manganese (0.16 µg/L), and total sodium (21.9 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved sodium (26.6 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Total Arsenic (0.17 µg/L), total calcium (13.6 µg/L), and total manganese (0.2 µg/L) were detected in rinsate RB2-052710-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples, except calcium in all CCBs and ICB ranging between 35 µg L to 107 µg L.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-052710-U/F was collected as the field duplicate of sample SHM-10-07-052710-U/F. RPDs were within acceptance criteria, except for lead. Both lead results were below the LOQ.	No qualification warranted.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	The RPDs for total and dissolved arsenic (30%/21%), total and dissolved calcium (35%/30%), total and dissolved iron (82%/115%), total and dissolved manganese (28%/28%) between MS and MSD performed on sample SHM-10-07-052710-U/F were above acceptance criteria.	AMEC J qualified the detected results for these metals from samples SHM-10-07-052710-U/F and its field duplicate DUP-052710-U/F with a Q (RPD was not within control limits) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Total arsenic (129%MS), total calcium (132%MS), total iron (550%/230%), and total manganese (132%MS) recoveries in the MS/MSD performed on sample SHM-10-07-052710-U were outside the QAPP specified limits. Dissolved arsenic (46%MS), dissolved calcium (143%MS), dissolved iron (670%/180%), dissolved manganese (142%MS), and dissolved sodium (126%MS) recoveries in the MS/MSD performed on sample SHM-10-07-052710-F were outside QAPP-specified limits.	The background concentrations of all analytes, except dissolved sodium, are outside QAPP-specified limits were more than 4x the spike concentration. AMEC J qualified the dissolved sodium result from sample SHM-10-07-052710-F and its field duplicate DUP-052710-F with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total manganese (200%), dissolved arsenic (156%), dissolved calcium (162%), dissolved iron (174%), and dissolved manganese (320%) on sample SHM-10-07-052710-U/F.	AMEC J qualified the detected results for these metals from sample SHM-10-07-052710-U/F and its field duplicate DUP-052710-U/F with a P (PDS recovery not within control limits) reason code.	High

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were outside acceptance limits: total and dissolved arsenic (12%/19%), total and dissolved calcium (12%/15%), total and dissolved iron (13%/14%), total lead (13%), dissolved magnesium (19%), total and dissolved manganese (12%/21%), dissolved potassium (16%), total nickel (11%), and dissolved sodium (19%).	AMEC J qualified the detected total arsenic, iron, and manganese results from samples SHM-10-07-052710-U and DUP-052710-U and the detected dissolved arsenic, calcium, iron, magnesium, manganese, potassium, and sodium from samples SHM-10-07-052710-F and DUP-052710-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: lead from sample SHM-10-07-052710-F and manganese, calcium, and arsenic from sample RB2-052710-U.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-07-052710-U/F and DUP-052710-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation.	Cooler temperatures upon arrival at Alpha were within acceptance		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
	2) Temperature ≤6°C 3) Sample delivery documentation.	criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days. preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field. Equipment. Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-052710-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-052710-U was collected as the field duplicate of sample SHM-10-07-052710-U. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-07-052710-U. % recovery was low at 49%.	AMEC J qualified the detected total alkalinity result from sample SHM-10-07-052710-U and its field duplicate DUP-052710-U with a Q (MS recovery not within control) reason code.	Low

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.27 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank result.	None
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria, with the exception of sulfate (21%) between MS/MSD performed on sample SHM-10-07-052710-U.	AMEC J qualified the detected sulfate result from sample SHM-10-07-052710-U and its field duplicate DUP-052710-U with a Q (MS/MSD RPD not within control) reason code.	Non-Directional
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-052710-U/F was collected as the field duplicate of sample SHM-10-07-52710-U/F. RPDs were within acceptance criteria except for nitrate at 47.6%. Both results were below LOQ.	No qualification warranted.	None
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-07-052710-U. The recoveries were low for chloride (25%/25%) and sulfate (55%MSD).	AMEC J qualified the detected chloride and sulfate results from sample SHM-10-07-052710-U and its field duplicate DUP-052710-U with a Q (MS/MSD recoveries not within control) reason code.	Low

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples SHM-10-07-052710-U and DUP-052710-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

August 11, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B

Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/

Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-07-052701-U was analyzed in duplicate for ammonia and nitrite. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-052710-U was collected as the field duplicate of sample SHM-10-07-052710-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample SHM-10-07-052710-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon (TOC) by SM 5310C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days. preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant. concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and TOC were not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-052710-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-052710-U was collected as the field duplicate of sample SHM-10-07-052710-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-07-052710-U. The recoveries were within acceptance criteria at 102% (TOC) and 106% (COD).		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and TOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-07-052710-U/F and DUP-052710-F/U have elevated detection limits for TOC due to the dilutions required by the sample matrix.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		

August 11, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/6010B
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540C/D

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TDS and TSS were not detected in associated method blanks.		
LCS	No qualification if recovery between 72-121%; RPD<4%	LCS recovery for TDS was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-052710-U was analyzed in duplicate by the laboratory for TDS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are > QL for water	Sample DUP-052710-U/F was collected as the field duplicate of sample SHM-10-07-052710-U/F. TSS RPD was high at 137%.	AMEC J qualified the detected TSS result from samples SHM-10-07-052710-U and its field duplicate DUP-052710-U with an E (poor agreement between duplicates) reason code.	Non-Directional
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TDS and TSS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	A laboratory duplicate was not performed for TSS due to insufficient sample volume available for analysis.	No qualification warranted	None

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 11, 2010 Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 1st, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 1st, 2010 and assigned sample delivery group (SDG) number L1008123 upon receipt. Alpha analyzed the samples for metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008123-01	6/01/2010	GP-10-09-041-F	MS/MSD
L1008123-02	6/01/2010	GP-10-09-051-F	
L1008123-03	6/01/2010	GP-10-09-061-F	
L1008123-04	6/01/2010	GDUP-060110-F	Field Duplicate of GP-10-09-051-F
L1008123-05	6/01/2010	RB-060110-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 06/01/2010 at a temperature of 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008123

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero. are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

August 11, 2010 Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (21.3 µg/L) and dissolved sodium (28.2 µg/L) were detected in rinsate RB-060110-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples, except for calcium in all CCBs and ICB ranging from 48.6 µg/L to 107 µg/L.	The associated sample concentrations were more than 10 times the blanks concentrations; therefore, data usability is not adversely affected by the blanks results.	None
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-060110-F was collected as the field duplicate of sample GP-10-09-051-F. RPDs were within acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	The RPD for dissolved sodium (40%) between MS and MSD performed on sample GP-10-09-041-F was above acceptance criteria.	AMEC J qualified the detected dissolved sodium result from sample GP-10-09-041-F with a Q (RPD was not within control limits) reason code.	Non-Directional

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved sodium (30%/20%) recoveries in the MS/MSD performed on sample GP-10-09-041-F were outside the QAPP specified limits.	The dissolved sodium (134000 µg/L) concentration was more than 4 times the spike concentrations of 10000. Therefore, data usability is not adversely affected.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: arsenic from samples GP-10-09-041-F, GP-10-09-051-F, and GDUP-060110-F; and, sodium and calcium from sample RB-060110-U.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days. preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in the preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-09-041-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060110-F was collected as the field duplicate of sample GP-10-09-051-F. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-09-041-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements for chloride and sulfate. All samples from this SDG were analyzed for nitrate past the required holding time.	AMEC J qualified the detected nitrate results from all samples from this SDG with an H (hold time exceeded) reason code.	Unknown

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.71 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10x the MB concentration. Data usability not affected.	None
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-060110-F was collected as the field duplicate of sample GP-10-09-051-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-09-041-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Chloride, nitrate, and sulfate results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Ammonia and nitrite were not detected in method blanks.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-09-041-F was analyzed in duplicate. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-060110-F was collected as the field duplicate of sample GP-10-09-051-F. Ammonia RPD was high at 747%.	AMEC J qualified the detected ammonia results from samples GP-10-09-051-F and GDUP-060110-F with and E (FD poor agreement) reason code.	High
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite) 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-09-041-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GP-10-09-041-F, GP-10-09-051-F, GP-10-09-061-F, and GDUP-060110-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite and ammonia results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blank.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-09-041-F was analyzed in duplicate by the laboratory. Both results were reported as not detected.		

August 11, 2010 Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060110-F was collected as the field duplicate of sample GP-10-09-051-F. Neither of the COD results were above the LOQ of 20 mg/L.	No qualification warranted.	None
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-09-041-F. The recovery was within acceptance criteria at 106%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD result from sample GP-10-09-051-F because of detection between the LOD and the LOQ	AMEC J qualified the COD result from this sample with a TR (trace level) reason code	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

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August 16, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 6 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 01 and June 02, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 02, 2010 and assigned sample delivery group (SDG) number L1008178 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008178-01	6/01/2010	GP-10-09-071-F	
L1008178-02	6/01/2010	GP-10-09-081-F	
L1008178-03	6/02/2010	GP-10-10-011-F	MS/MSD
L1008178-04	6/02/2010	GP-10-10-021-F	
L1008178-05	6/02/2010	GDUP-060210-F	Field Duplicate of GP-10-10-021-F
L1008178-06	6/02/2010	RB-060210-F	Rinsate blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 06/02/2010 at a temperature of 2.3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008178

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470) 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Dissolved calcium (172 µg/L), dissolved iron (22 µg/L), dissolved magnesium (9.18 µg/L), dissolved manganese (0.24 µg/L), and dissolved sodium (48.6 µg/L) were detected in rinsate RB-060210-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals detected in the ICB/CCBs associated with these samples.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result < LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-060210-F was collected as the field duplicate of sample GP-10-10-021-F. RPDs were within acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	RPDs were within acceptance criteria.		

August 16, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD was performed on sample GP-10-10-011-F. % recoveries were within acceptance criteria.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The dissolved calcium recovery in the PDS performed on sample GP-10-10-011-F was high at 142%.	AMEC J qualified the dissolved calcium from sample GP-10-10-011-F with a P (PDS recovery not within control limits) reason code.	High
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits, except for dissolved calcium (11%) and dissolved iron (12%) in the SD performed on sample GP-10-10-011-F.	The detected iron concentration was <50 times the LOQ. Data usability is not adversely affected. AMEC J qualified the detected calcium result from sample GP-10-10-011-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: GP-10-10-011-F, GP-10-10-021-F, and GDUP-060210-F (arsenic), RB-060210-U (magnesium, sodium, iron, and manganese).	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for alkalinity linear calibration Analytes with low r flag detected results "J" and nondetected results "UJ"	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 85-115% a) %R >115% flag detected results "J" b) %R <85% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in the rinsate or preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-10-011-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060210-F was collected as the field duplicate of sample GP-10-10-021-F. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-10-011-F. %R recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

August 16, 2010 Dissolved Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements for chloride and sulfate. Samples GP-10-09-071-F and GP-10-09-081-F were analyzed for nitrate past the holding time.	AMEC J qualified the detected nitrate results from these samples with an H (hold time exceeded) reason code.	Unknown
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.8 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate result from sample GP-10-10-011-F because the sample concentration was less than 10x the MB concentration. A B (contamination detected in preparation blank) reason code was applied.	High
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		

August 16, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	% RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-060210-F was collected as the field duplicate of sample GP-10-10-021-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-10-011-F. The recoveries were within acceptance criteria		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GP-10-09-071-F and GP-10-09-081-F, and sulfate from sample GP-10-10-011-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Chloride results from samples GP-10-09-071-F, GP-10-09-081-F, GP-10-10-021-F, and GDUP-060210-F and nitrate results from samples GP-10-09-071-F and GP-10-09-081-F have elevated detection limits due to dilutions required to quantitate the results within the calibration range.	No qualification warranted.	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.995 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia and nitrite were not detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) RPD≤20%	Sample GP-10-10-011-F was analyzed in duplicate. % RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-060210-F was collected as the field duplicate of sample GP-10-10-021-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-10-011-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GP-10-09-071-F, GP-10-09-081-F, GP-10-10-021-F, and GDUP-060210-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the ammonia results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	COD was not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-10-011-F was analyzed in duplicate by the laboratory. Both results were reported as not detected.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060210-F was collected as the field duplicate of sample GP-10-10-021-F. The RPD could not be calculated because the COD result from sample GDUP-060210-F at 11 mg/L was below the QL of 20 mg/L.	No qualification warranted.	
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-10-011-F. The recovery was within acceptance criteria at 102%.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD result from sample GDUP-060210-F detected between the LOD and the LOQ.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 12, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 10 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 02 and June 03, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 03, 2010 and assigned sample delivery group (SDG) numbers L1008257 and L1008411 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008257-01/L1008411-01	6/02/2010	GP-10-10-031-F	
L1008257-02/L1008411-02	6/02/2010	GP-10-10-041-F	
L1008257-03/L1008411-03	6/02/2010	GP-10-10-051-F	
L1008257-04/L1008411-04	6/02/2010	GP-10-10-061-F	
L1008257-05/L1008411-05	6/03/2010	GP-10-10-071-F	
L1008257-06/L1008411-06	6/03/2010	GP-10-08-011-F	
L1008257-07/L1008411-07	6/03/2010	GP-10-08-021-F	
L1008257-08/L1008411-08	6/03/2010	GP-10-08-031-F	
L1008257-09/L1008411-09	6/03/2010	GDUP-060310-F	Field Duplicate of GP-10-08-011-F
L1008257-10/L1008411-10	6/03/2010	RB-060310-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 6/03/2010 at temperatures of 2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008257 L1008411

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Dissolved manganese (0.19 µg/L) was detected in the method blank associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J- detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-060310-F was collected as the field duplicate of sample GP-10-08-011-F. RPDs were within acceptance criteria.		

August 12, 2010 — Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	Dissolved calcium RPD (29%) was high in the MS/MSD performed on sample GP-10-10-071-F.	AMEC J qualified the detected dissolved calcium from sample GP-10-10-071-F with a Q (RPD not within control) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved calcium (60% MSD), dissolved iron (77% MSD), and dissolved manganese (20%/20%) were outside acceptance criteria in the MS/MSD performed on sample GP-10-10-071-F.	Dissolved calcium, iron, and manganese background concentrations were more than 4x the spike concentrations. Data could not be fully evaluated.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS was not performed with this SDG.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Dissolved arsenic results from samples GP-10-10-041-F, GP-10-10-051-F, and GP-10-08-031-F were detected and reported between the LOD and LOQ. J qualified by the laboratory.	AMEC J qualified the arsenic results from these samples with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-10-031-F, GP-10-10-041-F, GP-10-10-051-F, GP-10-10-061-F, GP-10-10-071-F, and GP-10-08-031-F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in the rinsate or preparation blanks.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Samples GP-10-10-071-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060310-F was collected as the field duplicate of sample GP-10-08-011-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-10-071-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

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Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements for chloride and sulfate. Samples GP-10-10-031-F, GP-10-10-041-F, GP-10-10-051-F, and GP-10-10-061-F were analyzed for nitrate past the holding time.	AMEC J qualified the detected nitrate results from these samples with an H (hold time exceeded) reason code.	Unknown
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.63 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate results from samples GP-10-10-041-F, GP-10-10-051-F, GP-10-10-061-F, and GP-10-10-071-F because the sample concentrations were less than 10x the MB concentration. A B (contamination detected in preparation blank) reason code was applied.	High
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	% RPDs were within acceptance criteria		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-060310-F was collected as the field duplicate of sample GP-10-08-011-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-10-071-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Nitrate results from samples GP-10-10-041-F, GP-10-10-051-F, GP-10-08-011-F, and GDUP-060310-F and sulfate result from sample GP-10-10-051-F were reported between LOD and LOQ with a J qualifier.	AMEC J qualified the nitrate and sulfate results from these samples with a TR (trace level) reason code, unless they have been U qualified.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Chloride results from samples GP-10-10-031-F, GP-10-10-041-F, GP-10-10-061-F, GP-10-10-071-F, and GP-10-08-031-F have elevated detection limits due to the dilutions required to quantitate the results within the calibration range.	Not required	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Ammonia and nitrite were not detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	1) RPD≤20%	Sample GP-10-10-071-F was analyzed in duplicate. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-060310-F was collected as the field duplicate of sample GP-10-08-011-F. Nitrite RPD was within acceptance criteria. Ammonia RPD could not be evaluated as both results were below the LOQ.	No qualification warranted.	None
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-10-071-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GP-10-08-011-F and GP-10-08-031-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the nitrite and ammonia results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

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Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blank.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-10-071-F was analyzed in duplicate by the laboratory.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060310-F was collected as the field duplicate of sample GP-10-08-011-F. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-10-071-F. The recovery was within acceptance criteria at 104%.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD results detected between the LOD and the LOQ. The affected samples are: GP-10-10-051-F and GP-10-10-041-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 12, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 03, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 04, 2010 and assigned sample delivery group (SDG) numbers L1008317 and L1008410 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008317-01/L1008410-01	6/03/2010	GP-10-08-041-F	MS/MSD
L1008317-02/L1008410-02	6/03/2010	GP-10-08-051-F	
L1008317-03/L1008410-03	6/03/2010	GP-10-08-061-F	
L1008317-04/L1008410-04	6/03/2010	GDUP2-060310-F	Field Duplicate of GP-10-08-051-F
L1008317-05/L1008410-05	6/03/2010	RB2-060310-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler were received on 6/04/2010 at a temperature of 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008317 L1008410

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Dissolved calcium (24.5 µg/L), dissolved magnesium (4.24 µg/L), and dissolved manganese (0.19 µg/L) were detected in rinsate blank RB2-060310-U associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP2-060310-F was collected as the field duplicate of sample GP-10-08-051-F. RPDs were within acceptance criteria.		
MS/MSD RPD	RPD ≤ 20%	RPDs were within specified limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD was performed on sample GP-10-08-041-F. All recoveries were within specified limits.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS recovery was within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Dissolved manganese, dissolved calcium, and dissolved magnesium from sample RB2-060310-F and arsenic from samples GP-10-08-041-F, GP-10-08-061-F, and GDUP2-060310-F were reported between LOD and LOQ. The laboratory J qualified these analytes.	AMEC J qualified the manganese, calcium, magnesium, and arsenic results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-08-041-F, GP-10-08-051-F, GP-10-08-061-F, and GDUP2-060310-F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed as litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and < LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in the preparation blank		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-08-041-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP2-060310-F was collected as the field duplicate of sample GP-10-08-051-F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on samples GP-10-08-041-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

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Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.71 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	%RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP2-060310-F was collected as the field duplicate of sample GP-10-08-051-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-08-041-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Chloride results from samples GP-10-08-041-F, GP-10-08-051-F, GP-10-08-061-F, and GDUP2-060310-F have elevated detection limits due to the dilutions required to quantitate the results within the calibration range.	Not required	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia at a concentration of 0.0172 mg/L was detected in the method blank associated with the analysis of samples from this SDG	AMEC U qualified the detected ammonia results from samples GP-10-08-041-F, GP-10-08-051-F, GP-10-08-061-F, and GDUP2-060310-F with a B (contaminant detected in method blank) reason code.	High
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-08-041-F was analyzed in duplicate. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP2-060310-F was collected as the field duplicate of sample GP-10-08-051-F. Nitrite RPD was within acceptance criteria. Ammonia RPD was high at 71.2%.	No qualification required because both ammonia results were below the LOQ.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-08-041-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GP-10-08-041-F, GP-10-08-051-F, GP-10-08-061-F, and GDUP2-060310-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified the ammonia results from these samples with a TR (trace level) reason code, unless U qualified because of blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		

August 12, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blank.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-08-041-F was analyzed in duplicate by the laboratory.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP2-060310-F was collected as the field duplicate of sample GP-10-08-051-F. RPD could not be calculated as both results were below the LOQ.	Not warranted.	None
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-08-041-F. The recovery was within acceptance criteria at 103%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD results detected between the LOD and the LOQ. The affected samples are: GP-10-08-041-F, GP-10-08-051-F, and GP-10-08-061-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Melanie Roshu
Environmental Chemist

REVIEWED BY:

Denise King
Environmental Chemist

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 8 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 7, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 7, 2010 and assigned sample delivery group (SDG) numbers L1008425 and L1008426 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008425-01/L1008426-01	6/07/2010	GP-10-02-024-F	MS/MSD
L1008425-02/L1008426-02	6/07/2010	GP-10-02-034-F	
L1008425-03/L1008426-03	6/07/2010	GP-10-02-044-F	
L1008425-04/L1008426-04	6/07/2010	GP-10-02-054-F	
L1008425-05/L1008426-05	6/07/2010	GPDUP-060710-F	Field Duplicate of GP-10-02-034-F
L1008425-06/L1008426-06	6/07/2010	RB-060710-F	Rinsate Blank
L1008425-07/L1008426-07	6/07/2010	GP-10-02-064-F	
L1008425-08/L1008426-08	6/07/2010	GP-10-02-074-F	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 6/07/2010 at temperature of 3 and 2.2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008425 L1008426

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (30.7 µg/L), dissolved iron (10.3 µg/L), dissolved magnesium (20.6 µg/L), and dissolved manganese (0.27 µg/L) were detected in rinsate blank RB-060710-F associated with these samples. Dissolved calcium (36.1 µg/L), dissolved magnesium (22.4 µg/L), and dissolved manganese (0.19 µg/L) were detected in method blank associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GPDUP-060710-F was collected as the field duplicate of sample GP-10-02-034-F. RPDs were within acceptance criteria.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	RPDs were within specified limit.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD was performed on sample GP-10-02-024-F. All recoveries were within specified limits, except for dissolved calcium (142%/132%) and dissolved sodium (125% MS).	AMEC J qualified the detected sodium result from sample GP-10-02-024-F with a Q (MS/MSD recovery not within control limit) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS recovery was within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Dissolved calcium, iron, magnesium, and manganese from sample RB-060710-F and dissolved arsenic from samples GP-10-02-024-F, GP-10-02-034-F, GP-10-02-044-F, GP-10-02-054-F, GP-10-02-064-F, and GP-10-02-074-F were reported between LOD and LOQ. The laboratory J qualified these analytes.	AMEC J qualified the manganese, calcium, magnesium and arsenic results from this sample with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	Samples GP-10-02-034-F, GP-10-02-044-F, GP-10-02-054-F, GPDUP-060710-F, GP-10-02-064-F and GP-10-02-074-F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field. Equipment. Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in the preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-02-024-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060710-F was collected as the field duplicate of sample GP-10-02-034-F. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-02-024-F. % recovery was low at 82%.	AMEC J qualified the detected total alkalinity result from sample GP-10-02-024-F with a Q (MS recovery not within control limit) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.71 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	% RPDs were within acceptance criteria.		
Field Duplicates	1) RPD < 30% when detects for both samples are ≥ LOQ for water	Sample GPDUP-060710-F was collected as the field duplicate of sample GP-10-02-034-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs/MSDs were performed on sample GP-10-02-024-F. The recoveries were within acceptance criteria. % RPDs were within acceptance criteria, except for sulfate RPD between MS/MSD at 22%.	AMEC J qualified the detected sulfate result from sample GP-10-02-024-F with a Q (RPD was not within control) reason code.	Non-Directional
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Nitrate result from sample GP-10-02-074-F was reported between LOD and LOQ and J qualified by the laboratory.	AMEC J qualified the nitrate result from this sample with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Chloride results from samples GP-10-02-024-F, GP-10-02-034-F, GP-10-02-044-F, GP-10-02-054-F, GPDUP-060710-F, GP-10-02-064-F, and GP-10-02-074-F have elevated detection limits due to the dilutions required to quantitate the results within the calibration range.	Not required	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No ammonia and nitrite were detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-02-024-F was analyzed in duplicate. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-060710-F was collected as the field duplicate of sample GP-10-02-034-F. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-02-024-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	COD was not detected in associated method blank.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-02-024-F was analyzed in duplicate by the laboratory.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GPDUP-060710-F was collected as the field duplicate of sample GP-10-02-034-F. RPD was high at 51.2%	AMEC J qualified the detected COD results from these samples with an E (duplicates showed poor agreement) reason code.	None
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-02-024-F. The recovery was within acceptance criteria at 104%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD results detected between the LOD and the LOQ. The affected samples are: GP-10-02-024-F, GP-10-02-034-F, GP-10-02-044-F, and GP-10-02-054-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 9 water samples (including 1 rinsate blank and 1 field duplicate) collected on June 7 and June 8, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 8, 2010 and assigned sample delivery group (SDG) number L1008513 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008513-01	6/07/2010	GP-10-02-084-F	
L1008513-02	6/08/2010	GP-10-02-094-F	
L1008513-03	6/08/2010	GP-10-02-102-F	
L1008513-04	6/08/2010	RB-060810-U	Rinsate Blank
L1008513-05	6/08/2010	GP-10-04-014-F	MS/MSD
L1008513-06	6/08/2010	GP-10-04-024-F	
L1008513-07	6/08/2010	GP-10-04-034-F	
L1008513-08	6/08/2010	GP-10-04-044-F	
L1008513-09	6/08/2010	GDUP-060810-F	Field Duplicate of GP-10-04-024-F

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 6/08/2010 at temperatures of 2 and 5°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008513

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) Evaluate down to the LOD 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (24.4 µg/L). dissolved iron (10.2 µg/L). and dissolved manganese (0.25 µg/L) were detected in rinsate blank RB-060810-F associated with these samples. Dissolved calcium (34.1 µg/L). dissolved iron (18.5 µg/L). and dissolved manganese (0.34 µg/L) were detected in method blank associated with these samples.	The associated sample concentrations were more than 10 times the blank concentrations; therefore. data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters): ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample GDUP-060810-F was collected as the field duplicate of sample GP-10-04-024-F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD RPD	RPD ≤ 20%	RPDs were within specified limit.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS/MSD was performed on sample GP-10-04-014-F. All recoveries were within specified limits.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries < 10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Dissolved calcium, iron, and manganese from sample RB-060810-F and dissolved arsenic from samples GP-10-02-094-F, GP-10-04-014-F, GP-10-04-024-F, GP-10-04-034-F, GP-10-04-044-F, and GDUP-060810-F were reported between LOD and LOQ. The laboratory J qualified these analytes.	AMEC J qualified the manganese, calcium, magnesium and arsenic results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-02-084-F, GP-10-02-094-F, and GP-10-02-102-F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limit was not achieved for arsenic on sample GP-10-02-094-F.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result >10x contaminant concentration; no qualification required.	Total alkalinity was not detected in the preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-04-014-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060810-F was collected as the field duplicate of sample GP-10-04-024-F. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on samples GP-10-04-014-F. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature 6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.14 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate results from samples GP-10-04-014-F and GP-10-04-024-F with a B (contamination detected in method blank) reason code.	None
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	% RPDs were within acceptance criteria, except for chloride which had a RPD of 40% in sample GP-10-04-014-F.	AMEC J qualified the detected chloride result from sample GP-10-04-014-F with an I (poor agreement between duplicates) reason code.	Non-Directional
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample GDUP-060810-F was collected as the field duplicate of sample GP-10-04-024-F. Chloride RPD was within acceptance criteria. Nitrate RPD was high at 48.1%. Sulfate RPD could not be calculated as one result was not detected.	Sulfate and nitrate were detected in sample GP-10-04-024-F below the LOQ. Data not affected.	None
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample GP-10-04-014-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Nitrate results from samples GP-10-04-014-F, GP-10-04-024-F, and GDUP-060810-F and sulfate results from samples GP-10-04-014-F and GP-10-04-024-F were reported between LOD and LOQ and, J qualified by the laboratory.	AMEC J qualified the nitrate and sulfate results from these samples with a TR (trace level) reason code, unless U qualified because blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Chloride results from samples GP-10-02-084-F, GP-10-02-094-F, and GP-10-02-102-F and nitrate from sample GP-10-04-044-F have elevated detection limits due to the dilutions required to quantitate the results within the calibration range.	Not required	None

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No ammonia or nitrite were detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-04-014-F was analyzed in duplicate. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample GDUP-060810-F was collected as the field duplicate of sample GP-10-04-024-F. Ammonia RPD was high at 56.6%, but both results were reported below the LOQ.	No qualification warranted	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-04-014-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Ammonia results from samples GP-10-04-014-F, GP-10-04-024-F, GP-10-04-034-F, GP-10-04-044-F and GDUP-060810-F were reported between LOD and LOQ and, J qualified by the laboratory.	AMEC J qualified the ammonia results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated method blank.		

August 13, 2010 — **Dissolved Metals by USEPA Method 6020A**

Region I Data Review Worksheet — **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-04-014-F was analyzed in duplicate by the laboratory. RPD could not be calculated as both results were below the LOQ.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample GDUP-060810-F was collected as the field duplicate of sample GP-10-04-024-F. RPD could not be calculated as one both results were below the LOQ.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-04-014-F. The recovery was within acceptance criteria at 100%.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD results detected between the LOD and the LOQ. The affected sample is: GP-10-04-024-F.	AMEC J qualified the COD results from these samples with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 15 water samples (including 1 rinsate blank and 2 field duplicates) collected on June 8 and 9, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 9, 2010 and assigned sample delivery group (SDG) number L1008586 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008586-01	6/08/10	GP-10-04-054-F	
L1008586-02	6/08/10	GP-10-04-064-F	
L1008586-03	6/08/10	GP-10-04-074-F	
L1008586-04	6/08/10	GP-10-04-084-F	
L1008586-05	6/08/10	GP-10-04-094-F	
L1008586-06	6/09/10	GP-10-05-015-F	MS/MSD
L1008586-07	6/09/10	GP-10-05-025-F	
L1008586-08	6/09/10	GP-10-05-035-F	
L1008586-09	6/09/10	GP-10-05-045-F	
L1008586-10	6/09/10	GP-10-05A-029-F	
L1008586-11	6/09/10	GP-10-05A-039-F	
L1008586-12	6/09/10	GP-10-05A-049-F	
L1008586-13	6/09/10	GDUP-060910-F	Field Duplicate of GP-10-05-025-F
L1008586-14	6/09/10	GDUP2-060910-F	Field Duplicate of GP-10-05A-039-F
L1008586-15	6/09/10	RB-060910-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 6/9/2010 at temperatures of 3, 3, 3, and 2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008586

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (56.2 µg/L) and dissolved manganese (0.18 µg/L) were detected in method blank.	Dissolved calcium and dissolved manganese concentration in the associated samples were greater than 10x the blank concentrations. Qualification is not warranted.	None

August 13, 2010 Dissolved Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120% method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Samples GDUP-060910-F and GDUP2-060910-F were collected as the field duplicates of samples GP-10-05-025-F and GP-10-05A-039-F, respectively. The dissolved iron RPD (67.1%) was high between GDUP-060910-F and GP-10-05-025-F.	AMEC J qualified the detected dissolved iron results from samples GDUP-060910-F and GP-10-05-025-F.	Non-Directional
Laboratory Duplicate RPD	RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects	No anomalies		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Recoveries were within the QAPP specified limits.		
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Dissolved calcium recovery (202%) was high in the PDS performed on sample GP-10-05-015-F.	The dissolved calcium (7,540 µg/L) concentration in the unspiked sample is more than 4 times the spike concentration of 500 µg/L. No qualifications are necessary.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for dissolved calcium (14%) was above acceptance limits in the serial dilution analysis of sample GP-10-05-015-F.	AMEC J qualified the detected dissolved calcium result from sample GP-10-05-015-F with an A (ICP SD % difference was not within control limits) reason code.	High
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: Dissolved Arsenic GP-DUP2-060910-F GP-10-04-054-F GP-10-04-064-F GP-10-04-074-F GP-10-05-015-F GP-10-05-025-F GP-10-05A-029-F GP-10-05A-039-F Dissolved Manganese and Sodium RB-060910-F	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	The requested arsenic reporting limits were not achieved for samples GP-10-04-074-F, GP-10-05-025-F, GP-10-05A-029-F, and GDUP-060910-F due to dilutions required because of high concentrations of non-target analytes.	None	

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Alkalinity was not detected in the associated blanks.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Samples GDUP-060910-F and GDUP2-060910-F were collected as the field duplicates of samples GP-10-05-025-F and GP-10-05A-039-F, respectively. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The laboratory analyzed samples GP-10-04-054-F, GP-10-04-064-F GP-10-04-074-F, GP-10-04-084-F, and GP-10-04-094-F for nitrate beyond the 48 hour holding time.	AMEC J qualified the detected nitrate results from samples GP-10-04-054-F, GP-10-04-064-F, GP-10-04-074-F, and GP-10-04-084-F and UJ qualified the nondetected nitrate result from sample GP-10-04-094-F with an H (hold time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate (0.96 mg/L) was detected in the method blank.	AMEC U qualified the detected sulfate results from the following samples: GDUP-060910-F, GP-10-04-054-F, GP-10-04-064-F, GP-10-05-025-F, GP-10-05-035-F, and GP-10-05-045-F.	High

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Samples GDUP-060910-F and GDUP2-060910-F were collected as the field duplicates of samples GP-10-05-025-F and GP-10-05A-039-F, respectively. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Quality results for samples collected at same location but differing depths as well)	Chloride was not recovered in the MS/MSD analysis of sample GP-10-05-015-F.	AMEC J qualified the detected chloride result from sample GP-10-05-015-F with a Q (MS/MSD recovery not within control limit) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample GP-10-05-025-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and <LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Ammonia or nitrite were not detected in the associated blanks.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20% when detects for both samples are ≥ LOQ for water	RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Samples GDUP-060910-F and GDUP2-060910-F were collected as the field duplicates of samples GP-10-05-025-F and GP-10-05A-039-F, respectively. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GDUP2-060910-F, GP-10-04-074-F GP-10-04-084-F, GP-10-04-094-F GP-10-05-015-F, GP-10-05A-029-F GP-10-05A-039-F, and GP-10-05A-049-F and the nitrite results from samples GP-10-04-054-F and GP-10-04-064-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H_2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated blanks.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	The RPD was in acceptance criteria.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Samples GDUP-060910-F and GDUP2-060910-F were collected as the field duplicates of samples GP-10-05-025-F and GP-10-05A-039-F, respectively. RPDs was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The recovery was within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD results from samples GDUP2-060910-F, GP-10-04-054-F GP-10-04-084-F, GP-10-05A-039-F, and GP-10-05A-049-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimator
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

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August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

INTRODUCTION

This data validation report covers 14 water samples (including 1 rinsate blank and 2 field duplicates) collected on June 9 and 10, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by an Alpha Analytical Laboratory in Westborough, MA (Alpha) courier and brought to the laboratory on June 10, 2010 and assigned sample delivery group (SDG) number L1008682 upon receipt. Alpha analyzed the samples for dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 7. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1008682-01	6/09/10	GP-10-05A-059-F	
L1008682-02	6/09/10	GP-10-05A-069-F	
L1008682-03	6/09/10	GP-10-05A-079-F	
L1008682-04	6/09/10	GP-10-05A-089-F	
L1008682-05	6/09/10	GP-10-05A-099-F	
L1008682-06	6/09/10	GP-10-05A-109-F	
L1008682-07	6/10/10	GP-10-03-029-F	MS/MSD
L1008682-08	6/10/10	GP-10-03-039-F	
L1008682-09	6/10/10	GP-10-03-049-F	
L1008682-10	6/10/10	GP-10-03-059-F	
L1008682-11	6/10/10	GP-10-03-069-F	
L1008682-12	6/10/10	GDUP-061010-F	Field Duplicate of GP-10-03-039-F
L1008682-13	6/10/10	GDUP2-061010-F	Field Duplicate of GP-10-03-069-F
L1008682-14	6/10/10	RB-061010-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 6/10/2010 at temperatures of 2.1, 2.9, 2.1, and 2.2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008682

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2. 2) Hg - 28 days to analysis.	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Dissolved calcium (37.5 µg/L) and dissolved sodium (24.6 µg/L) were detected in method blank.	Dissolved calcium and dissolved sodium concentration in the associated samples were greater than 10x the blank concentrations. Qualification is not warranted.	None

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Samples GDUP-061010-F and GDUP2-061010-F were collected as the field duplicates of samples GP-10-03-039-F and GP-10-03-069-F, respectively. RPDs were within limits.		
Laboratory Duplicate RPD	RPD ≤ 20% a) If exceeds RPD limit: J qualify detects, UJ qualify non detects b) If one result > LOQ and other ND: J-detections, UJ qualify non detects	No anomalies		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved sodium (150% MS) and dissolved calcium (138%/122%) recoveries in the MS/MSD performed on sample GP-10-03-029-F were outside the QAPP specified limits.	The dissolved sodium (126,000 µg/L) concentration in sample GP-10-03-029-F was more than 4 times the spike concentration of 10,000 µg/L. Therefore, data usability is not adversely affected. AMEC J qualified the detected dissolved calcium result from sample GP-10-03-029-F.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	PDS recoveries were within the QAPP specified limits.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	Serial dilution %Ds were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Quality detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: Dissolved Arsenic GP-10-03-039-F GP-10-03-059-F GP-10-05A-059-F Dissolved Sodium RB-061010-U	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Alkalinity was not detected in the associated blanks.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are >QL for water	Samples GDUP-061010-F and GDUP2-061010-F were collected as the field duplicates of samples GP-10-03-039-F and GP-10-03-069-F, respectively. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	Recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The laboratory analyzed all samples for nitrate beyond the 48 hour holding time.	AMEC J qualified the detected nitrate results from all samples.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate (0.48 mg/L) was detected in method blank.	AMEC U qualified the detected sulfate results from samples GP-10-03-029-F, GP-10-05A-089-F, and GP-10-05A-099-F.	Low
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Samples GDUP-061010-F and GDUP2-061010-F were collected as the field duplicates of samples GP-10-03-039-F and GP-10-03-069-F, respectively. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GDUP2-061010-F and GP-10-03-069-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia and Nitrite by Standard Methods 4500NH3-BH/4500NO2-B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite)	The samples were analyzed and preserved as per EPA Method requirements.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Ammonia and nitrite were not detected in the associated blanks.		
LCS	No qualification if recovery between 80-120% for ammonia and 90-110% for nitrite.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20% when detects for both samples are ≥ LOQ for water	RPDs were within acceptance criteria		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Samples GDUP-061010-F and GDUP2-061010-F were collected as the field duplicates of samples GP-10-03-039-F and GP-10-03-069-F, respectively. RPDs were within acceptance criteria		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia) and 85-115% (nitrite). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia results from samples GP-10-03-029-F, GP-10-03-039-F, GP-10-03-049-F, GP-10-03-059-F, GP-10-03-069-F, GP-10-05A-069-F, GP-10-05A-079-F, and GP-10-05A-089-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		None

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H_2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated blanks.		
LCS	No qualification if recovery between 95-105%	LCS recovery was within acceptance criteria.		
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	The RPD was in acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Samples GDUP-061010-F and GDUP2-061010-F were collected as the field duplicates of samples GP-10-03-039-F and GP-10-03-069-F, respectively. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The recovery was within acceptance criteria.		

August 13, 2010 Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD results from samples GP-10-05A-089-F and GP-10-05A-109-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Glenn Esler
Environmental Chemist

REVIEWED BY:

Denise King
Environmental Chemist

Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 36 water samples collected between June 7 and 10, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on June 10, 2010 and assigned sample delivery group (SDG) number L1008691 upon receipt. Alpha analyzed the samples for total arsenic using United States Environmental Protection Agency (USEPA) Method 6020A. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Table 3. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
GP-10-02-024-U	6/07/10	L1008691-01	
GP-10-02-034-U	6/07/10	L1008691-02	
GP-10-02-044-U	6/07/10	L1008691-03	
GP-10-02-054-U	6/07/10	L1008691-04	
GP-10-02-064-U	6/07/10	L1008691-05	
GP-10-02-074-U	6/07/10	L1008691-06	
GP-10-02-084-U	6/07/10	L1008691-07	
GP-10-02-094-U	6/08/10	L1008691-08	
GP-10-02-102-U	6/08/10	L1008691-09	
GP-10-04-014-U	6/08/10	L1008691-10	
GP-10-04-024-U	6/08/10	L1008691-11	
GP-10-04-034-U	6/08/10	L1008691-12	
GP-10-04-044-U	6/08/10	L1008691-13	
GP-10-04-054-U	6/08/10	L1008691-14	
GP-10-04-064-U	6/08/10	L1008691-15	
GP-10-04-074-U	6/08/10	L1008691-16	
GP-10-04-084-U	6/08/10	L1008691-17	
GP-10-04-094-U	6/08/10	L1008691-18	
GP-10-05-015-U	6/09/10	L1008691-19	
GP-10-05-025-U	6/09/10	L1008691-20	
GP-10-05-035-U	6/09/10	L1008691-21	
GP-10-05-045-U	6/09/10	L1008691-22	

Lab Sample Number	Sample Date	Field ID	Comments
GP-10-05A-029-U	6/09/10	L1008691-23	
GP-10-05A-039-U	6/09/10	L1008691-24	
GP-10-05A-049-U	6/09/10	L1008691-25	
GP-10-05A-059-U	6/09/10	L1008691-26	
GP-10-05A-069-U	6/09/10	L1008691-27	
GP-10-05A-079-U	6/09/10	L1008691-28	
GP-10-05A-089-U	6/09/10	L1008691-29	
GP-10-05A-099-U	6/09/10	L1008691-30	
GP-10-05A-109-U	6/09/10	L1008691-31	
GP-10-03-029-U	6/10/10	L1008691-32	
GP-10-03-039-U	6/10/10	L1008691-33	
GP-10-03-049-U	6/10/10	L1008691-34	
GP-10-03-059-U	6/10/10	L1008691-35	
GP-10-03-069-U	6/10/10	L1008691-36	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 6/10/2010 at temperatures of 2.1 and 2.2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1008691

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total Arsenic by USEPA 6020A

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

August 13, 2010 Total Arsenic by USEPA Method 6020A

Region I Data Review Worksheet

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify non-detects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020); J qualify detects, no qualification is necessary for non-detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020); J qualify detects; UJ qualify non-detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Arsenic was not detected in the associated blanks.		
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	Arsenic was not detected in the associated blanks.		
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

August 13, 2010 Total Arsenic by USEPA Method 6020A

Region I Data Review Worksheet

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters): ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Field duplicates were not collected with this data set.		
Laboratory Duplicate RPD	RPD ≤ 20% a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects	No anomalies		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	MS analysis was performed on samples GP-10-02-024-U and GP-10-05-035-U. Recoveries were within acceptance limits.		

August 13, 2010 Total Arsenic by USEPA Method 6020A
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	No anomalies		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples are: GP-10-02-024-U and GP-10-05-025-U	AMEC J qualified these results with a TR (trace level) reason code. unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	The laboratory diluted sample GP-10-05-025-U because of high concentration of non-target analytes. The arsenic detection limit was elevated in this sample and the requested reporting limit was not achieved.	None	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Glenn Esler
Environmental Chemist

REVIEWED BY:

Denise King
Environmental Chemist

August 13, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet

Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B /4500S2-AD/5310C/2540D/2540C

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 3 water samples (including 1 rinsate blank and 1 field duplicate) collected on July 7, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on July 8, 2010 and assigned sample delivery group (SDG) number L1010228 upon receipt. Alpha analyzed the samples for total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, sulfide using SM 4500S2-AD, total organic carbon using SM 5310C, total suspended solids (TSS) using SM 2540D, total dissolved solids (TDS) using SM 2540C, total hardness using EPA 6010B, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1010228-01/03	7/7/2010	SHM-10-06A-070710-U/F	
L1010228-02/04	7/7/2010	DUP-070710-U/F	Field Duplicate of SHM-10-06A-070710-U/F
L1010228-05	7/7/2010	RB-070710-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 7/8/2010 at temperatures of 3.8 and 3.2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1010228

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were within acceptance criteria. Sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify non-detects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non-detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects; UJ qualify non-detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is < 10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Aluminum (12.9 µg/L), calcium (25.7µg/L), chromium (0.28 µg/L), iron (31.9 µg/L), manganese (0.58 µg/L), and sodium (19.3 µg/L) were detected in the rinsate RB-070710-U associated with the analysis of samples from this SDG. Dissolved aluminum (2.26 µg/L), dissolved calcium (13.6 µg/L) and dissolved potassium (19.8 µg/L) were detected in method blank. Total calcium (15 µg/L), total iron (9.24 µg/L), and total potassium (19 µg/L) were detected in method blank.	AMEC U qualified the detected total aluminum and chromium results from samples SHM-10-06A-070710-U and DUP-070710-U. AMEC U qualified the detected dissolved aluminum results from samples SHM-10-06A-070710-U and DUP-070710-U.	Low
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	Calcium (38.87 µg/L) and potassium (18.73 µg/L) were detected in CCB1 (07/12/10 at 21:08). Arsenic (0.14 µg/L) was detected in CCB3 (07/12/10 at 23:33). Manganese (0.14 µg/L) was detected in CCB4 (7/13/10 at 00:45)	None	None
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

August 13, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**

Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-070710-U/F was collected as the field duplicate of sample SHM-10-06A-070710-U/F. The RPD for total aluminum (33.1%), total lead (51.4%), and total nickel (62.7%) were high.	AMEC J qualified, unless previously U qualified, the detected total aluminum and total nickel results from samples DUP-070710-U and SHM-10-06A-070710-U because of the imprecision. Both total lead results were detected below the LOQ so no qualifications are warranted.	Non-Directional
Laboratory Duplicate RPD	RPD ≤ 20% a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects	No anomalies		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Total iron (150% MS) recovery in the MS/MSD performed on sample SHM-10-06A-070710-U was outside the QAPP specified limits. Dissolved iron (230%/190%) and dissolved calcium (121% MSD) recoveries in the MS/MSD performed on sample SHM-10-06A-070710-F were outside the QAPP specified limits.	Total iron (20,900 µg/L) and dissolved iron (19,900 µg/L) concentrations in sample SHM-10-06A-070710-U/F were more than 4 times the spike concentrations of 1,000 µg/L. Therefore, data usability is not adversely affected. AMEC J qualified the dissolved calcium results from samples SHM-10-06A-070710-F and DUP-070710-F.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	Total aluminum (74%), total iron (160%) and total manganese (600%) recoveries in the PDS performed on sample SHM-10-06A-070710-U were outside the QAPP specified limits. Dissolved iron (200%) and dissolved calcium (140%) recoveries in the PDS performed on sample SHM-10-06A-070710-U were outside the QAPP specified limits.	Total iron (20,900 µg/L), dissolved calcium (15,300 µg/L) and dissolved iron (19,900 µg/L) concentrations in sample SHM-10-06A-070710-U/F were more than 4 times the spike concentrations of 500 µg/L. Therefore, data usability is not adversely affected. Total aluminum (38.7 µg/L) and total manganese (1,650 µg/L) concentration was more than 4 times the spike concentration of 5 µg/L. Therefore, data usability is not adversely affected.	None

August 13, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**
Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	Total arsenic (20%), total calcium (22%), total iron (24%), total magnesium (20%), total manganese (21%), total potassium (19%), and total sodium (23%) %Ds were high in the serial dilution analysis of sample SHM-10-06A-070710-U. Dissolved calcium (12%) and dissolved iron (12%) %Ds were high in the serial dilution analysis of sample SHM-10-06A-070710-F.	AMEC J qualified the detected total arsenic, total calcium, total iron, total magnesium, total manganese, total potassium, and total sodium results from samples SHM-10-06A-070710-U and DUP-06A-070710-U. AMEC J qualified the dissolved calcium and dissolved iron results from samples SHM-10-06A-070710-F and DUP-06A-070710-F.	Non-Directional
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Quality detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: SHM-10-06A-070710-U/F Total lead Dissolved chromium Dissolved lead DUP-070710F Total lead Dissolved lead Dissolved chromium RB-070710-U Calcium Chromium Iron Manganese Sodium	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.	None	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Alkalinity was not detected in the associated blanks.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R".	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-06A-070710-U was analyzed in duplicate. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-070710-U was collected as the field duplicate of sample SHM-10-06A-070710-U. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	An MS was performed on sample SHM-10-06A-070710-U. Recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	Chloride (0.088 mg/L) and sulfate (0.73 mg/L) were detected in method blank. Nitrate was not detected in the associated blanks.	AMEC U qualified the detected sulfate results from samples SHM-10-06A-070710-U and DUP-070710-U.	Low
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	None performed.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-070710-U was collected as the field duplicate of sample SHM-10-06A-070710-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-06A-070710-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples SHM-10-06A-070710-U and DUP-070710-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.	None	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

August 13, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**

Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia, nitrite, and sulfide were not detected in the associated blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite and 75%-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-06A-070710-U was analyzed in duplicate for ammonia, sulfide, and nitrite. RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-070710-U was collected as the field duplicate of sample SHM-10-06A-070710-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite) and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-06A-070710-U for ammonia, sulfide, and nitrite. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon by SM 5310C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H_2SO4 to pH<2	Samples were analyzed as per EPA Method requirements		
Initial Calibration	$r \geq 0.995$ for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD was not detected in associated blanks. TOC (0.03 mg/L) was detected in method blank.	TOC concentrations in the associated samples were greater than 10 times the method blank concentration. Qualification is not warranted.	None
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	TOC was detected in CCB (07/14/10 at 16:54) at 0.034 mg/L.	TOC concentrations in the associated samples were greater than 10 times the CCB concentration. Qualification is not warranted.	None
LCS	No qualification if recovery between 95-105% for COD and 90%-110% for TOC	LCS recovery was within acceptance criteria.		

Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	20% ≤RPD, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-06A-070710-U was analyzed in duplicate by the laboratory. The RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-070710-U was collected as the field duplicate of sample SHM-10-06A-070710-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-06A-070710-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample SHM-10-06A-070710-U was detected and reported between the LOD and the LOQ. This result was J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

August 13, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**
Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks. TDS was detected in method blank at a concentration of 6 mg/L.		
LCS	No qualification if recovery between 72-121%; RPD<4%	LCS recovery was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-06A-070710-U was analyzed in duplicate by the laboratory for TDS. The RPD was within acceptance criteria.		
Field Duplicates	RPD < 30% when detects for both duplicates are ≥QL for water	Sample DUP-070710-U was collected as the field duplicate of sample SHM-10-06A-070710-U. RPDs were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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August 12, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet

Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B /4500S2-AD/5310C/2540D/2540C

Project: Shepley's Hill Landfill Supplemental Investigation

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 3 water samples (including 1 rinsate blank and 1 field duplicate) collected on July 8, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on July 9, 2010 and assigned sample delivery group (SDG) number L1010331 upon receipt. Alpha analyzed the samples for total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A, total alkalinity using SM 2320B, chloride, sulfate, and nitrate using USEPA Method 300.0, chemical oxygen demand (COD) using USEPA Method 410.4, ammonia using standard method (SM) 4500NH3-BH, sulfide using SM 4500S2-AD, total organic carbon using SM 5310C, total suspended solids (TSS) using SM 2540D, total dissolved solids (TDS) using SM 2540C, total hardness using EPA 6010B, and nitrite using SM 4500NO2-B. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, ir EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1010331-01/03	7/8/2010	SHM-10-06-070810-U/F	
L1010331-02/04	7/8/2010	DUP-070810-U/F	Field Duplicate of SHM-10-06-070810-U/F
L1010331-05	7/8/2010	RB-070810-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 7/9/2010 at temperatures of 2.6 and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1010331

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Coolers temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration, r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points. not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery. J qualify detects and UJ qualify non-detects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non-detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects; UJ qualify non-detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Aluminum (2.5 µg/L), arsenic (0.13 µg/L), calcium (23µg/L), chromium (0.2 µg/L), and lead (0.09 µg/L) were detected in the rinsate RB-070810-U associated with the analysis of samples from this SDG. Dissolved calcium (19.7 µg/L) and dissolved iron (9.35 µg/L) were detected in method blank. Total aluminum (2.51 µg/L), total calcium (21.2 µg/L), total iron (12 µg/L), and total potassium (20.1 µg/L) were detected in method blank.	Dissolved aluminum and dissolved chromium in samples SHM-10-06-070810-F and DUP-070810-F should be U qualified. The concentrations of the remaining metals were greater than 10x the blank concentrations. Qualification is not warranted.	None
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample. U qualify detects 4) Sample results >10x blank level, no action required.	Arsenic (0.14 µg/L) was detected in CCB3 (07/12/10 at 23:27). Dissolved calcium (42.24 µg/L) was detected in ICB (07/14/20 at 18:48). Dissolved arsenic (0.19 µg/L) was detected in CCB3 (07/14/10 at 22:25).	The concentrations in the associated samples were greater than 10x the blank concentrations. Qualification is not warranted.	None
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10× the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		

August 12, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B

Project: Shepley's Hill Landfill Supplemental Investigation /4500S2-AD/5310C/2540D/2540C

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-070810-U/F was collected as the field duplicate of sample SHM-10-06-070810-U/F. The RPD for total lead was high at 62%.	AMEC J qualified the detected total lead results from samples DUP-070810-U and SHM-10-06-070810-U because of the imprecision.	Non-Directional
Laboratory Duplicate RPD	RPD ≤ 20% a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects.	No anomalies		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Total arsenic (167%/125%). total calcium (132% MS). total iron (900%/500%) recoveries in the MS/MSD performed on sample SHM-10-06-070810-U were outside the QAPP specified limits. Dissolved arsenic (75%/8%). dissolved calcium (77% MSD). dissolved iron (0% MSD) recoveries in the MS/MSD performed on sample SHM-10-06-070810-F were outside the QAPP specified limits.	Total arsenic (2210 µg/L). total calcium (40900 µg/L). and total iron (130,000 µg/L) concentrations in sample SHM-10-06-070810-U were more than 4 times the spike concentrations of 120. 10.000 and 1.000 µg/L. respectively. Therefore. data usability is not adversely affected. Dissolved arsenic (1680 µg/L), dissolved calcium (41000 µg/L). and dissolved iron (117.000 µg/L) concentrations in sample SHM-10-06-070810-F were more than 4 times the spike concentrations of 120. 10.000 and 1.000 µg/L. respectively. Therefore. data usability is not adversely affected.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	No anomalies		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ. The affected samples and analytes are: SHM-10-06-070810-U/F Total arsenic Total iron Total lead Dissolved aluminum Dissolved arsenic Dissolved calcium Dissolved chromium DUP-070810-F Dissolved aluminum Dissolved chromium RB-070810-U Dissolved aluminum Dissolved arsenic Dissolved calcium Dissolved chromium Dissolved lead	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	The laboratory diluted samples SHM-10-06-070810-U and DUP-070810-U because of high concentration of non-target analytes. Total metal detection limits were elevated in these samples and requested reporting limits were not achieved.	None	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity (0.03 mg/L) was detected in method blank.	Alkalinity concentrations in the associated samples were greater than 10x the blank concentrations. Qualification is not warranted.	
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-070810-U was collected as the field duplicate of sample SHM-10-06-070810-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	An MS was performed on sample SHM-10-06-070810-U. The recovery was low at 30%.	AMEC J qualified the detected alkalinity results from samples SHM-10-06-070810-U and DUP-070810-U	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the method reporting limit of 2.0 mg/L.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.00

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements for chloride, sulfate and nitrate.		
Initial Calibration	1) $r \geq 0.99$ for chloride, sulfate and nitrate, linear calibration Analytes with low $r < 0.99$ flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

August 12, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**
Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate (0.19 mg/L) was detected in method blank.	AMEC U qualified the detected sulfate results from samples SHM-10-06-070810-U and DUP-070810-U.	High
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	Sample SHM-10-06-070810-U was analyzed in duplicate. The chloride RPD was above acceptance limits.	AMEC J qualified the detected chloride results from samples SHM-10-06-070810-U and DUP-070810-U due to the imprecision.	Non-Directional
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-070810-U was collected as the field duplicate of sample SHM-10-06-070810-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Quality only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-06-070810-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate and sulfate results from samples SHM-10-06-070810-U and DUP-070810-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO3-F/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		

August 12, 2010

Total and Dissolved Metals by USEPA Method 6020A
Total Hardness by USEPA 6010B

Region I Data Review Worksheet **Other Inorganics by USEPA 2320B/300.0/410.4 and SM 4500NH3-BH/4500NO2-B**
Project: Shepley's Hill Landfill Supplemental Investigation **/4500S2-AD/5310C/2540D/2540C**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Ammonia, nitrite, or sulfide were not detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-06-070810-U was analyzed in duplicate for ammonia, nitrite and sulfide. RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-070810-U was collected as the field duplicate of sample SHM-10-06-070810-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite) and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-06-070810-U for ammonia, nitrite and sulfide. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon by SM 5310C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H_2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 80-120% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD or TOC were not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	TOC was detected in CCB (07/14/10 at 16:54) at 0.034 mg/L.	TOC concentrations in the associated samples were greater than 10 times the CCB concentration. Qualification is not warranted.	None
LCS	No qualification if recovery between 95-105% for COD and 90-110% for TOC	LCS recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	20% ≤RPD. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-06-070810-U was analyzed in duplicate for COD and TOC by the laboratory. The RPD was high at 22% for COD.	AMEC J qualified the detected COD results from samples SHM-10-06-070810-U and DUP-070810-U.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-070810-U was collected as the field duplicate of sample SHM-10-06-070810-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-06-070810-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TSS or TDS were not detected in associated method blanks.		
LCS	No qualification if recovery between 72-121%; RPD 4%	LCS recovery was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-06-070810-U was analyzed in duplicate by the laboratory for TDS. The RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-070810-U was collected as the field duplicate of sample SHM-10-06-070810-U. RPDs were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No anomalies		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies		

If you have any questions or comments regarding this report, please contact the undersigned at (503) 639-3400.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on July 13, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off at Alpha Analytical Laboratory in Westborough, MA (Alpha) on July 13, 2010 by Sovereign Consulting and assigned sample delivery group (SDG) number L1010527 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; hardness by USEPA Method 6010B; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total organic carbon (TOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1010527-01/02	7/13/2010	SHM-10-01-071310-U/F	MS/MSD
L1010527-03/04	7/13/2010	SHM-10-10-071310-U/F	
L1010527-05/06	7/13/2010	DUP-071310-U/F	Field Duplicate of SHM-10-10-071310-U/F
L1010527-07	7/13/2010	RB-071310-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 07/13/2010 at temperatures of 5.2°C and 5.5°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1010527

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total aluminum (3.12 µg/L), total calcium (18.4 µg/L), total iron (11.2 µg/L), and total potassium (18.5 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved aluminum (2.55 µg/L), dissolved calcium (18.6 µg/L), dissolved iron (12.5 µg/L), and dissolved potassium (20.6 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total Aluminum (2.6 µg/L), total chromium (0.29 µg/L), and total lead (0.06 µg/L) were detected in rinsate RB-071310-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified total aluminum from samples DUP-071310-U, SHM-10-01-071310-U and SHM-10-10-071310-U; total iron from samples SHM-10-10-071310-U and DUP-071310-U; dissolved iron from samples DUP-071310-F, SHM-10-01-071310-F and SHM-10-10-071310-F with a B (contamination in the method blank) reason code. AMEC U qualified the total lead from sample SHM-10-01-071310-U with an F (contamination in the equipment rinsate blank) reason code. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	High

October 15, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/6010B
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
4500S2-AD/5310C/2320B/2540C/D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters): ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-071310-U/F was collected as the field duplicate of sample SHM-10-10-071310-U/F. RPDs were within acceptance criteria. except for total arsenic. Both total arsenic results were below the LOQ.	No qualification warranted.	None
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total manganese (140%MSD) recovery in the MS/MSD performed on sample SHM-10-01-071310-U was outside the QAPP specified limits. The RPD for total manganese (33%) between MS and MSD performed on sample SHM-10-01-071310-U was above acceptance criteria.	The background concentration, outside the QAPP-specified limit, was more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total arsenic (126%) and dissolved aluminum (0%) on sample SHM-10-01-071310-U/F	AMEC J qualified the detected total arsenic result and UJ qualified the non-detect dissolved aluminum result from sample SHM-10-01-071310-U/F with a P (PDS recovery not within control limits) reason code.	High/Low
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-01-071310-U/F, SHM-10-10-071310-U/F and DUP-071310-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

October 15, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B

Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/

Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D

Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-071310-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071310-U was collected as the field duplicate of sample SHM-10-10-071310-U. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-00-071310-U.. Recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Sulfate at a concentration of 0.22 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	AMEC U qualified the detected sulfate from samples DUP-071310-U and SHM-10-10-071310-U.	High
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The lab duplicate was performed on sample SHM-10-01-071310-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-071310-U was collected as the field duplicate of sample SHM-10-10-071310-U. RPDs were within acceptance criteria except for sulfate; however both results were below LOQ.	No qualification warranted.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-01-071310-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The sulfate results from samples SHM-10-10-071310-U and DUP-071310-U were detected and reported between the LOD and the LOQ.	AMEC previously U qualified these results due to blank contamination.	None
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

October 15, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/6010B
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540C/D

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-01-071301-U was analyzed in duplicate for ammonia, nitrite and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-071310-U was collected as the field duplicate of sample SHM-10-10-071310-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide) 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample SHM-10-01-071310-U. The recoveries were within acceptance criteria, except for sulfide which recovered low at 58% in the MS.	AMEC UJ qualified the non-detected results for sulfide from sample SHM-10-01-071310-U with a Q (MS recovery was not within control limits) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon (TOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "J" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was detected in the method blank at a concentration of 0.06 mg/L.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-071310-U was analyzed in duplicate by the laboratory. RPDs were either not calculable or within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071310-U was collected as the field duplicate of sample SHM-10-10-071310-U. COD RPD elevated at 32%	AMEC J qualified the COD from samples DUP-071310-U and SHM-10-10-071310-U with an E reason code (duplicates showed poor agreement).	Non-Directional

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-01-071310-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the COD result in sample SHM-10-01-071310-U that was detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies		

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		

October 15, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TDS and TSS were not detected in associated method blanks.		
LCS	No qualification if recovery between 72-121%; RPD<4%	LCS recovery for TDS was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-071310-U was analyzed in duplicate by the laboratory for TDS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071310-U was collected as the field duplicate of sample SHM-10-10-071310-U. RPDs were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TDS and TSS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on July 14, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off at Alpha Analytical Laboratory in Westborough, MA (Alpha) on July 15, 2010 by Sovereign Consulting and assigned sample delivery group (SDG) number L1010647 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; hardness by USEPA Method 6010B; total alkalinity using Standard Method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total organic carbon (TOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1010647-01/02	7/14/2010	SHM-10-04-071410-U/F	MS/MSD
L1010647-03/04	7/14/2010	SHM-10-03-071410-F/U	
L1010647-05/06	7/14/2010	DUP-071410-U/F	Field Duplicate of SHM-10-03-071410-F/U
L1010647-07	7/14/2010	RB-071410-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 07/15/2010 at temperatures of 2.1°C and 2.5°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1010647

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total aluminum (2.31 µg/L) and total calcium (27.2 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved calcium (15 µg/L) and dissolved lead (0.05 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total calcium (18.7 µg/L), total chromium (0.28 µg/L), and total manganese (0.2 µg/L) were detected in rinsate RB-071410-U.	AMEC U qualified the detected dissolved lead from sample SHM-10-03-071410-F with a B (contamination in the method blank) reason code. AMEC U qualified the detected dissolved chromium from sample SHM-10-04-071410-F with an F (contamination in the equipment rinsate blank) reason code. All other associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-071410-U/F was collected as the field duplicate of sample SHM-10-03-071410-F/U. RPDs were within acceptance criteria, except for dissolved arsenic, dissolved lead, total aluminum, total arsenic, total chromium and total iron. Both dissolved arsenic results were below the LOQ. One dissolved lead result was less than the LOQ and the other was just over the LOQ – no qualification	AMEC J qualified the total aluminum, total arsenic, total chromium and total iron from samples DUP-071410-U and SHM-10-03-071410-U with an E reason code (duplicates showed poor agreement).	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total calcium (147%, 181%), total iron (126%MSD), total manganese (130%/156%) and total sodium (123%/136%) recoveries in the MS/MSD performed on sample SHM-10-04-071410-U were outside the QAPP specified limits. Dissolved calcium (147%/158%), dissolved iron (122%MSD), and dissolved manganese (130%/148%) recoveries in the MS/MSD performed on sample SHM-10-04-071410-F were outside QAPP-specified limits. The RPDs for total calcium (21%) and total iron (25%) between MS and MSD performed on sample SHM-10-04-071410-U were above acceptance criteria.	The background concentrations of all analytes, except total iron and total sodium, are outside QAPP-specified limits were more than 4x the spike concentration. AMEC J qualified the total iron and total sodium results from sample SHM-10-04-071410-U with a Q (MS/MSD recovery not within control) reason code. AMEC J qualified the detected results for total iron from samples SHM-10-04-071410-U with a Q (RPD was not within control limits) reason code.	High

October 15, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/6010B
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540C/D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total magnesium (180%) and dissolved aluminum (0%) on sample SHM-10-04-071410-U/F.	The background concentration of total magnesium was >4x so no qualifications are necessary. AMEC J qualified the detected result for dissolved aluminum from sample SHM-10-04-071410-F with a P (PDS recovery not within control limits) reason code.	Low
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were with acceptance criteria expect for - total magnesium (11%)	AMEC J qualified the detected total magnesium from sample SHM-10-04-071410-U with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-03-071410-U/F and DUP-071410-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "J" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-04-071410-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071410-U was collected as the field duplicate of sample SHM-10-03-071410-U. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-04-071410-U. % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfate at a concentration of 0.21 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank result.	None
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%.	Sample SHM-10-04-071410-U was used as the laboratory duplicate. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-071410-U was collected as the field duplicate of sample SHM-10-03-071410-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-04-071410-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-04-071410-U, SHM-10-03-071410-U and DUP-071410-U have elevated detection limits for chloride and/or nitrate due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-04-071401-U was analyzed in duplicate for ammonia, nitrite and sulfide. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-071410-U was collected as the field duplicate of sample SHM-10-03-071410-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample SHM-10-04-071410-U. The recoveries were within acceptance criteria, except for sulfide which recovered low at 58%.	AMEC UJ qualified the sulfide result from sample SHM-10-04-071410-U with a Q (MS/MSD recovery not within control) reason code.	Low

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified ammonia results from samples SHM-10-04-071410-U, SHM-10-03-071410-U and DUP-071401-U which were detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon (TOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TOC at a concentration of 0.06 mg/L was detected in the method blank associated with the analysis of samples from this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank result.	None
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-04-071410-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071410-U was collected as the field duplicate of sample SHM-10-03-071410-U. The % RPD for COD was outside acceptance criteria.	AMEC J qualified the COD results from samples DUP-071410-U and SHM-10-03-071410-U with an E reason code (duplicates showed poor agreement).	Non-directional
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-04-071410-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified COD results from sample SHM-10-04-071410-U, which was detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

October 15, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B
Region 1 Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region 1 Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TDS and TSS were not detected in associated method blanks.		
LCS	No qualification if recovery between 72-121%; RPD<4%	LCS recovery for TDS was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-04-071410-U was analyzed in duplicate by the laboratory for TDS and TSS. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071410-U was collected as the field duplicate of sample SHM-10-03-071410-U. TSS RPD was high at 49%.	AMEC J qualified the detected TSS result from samples DUP-071410-U and SHM-10-03-071410-U with an E (poor agreement between duplicates) reason code.	Non-Directional
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TDS and TSS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on July 15, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off at Alpha Analytical Laboratory in Westborough, MA (Alpha) on July 15, 2010 by Sovereign Consulting and assigned sample delivery group (SDG) number L1010677 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; hardness by USEPA Method 6010B; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total organic carbon (TOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1010677-01/02	7/15/2010	SHM-10-05A-071510-U/F	
L1010677-03/04	7/15/2010	SHM-10-08-071510-U/F	MS/MSD
L1010677-05/06	7/15/2010	SHM-10-02-071510-U/F	
L1010677-07/08	7/15/2010	DUP-071510-U/F	Field Duplicate of SHM-10-02-071510-U/F
L1010677-09	7/15/2010	RB-071510-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 07/15/2010 at temperatures of 4.8°C and 5.3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1010677

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and Hardness by USEPA 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total aluminum (2.31 µg/L) and total calcium (27.2 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved calcium (15 µg/L) and dissolved lead (0.05 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (3.59 µg/L), total calcium (60.3 µg/L), total chromium (0.21 µg/L), total iron (16.5 µg/L), and total manganese (0.21 µg/L) were detected in rinsate RB-071510-U.	The associated sample concentrations were more than 10 times the blank concentrations; with the following exceptions: AMEC U qualified the dissolved lead from samples from DUP-0715-F, SHM-10-02-071510-F, and SHM-10-05A-071510-F with a B (contamination in the method blank) reason code. AMEC U qualified the dissolved aluminum from DUP-0715-F, SHM-10-02-071510-F; total and dissolved aluminum from SHM-10-05A-071510-U/F; the total and dissolved chromium from DUP-0715-U/F, SHM-10-02-071510-U/F, and SHM-10-05A-071510-U/F with an F (contamination in the equipment rinsate blank) reason code. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-071510-U/F was collected as the field duplicate of sample SHM-10-02-071510-U/F. RPDs were within acceptance criteria.		
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries ≥120% flag detected results "J" 4) RPD ≤ 20%	Total calcium (130%MS) recovery in the MS/MSD performed on sample SHM-10-08-071510-U was outside the QAPP specified limits. Dissolved calcium (230%/270%), dissolved iron (121%MSD), dissolved manganese (123%/125%), dissolved magnesium (125%MSD), and dissolved sodium (121%MSD) recoveries in the MS/MSD performed on sample SHM-10-08-071510-F were outside QAPP-specified limits. The RPD for total sodium (25%) between MS and MSD performed on sample SHM-10-08-071510-U was above acceptance criteria.	The background concentrations of all analytes, except those listed below, are outside QAPP-specified limits were more than 4x the spike concentration. AMEC J qualified the dissolved iron, dissolved magnesium, and dissolved manganese results from sample SHM-10-08-071510-F with a Q (MS/MSD recovery not within control) reason code. AMEC J qualified the detected total sodium from sample SHM-10-08-071510-U with a Q (RPD was not within control limits) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits except for dissolved aluminum (132%), dissolved magnesium (180%), and dissolved manganese (530%) on sample SHM-10-08-071510-F.	The background concentrations of magnesium and manganese were more than 4x the spike concentration and aluminum was not detected.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits except for: dissolved manganese (11%).	AMEC J qualified the detected dissolved manganese results from samples SHM-10-08-071510-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-08-071510-U/F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-08-071510-U was analyzed in duplicate for total alkalinity. The RPD was within acceptance criteria.		
Field Duplicates	RPD ≥ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071510-U was collected as the field duplicate of sample SHM-10-02-071510-U. The RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-08-071510-U. The % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Chloride, nitrate and sulfate were not detected in method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-071510-U was collected as the field duplicate of sample SHM-10-02-071510-U. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-08-071510-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-08-071510-U, SHM-10-02-071510-U, and DUP-071510-U have elevated detection limits for chloride due to the dilutions required by the high concentrations of the analyte. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		

October 18, 2010 — Total and Dissolved Metals by USEPA Method 6020A/6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-08-071501-U was analyzed in duplicate for ammonia, nitrite and sulfide. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-071510-U was collected as the field duplicate of sample SHM-10-02-071510-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample SHM-10-08-071510-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Nitrite and ammonia were reported between the LOD and LOQ in sample SHM-10-05A-071510-U.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total Organic Carbon (TOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TOC was detected at 0.06 mg/L in the method blank.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-08-071510-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071510-U was collected as the field duplicate of sample SHM-10-02-071510-U. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-08-071510-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and TOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D and Total Dissolved Solids (TDS) by SM2540C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		

October 18, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/6010B
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
4500S2-AD/5310C/2320B/2540C/D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TDS and TSS were not detected in associated method blanks.		
LCS	No qualification if recovery between 72-121%; RPD<4%	LCS recovery for TDS was within acceptance criteria.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Samples from other SDGs were used as the source of the laboratory duplicate. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-071510-U was collected as the field duplicate of sample SHM-10-02-071510-U. TSS was detected in DUP-071510-U but was ND in SHM-10-02-071510-U so the RPD was not calculable.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TDS and TSS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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REVIEWED BY:

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Environmental Chemist

October 20, 2010 Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet Other Inorganics by SM 5310C/2540D
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 2, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 2, 2010 and assigned sample delivery group (SDG) number L1011707 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; dissolved organic carbon (DOC) using Standard Method (SM) 5310C; and, total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 5. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1011707-01/02	08/02/2010	GP-10-17-009-F/U	MS/MSD
L1011707-03/04	08/02/2010	GP-10-17-019-F/U	
L1011707-05/06	08/02/2010	GP-10-17-029-F/U	
L1011707-07/08	08/02/2010	DUP-080210-F/U	Field Duplicate of GP-10-17-019-F/U
L1011707-09	08/02/2010	RB-080210-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 08/02/2010 at a temperature of 2.0°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1011707

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total iron was detected in RB-080210-U at a concentration of 15.2 µg/L.	All associated sample concentrations were more than 10 times the blank concentration; therefore, data usability is not adversely affected.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-080210-U/F was collected as the field duplicate of sample GP-10-17-019-U/F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total iron (125%/121%) recoveries in the MS/MSD performed on sample GP-10-17-009-U were outside the QAPP specified limits.	AMEC J qualified the total iron result from sample GP-10-17-009-U with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code. unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and < LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	DOC was not detected in associated method blank.		
LCS	No qualification if recovery between 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-17-009-U was analyzed in duplicate by the laboratory. The RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-080210-U was collected as the field duplicate of sample GP-10-17-019-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-17-009-U. The recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

Table 5. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TSS was not detected in associated method blank.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-17-009-U was analyzed in duplicate by the laboratory for TSS. RPD was elevated at 93%.	AMEC J qualified the detected TSS from sample GP-10-17-009-U with an E (poor agreement between duplicates) reason code.	Non-Directional

October 20, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A
Other Inorganics by SM 5310C/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-080210-U was collected as the field duplicate of sample GP-10-17-019-U. TSS RPD was high at 119%.	AMEC J qualified the detected TSS result from samples GP-10-17-019-U and its field duplicate DUP-080210-U with an F (poor agreement between duplicates) reason code.	Non-Directional
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

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Environmental Chemist

REVIEWED BY:

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Environmental Chemist

October 20, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 3, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 3, 2010 by Sovereign Consulting and assigned sample delivery group (SDG) number L1011792 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; total alkalinity using Standard Method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1011792-01/02	08/03/2010	GP-10-11-039-F/U	MS/MSD
L1011792-03/04	08/03/2010	GP-10-11-049-F/U	
L1011792-05/06	08/03/2010	DUP3-080310-F/U	Field Duplicate of GP-10-11-049-F/U
L1011792-07	08/03/2010	RB2-080310-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 08/03/2010 at a temperature of 3°C	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1011792

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total aluminum (2.91 µg/L) and total iron (9.87 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (4.07 µg/L), total arsenic (0.17 µg/L), total calcium (19 µg/L), total chromium (0.22 µg/L), total iron (9.89 µg/L) and total manganese (0.47 µg/L) were detected in rinsate RB2-080310-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS/LCSD recoveries were within acceptance limits.		

October 20, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP3-080310-U/F was collected as the field duplicate of sample GP-10-11-049-U/F. RPDs were within acceptance criteria, except for total magnesium which had an RPD of 31%.	AMEC J qualified the detected total magnesium result from samples GP-10-11-049-U and DUP3-080310-U with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total iron (20%/40) recoveries in the MS/MSD performed on sample GP-10-11-039-U were outside the QAPP specified limits. Dissolved iron (200%10%) recoveries in the MS/MSD performed on sample GP-10-11-039-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code. unless they were previously U qualified due to blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-11-039-U/F, GP-10-11-049-U/F and DUP3-080310-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-11-039-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-11-039-U. % Recovery was low at 54%.	AMEC J qualified the detected total alkalinity result from sample GP-10-11-039-U with a Q (MS recovery not within control) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

October 20, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements, except for nitrate in sample GP-10-11-039-U.	AMEC J qualified the detected nitrate result from sample GP-10-11-039-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Analytes were not detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%. 2) Nitrate RPD <15%. 3) Sulfate RPD <20%	Sample GP-10-11-039-U was analyzed in duplicate by the lab. RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-11-039-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GP-10-11-039-U and GP-10-11-049-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in the method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-11-039-U was analyzed in duplicate for ammonia, nitrite, and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-11-039-U. The recoveries were within acceptance criteria, except for sulfide which recovered low at 71%.	AMEC UJ qualified the non-detect sulfide result from sample GP-10-11-039-U with a Q (MS recovery not within control limits) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-11-039-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for these analyses.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS for COD was performed on sample GP-10-11-039-U and the MS for DOC was performed on sample GP-10-11-049-U. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

October 20, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blank.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-11-049-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-11-049-U has an elevated detection limit due to the dilutions required. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

INTRODUCTION

This data validation report covers 13 water samples (including 1 rinsate blank and 2 field duplicates) collected on August 2-3, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 3, 2010 by Sovereign Consulting and assigned sample delivery group (SDG) number L1011805 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; dissolved organic carbon (DOC) using Standard Method (SM) 5310C; and, total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 5. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1011805-01/02	08/02/2010	GP-10-17-039-F/U	
L1011805-03/04	08/02/2010	GP-10-17-049-F/U	
L1011805-05/06	08/02/2010	GP-10-17-056-F/U	
L1011805-07/08	08/02/2010	GP-10-18-007-F/U	
L1011805-09/10	08/03/2010	GP-10-18-017-F/U	
L1011805-11/12	08/03/2010	GP-10-18-027-F/U	
L1011805-13/14	08/03/2010	GP-10-18-037-F/U	MS/MSD
L1011805-15/16	08/03/2010	GP-10-18-047-F/U	
L1011805-17/18	08/03/2010	GP-10-19-009-F/U	
L1011805-19/20	08/03/2010	GP-10-19-019-F/U	
L1011805-21/22	08/03/2010	DUP-080310-F/U	Field Duplicate of GP-10-18-027-F/U (Metals Only)
L1011805-23/24	08/03/2010	DUP2-080310-F/U	Field Duplicate of GP-10-19-009-F/U (Metals Only)
L1011805-25	08/03/2010	RB-080310-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 08/03/2010 at temperatures of 2.2°C and 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1011805

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total iron (9.87 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Total iron (13.3 µg/L) was detected in rinsate RB-080310-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	None

October 21, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by SM 5310C/2540D
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-080310-U/F was collected as the field duplicate of sample GP-10-18-027-U/F. Sample DUP2-080310-U/F was collected as the field duplicate of sample GP-10-19-009-U/F. RPDs were within acceptance criteria.		
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total iron (0%/40%) recoveries in the MS/MSD performed on sample GP-10-18-037-U were outside the QAPP specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	A PDS was not performed, since all MS recoveries with background concentrations <4x the spike concentration, were within criteria.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-17-039-U/F, GP-10-17-049-U/F, GP-10-17-056-U/F, GP-10-18-017-U/F, GP-10-18-027-U/F, GP-10-18-037-U/F, GP-10-18-047-U/F, and DUP-080310-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

October 21, 2010 — **Total and Dissolved Metals by USEPA Method 6020A**
Region I Data Review Worksheet — **Other Inorganics by SM 5310C/2540D**
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per Standard Method requirements. Samples GP-10-17-039-U, GP-10-17-049-U, GP-10-17-056-U, and GP-10-18-007-U were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-17-039-U, GP-10-17-049-U, GP-10-17-056-U, and GP-10-18-007-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	DOC was not detected in associated method blanks. A filter blank was initially prepared but the batch required re-analysis and insufficient volume remained for the re-analysis.	No qualification warranted.	None
LCS	No qualification if recovery between 90-110%.	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	A sample from a different SDG was analyzed in duplicate.	No qualifications are necessary.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG. The recoveries were within acceptance criteria.	No qualifications are necessary.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	DOC results were reported as detected above the LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blank.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-18-037-U was analyzed in duplicate by the laboratory for TSS. RPD was outside acceptance criteria at 40%.	AMEC J qualified the detected TSS result from sample GP-10-18-037-U with an E (duplicate showed poor agreement) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		

October 21, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A
Other Inorganics by SM 5310C/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

October 21, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 15 water samples (including 2 rinsate blanks and 2 field duplicates) collected on August 3-4, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 4, 2010 and assigned sample delivery group (SDG) number L1011870 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1011870-01/02	08/03/2010	GP-10-19-029-F/U	
L1011870-03/04	08/03/2010	GP-10-19-039-F/U	
L1011870-05/06	08/03/2010	GP-10-19-046-F/U	
L1011870-07/08	08/04/2010	GP-10-20-009-F/U	MS/MSD
L1011870-09/10	08/04/2010	GP-10-20-019-F/U	
L1011870-11/12	08/03/2010	GP-10-11-059-F/U	
L1011870-13/14	08/04/2010	GP-10-11-064-F/U	MS/MSD
L1011870-15/16	08/04/2010	GP-10-20-029-F/U	
L1011870-17/18	08/04/2010	GP-10-20-039-F/U	
L1011870-19/20	08/04/2010	GP-10-21-011-F/U	
L1011870-21/22	08/04/2010	DUP-080410-F/U	Field Duplicate of GP-10-20-019-F/U (Metals only)
L1011870-23	08/04/2010	RB-080410-U	Rinsate Blank
L1011870-24	08/04/2010	RB2-080410-U	Rinsate Blank
L1011870-25/26	08/04/2010	DUP2-080410-F/U	Field Duplicate of GP-10-21-021-F/U (Metals only)
L1011870-27/28	08/04/2010	GP-10-21-021-F/U	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 08/04/2010 at temperatures of 4.8°C, 4.8°C, 2°C and 2.3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1011870

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A/7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved aluminum (2.34 µg/L) and dissolved silver (0.830 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total iron (12.7 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Total and dissolved calcium (both 18.8 µg/L) and total and dissolved iron (both 11.5 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved mercury (0.03447 µg/L and 0.1159 µg/L) were detected in the method blanks associated with the analysis of samples from this SDG. Total iron (10.6 µg/L) was detected in rinsate RB-080410-U. Total aluminum (2.47 µg/L), total calcium (49.6 µg/L), total chromium (0.27 µg/L), total iron (11.3 µg/L), and total manganese (0.18 µg/L) were detected in the rinsate RB2-080410-U.	The associated sample concentrations were either not detected or were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the detected dissolved aluminum from samples GP-10-20-019-F and DUP-080410-F with a B (detected in method blank) reason code. AMEC U qualified the detected dissolved mercury from samples GP-10-11-059-F and GP-10-11-064-F with a B (detected in method blank) reason code. Rinsate Blanks have not been qualified due to method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-080410-U/F was collected as the field duplicate of sample GP-10-20-019-U/F. Sample DUP2-080410-U/F was collected as the field duplicate of sample GP-10-21-021-U/F. RPDs were within acceptance criteria, except for total and dissolved lead. Lead results were either non-detect or below the LOQ. The RPD for dissolved arsenic in samples GP-10-20-019-F and DUP-080410-F was elevated at 43%.	AMEC J qualified the detected dissolved arsenic results from samples GP-10-20-019-F and DUP-080410-F with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Dissolved sodium (122%MSD) recovery in the MS/MSD performed on sample GP-10-11-064-F was outside the QAPP specified limits. Total aluminum (0%/0%), total calcium (0%/20%), total chromium (73%/71%), total iron (0%/0%), total magnesium (77%MS), total manganese (28%/26%), and total potassium (79%MS) recoveries in the MS/MSD performed on sample GP-10-11-064-U were outside QAPP-specified limits. Total sodium (150%MS) recovery in the MS/MSD performed on sample DUP2-080410-U was outside the QAPP specified limits. Dissolved calcium (123%MS), dissolved manganese (76%MSD), and dissolved sodium (0%MSD) recovery in the MS/MSD performed on sample GP-10-21-021-F was outside the QAPP specified limits. Dissolved mercury (128%/128%) recovery in the MS/MSD performed on sample GP-10-11-064-F was outside the QAPP specified limits. Dissolved mercury (130%/129%) recovery in the MS/MSD performed on sample DUP-080410-F was outside the QAPP specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were either more than 4x the spike concentration or not detected, with the following exceptions: AMEC J qualified the total chromium and total magnesium results from sample GP-10-11-064-U with a Q (MS/MSD recovery not within control) reason code. AMEC J qualified the detected dissolved calcium and dissolved manganese from samples GP-10-21-021-F with a Q (MS/MSD recovery not within control) reason code.	Low/High

October 21, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for dissolved aluminum (70%) and dissolved zinc (161%) on sample GP-10-11-064-F.	AMEC J qualified the detected results for these metals from sample GP-10-11-064-F with a P (PDS recovery not within control limits) reason code.	Low/High
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits with the following exceptions: dissolved barium (25%), dissolved calcium (32%), dissolved iron (30%), dissolved magnesium (31%), dissolved manganese (32%), dissolved potassium (28%), and dissolved sodium (28%).	AMEC J qualified the detected dissolved barium, calcium, iron, magnesium, manganese, potassium and sodium results from sample GP-10-11-064-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-19-029-U/F, GP-10-19-039-U/F, GP-10-19-046-U/F, GP-10-20-019-U, GP-10-11-059-U/F, GP-10-11-064-U, GP-10-20-029-U/F, GP-10-20-039-U/F, DUP-080410-U, DUP2-080410-F/U, and GP-10-21-021-U/F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is < 10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	A sample from a different SDG was utilized as the lab duplicate.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG.	No qualifications are warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		

October 21, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region 1 Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Chloride, nitrate, and sulfate were not detected in method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The lab performed duplicate analysis on sample GP-10-11-064-U. The RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-11-064-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results for samples GP-10-11-059-U and GP-10-11-064-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes were detected in the method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-11-064-U was analyzed in duplicate for ammonia, nitrite, and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on sample GP-10-11-064-U ammonia and sulfide. The MS for the nitrite analysis was performed on sample GP-10-11-059-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia result from sample GP-10-11-059-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements with the following exception. Samples GP-10-19-029-U, GP-10-19-039-U, GP-10-19-046-U, and GP-10-11-059-U for DOC analysis were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-19-029-U, GP-10-19-039-U, GP-10-19-046-U, and GP-10-11-059-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-20-019-U was analyzed in duplicate by the laboratory for DOC. The COD duplicate was performed on a sample from a different SDG. The RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample GP-10-20-009-U for DOC. The COD MS was performed on a sample from a different SDG. The recovery was within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

October 21, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-11-064-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-11-059-U and GP-10-11-064-U have elevated detection limits. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King
Environmental Chemist

REVIEWED BY:

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INTRODUCTION

This data validation report covers 15 water samples (including 2 rinsate blanks and 2 field duplicates) collected on August 4-5, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 5, 2010 and assigned sample delivery group (SDG) number L1011964 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1011964-01/02	08/04/2010	GP-10-21-031-F/U	
L1011964-03/04	08/04/2010	GP-10-21-041-F/U	
L1011964-05/06	08/04/2010	GP-10-21-051-F/U	
L1011964-07/08	08/04/2010	GP-10-21-060-F/U	
L1011964-09/10	08/05/2010	GP-10-23-017-F/U	
L1011964-11/12	08/05/2010	GP-10-23-027-F/U	MS/MSD
L1011964-13/14	08/05/2010	GP-10-23-037-F/U	
L1011964-15/16	08/05/2010	GP-10-23-047-F/U	
L1011964-17/18	08/05/2010	GP-10-12-044-F/U	
L1011964-19	08/05/2010	GP-10-12-054-F	
L1011964-20/21	08/05/2010	DUP-080510-F/U	Field Duplicate of GP-10-23-017-F/U (Metals Only)
L1011964-22/23	08/05/2010	DUP2-080510-F/U	Field Duplicate of GP-10-23-057-F/U (Metals Only)
L1011964-24	08/05/2010	RB-080510-U	Rinsate Blank
L1011964-25	08/05/2010	RB2-080510-U	Rinsate Blank
L1011964-26/27	08/05/2010	GP-10-23-057-F/U	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Three sample coolers were received on 08/05/2010 at temperatures of 3°C, 3.9°C, and 3.8°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1011964

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total calcium (12.7 µg/L), total iron (16.8 µg/L), total manganese (0.19 µg/L), and total sodium (18.3 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved iron (12 µg/L) and dissolved sodium (43.9 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved mercury (0.06857 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Total Arsenic (0.27 µg/L), total calcium (26.4 µg/L), total chromium (0.29 µg/L), total iron (15.5 µg/L), total manganese (0.2 µg/L), and total sodium (22.5 µg/L) were detected in rinsate RB-080510-U. Total aluminum (2.2 µg/L), total arsenic (0.13 µg/L), total calcium (40 µg/L), total chromium (0.39 µg/L), total iron (19.3 µg/L), total lead (0.11 µg/L), and total sodium (30.1 µg/L) were detected in rinsate RB2-080510-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions. AMEC U qualified the dissolved sodium result from sample GP-10-12-044-F with a B (detected in method blank) reason code. AMEC U qualified the dissolved mercury results from samples DUP-080510-F, DUP2-080510-F, GP-10-12-044-F, and GP-10-12-054-F with a B (detected in method blank) reason code. AMEC U qualified dissolved arsenic from samples DUP-080510-F, GP-10-23-017-F, GP-10-23-027-F, and GP-10-23-037-F and total arsenic from DUP-080510-U and GP-10-23-017-U with an F (detected in equipment rinsate blank) reason code. AMEC U qualified dissolved chromium from samples DUP-080510-F, DUP2-080510-F, and GP-10-23-017-F and total chromium from DUP-080510-U and GP-10-23-017-U with an F (detected in equipment rinsate blank) reason code. Rinsate blank samples have not been qualified due to method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-080510-U/F was collected as the field duplicate of sample GP-10-23-017-U/F. Sample DUP2-080510-U/F was collected as the field duplicate of sample GP-10-23-057-U/F. RPDs were within acceptance criteria, with the following exceptions: Sample GP-10-23-017-F and its field duplicate DUP-080510-F had an elevated RPD for dissolved arsenic at 115%. Sample GP-10-23-017-U and its field duplicate DUP-080510-U had elevated RPDs for total arsenic and total chromium at 95% and 33%, respectively. Sample GP-10-23-057-U and its field duplicate DUP2-080510-U had elevated RPDs for total aluminum and total chromium at 36% and 33%, respectively.	Sample GP-10-23-017-U and its field duplicate were previously U qualified due to Rinsate Blank contamination and have not been further qualified. AMEC J qualified the total aluminum and total chromium results from GP-10-23-057-U and DUP2-080510-U with an F (poor agreement between duplicates) reason code. The other detections were reported below the LOQ and qualifications are not warranted.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total sodium (0%/60%) recoveries in the MS/MSD performed on sample GP-10-23-027-U were outside the QAPP specified limits. Dissolved sodium (40%/50%) recoveries in the MS/MSD performed on sample GP-10-23-027-F were outside the QAPP specified limits. Dissolved mercury (132%MS) recovery in the MS/MSD performed on sample GP-10-12-054-F was outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration or the analytical results were previously U qualified due to method blank contamination and have not been further qualified.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits except for: dissolved calcium (11%) and dissolved sodium (13%).	AMEC J qualified the detected dissolved calcium and sodium results from sample GP-10-23-027-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code. unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	Samples GP-10-21-031-U/F, GP-10-21-041-U/F, GP-10-21-051-U/F, GP-10-21-060-U/F, GP-10-23-027-U/F, GP-10-23-047-U/F, GP-10-12-044-U/F, GP-10-12-054-F, DUP2-080510-U/F, and GP-10-23-057-U/F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and < LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	A sample from a different SDG was analyzed in duplicate.	No qualifications warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG.	No qualifications warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6° C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements except for nitrate in samples GP-10-12-044-F and GP-10-12-054-F. Due to instrument failure these samples were analyzed past holding time.	AMEC J qualified the nitrate results from samples GP-10-12-044-F and GP-10-12-054-F with an H (holding times were exceeded) reason code.	Low

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Nitrate, sulfate and chloride were not detected in the method blanks.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	Sample GP-10-12-044-F was analyzed in duplicate by the lab. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-12-044-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample GP-10-12-044-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-12-054-F was analyzed in duplicate for nitrite and sulfide and GP-10-12-044-F was analyzed in duplicate for ammonia. % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-12-054-F for sulfide and GP-10-12-044-F for nitrite and ammonia. Sulfide recovered low at 67%.	AMEC UJ qualified the non-detected sulfide result from sample GP-10-12-054-F with a Q (MS recovery was not within control limits) reason code.	Low

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements with the following exception. Samples GP-10-21-031-U, GP-10-21-041-U, GP-10-21-051-U, and GP-10-21-060-U for DOC analysis were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-21-031-U, GP-10-21-041-U, GP-10-21-051-U, and GP-10-21-060-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-23-027-U was analyzed in duplicate by the laboratory for DOC. The lab performed duplicate analysis for COD on a sample from a different SDG. RPDs were within acceptance criteria.	No qualifications warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS for DOC was performed on sample GP-10-23-017-U. The recovery was within acceptance criteria. The COD MS was performed on a sample from a different SDG.	No qualifications warranted.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample GP-10-12-044-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

October 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-12-044-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-12-044-U has an elevated detection limits due to required dilutions. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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REVIEWED BY:

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October 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 9 water samples (including 2 rinsate blanks and 1 field duplicate) collected on August 9, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 9, 2010 and assigned sample delivery group (SDG) number L1012165 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012165-01/02	08/09/2010	SHP-05-046B-F/U	
L1012165-03/04	08/09/2010	SHP-05-045A-F/U	
L1012165-05/06	08/09/2010	SHM-05-041B-F/U	MS/MSD
L1012165-07	08/09/2010	GP-10-12-065-F	
L1012165-08/09	08/09/2010	GP-10-13-039-F/U	
L1012165-10	08/09/2010	RB-080910-U	Rinsate Blank
L1012165-11/12	08/09/2010	GP-10-24-015-F/U	
L1012165-13/14	08/09/2010	DUP-080910-F/U	Field Duplicate of GP-10-24-015-F/U (Metals Only)
L1012165-15	08/09/2010	RB2-080910-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 08/09/2010 at temperatures of 3°C and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012165

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total aluminum (2.65 µg/L), total arsenic (0.2 µg/L), and total sodium (31.5 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved antimony (0.12 µg/L), dissolved calcium (32.9 µg/L), dissolved sodium (26.1 µg/L), and dissolved zinc (2.03 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (2.89 µg/L), total arsenic (0.36 µg/L), total calcium (25.6 µg/L), total lead (0.05 µg/L), total manganese (0.15 µg/L), and total sodium (23 µg/L) were detected in rinsate RB-080910-U. Total aluminum (2.41 µg/L), total arsenic (0.17 µg/L), total calcium (17.7 µg/L), and total chromium (0.25 µg/L) were detected in rinsate RB2-080910-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified total arsenic from DUP-080910-U and GP-10-24-015-U; dissolved antimony and dissolved zinc from GP-10-12-065-F and GP-10-13-039-F, and dissolved zinc from DUP-080910-F with a B (detected in method blank) reason code. AMEC U qualified dissolved aluminum from sample SHM-05-041B-F; dissolved aluminum from samples DUP-080910-F and GP-10-24-015-F; total and dissolved arsenic from sample DUP-080910-F/U and just dissolved arsenic from GP-10-24-015-F; and qualified total chromium from sample DUP-080910-U and GP-10-24-015-U with an F (detected in equipment rinsate blank) reason code. Rinsate blank samples have not been qualified due to method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-080910-U/F was collected as the field duplicate of sample GP-10-24-015-U/F. RPDs were within acceptance criteria.		
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (67%/42%) and total iron (150%MS) recoveries in the MS/MSD performed on sample SHM-05-014B-U were outside the QAPP specified limits. Dissolved arsenic (167%/150%), dissolved calcium (132%/130%), dissolved iron (590%/520%), dissolved manganese (125%/125%), dissolved potassium (125%/122%), and dissolved sodium (133%MS) recoveries in the MS/MSD performed on sample SHM-05-041B-F were outside QAPP-specified limits. Dissolved mercury (127%MS) recovery in the MS performed on sample GP-10-12-065-F was outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the dissolved calcium, dissolved manganese, dissolved potassium, and dissolved sodium result from sample SHM-05-041B-F with a Q (MS/MSD recovery not within control) reason code. AMEC J qualified the dissolved mercury result from sample GP-10-12-065-F with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits for all analytes with concentrations <4x spike concentrations.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits except for: dissolved calcium (12%), dissolved iron (13%), dissolved manganese (14%), and dissolved potassium (11%).	AMEC J qualified the detected dissolved calcium, iron, manganese, and potassium from sample SHM-05-041B-F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code. unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	Samples GP-10-12-065-F. GP-10-13-039-U. GP-10-24-015-F/U and DUP-080910-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days. preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

October 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	The lab analyzed a sample from a different SDG for duplicate analysis.	No qualifications warranted.	None.
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG.	No qualifications warranted.	None.
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements, except for nitrate. Samples GP-10-12-065-F and GP-10-13-039-F were analyzed past the nitrate holding time due to instrument failure.	AMEC J qualified the nitrate from samples GP-10-12-065-F and GP-10-13-039-F with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blanks.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	A lab duplicate was performed on sample GP-10-13-039-F. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-13-039-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample GP-10-13-039-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-13-039-F was analyzed in duplicate for sulfide and sample GP-10-12-065-F for ammonia and nitrite. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-12-065-F for ammonia and sulfide. The nitrite MS was performed on a sample from a different SDG. The sulfide recovery was low at 71%.	AMEC UJ qualified the sulfide from sample GP-10-12-065-F with a Q (MS recovery not within control limits) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-12-065-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHP-05-045A-U was analyzed in duplicate for DOC and sample GP-10-12-065-F for COD. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The COD MS was performed on sample GP-10-12-065-F. The DOC MS was performed on sample SHM-05-41B-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SHP-05-046B-U has elevated detection limits for DOC due to the dilutions required by the elevated sample concentration.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-13-039-U was analyzed in duplicate by the laboratory for TSS. The RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-013-039-U has elevated detection limits for TSS due to the dilutions required by the elevated sample concentration.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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October 25, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 17 water samples (including 2 rinsate blanks and 2 field duplicates) collected on August 9-10, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 10, 2010 and assigned sample delivery group (SDG) number L1012243 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012243-01/02	08/09/2010	GP-10-24-025-F/U	
L1012243-03/04	08/09/2010	GP-10-24-035-F/U	
L1012243-05/06	08/09/2010	GP-10-24-045-F/U	
L1012243-07/08	08/09/2010	GP-10-24-055-F/U	
L1012243-09/10	08/10/2010	GP-10-25-025-F/U	MS/MSD
L1012243-11/12	08/10/2010	GP-10-25-035-F/U	
L1012243-13/14	08/10/2010	GP-10-25-045-F/U	
L1012243-15	08/09/2010	GP-10-13-049-F	
L1012243-16/17	08/10/2010	GP-10-13-059-F/U	
L1012243-18	08/10/2010	GP-10-13-069-F	
L1012243-19	08/10/2010	GP-10-13-079-F	
L1012243-20	08/10/2010	RB2-081010-U	Rinsate Blank
L1012243-21	08/10/2010	RB-081010-U	Rinsate Blank
L1012243-22/23	08/10/2010	DUP-081010-F/U	Field Duplicate of GP-10-25-035-F/U (Metals Only)
L1012243-24/25	08/10/2010	DUP2-081010-F/U	Field Duplicate of GP-10-25-045-F/U (Metals Only)
L1012243-26/27	08/10/2010	GP-10-22-011-F/U	
L1012243-28/29	08/10/2010	GP-10-22-021-F/U	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 08/10/2010 at temperatures of 3.0°C, 4.0°C, 3.2°C, and 3.1°C.	Alpha Analytical 8 Walkup Drive Westborough. MA 01581	L1012243

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total aluminum (3.54 µg/L), total iron (17 µg/L), total potassium (21.4 µg/L), and total sodium (36.5 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved aluminum (2.47 µg/L), dissolved calcium (14.2 µg/L), dissolved iron (15.5 µg/L), dissolved potassium (20.3 µg/L), and dissolved sodium (47.2 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (3.04 µg/L), total calcium (25.5 µg/L), total chromium (0.33 µg/L), total iron (19.1 µg/L), total manganese (0.15 µg/L), and total sodium (34.2 µg/L) were detected in rinsate RB-081010-U. Total aluminum (2.52 µg/L), total chromium (0.24 µg/L), and total iron (12.3 µg/L) were detected in rinsate RB2-081010-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the dissolved aluminum from samples GP-10-25-035-F, GP-10-25-045-F, GP-10-13-049-F, GP-10-13-059-F, GP-10-13-079-F, DUP-081010-F, and DUP2-081010-F with a B (contamination in the method blank) reason code. AMEC U qualified the dissolved chromium from samples GP-10-25-035-F, GP-10-25-045-F, DUP-081010-F, GP-10-13-059-F and GP-10-13-079-F with an F (contamination in the equipment rinsate blank) reason code. Rinsate blanks have not been qualified due to method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081010-U/F was collected as the field duplicate of sample GP-10-25-035-U/F. Sample DUP2-081010-U/F was collected as the field duplicate of sample GP-10-25-045-U/F. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (210%/70%), total calcium (141%MS), total iron (400%/0%), and total sodium (148%/78%) recoveries in the MS/MSD performed on sample GP-10-25-025-U were outside the QAPP specified limits. Dissolved calcium (122%/125%), dissolved iron (123%/124%), and dissolved sodium (149%/149%) recoveries in the MS/MSD performed on sample GP-10-25-025-F were outside QAPP-specified limits. The MS recovery for dissolved mercury in sample GP-10-13-049-F was outside criteria at 76%. Also the RPD between the MS and MSD was above acceptance criteria at 29%	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the dissolved iron from sample GP-10-25-025-F with a Q (MS/MSD recovery not within control) reason code. AMEC UJ qualified the dissolved mercury from sample GP-10-13-049-F with a Q (MS recovery and RPD not within control) reason code.	High/Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits except for: total arsenic (14%) and total iron (27%).	AMEC J qualified the detected total arsenic and iron results from sample GP-10-25-025-U with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-24-035-U/F, GP-10-24-045-U/F,GP-10-24-055-U/F, GP-10-25-035-U/F, GP-10-25-045-U/F, GP-10-13-049-F, GP-10-13-069-F, DUP-081010-F/U, and DUP2-081010-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-13-049-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-13-079-F. The % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ limit of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements, with the exception of nitrate. Sample GP-10-13-049-F was analyzed past holding time.	AMEC J qualified the nitrate result from sample GP-10-13-049-F with an H (holding time exceeded) reason code.	Unknown
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes were detected in the method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	Sample GP-10-13-049-F was analyzed in duplicate for nitrate, sulfate and chloride. The %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-13-049-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample GP-10-13-049-F was detected and reported between the LOD and the LOQ. The sulfate results from samples GP-10-13-049-F and GP-10-13-069-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-13-079-F has an elevated detection limit for chloride due to the dilutions required by the sample matrix.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-13-049-F was analyzed in duplicate for ammonia. Sample GP-10-13-069-F was analyzed in duplicate for sulfide. The nitrite duplicate was performed on a sample from a different SDG. %RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs for nitrite and ammonia were performed on sample GP-10-13-049-F. The MS for sulfide was performed on sample GP-10-13-079-F The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

October 25, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements with the following exception: Samples GP-10-24-025-U, GP-10-24-035-U, GP-10-24-045-U, GP-10-24-055-U, and GP-10-13-049-F for DOC analysis were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-24-035-U, GP-10-24-045-U, GP-10-24-055-U, and GP-10-13-049-F and UJ qualified the non detect DOC result for sample GP-10-24-025-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-13-049-F was analyzed in duplicate for COD and GP-10-24-035-U for DOC. The DOC RPD was elevated at 42%.	AMEC J qualified the DOC result from sample GP-10-24-035-U with an E (poor agreement between duplicates) reason code.	
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-13-049-F for COD and GP-10-25-025-U for DOC. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample GP-10-13-079-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-24-045-U has an elevated detection limit for DOC due to the dilutions required by the sample matrix.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-25-025-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		

October 25, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-25-025-U and GP-10-25-035-U have elevated detection limits for TSS due to elevated concentration and dilutions required by the sample matrix.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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INTRODUCTION

This data validation report covers 19 water samples (including 2 rinsate blanks and 2 field duplicates) collected on August 10-11, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 11, 2010 and assigned sample delivery group (SDG) number L1012323 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012323-01/02	08/10/2010	GP-10-22-031-F/U	
L1012323-03/04	08/10/2010	GP-10-22-041-F/U	
L1012323-05/06	08/10/2010	GP-10-22-051-F/U	
L1012323-07/08	08/10/2010	GP-10-22-061-F/U	
L1012323-09/10	08/11/2010	GP-10-26-011-F/U	MS/MSD
L1012323-11/12	08/11/2010	GP-10-26-021-F/U	
L1012323-13/14	08/11/2010	GP-10-26-031-F/U	
L1012323-15/16	08/11/2010	GP-10-26-041-F/U	
L1012323-17/18	08/11/2010	GP-10-26-051-F/U	
L1012323-19/20	08/11/2010	GP-10-26-061-F/U	
L1012323-21/22	08/11/2010	GP-10-26-071-F/U	
L1012323-23	08/11/2010	GP-10-15-039-F	
L1012323-24/25	08/11/2010	GP-10-15-049-F/U	
L1012323-26	08/11/2010	GP-10-15-059-F	
L1012323-27/28	08/11/2010	GP-10-27-025-F/U	
L1012323-29	08/11/2010	RB-081110-U	Rinsate Blank
L1012323-30	08/11/2010	RB2-081110-U	Rinsate Blank

Lab Sample Number	Sample Date	Field ID	Comments
L1012323-31/32	08/11/2010	DUP-081110-F/U	Field Duplicate of GP-10-26-021-F/U (Metals Only)
L1012323-33/34	08/11/2010	DUP2-081110-F/U	Field Duplicate of GP-10-27-025-F/U (Metals Only)

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 08/11/2010 at temperatures of 2.9°C, 2.6°C, 5.1°C, and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012323

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects: UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total calcium (14.9 µg/L), total iron (10.7 µg/L), and total sodium (29.2 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved aluminum (2.62 µg/L), dissolved iron (19.6 µg/L), dissolved manganese (0.15 µg/L), dissolved potassium (21.8 µg/L), and dissolved sodium (31.3 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total calcium (44.2 µg/L), total chromium (0.29 µg/L), total iron (18.6 µg/L), total manganese (0.23 µg/L), total potassium (24.6 µg/L), and total sodium (58.5 µg/L) were detected in rinsate RB-081110-U. Total aluminum (2.26 µg/L), total arsenic (0.12 µg/L), total calcium (53.5 µg/L), total chromium (0.26 µg/L), total iron (18 µg/L), total lead (0.1 µg/L), total manganese (0.23 µg/L), total potassium (19.4 µg/L), and total sodium (43 µg/L) were detected in rinsate RB2-081110-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified dissolved aluminum results from samples DUP-081110-F, DUP-2-081110-F, GP-10-15-039-F, GP-10-26-011-F, GP-10-26-021-F, and GP-10-27-025-F with a B (detected in the method blank) reason code. AMEC U qualified dissolved chromium results from samples DUP-081110-F and GP-10-26-021-F and total chromium from GP-10-26-011-U with an F (detected in the equipment rinsate blank) reason code. Rinsate Blank results have not been qualified due to method blank concentrations.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample. U qualify detects 4) Sample results >10x blank level, no action required.	Calcium was detected in all CCBs and ICB ranging between 74.66 µg/L to 335.3 µg/L. Iron was detected in all the CCBs ranging between 11.69 µg/L to 22.25 µg/L. Arsenic was detected in a number of the CCBs ranging between 0.15 µg/L to 0.35 µg/L. Potassium was detected in a number of the CCBs ranging between 18.9 µg/L to 21.55 µg/L. Sodium was detected in a number of the CCBs ranging between 21.63 µg/L to 31.02 µg/L. Manganese was detected in a number of the CCBs ranging between 0.14 µg/L to 0.19 µg/L. A number of other metals had low level detections however they did not bracket project samples or the analyte was not requested on those samples.	The associated sample concentrations were either more than 10 times the blank concentrations or not detected: therefore, data usability is not adversely affected by the blank results.	None
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470). a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J- detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081110-U/F was collected as the field duplicate of sample GP-10-26-021-U/F. Sample DUP2-081110-U/F was collected as the field duplicate of sample GP-10-27-025-U/F. RPDs were within acceptance criteria, except for the RPD of total arsenic for samples DUP2-081110-U and GP-10-27-025-U. Other RPDs were elevated but the detections were below the LOQ.	AMEC J qualified the detected total arsenic results from samples DUP2-081110-U and GP-10-27-025-U with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved iron (123%MSD) recovery in the MS/MSD performed on sample GP-10-26-011-F were outside the QAPP specified limits.	AMEC J qualified the dissolved iron result from sample GP-10-26-011-F a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were outside acceptance limits: dissolved calcium (18%), dissolved iron (27%), dissolved magnesium (26%), dissolved manganese (24%), dissolved potassium (18%), and dissolved sodium (17%).	AMEC J qualified the detected dissolved calcium, dissolved iron, dissolved magnesium, dissolved manganese, dissolved potassium and dissolved sodium results from samples GP-10-26-011-F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-22-031-U/F, GP-10-22-041-U/F, GP-10-22-051-U/F, GP-10-22-061-U/F, GP-10-26-051-U/F, GP-10-26-061-U/F, GP-10-26-071-U/F, GP-10-15-039-F, and GP-10-15-049-U/F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-15-039-F was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are >QL for water	A field duplicate was not submitted for this analysis		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-15-059-F. The % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Nitrate, sulfate and chloride were not detected in the method blanks.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample GP-10-15-059-F for nitrate and GP-10-15-039-F for chloride and sulfate. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-15-059-F for nitrate and GP-10-15-039-F for chloride and sulfate. The % recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The sulfate result from sample GP-10-15-039-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-15-059-F has an elevated detection limit for chloride in order to quantitate the sample within the calibration range.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

October 26, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result >10x contaminant concentration; no qualification required.	Ammonia was detected in method blank at a concentration of 0.0178 mg/L.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-15-039-F was analyzed in duplicate for sulfide and sample GP-10-15-059-F for ammonia and nitrite. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-15-039-F was analyzed in duplicate for nitrite and sample GP-10-15-059-F for ammonia and sulfide. The % recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-15-059-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements with the following exception: Samples GP-10-22-031-U, GP-10-22-041-U, GP-10-22-051-U, and GP-10-22-061-U for DOC analysis were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-22-031-U, GP-10-22-041-U, GP-10-22-051-U, and GP-10-22-061-U with an H (holding time exceeded) reason code.	Low
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		

October 26, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-26-021-U was analyzed in duplicate by the laboratory for DOC. The COD duplicate was performed on a sample from a different SDG. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample GP-10-22-041-U for DOC. A sample from a different SDG was utilized for the COD MS. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-26-061-U was analyzed in duplicate by the laboratory for TSS. RPD was above acceptance criteria at 36%.	AMEC J qualified the TSS result from sample GP-10-26-061-U with an E (poor agreement between duplicates) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	Sample GP-10-26-061-U has an elevated detection limit for TSS due to the elevated concentration.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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November 1, 2010 — Total and Dissolved Metals by USEPA Method 6020A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 15 water samples (including 1 rinsate blank and 2 field duplicates) collected on August 11-12, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 12, 2010 and assigned sample delivery group (SDG) number L1012444 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012444-01/02	08/11/2010	GP-10-27-035-F/U	
L1012444-03/04	08/11/2010	GP-10-27-045-F/U	
L1012444-05/06	08/11/2010	GP-10-27-055-F/U	
L1012444-07	08/12/2010	SHL-23-F	
L1012444-08	08/12/2010	SHM-05-39A-F	MS/MSD
L1012444-09	08/12/2010	SHM-07-05-F	
L1012444-10	08/12/2010	SHM-99-31B-F	
L1012444-11	08/12/2010	SHM-10-10-F	
L1012444-12	08/12/2010	SHM-07-03-F	
L1012444-13	08/12/2010	SHM-10-01-F	
L1012444-14	08/12/2010	SHM-05-42A-F	
L1012444-15	08/12/2010	RB-081210-U	Rinsate Blank
L1012444-16	08/12/2010	DUP-081210-F	Field Duplicate of SHM-07-05-F (Metals Only)
L1012444-17	08/12/2010	DUP2-081210-F	Field Duplicate of SHM-07-03-F (Metals Only)
L1012444-18/19	08/11/2010	GP-10-27-065-F/U	

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Four sample coolers were received on 08/12/2010 at temperatures of 3.1°C, 2.0°C, 4°C, and 2.1°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012444

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis.	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero, are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995, quadratic calibration (at least 6 points, not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020) 3) 75-89% recovery, J qualify detects and UJ qualify nondetects. 4) 111-125% recovery, J qualify detects. 5) 80-120% recovery (EPA 7470) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards: analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects: UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total arsenic (0.13 µg/L) and total potassium (30.4 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total iron (10.3 µg/L) and dissolved iron (10.3 µg/L) were detected in the method blanks associated with the analysis of samples from this SDG. Dissolved iron (13.9 µg/L) and dissolved potassium (29.1 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved potassium (24.4 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. . Total calcium (14.1 µg/L) and total sodium (25.7 µg/L) were detected in rinsate RB-081210-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the dissolved iron result from samples SHL-23-F, SHM-10-10-F and SHM-07-03-F with a B (detected in the method blank) reason code. AMEC U qualified the dissolved potassium result from sample SHM-10-01-F with a B (detected in the method blank) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals were detected in the ICB/CCBs associated with these samples with the following exceptions: Arsenic and iron were detected in a CCB at 0.13 µg/L and 10.36 µg/L, respectively. Arsenic was detected in two CCBs at 0.42 µg/L and 0.17 µg/L. Calcium was detected in two CCBs at 40.21 µg/L and 24 µg/L. Lead was detected in a CCB at 0.05 µg/L. Magnesium was detected in a CCB at 5.76 µg/L. Sodium was detected in a CCB at 23.51 µg/L.	AMEC U qualified the dissolved arsenic from samples SHL-23-F, SHM-10-10-F, and SHM-07-03-F because the sample concentrations were less than 10x the CCB concentration. A B (contamination detected in blank) reason code was applied. All remaining associated sample concentrations were either not detected or detected more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	High
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081210-F was collected as the field duplicate of sample SHM-07-05-F. Sample DUP2-081210-F was collected as the field duplicate of sample SHM-07-03-F. RPDs were within acceptance criteria with the exception of dissolved arsenic for sample SHM-07-03-F and its field duplicate DUP2-081210-F – RPD 91%. Sample result below LOQ.	No qualification warranted.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J"	Dissolved iron (140%/150%) recoveries in the MS/MSD performed on sample SHM-05-39A-F were outside the QAPP specified limits. Total arsenic (75%) and total iron (0%) recoveries in the MS performed on sample GP-10-27-065-U were outside the QAPP specified limits. Dissolved arsenic (150%) and dissolved iron (190%) recoveries in the MS performed on sample GP-10-27-065-F were outside the QAPP specified limits. Dissolved arsenic (67%/75%) and dissolved iron (70%/60%) recoveries in the MS/MSD performed on sample SHM-07-05-F were outside QAPP-specified limits. Dissolved iron (160%/220%) recoveries in the MS/MSD performed on sample SHM-09-31B-F were outside QAPP-specified limits. Dissolved calcium (32%/40%) and dissolved manganese (0%/0%) recoveries in the MS/MSD performed on sample SHM-10-10-F were outside QAPP-specified limits. Dissolved calcium (67%/62%) and dissolved manganese (0%/0%) recoveries in the MS/MSD performed on sample SHM-10-01-F were outside QAPP-specified limits. Dissolved arsenic (183%MS) and dissolved iron (150%MS) recoveries in the MS/MSD performed on sample DUP-081210-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were outside acceptance limits: -dissolved arsenic (17%); -dissolved iron (29%), dissolved nickel (13%), dissolved potassium (21%); -dissolved manganese (52%); - dissolved magnesium (14%), dissolved potassium (12%) and dissolved sodium (12%); -dissolved magnesium (15%) and dissolved manganese (30%); and -dissolved iron (12%).	AMEC J qualified the detected dissolved arsenic result from sample SHM-99-31B-F; the detected dissolved nickel and dissolved potassium from sample SHM-10-10-F; dissolved magnesium, dissolved potassium, and dissolved sodium from sample SHM-05-42A-F; dissolved magnesium and dissolved manganese from sample DUP2-081210-F and SHM-07-03-F; and dissolved iron from sample GP-10-27-065-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-27-035-F/U, GP-10-27-045-F/U, GP-10-27-055-F/U, SHM-07-05-F, SHM-10-10-F, SHM-10-01-F, GP-10-27-065-F/U and DUP-081210-F have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is ≤10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-05-42A-F was analyzed in duplicate for total alkalinity. RPD was elevated at 15%.	AMEC J qualified the alkalinity result from sample SHM-05-42A-F with an E (poor agreement between duplicate) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-05-42A-F. The % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Initial Calibration	1) r ≥ 0.99 for chloride, sulfate and nitrate, linear calibration Analytes with low r <0.99 flag detected results "J" and nondetected results "UJ" 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank.		
ICBs/CCBs	Evaluate absolute values down to the MDL. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The lab performed duplicate analysis on sample SHM-05-42A-F. The % RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-05-42A-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample SHM-SHM-05-39A-F and the sulfate result from sample SHM-10-10-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SHM-07-03-F has an elevated detection limit for nitrate due to the dilution required in order to quantitate the result within the calibration range. The requested reporting limit was not achieved	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

November 1, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Initial Calibration	1) $r \geq 0.995$ 2) Use professional judgment if not enough points were used for curves. Determine if system imprecision or bias	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110%	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHL-23-F was analyzed in duplicate for ammonia, sample SHM-05-42A-F was analyzed in duplicate for nitrite, and sample SHM-10-10-F was analyzed in duplicate for sulfide. All results were ND or reported below the LOQ, and % RPDs were not calculable.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHL-23-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample SHM-07-05-F and the ammonia results from samples SHL-23-F, SHM-07-03-F, and SHM-05-42A-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements with the following exception: Samples GP-10-27-035-U, GP-10-27-045-U, GP-10-27-055-U, and GP-10-27-065-U for DOC analysis were filtered at the lab past the recommended 24 hours.	AMEC J qualified the detected DOC results for samples GP-10-27-045-U, GP-10-27-055-U, and GP-10-27-065-U with an H (holding time exceeded) reason code.	Low
Initial Calibration	r ≥ 0.995 for a valid calibration curve	Initial calibration criteria were met.		
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs and CCVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHL-23-F was analyzed in duplicate for COD and sample SHM-07-05-F for DOC. The DOC RPD was elevated at 33%.	AMEC J qualified the DOC result from sample SHM-07-05-F with an E (poor agreement between duplicate) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHL-23-F for COD and sample SHM-05-39A-F for DOC. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from samples SHM-05-39A-F and SHM-99-31B-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Sample GP-10-27-065-U was analyzed past the holding time due to required dilution.	AMEC J qualified the TSS result from sample GP-10-27-065-U with an H (holding time exceeded) reason code.	Low
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-27-065-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-27-045-U, GP-10-27-055-U, and GP-10-27-065-U have elevated detection limits due to the dilutions required by the elevated concentrations. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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November 16, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers sixteen soil samples (including 2 field duplicates) and one water sample (rinsate blank) collected on August 12, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 12, 2010 and assigned sample delivery group (SDG) number L1012496 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A for soils and 6020A/7470A for the rinsate, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplementa Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012496-01	08/12/2010	SP-10-15-001	
L1012496-02	08/12/2010	SP-10-15-004	
L1012496-03	08/12/2010	SP-10-15-005	
L1012496-04	08/12/2010	SP-10-15-010	
L1012496-05	08/12/2010	SP-10-15-015	
L1012496-06	08/12/2010	SP-10-15-017	
L1012496-07	08/12/2010	SP-10-15-018	
L1012496-08	08/12/2010	SP-10-15-020	
L1012496-09	08/12/2010	SP-10-15-025	
L1012496-10	08/12/2010	SP-10-15-028	
L1012496-11	08/12/2010	SP-10-15-030	MS/MSD
L1012496-12	08/12/2010	SP-10-15-035	
L1012496-13	08/12/2010	SP-10-15-040	
L1012496-14	08/12/2010	SP-10-15-055	
L1012496-15	08/12/2010	SDUP6-081210	Field Duplicate of SP-10-15-025
L1012496-16	08/12/2010	SDUP7-081210	Field Duplicate of SP-10-15-030
L1012496-17	08/12/2010	RB2-081210-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil	As required by method	One sample cooler was received on 08/12/2010 at a temperature of 4.4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012496

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A and 6020A/7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. Rinsate sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total arsenic (0.13 µg/L), total copper (0.12 µg/L), total potassium (30.4 µg/L), and total silver (0.24 µg/L) were detected in the method blank associated with the analysis of RB2-081210-U from this SDG. Total antimony (0.22 mg/kg), total silver (0.081 mg/kg), and total sodium (24 mg/kg) were detected in the method blank associated with the analysis of soil samples from this SDG. Total antimony (0.43 µg/L), total arsenic (0.14 µg/L), total barium (0.14 µg/L), total calcium (28.3 µg/L), total chromium (0.2 µg/L), total copper (0.14 µg/L), total mercury (0.05228 µg/L), and total sodium (142 µg/L) were detected in rinsate RB2-081210-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the detected total antimony from samples SDUP7-081210, SP-10-15-004, SP-10-15-005, SP-10-15-010, SP-10-15-015, SP-10-15-017, SP-10-15-018, SP-10-15-030, SP-10-15-040, and SP-10-15-055 with a B (contamination in the method blank) reason code. AMEC U qualified the detected total silver from samples SDUP6-081210, SDUP7-081210, SP-10-15-001, SP-10-15-005, SP-10-15-017, SP-10-15-018, SP-10-15-025, SP-10-15-028, SP-10-15-030, SP-10-15-035, and SP-10-15-040 with a B (contamination in the method blank) reason code. AMEC U qualified the detected total sodium from samples SDUP6-081210, SDUP7-081210, SP-10-15-004, SP-10-15-005, SP-10-15-010, SP-10-15-015, SP-10-15-017, SP-10-15-018, SP-10-15-020, SP-10-15-025, SP-10-15-028, SP-10-15-030, SP-10-15-035, SP-10-15-040, and SP-10-15-055 with a B (contamination in the method blank) reason code. AMEC U qualified the detected total mercury from samples SP-10-15-005, SP-10-15-010, and SP-10-15-020 with an F (contamination in the equipment rinsate blank) reason code. AMEC did not qualify any rinsate blank detections due to method blank concentrations.	High
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120% method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP6-081210 was collected as the field duplicate of sample SP-10-15-025. Sample SDUP7-081210 was collected as the field duplicate of sample SP-10-15-030. The RPDs for analytes detected above the LOQ were within the acceptance criteria with the following exceptions: total potassium (64%), total zinc (53%) and total mercury (72%) for SDUP6-081210 and SP-10-15-025 and total arsenic (56%) for SDUP7-081210 and SP-10-15-030.	AMEC J qualified the total potassium, total zinc, and total mercury from sample SDUP6-081210 and SP-10-15-025 and total arsenic from sample SDUP7-081210 and SP-10-15-030 with an E (poor agreement between duplicate) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (196%/0%), total antimony (74%/74%), total arsenic (0%/0%), total iron (0%/0%), total chromium (78%MSD), total magnesium (58% MSD), and total manganese (58%MSD) recoveries in the MS/MSD performed on sample SP-10-15-030 were outside the QAPP specified limits. Total mercury (138%) recovery in the MS performed on sample RB2-081210-U was outside the QAPP specified limits	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the total chromium, total magnesium, and total manganese results from sample SP-10-15-030 and its field duplicate SDUP7-081210 with a Q (MS/MSD recovery not within control) reason code. The total antimony was previously U qualified due to blank contamination and has not been further qualified. AMEC J qualified the total mercury result from sample RB2-081210-U with a Q (MS/MSD recovery not within control) reason code.	Low/High

November 16, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for aluminum and iron each at 0%, in sample SP-10-15-030.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration	None
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on sample SP-10-15-030 were within acceptance limits, with the following exceptions: total aluminum (11%), total arsenic (15%), total barium (16%), total calcium (21%), total chromium (16%), total copper (14%), total iron (17%), total lead (21%), total magnesium (14%), total manganese (17%), total nickel (15%), and total zinc (15%).	AMEC J qualified the detected total aluminum, total arsenic, total barium, total calcium, total chromium, total copper, total iron, total lead, total magnesium, total manganese, total nickel, and total zinc from sample SP-10-15-030 and its field duplicate SDUP7-052110 with an A (ICP SD %a difference was not within control limits) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SP-10-15-018 has elevated detection limits for all analytes, except mercury, due to the dilutions required by the target spectral interferences. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed as litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060(M)

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and < LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was not detected in associated preparation blanks.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD. RPD >25% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on sample SP-10-15-025. The RPD for replicate 2 was elevated at 43%.	AMEC J qualified the TOC result from sample SP-10-15-025 with an E (poor agreement between duplicate) reason code.	Non-Directional
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample SP-10-15-025. The recoveries were outside acceptance criteria in replicate 1 at 198% and replicate 2 at 69%.	AMEC J qualified the TOC result from sample SP-10-15-025 with a Q (MS recovery outside acceptance criteria) reason code.	High/Low

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

November 16, 2010 — Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet — TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers eighteen soil samples (including 2 field duplicates) collected on August 12, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 12, 2010 and assigned sample delivery group (SDG) number L1012501 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012501-01	08/12/2010	SP-10-12-001	
L1012501-02	08/12/2010	SP-10-12-005	
L1012501-03	08/12/2010	SP-10-12-009	
L1012501-04	08/12/2010	SP-10-12-015	
L1012501-05	08/12/2010	SP-10-12-017	
L1012501-06	08/12/2010	SP-10-12-025	
L1012501-07	08/12/2010	SP-10-12-035	
L1012501-08	08/12/2010	SP-10-12-040	
L1012501-09	08/12/2010	SP-10-12-042	
L1012501-10	08/12/2010	SP-10-12-052	
L1012501-11	08/12/2010	SP-10-12-055	
L1012501-12	08/12/2010	SP-10-13-050	MS/MSD
L1012501-13	08/12/2010	SP-10-13-072	
L1012501-14	08/12/2010	SP-10-13-075	
L1012501-15	08/12/2010	SP-10-13-077	
L1012501-16	08/12/2010	SP-10-13-083	
L1012501-17	08/12/2010	SDUP2-081210	Field Duplicate of SP-10-12-035
L1012501-18	08/12/2010	SDUP3-081210	Field Duplicate of SP-10-12-040

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil	As required by method	One sample cooler was received on 08/12/2010 at a temperature of 2.3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012501

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes were detected in the method blanks.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120% method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP2-081210 was collected as the field duplicate of sample SP-10-12-035. Sample SDUP3-081210 was collected as the field duplicate of sample SP-10-12-040. All the RPDs for analytes detected above the LOQ were within the acceptance criteria, with the exception of total mercury, which had an elevated RPD of 113% for SP-10-12-040 and SDUP3-081210.	AMEC J qualified the total mercury from SP-10-12-040 and DUP3-081210 with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (0%/0%), total antimony (63%/67%), total iron (226%/0%), total magnesium (68%/22%), total calcium (72%MSD), and total manganese (76%MSD) recoveries in the MS/MSD performed on sample SP-10-13-050 were outside the QAPP specified limits. The RPD for total mercury (24%) between MS and MSD performed on sample SP-10-13-050 was above acceptance criteria.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the detected total magnesium, total calcium, and total manganese and UJ qualified the nondetected total antimony from sample SP-10-13-050 with a Q (MS/MSD recovery not within control) reason code. Total mercury was not detected in sample SP-10-13-050 and no qualifications are warranted.	Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS performed on sample SP-10-13-050 had recoveries within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on SP-10-13-050 were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis. preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		

November 16, 2010 — Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet — TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was not detected in associated preparation blanks.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD, RPD >25% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on sample SP-10-12-025. Both samples were non detect.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample SP-10-12-025 and the recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination. sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

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REVIEWED BY:

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November 17, 2010 Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers twenty soil samples (including 2 field duplicates) collected on August 12, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 12, 2010 and assigned sample delivery group (SDG) number L1012502 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012502-01	08/12/2010	SP-10-13-001	
L1012502-02	08/12/2010	SP-10-13-005	
L1012502-03	08/12/2010	SP-10-13-008	
L1012502-04	08/12/2010	SP-10-13-010	
L1012502-05	08/12/2010	SP-10-13-011	
L1012502-06	08/12/2010	SP-10-13-015	
L1012502-07	08/12/2010	SP-10-13-017	
L1012502-08	08/12/2010	SP-10-13-020	
L1012502-09	08/12/2010	SP-10-13-023	
L1012502-10	08/12/2010	SP-10-13-025	
L1012502-11	08/12/2010	SP-10-13-027	
L1012502-12	08/12/2010	SP-10-13-030	
L1012502-13	08/12/2010	SP-10-13-032	
L1012502-14	08/12/2010	SP-10-13-035	
L1012502-15	08/12/2010	SP-10-13-040	
L1012502-16	08/12/2010	SP-10-13-065	MS/MSD
L1012502-17	08/12/2010	SP-10-13-067	
L1012502-18	08/12/2010	SP-10-13-070	
L1012502-19	08/12/2010	SDUP4-081210	Field Duplicate of SP-10-13-032
L1012502-20	08/12/2010	SDUP5-081210	Field Duplicate of SP-10-13-067

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil	As required by method	One sample cooler was received on 08/12/2010 at a temperature of 2.7°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012502

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation	Cooler temperature upon arrival at Alpha was within acceptance criteria. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes were detected in the method blanks associated with the samples in this SDG.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

November 17, 2010 — **Total Metals by USEPA Method 6010B/7471A**
Region I Data Review Worksheet — **TOC by USEPA 9060**
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP4-081210 was collected as the field duplicate of sample SP-10-13-032 and sample SDUP5-081210 was collected as a field duplicate of SP-10-13-067. The RPDs for analytes detected above the LOQ were within the acceptance criteria.		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 1) RPD ≤ 20%	Total aluminum (1840%MS), total antimony (69%/68%), total calcium (63%MSD), total chromium (143%MS), total iron (6450%/0%), total magnesium (316% MS), and total manganese (212%MS) recoveries in the MS/MSD performed on sample SP-10-13-065 were outside the QAPP specified limits. The RPDs for total aluminum (45%) total chromium (27%), total iron (53%) total magnesium (49%) and total manganese (39%) between MS and MSD performed on sample SP-10-13-065 were above acceptance criteria.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the detected total calcium, total chromium, total magnesium and total manganese and UJ qualified the nondetected total antimony from sample SP-10-13-065 with a Q (MS/MSD recovery not within control) reason code.	High/Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS performed on sample SP-10-13-065 had recoveries were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on sample SP-10-13-065 were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SP-10-13-023 has elevated detection limits for thallium and zinc and sample SP-10-13-027 has an elevated detection limit for zinc. The zinc dilutions were required in order to quantitate results within the calibration range and the thallium dilution was necessary due to non-target spectral interferences. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060(M)

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		

November 17, 2010 — Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet — TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was not detected in associated preparation blanks.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD, RPD >25% flag detected results "J" and nondetected results "UJ"	Sample SP-10-13-040 was analyzed in duplicate by the laboratory. The % RPDs were within control limit.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SP-10-13-040. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

October 28, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 6 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 16, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 16, 2010 and assigned sample delivery group (SDG) number L1012632 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012632-01/02	08/16/2010	GP-10-14-039-F/U	
L1012632-03/04	08/16/2010	GP-10-14-049-F/U	
L1012632-05	08/16/2010	GP-10-14-059-F	
L1012632-06/07	08/16/2010	GP-10-14-069-F/U	
L1012632-08/09	08/16/2010	DUP-081610-F/U	Field Duplicate of GP-10-14-049-F/U
L1012632-10	08/16/2010	RB-081610-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 08/16/2010 both at temperatures of 6°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012632

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total calcium (14.3 µg/L), total potassium (21.3 µg/L), and total sodium (34.4 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved antimony (0.3 µg/L), dissolved calcium (14.3 µg/L), dissolved potassium (21.3 µg/L), and dissolved sodium (34.4 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total arsenic (0.22 µg/L), total calcium (14.2 µg/L), total manganese (0.2 µg/L), total potassium (25.6 µg/L), and total sodium (40.6 µg/L) were detected in rinsate RB-081610-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U-qualified the detected dissolved antimony from samples GP-10-14-039-F, GP-10-14-049-F, and GP-10-14-059-F with a B (detected in the method blank) reason code. Rinsate blank results were not qualified due to method blank concentrations.	High

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Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081610-U/F was collected as the field duplicate of sample GP-10-14-049-U/F. RPDs were within acceptance criteria, except for total aluminum (86%), total chromium (58%), total lead (86%), and total nickel (65%).	AMEC J qualified the total aluminum, total chromium, total lead, and total nickel from samples GP-10-14-049-U and DUP-081610-U with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total calcium (145%/143%) and total iron (380%/400%) recoveries in the MS/MSD performed on sample GP-10-14-039-U were outside the QAPP specified limits. Dissolved calcium (138%135%) and dissolved iron (310%/300%) recoveries in the MS/MSD performed on sample GP-10-14-039-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total manganese (38%) on sample GP-10-14-039-U.	No qualification is warranted since the background concentration is more than 4x the spike concentration	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on samples GP-10-14-039-U/F that were outside acceptance limits: total iron (11%) and dissolved manganese (11%).	AMEC J qualified the detected total iron and dissolved manganese results from samples GP-10-14-039-U/F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-14-049-U/F, GP-10-14-059-F, GP-10-14-069-F/U and DUP-081610-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (EPA Method 2320B)	Samples were analyzed as per Standard Method requirements.		

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Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	The lab duplicate was performed on a sample from a different SDG.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J". %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG.	No qualifications are warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Nitrate, chloride, and sulfate were not detected in the method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J". c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample GP-10-14-069-F and the % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-14-069-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples GP-10-14-039-F, GP-10-14-049-F, GP-10-14-059-F, and GP-10-14-069- F and the sulfate result from sample GP-10-14-049-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

October 28, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-14-049-F was analyzed in duplicate for ammonia and sample GP-10-14-039-F for nitrite and sulfide. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-14-039-F for nitrite and ammonia and sample GP-10-14-059-F for sulfide. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is < 10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-14-039-F was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD < 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-14-039-F for COD and sample GP-10-14-069-F for DOC. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualifications are warranted.	None

October 28, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

INTRODUCTION

This data validation report covers fourteen soil samples (including 2 field duplicates) collected on August 12, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 16, 2010 and assigned sample delivery group (SDG) number L1012639 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012639-01	08/12/2010	SP-10-11-003	
L1012639-02	08/12/2010	SP-10-11-005	
L1012639-03	08/12/2010	SP-10-11-007	
L1012639-04	08/12/2010	SP-10-11-012	
L1012639-05	08/12/2010	SP-10-11-015	
L1012639-06	08/12/2010	SP-10-11-020	MS/MSD
L1012639-07	08/12/2010	SP-10-11-023	
L1012639-08	08/12/2010	SP-10-11-025	
L1012639-09	08/12/2010	SP-10-11-033	
L1012639-10	08/12/2010	SP-10-11-040	
L1012639-11	08/12/2010	SP-10-11-055	
L1012639-12	08/12/2010	SP-10-11-062	
L1012639-13	08/12/2010	SDUP-081210	Field Duplicate of SP-10-11-020
L1012639-14	08/12/2010	SDUP8-081210	Field Duplicate of SP-10-11-025

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil	As required by method	One sample cooler was received on 08/16/2010 at a temperature of 5°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012639

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total calcium (0.9 mg/kg), total chromium (0.068 mg/kg) and total iron (1.1 mg/kg) were detected in the method blank associated with the samples in this SDG.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

November 17, 2010 — Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet — TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP-081210 was collected as the field duplicate of sample SP-10-11-020 and sample SDUP8-081210 was collected as the field duplicate of sample SP-10-11-025. The RPDs for analytes detected above the LOQ were within the acceptance criteria, with the following exception: total chromium had an elevated RPD of 75% from SDUP8-081210 and SP-10-11-025.	AMEC J qualified the total chromium from samples SDUP8-081210 and SP-10-11-025 with an E (poor agreement between duplicates) reason code.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (0%/0%), total antimony (54%/54%), total barium (67%/66%), total cadmium (209%MS), total calcium (79%/62%), total chromium (74%MSD), total copper (69%MSD), total iron (0%/0%), total magnesium (0%/0%), total manganese (198%/0%), total potassium (79%MSD), total sodium (129%/121%), and total zinc (74%MSD) recoveries in the MS/MSD performed on sample SP-10-11-020 were outside the QAPP specified limits. The RPDs for total cadmium (44%) and total manganese (31%) between MS and MSD performed on sample SP-10-11-020 were above acceptance criteria.	The background concentrations of all analytes that are outside QAPP-specified limits were either more than 4x the spike concentration or not detected with the following exceptions: AMEC J or UJ qualified the total antimony, total barium, total cadmium, total calcium, total chromium, total copper, total potassium, and total zinc from sample SP-10-11-020 and its field duplicate with a Q (MS/MSD recovery not within control) reason code.	High/Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS performed on sample SP-10-11-020 had recoveries within acceptance limits, except for total calcium at 247%, total chromium at 227%, total copper at 222%, and total potassium at 253% and total zinc at 207%.	AMEC J qualified the total calcium, total chromium, total copper, total potassium and total zinc in sample SP-10-11-020 and its field duplicate SDUP-081210 with a P (PDS recovery not within control limits) reason code.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on sample SP-10-11-020 were within acceptance limits, except for total arsenic (18%), total calcium (13%), total chromium (17%), total cobalt (15%), total copper (15%), total lead (13%), total nickel (17%), and total zinc (12%).	AMEC J qualified the detected total arsenic, total calcium, total chromium, total cobalt, total copper, total lead, total nickel, and total zinc from sample SP-10-11-020 and its field duplicate SDUP-081210 with an A (ICP SD % difference was not within control limits) reason code.	High
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SP-10-11-062 had an elevated detection limit for selenium due to the dilution that was necessary due to non-target spectral interferences. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

November 17, 2010 — Total Metals by USEPA Method 6010B/7471A
Region I Data Review Worksheet — TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TOC was not detected in associated preparation blanks.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD, RPD >25% flag detected results "J" and nondetected results "UJ"	Sample SP-10-11-020 was analyzed in duplicate by the laboratory. The RPDs were within control limits.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample SP-10-11-020. The recovery was high in the first replicate at 183%. The second replicate was within acceptance criteria.	AMEC J qualified the TOC from sample SP-10-11-020 with a Q (MS recovery outside acceptance criteria) reason code.	High
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported at or slightly above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SP-10-11-003, SP-10-11-005, SP-10-11-007, SP-10-11-012, SP-10-11-015, SP-10-11-023, SP-10-11-025, SP-10-11-033-SP-10-11-040, SP-10-11-055, and SP-10-11-062 were received at the lab without a separate container. An aliquot was taken from an unpreserved container and sent to the Mansfield laboratory for analysis.	No qualifications warranted	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 17, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 17, 2010 and assigned sample delivery group (SDG) number L1012679 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012679-01/02	08/17/2010	GP-10-14-079-F/U	MS/MSD
L1012679-03/04	08/17/2010	GP-10-16-024-F/U	
L1012679-05/06	08/17/2010	DUP-081710-F/U	Field Duplicate of GP-10-16-024-F/U (Metals only)
L1012679-07	08/17/2010	RB-081710-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 08/17/2010 at temperatures of 3°C and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012679

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total aluminum (6.6 µg/L), total calcium (43.7 µg/L), total iron (12.4 µg/L), and total zinc (2.47 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved aluminum (6.6 µg/L), dissolved calcium (43.7 µg/L), dissolved iron (12.4 µg/L), and dissolved zinc (2.47 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Dissolved mercury (0.05098 µg/L) was detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (4.62 µg/L), total arsenic (0.830 µg/L), total calcium (76.3 µg/L), total chromium (0.19 µg/L), total copper (0.39 µg/L), total iron (11.6 µg/L), total magnesium (4.39 µg/L), total manganese (0.32 µg/L), total sodium (35.2 µg/L), total zinc (2.18 µg/L), and total mercury (0.0882 µg/L) were detected in rinsate RB-081710-U.	The associated sample concentrations were more than 10 times the blank concentrations; with the following exceptions: AMEC U qualified the total zinc result from sample GP-10-14-079-U; dissolved aluminum results from samples GP-10-16-024-F and DUP-081710-F; dissolved zinc results from samples DUP-081710-F, GP-10-14-079-F and GP-10-16-024-F; dissolved mercury results from samples DUP-081710-F, GP-10-14-079-F and GP-10-16-024-F with a B (contamination in the method blank) reason code. AMEC U qualified the dissolved arsenic results from GP-10-16-024-F and DUP-081710-F; dissolved chromium results from samples GP-10-16-024-F and DUP-081710-F; dissolved copper results from samples GP-10-16-024-F and DUP-081710-F; and total mercury from DUP-081710-U and GP-10-16-024 with an F (contamination from equipment rinsate) reason code. The rinsate blank was not qualified due to the method blank concentrations.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters): ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081710-U/F was collected as the field duplicate of sample GP-10-16-24-U/F. RPDs, for detections above the LOQ, were within acceptance criteria.	No qualification warranted.	None
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (126%MS), total arsenic (333%/0%), total iron (280%/0%), and total manganese (132%/38%) recoveries in the MS/MSD performed on sample GP-10-14-079-U were outside the QAPP specified limits. Dissolved arsenic (0%/667%), dissolved iron (0%/290%), and dissolved manganese (72%/124%) recoveries in the MS/MSD performed on sample GP-10-14-079-F were outside QAPP-specified limits. Dissolved mercury (123%/125%) recoveries in the MS/MSD performed on sample GP-10-14-079-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration or were non-detect and recovered high in the MS/MSD.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits on sample GP-10-14-079-U/F.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on GP-10-14-079-U/F were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Quality detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-14-079-U/F, GP-10-16-024-U and DUP-081710-U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed as' litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	A sample from a different SDG was analyzed in duplicate for total alkalinity.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" "%R > 116"% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG	No qualifications are warranted	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

November 1, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/4500S2-AD/5310C/2320B/2540D
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110%. a) %R~90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	Sample GP-10-14-079-F was analyzed in duplicate by the lab. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-14-079-F. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-024-F has an elevated detection limit for nitrate due to the dilution required in order to quantitate the result within the calibration range. The requested reporting limit was not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT):	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	1) RPD≤20%	Sample GP-10-16-024-F was analyzed in duplicate for nitrite and sample GP-10-14-079-F for ammonia and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for these analyses.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-16-024-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-14-079-F and the ammonia result from sample GP-10-16-024-F were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-14-079-F was analyzed in duplicate by the laboratory for DOC. A sample from a different SDG was analyzed in duplicate for COD. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for these analyses.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MSs were performed on samples from a different SDG..	No qualifications are warranted.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample GP-10-16-024-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-16-024-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-024-U has an elevated detection limit for TSS due to elevated concentration. The requested reporting limit was not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 18, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 18, 2010 and assigned sample delivery group (SDG) number L1012735 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012735-01/02	08/18/2010	GP-10-16-034-F/U	MS/MSD
L1012735-03/04	08/18/2010	GP-10-16-054-F/U	
L1012735-05	08/18/2010	GP-10-16-064-F	
L1012735-06/07	08/18/2010	DUP-081810-F/U	Field Duplicate of GP-10-16-054-F/U
L1012735-08	08/18/2010	RB-081810-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 08/18/2010 at temperatures of 3.9°C and 5.1°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012735

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (25.7 µg/L), dissolved iron (10.3 µg/L), dissolved manganese (0.24 µg/L), and dissolved zinc (2.12 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (3.04 µg/L), total arsenic (0.15 µg/L), total calcium (25.1 µg/L), total chromium (0.21 µg/L), total copper (0.14 µg/L), total iron (9.64 µg/L), total manganese (0.16 µg/L), total sodium (28.3 µg/L), and total zinc (1.84 µg/L) were detected in rinsate RB-081810-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the detected dissolved zinc from samples DUP-081810-F, GP-10-16-034-F, GP-10-16-054-F, and GP-10-16-064-F with a B (contamination in the method blank) reason code. AMEC U qualified the detected dissolved aluminum from samples DUP-081810-F, GP-10-16-054-F, and GP-10-16-064-F; dissolved chromium from samples DUP-081810-F, GP-10-16-034-F, GP-10-16-054-F, and GP-10-16-064-F; dissolved copper from samples DUP-081810-F, GP-10-16-034-F, and GP-10-16-064-F with a with a F (contamination in the equipment rinsate blank) reason code.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081810-U/F was collected as the field duplicate of sample GP-10-16-054-U/F. RPDs for analytes detected above the LOQ were within acceptance criteria, except for total aluminum.	AMEC J qualified the total aluminum results from samples GP-10-16-054-U and its field duplicate DUP-081810-U with an E (poor agreement between duplicates) reason code.	Non-Directional

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (165%/0%), total antimony (64%/64%), total arsenic (58%/50%), total calcium (74%MSD), total iron (0%/0%), total selenium (74%/74%), and total magnesium (75%MSD), total manganese (44%MSD), and total mercury (121%MSD) recoveries in the MS/MSD performed on sample GP-10-16-034-U were outside the QAPP specified limits. Dissolved mercury (141%/138%) recoveries in the MS/MSD performed on sample GP-10-16-034-F were outside QAPP-specified limits but the sample was non-detect and not impacted by the high bias.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the total antimony, total arsenic, total magnesium, total selenium and total mercury results from sample GP-10-16-034-U with a Q (MS/MSD recovery not within control) reason code.	Low / High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is <4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits on sample GP-10-16-034-U/F		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed samples GP-10-16-034-U/F were within acceptance limits with the following exceptions: dissolved barium (12%), dissolved calcium (16%), dissolved cobalt (18%), dissolved magnesium (15%), dissolved manganese (16%), dissolved potassium (12%), and dissolved sodium (11%).	AMEC J qualified the detected dissolved barium, dissolved calcium, dissolved cobalt, dissolved magnesium, dissolved manganese, dissolved potassium, and dissolved sodium from sample GP-10-16-034-F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-034-U has elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed at litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		

November 2, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample GP-10-16-064-F was analyzed in duplicate for total alkalinity. RPD was elevated at 5%.	AMEC J qualified the detected total alkalinity result from sample GP-10-16-064-F with an E (poor agreement between duplicate) reason code.	
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample GP-10-16-064-F. % recovery was low at 80%.	AMEC J qualified the detected total alkalinity result from sample GP-10-16-064-F with a Q (MS recovery not within control) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blanks.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The lab performed duplicate analysis on sample GP-10-16-064-F. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-16-064-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All detected results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-054-F has an elevated detection limits for chloride in order to quantitate the result within the calibration range. The requested reporting limit was not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

November 2, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-16-034-F was analyzed in duplicate for nitrite and sample GP-10-16-064-F for ammonia and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-16-034-F for nitrite and sulfide and sample GP-10-16-064-F for ammonia. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample GP-10-16-054-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis for COD and DOC on a sample from a different SDG.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS for DOC was performed on sample GP-10-16-064-F. The lab performed MS analysis for COD on a sample from a different SDG. The recoveries were within acceptance.	No qualifications are warranted.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample GP-10-16-034-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blank.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-16-034-U was analyzed in duplicate by the laboratory for TSS. RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-034-U and has an elevated detection limit due to the elevated concentration. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

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Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

November 17, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers nineteen soil samples (including 2 field duplicates) and one water sample (rinsate blank) collected on August 17, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 18, 2010 and assigned sample delivery group (SDG) number L1012787 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A for soils and 6020A/7470A for the rinsate, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012787-01	08/17/2010	SP-10-14-005	
L1012787-02	08/17/2010	SP-10-14-010	
L1012787-03	08/17/2010	SP-10-14-015	
L1012787-04	08/17/2010	SP-10-14-020	
L1012787-05	08/17/2010	SP-10-14-023	
L1012787-06	08/17/2010	SP-10-14-027	
L1012787-07	08/17/2010	SP-10-14-030	
L1012787-08	08/17/2010	SP-10-14-031	
L1012787-09	08/17/2010	SP-10-14-035	
L1012787-10	08/17/2010	SP-10-14-040	
L1012787-11	08/17/2010	SP-10-14-044	
L1012787-12	08/17/2010	SP-10-14-046	
L1012787-13	08/17/2010	SP-10-14-055	
L1012787-14	08/17/2010	SP-10-14-060	
L1012787-15	08/17/2010	SP-10-14-070	
L1012787-16	08/17/2010	SP-10-14-075	
L1012787-17	08/17/2010	SP-10-14-080	MS/MSD
L1012787-18	08/17/2010	SDUP-081710	Field Duplicate of SP-10-14-030
L1012787-19	08/17/2010	SDUP2-081710	Field Duplicate of SP-10-14-055
L1012787-20	08/17/2010	RB2-081710-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil and Aqueous	As required by method	One sample cooler was received on 08/18/2010 at a temperature of 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012787

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A and 6020A/7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. Rinsate sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total calcium (25.7 µg/L), total iron (10.3 µg/L), total manganese (0.24 µg/L), and total zinc (2.12 µg/L) were detected in the method blank associated with the analysis of RB2-081710-U from this SDG. Total antimony (0.2 mg/kg), total calcium (1.9 mg/kg), total chromium (0.049 mg/kg), and total manganese (0.032 mg/kg) were detected in the method blank associated with the analysis of soil samples from this SDG. Total aluminum (5.65 µg/L), total arsenic (0.37 µg/L), total calcium (62.5 µg/L), total chromium (0.33 µg/L), total copper (0.21 µg/L), total iron (10.7 µg/L), total manganese (0.2 µg/L), total potassium (18.6 µg/L), and total zinc (5.68 µg/L) were detected in rinsate RB2-081710-U	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results, with the following exceptions: AMEC U qualified the detected total antimony from samples SDUP-081710, SDUP2-081710, SP-10-14-005, SP-10-14-010, SP-10-14-015, SP-10-14-020, SP-10-14-023, SP-10-14-027, SP-10-14-030, SP-10-14-035, SP-10-14-040, SP-10-14-044, SP-10-14-046, SP-10-14-055, SP-10-14-060, SP-104-14-075, and SP-10-14-080 with a B (contamination in the method blank) reason code. The rinsate blank was not qualified due to the method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Samples SDUP-081710 and SDUP2-081710 were collected as field duplicates of samples SP-10-14-030 and SP-10-14-055, respectively. The RPDs for analytes detected above the LOQ were within the acceptance criteria with the following exception: total calcium had an elevated RPD of 106% between SDUP-081710 and SP-10-14-030.	AMEC J qualified the total calcium from samples SDUP-081710 and SP-10-14-030 with and E (poor agreement between duplicates) reason code.	Non-Directional

November 17, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total aluminum (1060%/944%), total antimony (43%/47%), total arsenic (138%/79%), total iron (4020%/2360%), total magnesium (284%/165%), total manganese (189%/142%), and total potassium (165%MSD) recoveries in the MS/MSD performed on sample SP-10-14-080 were outside the QAPP specified limits. Total mercury (134%MS) recovery in the MS performed on sample RB2-081710-U was outside the QAPP specified limit	The background concentrations of all analytes that are outside QAPP-specified limits were either more than 4x the spike concentration or not detected with the following exceptions: AMEC previously U qualified the detected total antimony from sample SP-10-14-080 and has not further qualified the results.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS performed on sample SP-10-14-080 had recoveries within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on SP-10-14-080 were within acceptance limits.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TOC was not detected in associated preparation blanks.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% ≤RPD, RPD >25% flag detected results "J" and nondetected results "UJ"	Sample SP-10-14-010 was analyzed in duplicate by the laboratory. The RPDs were within the control limit.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		

November 17, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample SP-10-14-080. The recovery was high in the first replicate at 126%. The second replicate was within acceptance criteria.	AMEC J qualified the TOC result for replicate 1 from sample SP-10-14-080 with a Q (MS recovery outside acceptance criteria) reason code.	High
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported at or slightly above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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REVIEWED BY:

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Environmental Chemist

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 19, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 19, 2010 and assigned sample delivery group (SDG) number L1012830 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o. data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012830-01/02	08/19/2010	GP-10-16-074-F/U	MS/MSD
L1012830-03/04	08/19/2010	GP-10-16-084-F/U	
L1012830-05/06	08/19/2010	GP-10-16-094-F/U	
L1012830-07/08	08/19/2010	DUP-081910-F/U	Field Duplicate of GP-10-16-084-F/U (Metals only)
L1012830-09	08/19/2010	RB2-081910-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 08/19/2010 at a temperature of 3.6°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012830

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Dissolved calcium (25.7 µg/L), dissolved iron (10.3 µg/L), dissolved manganese (0.24 µg/L), and dissolved zinc (2.12 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total calcium (14.4 µg/L), total chromium (0.35 µg/L), total copper (0.13 µg/L), total iron (17.6 µg/L), and total manganese (0.23 µg/L) were detected in rinsate RB2-081910-U.	The associated sample concentrations were more than 10 times the blank concentrations, therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected dissolved zinc results from samples DUP-081910-F, GP-10-16-074-F, GP-10-16-084-F, and GP-10-16-094-F with a B (contamination in the method blank) reason code. AMEC U qualified the detected dissolved chromium result from sample GP-10-16-074-F; and the dissolved copper results from samples DUP-081910-F, GP-10-16-074-F, and GP-10-16-084-F with an F (contamination in the equipment rinsate blank) reason code.	High

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-081910-U/F was collected as the field duplicate of sample GP-10-16-084-U/F. The RPDs were within acceptance criteria for analytes detected above the LOQ.		
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (124%MS), total calcium (173%/156%), total iron (1150%/870%), total manganese (142%/128%), total potassium (132%/121%) and total sodium (126%MS) recoveries in the MS/MSD performed on sample GP-10-16-074-U were outside the QAPP specified limits. Dissolved arsenic (123%MS), dissolved calcium (155%/147%), dissolved iron (840%/610%), dissolved manganese (134%/122%), dissolved potassium (125%MS), and dissolved sodium (130%MS) recoveries in the MS/MSD performed on sample GP-10-16-074-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the total arsenic, total manganese, total potassium and total sodium results from sample GP-10-16-074-U with a Q (MS/MSD recovery not within control) reason code. AMEC J qualified the dissolved arsenic, dissolved manganese, dissolved potassium and dissolved sodium results from sample GP-10-16-074-F with a Q (MS/MSD recovery not within control) reason code.	High

November 5, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total iron (168%) and total manganese (240%) on sample GP-10-16-074-U/F.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on samples GP-10-16-074-U/F were within acceptance limits with the following exceptions: total copper (11%), total iron (13%), total magnesium (11%), total manganese (11%), and total nickel (11%).	AMEC J qualified the detected total copper, total iron, total magnesium, total manganese, and total nickel results from sample GP-10-16-074-U with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-16-084-U/F and DUP-081910-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and <LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualifications warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on a sample from a different SDG.	No qualifications warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)			

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample GP-10-16-084-F. The %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD < 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample GP-10-16-084-F. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The sulfate result from sample GP-10-16-084-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-16-074-F and GP-10-16-094-F have elevated detection limits for chloride in order to quantitate within the calibration range. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample GP-10-16-074-F was analyzed in duplicate for ammonia and sample GP-10-16-094-F for sulfide and nitrite. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample GP-10-16-074-F for ammonia and sample GP-10-16-094-F for sulfide and nitrite. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from samples GP-10-16-074-F and GP-10-16-084-F was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample GP-10-16-094-F was analyzed in duplicate for COD by the laboratory. The laboratory performed duplicate analysis for DOC on a sample from a different SDG. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample GP-10-16-094-F for COD. The DOC MS was performed on a sample from a different SDG. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample GP-10-16-074-F has an elevated detection limit for DOC due to the dilutions required by the elevated concentration in the sample.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

November 5, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples GP-10-16-074-U and GP-10-16-094-U have elevated detection limits due to dilutions required by the sample matrix. The requested reporting limits were not achieved.	No qualification warranted.	None

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King
Environmental Chemist

REVIEWED BY:

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INTRODUCTION

This data validation report covers ten soil samples (including 2 field duplicates) and one water sample (rinsate blank) collected on August 19, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Alpha Analytical Laboratory in Westborough, MA (Alpha) on August 19, 2010 and assigned sample delivery group (SDG) number L1012864 upon receipt. Alpha analyzed the samples for target analyte list (TAL) metals using United States Environmental Protection Agency (USEPA) Method 6010B/7471A for soils and 6020A/7470A for the rinsate, and total organic carbon (TOC) using USEPA 9060. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Method outlined in Tables 3 & 4. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1012864-01	08/19/2010	SP-10-16-036	
L1012864-02	08/19/2010	SP-10-16-050	
L1012864-03	08/19/2010	SP-10-16-053	
L1012864-04	08/19/2010	SP-10-16-060	
L1012864-05	08/19/2010	SP-10-16-065	
L1012864-06	08/19/2010	SP-10-16-070	
L1012864-07	08/19/2010	SP-10-16-080	
L1012864-08	08/19/2010	SP-10-16-093	
L1012864-09	08/19/2010	RB-081910-U	Rinsate Blank
L1012864-10	08/19/2010	SDUP-081910	Field Duplicate of SP-10-16-036
L1012864-11	08/19/2010	SDUP2-081910	Field Duplicate of SP-10-16-065

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Soil	As required by method	One sample cooler was received on 08/19/2010 at a temperature of 2°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1012864

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Target Analyte List Metals by USEPA 6010B/7471A and 6020A/7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. Rinsate sample was preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) 180 days from sampling to analysis 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Initial Calibration	1) Correct calibration standards. At least 3 standards points not forced through zero are required for linear calibration. r≥0.995 (EPA Method 6010/6020/7470). 2) r^2 ≥0.995. quadratic calibration (at least 6 points. not forced through zero)	Initial calibration met established criteria.		
2nd Source Initial Calibration Verification (ICV)	1) Following the calibration. 2) 90-110% recovery (EPA 6010/6020). 3) 75-89% recovery. J qualify detects and UJ qualify nondetects. 4) 111-125% recovery. J qualify detects. 5) 80-120% recovery (EPA 7471A) 6) RSD <5% for the replicate	ICV met acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Continuing Calibration Verification (CCV)	1) CCV using mid and high level standards; analyzed after every 10 samples and at the end of batch. 2) Concentrations 80-120% (EPA Method 7470) and 90-110% of expected value (EPA Method 6010/6020). a) CCV >120% (EPA Method 7470) or 110% (EPA Method 6010/6020): J qualify detects, no qualification is necessary for non detects. b) CCV <80% (EPA Method 7470) or 90% (EPA Method 6010/6020): J qualify detects; UJ qualify non detects. c) CCV outside 65-135%, reject data	All CCV recoveries were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is < 10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total calcium (25.7 µg/L), total iron (10.3 µg/L), total manganese (0.24 µg/L), and total zinc (2.12 µg/L) were detected in the method blank associated with the analysis of RB-081910-U from this SDG. Total calcium (0.92 mg/kg) and total manganese (0.035 mg/kg) were detected in the method blank associated with the analysis of soil samples from this SDG. Total aluminum (2.25 µg/L), total calcium (26.8 µg/L), total chromium (0.31 µg/L), total copper (0.44 µg/L), total iron (16.9 µg/L), total manganese (0.21 µg/L), total lead (0.05 µg/L), and total zinc (1.82 µg/L) were detected in rinsate RB-081910-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results. The rinsate blank results have not been qualified due to method blank contamination.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Initial Calibration Blanks and Continuing Calibration Blanks (ICB/CCB)	1) ICB and CCB after every ten samples or every batch whichever is greater. 2) Evaluate absolute values down to the LOD. 3) Sample results < 10x blank sample, U qualify detects 4) Sample results >10x blank level, no action required.	No metals were detected in the ICB. Silver was detected in a number of the CCBs ranging between 0.0006 mg/L to 0.00095 mg/L. Beryllium was detected in a number of the CCBs ranging between 0.00044 mg/L to 0.00079 mg/L. Manganese was detected in a number of the CCBs ranging between 0.00043 mg/L to 0.00099 mg/L. Arsenic was detected in two CCBs at 0.00243 mg/L and 0.00244 mg/L. Magnesium was detected in one CCB at 0.01289 mg/L. Antimony was detected in a number of the CCBs ranging between 0.00503 mg/L to 0.00799 mg/L.	The associated sample concentrations were either more than 10 times the blank concentrations or not detected; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected total silver from samples SP-10-16-070, SP-10-16-036, SP-10-16-060, SP-10-16-080, SDUP-081910, and SDUP2-081910; total beryllium from samples SP-10-16-050, SP-10-16-053, SP-10-16-065 and SDUP2-081910; total arsenic from sample SP-10-16-050 with a B (contamination in the calibration blank) reason code.	None
Negative blanks	1) If the blank has a negative result with an absolute value >LOD, qualify detected results ≤10 the absolute value of the contaminant concentration as estimated "J" and qualify nondetected results "UJ".	No negative blank concentrations were detected.		
Interelement checks ICS-A/ICS-AB Instrument performance check	1) No qualification required if recovery between 80-120%. a)%R< 80% flag detected results "J" and nondetected results "UJ" b) %R >120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R"	ICS-A/ICS-AB recoveries were within acceptance limits.		
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

November 18, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample SDUP-081910 was collected as the field duplicate of sample SP-10-16-036 and sample SDUP2-081910 was collected as the field duplicate of sample SP-10-16-065. The RPDs for analytes detected above the LOQ were within the acceptance criteria		
MS/MSD Recovery	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-11). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" d) RPD ≤ 20%	Total aluminum (0%/0%), total antimony (65%/66%), total calcium (73%MSD), total chromium (70%MSD), total iron (466%/470%), total magnesium (70%/47%), and total manganese (74%MS) recoveries in the MS/MSD performed on sample SP-10-16-070 were outside the QAPP specified limits. Total mercury recovered high in the MS performed on sample RB-081910-U at 128%. The sample was non-detect and not impacted by the high bias.	The background concentrations of all analytes that are outside QAPP-specified limits were either more than 4x the spike concentration or not detected with the following exceptions: AMEC J qualified the detected total antimony, total calcium, total chromium and total manganese from sample SP-10-16-070 with a Q (MS/MSD recovery not within control) reason code.	Low
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries for sample SP-10-16-070 were within acceptance limits.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50 times LOQ 3) %D>10% flag detected results "J"	The %Ds for the SD performed on sample SP-10-16-070 were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these metal results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Organic Carbon (TOC) by USEPA 9060

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperature upon arrival at Alpha was within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) Aqueous samples 28 days from sampling to analysis, preserved with H2SO4 to pH<2 2) Soil samples 28 days from sampling to analysis	Samples were analyzed as per EPA Method requirements.		
Initial Calibration	1) K-factor within ± 0.15% from mean value for carbon 2) r ≥ 0.995	Initial calibration criteria were met.		

November 18, 2010 Total Metals by USEPA Method 6010B/7471A and 6020A/7470A
Region I Data Review Worksheet TOC by USEPA 9060
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
ICV/CCV	No qualification if recovery between 90-110% a) %R >110% flag detected results "J" b) %R <90% flag detected results "J" and nondetected results "UJ"	ICVs were within acceptance limits.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TOC was not detected in associated preparation blanks.		
ICBs/CCBs	Evaluate absolute values down to the LOD. Evaluate ICBs/CCBs that bracket samples.	ICB/CCBs were analyzed every 10 samples with no detections.		
Standard Reference material (SRM)	No qualification if recovery between 75-125%	SRM recovery was within acceptance criteria.		
Lab Duplicate	25% < RPD. RPD > 25% flag detected results "J" and nondetected results "UJ"	Sample SP-10-16-050 was analyzed in duplicate by the laboratory. The % RPDs were within control limits.		
Field Duplicates	RPD ≤ 50% when detects for both duplicates are ≥QL for soil	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 75-125%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SP-10-16-093. The recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All TOC results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

November 5, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on August 30, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Analytical Laboratory in Westborough, MA (Alpha) on August 30, 2010 and assigned sample delivery group (SDG) number L1013407 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level c data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013407-01/02	08/30/2010	SHM-10-11-F/U	MS/MSD
L1013407-03/04	08/30/2010	SHM-10-12-F/U	
L1013407-05/06	08/30/2010	DUP-083010-F/U	Field Duplicate of SHM-10-12-F/U (Metals Only)
L1013407-07	08/30/2010	RB-083010-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 08/30/2010 at a temperature of 3.0°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013407

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

November 5, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total and dissolved aluminum (3.13 µg/L), total and dissolved calcium (19.4 µg/L), total and dissolved iron (15.8 µg/L), total and dissolved potassium (23 µg/L), total and dissolved silver (0.13 µg/L), and total mercury (0.01808 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (2.38 µg/L), total antimony (0.28 µg/L), total arsenic (0.29 µg/L), total barium (0.1 µg/L), total calcium (34.8 µg/L), total chromium (0.38 µg/L), total copper (0.520 µg/L), total iron (18.5 µg/L), total lead (0.05 µg/L), total manganese (0.83 µg/L), total nickel (0.38 µg/L), total potassium (33 µg/L), total sodium (56 µg/L), total zinc (2.25 µg/L), and total mercury (0.03853 µg/L) were detected in rinsate RB-083010-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected total aluminum results from samples DUP-083010-U and SHM-10-12-U; the dissolved aluminum from samples DUP-083010-F, SHM-10-11-F and SHM-10-12-F; and the total mercury from sample DUP-083010-U with a B (method blank contamination) reason code. AMEC U qualified the detected total antimony from samples SHM-10-11-U and SHM-10-12-U; the dissolved antimony from samples SHM-10-11-F and DUP-083010-U; total and dissolved chromium from SHM-10-11-U/F; total and dissolved copper from SHM-10-11-U/F; total and dissolved lead from sample SHM-10-11-U/F; total and dissolved zinc from sample SHM-10-11-U/F; and dissolved mercury from samples DUP-083010-F and SHM-10-11-F with an F (contamination in the rinsate blank) reason code. The rinsate blank was not qualified due to the method blank concentrations.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections, UJ qualify non detects	Sample DUP-083010-U/F was collected as the field duplicate of sample SHM-10-12-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total iron (0%MSD) and total manganese (74%MSD) recoveries in the MS/MSD performed on sample SHM-10-11-U were outside the QAPP specified limits. Dissolved arsenic (122%MS), dissolved calcium (125%MS), dissolved iron (670%/330%), and dissolved manganese (140%MS) recoveries in the MS/MSD performed on sample SHM-10-11-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exceptions: AMEC J qualified the dissolved arsenic and dissolved calcium result from sample SHM-10-11-F with a Q (MS/MSD recovery not within control) reason code	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <75% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J	The PDS recoveries were within acceptance limits, except for dissolved calcium (339%), dissolved iron (154%), and dissolved manganese (300%) on sample SHM-10-11-F.	The background concentrations of dissolved iron and manganese were more than 4x the spike concentration. AMEC J qualified the detected dissolved calcium result from sample SHM-10-11-F with a P (PDS recovery not within control limits) reason code	High
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on sample SHM-10-11-F were outside acceptance limits for dissolved barium (15%), dissolved calcium (12%), dissolved cobalt (15%), dissolved iron (15%), dissolved magnesium (15%), dissolved manganese (13%), dissolved potassium (15%), and dissolved sodium (11%).	AMEC J qualified the detected dissolved barium, dissolved calcium, dissolved cobalt, dissolved iron, dissolved magnesium, dissolved manganese, dissolved potassium, and dissolved sodium from sample SHM-10-11-F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-11-U/F, SHM-10-12-U/F and DUP-083010-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-12-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-12-U. The % recovery was low at 57%.	AMEC J qualified the detected total alkalinity result from sample SHM-10-12-U with a Q (MS recovery not within control) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on SHM-10-11-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-11-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate results from samples SHM-10-11-U and SHM-10-12-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

November 5, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-11-U was analyzed in duplicate for nitrite and sample SHM-10-12-U for ammonia and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-11-U for nitrite and sample SHM-10-12-U for ammonia and sulfide. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and > LOQ flag "U" 3) Sample result >10x contaminant concentration; no qualification required.	COD was detected at a concentration of 9.7 mg/L in associated method blanks.	AMEC U qualified the detected COD results from samples SHM-10-11-U and SHM-10-12-U with a B (contamination in the method blank) reason code.	
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-12-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-12-U for COD and SHM-10-11-U for DOC. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The lab performed duplicate analysis on a sample from a different SDG.	No qualifications warranted.	None

November 5, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on September 01, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Analytical Laboratory in Westborough, MA (Alpha) on September 01, 2010 and assigned sample delivery group (SDG) number L1013534 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013534-01/02	09/01/2010	SHM-10-13-090110-F/U	MS/MSD
L1013534-03/04	09/01/2010	SHM-10-15-090110-F/U	
L1013534-05/06	09/01/2010	DUP-090110-F/U	Field Duplicate of SHM-10-15-090110-U/F (Metals Only)
L1013534-07	09/01/2010	RB-090110-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 09/01/2010 at a temperature of 4.6°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013534

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH< 2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	Total and dissolved aluminum (2.41 µg/L), total and dissolved calcium (16.9 µg/L), total and dissolved copper (0.16 µg/L), total and dissolved iron (13 µg/L), total and dissolved manganese (0.14 µg/L), and total and dissolved silver (0.13 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total antimony (0.670 µg/L), total arsenic (0.25 µg/L), total calcium (14.1 µg/L), total chromium (0.25 µg/L), total iron (16.2 µg/L), total lead (0.08 µg/L), and total manganese (0.16 µg/L) were detected in rinsate RB-090110-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected total aluminum from sample SHM-10-15-090110-U; total copper from samples DUP-090110-U and SHM-10-13-090110-U; dissolved aluminum from sample SHM-10-13-090110-U; dissolved copper from sample SHM-10-13-090110-F with a B (method blank contamination) reason code. AMEC U qualified the detected total antimony from samples SHM-10-13-090110-U and SHM-10-15-090110-U; dissolved antimony from samples SHM-10-13-090110-F, SHM-10-15-090110-F, and DUP-090110-F; dissolved chromium from sample SHM-10-13-090110-F; total lead from samples SHM-10-13-090110-U and SHM-10-15-090110-U with an F (contamination in the rinsate blank) reason code. The rinsate blank results have not been qualified due to method blank contamination.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-090110-U/F was collected as the field duplicate of sample SHM-10-15-090110-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria, except for total aluminum.	The total aluminum from sample SHM-15-090110-U was previously U qualified due to blank contamination and has not been further qualified.	None
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total iron (340%/190%) recoveries in the MS/MSD performed on sample SHM-10-13-090110-U were outside the QAPP specified limits. Dissolved calcium (143%MS), dissolved iron (610%/170%), and dissolved manganese (122%MS) recoveries in the MS/MSD performed on sample SHM-10-13-090110-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exception: AMEC J qualified the dissolved manganese result from sample SHM-10-13-090110-F with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total arsenic (70%) on sample SHM-10-13-090110-U.	AMEC J qualified the detected total arsenic result from sample SHM-10-13-090110-U with a P (PDS recovery not within control limits) reason code.	Low
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on SHM-10-13-090110-U/F were within acceptance criteria with the following exceptions: total aluminum (28%), total and dissolved arsenic (28%/36%), total and dissolved barium (24%/31%), total and dissolved calcium (32%/42%), total and dissolved iron (33%/41%), total and dissolved magnesium (32%/41%), total and dissolved manganese (34%/40%), total and dissolved potassium (33%/39%), and total and dissolved sodium (27%/37%).	AMEC J qualified the detected total aluminum, total and dissolved arsenic, total and dissolved barium, total and dissolved calcium, total and dissolved iron , total and dissolved magnesium, total and dissolved manganese, total and dissolved potassium, and total and dissolved sodium results from sample SHM-10-13-090110-U/F with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-15-090110-U/F and DUP-090110-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualification warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on a sample from a different SDG.	No qualification warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

November 8, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-13-090110-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS/MSD was performed on sample SHM-10-13-090110-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample SHM-10-13-090110-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents c. All lab records of sample receipt, preparation and analysis	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Lab Duplicate	1) RPD≤20%	Sample SHM-10-13-090110-U was analyzed in duplicate for ammonia and sample SHM-10-15-090110-U for sulfide and nitrite. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSDs were performed on sample SHM-10-13-090110-U for ammonia and sulfide and sample SHM-10-15-090110 for nitrite. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

November 8, 2010 — **Total and Dissolved Metals by USEPA Method 6020A/7470A**
Region I Data Review Worksheet — **Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/**
Project: Shepley's Hill Landfill Supplemental Investigation — **4500S2-AD/5310C/2320B/2540D**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-13-090110-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD < 30% when detects for both duplicates are >5QL for water	A field duplicate was not submitted for this analysis		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-13-090110-U for COD and sample SHM-10-15-090110-U for DOC. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is < 10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualification warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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November 8, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on September 02, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Analytical Laboratory in Westborough, MA (Alpha) on September 02, 2010 and assigned sample delivery group (SDG) number L1013628 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013628-01/02	09/02/2010	SHM-10-14-090210-F/U	MS/MSD
L1013628-03/04	09/02/2010	SHM-10-16-090210-F/U	
L1013628-05/06	09/02/2010	DUP-090210-F/U	Field Duplicate of SHM-10-16-090210-F/U (Metals Only)
L1013628-07	09/02/2010	RB-090210-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 09/02/2010 at a temperature of 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013628

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total and dissolved calcium (18.8 µg/L) and total and dissolved iron (15.5 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total aluminum (3.24 µg/L), total antimony (0.18 µg/L), total calcium (87.9 µg/L), total chromium (0.27 µg/L), total copper (0.12 µg/L), total iron (16.2 µg/L), total lead (0.11 µg/L), total manganese (0.26 µg/L), total nickel (0.4 µg/L), and total zinc (3.93 µg/L) were detected in rinsate RB-090210-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected dissolved aluminum results from samples DUP-090210-F and SHM-10-16-090210-F; total and dissolved antimony from DUP-090210-U/F and SHM-10-16-090210-U/F; dissolved chromium from samples DUP-090210-F and SHM-10-16-090210-F; dissolved copper from samples DUP-090210-F and SHM-10-16-090210-F; total lead from sample SHM-10-14-090210-U; dissolved nickel from samples DUP-090210-F and SHM-10-16-090210-F; total and dissolved zinc from samples DUP-090210-U/F and SHM-10-16-090210-U/F; and dissolved zinc from sample SHM-10-14-090210-F with an F (contamination from a rinsate blank) reason code. The rinsate blank results have not been qualified based on method blank contamination.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit; J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND; J-detections. UJ qualify non detects	Sample DUP-090210-U/F was collected as the field duplicate of sample SHM-10-16-090210-U/F. All RPDs for analytes detected above the LOQ were within acceptance criteria.	No qualification warranted.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (133%/300%), total calcium (129%/154%), total iron (520%/750%), and total manganese (158%/176%) recoveries in the MS/MSD performed on sample SHM-10-14-090210-U were outside the QAPP specified limits. Dissolved arsenic (333%/467%), dissolved calcium (142%/191%), dissolved iron (500%/1100%), dissolved manganese (160%/238%), and dissolved potassium (132%MSD) recoveries in the MS/MSD performed on sample SHM-10-14-090210-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the following exception: AMEC J qualified the dissolved potassium result from sample SHM-10-14-090210-F with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total manganese (264%) on sample SHM-10-14-090210-U.	AMEC J qualified the detected total manganese result from sample SHM-10-14-090210-U with a P (PDS recovery not within control limits) reason code.	High
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on sample SHM-10-14-090210-U/F were within acceptance limits with the following exceptions: total magnesium (13%) total manganese (16%), and total potassium (12%).	AMEC J qualified the detected total magnesium, total manganese and total potassium results from samples SHM-10-14-090210-U with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Sample SHM-10-14-090210-U/F has elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.		
Field Duplicates	RPD 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R≤10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS was performed on a sample from a different SDG.	No qualification warranted.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-14-090210-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	A field duplicate was not submitted for this analysis.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-14-090210-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

November 8, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-14-090210-U was analyzed in duplicate for ammonia; sample SHM-10-16-090210-U for sulfide and the lab duplicate for nitrite was performed on a sample from a different SDG. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD < 30%	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS for ammonia were performed on sample SHM-10-14-090210-U, the MS for sulfide was performed on sample SHM-10-16-090210-U and the MS for nitrite was performed on a sample from a different SDG. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%; RPD >20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis for DOC on sample SHM-10-14-090210-U. A sample from a different SDG was analyzed in duplicate COD. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS for DOC was performed on sample SHM-10-16-090210-U. The MS for COD was performed on a sample from a different SDG. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	COD and DOC results were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample from a different SDG.	No qualification warranted.	None

November 8, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	A field duplicate was not submitted for this analysis.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

November 9, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 6 water samples (including 1 rinsate blank and 1 field duplicate) collected on September 07, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Analytical Laboratory in Westborough, MA (Alpha) on September 07, 2010 and assigned sample delivery group (SDG) number L1013810 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; hardness by USEPA Method 6010B; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total and dissolved organic carbon (TOC/DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, ii EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013810-01/02	09/07/2010	SHM-10-08-090710-F/U	
L1013810-03/04	09/07/2010	SHM-10-03-090710-F/U	
L1013810-05/06	09/07/2010	SHM-10-02-090710-F/U	MS/MSD
L1013810-07/08	09/07/2010	SHM-10-04-090710-F/U	
L1013810-09	09/07/2010	RB-090710-U	Rinsate Blank
L1013810-10/11	09/07/2010	DUP-090710-F/U	Field Duplicate of SHM-10-03-090710-F/U

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 09/07/2010 at temperatures of 3°C and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013810

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A, Hardness by 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH<2 2) Hg – 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration; flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total and dissolved aluminum (2.59 µg/L), total and dissolved calcium (28.7 µg/L), total and dissolved iron (12.3 µg/L), and total and dissolved potassium (26.3 µg/L) were detected in the method blank associated with the analysis of samples from this SDG. Total calcium (34 µg/L), total iron (13.3 µg/L), total manganese (0.3 µg/L) and total sodium (26.3 µg/L) were detected in rinsate RB-090710-11	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected dissolved aluminum result from sample SHM-10-02-090710-F with a B (contamination in the method blank) reason code.	None

November 9, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-090710-U/F was collected as the field duplicate of sample SHM-10-03-090710-U/F. The RPDs were within acceptance criteria.	No qualification warranted.	None
MS MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Dissolved sodium (69%MS) recovery in the MS/MSD performed on sample SHM-10-02-090710-I was outside the QAPP specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total calcium (60%), total manganese (0%), and dissolved calcium (150%) on sample SHM-10-02-090710-U/F.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed were within acceptance limits with the following exceptions: total and dissolved calcium (32%/17%), total and dissolved iron (34%/21%), total and dissolved magnesium (31%/14%), total and dissolved manganese (34%/16%), total and dissolved potassium (29%/13%), and total sodium (30%).	AMEC J qualified the detected total and dissolved calcium, total and dissolved iron, total and dissolved magnesium, total and dissolved manganese, total and dissolved potassium, and total sodium from samples SHM-10-02-090710-U/F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-08-090710-U/F, SHM-10-03-090710-U/F, SHM-10-02-090710-U/F, SHM-10-04-090710-U/F and DUP-090710-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R < 10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-02-090710-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090710-U was collected as the field duplicate of sample SHM-10-03-00907l0-U. The RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-08-090710-U. The % recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6 °C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	1) Chloride RPD <18%. 2) Nitrate RPD <15%. 3) Sulfate RPD <20%.	The laboratory performed duplicate analysis on sample SHM-10-02-090710-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-090710-U was collected as the field duplicate of sample SHM-10-03-090710-U. The RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-02-090710-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	All detected results were reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-08-090710-U, SHM-10-03-090710-U, SHM-10-02-090710-U, SHM-10-04-090710-U and DUP-090710-U for chloride and SHM-10-04-090710-U for nitrate have elevated detection limits in order to quantitate within the range of calibration. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		

November 9, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	Ammonia was detected in method blank at a detection of 0.0183 mg/L.	AMEC U qualified samples DUP-090710-U, SHM-10-03-090710-U, SHM-10-04-090710-U, and SHM-10-08-090710-U with a B (contamination in the method blank) reason code.	High
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-02-090710-U was analyzed in duplicate for ammonia, nitrite and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-090710-U was collected as the field duplicate of sample SHM-10-03-090710-U. The RPDs for analytes detected above the LOQ were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-02-090710-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified the ammonia results detected between the LOD and the LOQ.	AMEC previously U qualified the ammonia results and have not been further qualified.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total and Dissolved Organic Carbon (TOC and DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD, TOC and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC/DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-04-090710-U was analyzed in duplicate by the laboratory for DOC and SHM-10-02-090710-U for TOC and COD. The RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090710-U was collected as the field duplicate of sample SHM-10-03-090710-U. RPDs were within acceptance criteria except for COD.	AMEC J qualified the COD results from sample SHM-10-03-090710-U and its field duplicate DUP-090710-U with an E (poor agreement between duplicate) reason code.	Non-Directional
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-02-090710-U for TOC and COD. The recoveries were within acceptance criteria. Insufficient volume was available for the MS for DOC.	No qualification warranted.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TOC and DOC results were reported as detected above the LOQ. The laboratory J qualified the COD result which was detected between the LOD and the LOQ in sample SHM-10-08-090710-U	AMEC J qualified these results with a TR (trace level) reason code	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Dissolved Solids (TDS) by SM2540C and Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file a. Sample data package including case narrative. QC data and raw data b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

November 9, 2010 — **Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B**
Region I Data Review Worksheet — **Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/**
Project: Shepley's Hill Landfill Supplemental Investigation — **4500S2-AD/5310C/2320B/2540C/D**
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS and TDS were not detected in associated method blanks.		
Lab Duplicate	RPD ≤20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-02-090710-U was analyzed in duplicate by the laboratory for TDS. The lab performed duplicate analysis for TSS on a sample from a different SDG. The RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090710-U was collected as the field duplicate of sample SHM-10-03-090710-U. The TSS RPD was high at 113%.	AMEC J qualified the detected TSS result from samples SHM-10-03-090710-U and its field duplicate DUP-090710-U with an E (poor agreement between duplicates) reason code.	Non-Directional
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS and TSD were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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INTRODUCTION

This data validation report covers 6 water samples (including 1 rinsate blank and 1 field duplicate) collected on September 08, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by Analytical Laboratory in Westborough, MA (Alpha) on September 08, 2010 and assigned sample delivery group (SDG) number L1013865 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; hardness by USEPA Method 6010B; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total and dissolved organic carbon (TOC/DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, ii EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013865-01/02	09/08/2010	SHM-10-01-090810-F/U	MS/MSD
L1013865-03/04	09/08/2010	SHM-10-10-090810-F/U	
L1013865-05/06	09/08/2010	SHM-10-05A-090810-F/U	
L1013865-07/08	09/08/2010	SHM-10-06-090810-F/U	
L1013865-09	09/08/2010	RB-090810-U	Rinsate Blank
L1013865-10/11	09/08/2010	DUP-090810-F/U	Field Duplicate of SHM-10-10-090810-F/U

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Three sample coolers were received on 09/08/2010 at temperatures of 3.9°C, 4.4°C and 4°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013865

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A, Hardness by 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt. preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH 2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total aluminum (2.18 µg/L), total calcium (13.1 µg/L), total lead (0.06 µg/L), total manganese (0.15 µg/L), and total sodium (37.6 µg/L) were detected in rinsate RB-090810-U. No analytes were detected in the method blanks.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected dissolved aluminum from sample SHM-10-05A-090810-F; total lead from sample SHM-10-05A-090810-U; and dissolved lead from samples SHM-10-05A-090810-F and SHM-10-06-090810-F with an F (contamination in the equipment rinsate blank) reason code.	High

November 11, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%. method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-090810-U/F was collected as the field duplicate of sample SHM-10-10-090810-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria.		
MS MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1) 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total manganese (20%/220%) and total calcium (127%MSD) recoveries in the MS MSD performed on sample SHM-10-01-090810-U were outside the QAPP specified limits. Dissolved manganese (40%MS) recoveries in the MS/MSD performed on sample SHM-10-01-090810-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total manganese (20%) on sample SHM-10-01-090810-U.	The background concentration of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration.	None
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on sample SHM-10-01-090810-U/F were within acceptance limits with the following exceptions: total calcium (24%), total magnesium (32%), and total manganese (29%).	AMEC J qualified the detected total calcium, total magnesium, and total manganese results from sample SHM-10-01-090810-U with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-01-090810-U/F, SHM-10-10-090810-U/F, SHM-10-06-090810-F/U and DUP-090810-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		

November 11, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-090810-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD <30% when detects for both duplicates are ≥QL for water	Sample DUP-090810-U was collected as the field duplicate of sample SHM-10-10-090810-U. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-01-090810-U. The % recovery was within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes were detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-01-090810-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-090810-U was collected as the field duplicate of sample SHM-10-10-090810-U. RPDs for analytes detected above the LOQ were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-01-090810-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrate result from sample DUP-090810-U and the sulfate results from samples SHM-10-10-090810-U, SHM-10-06-090810-U, and DUP-090810-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-01-090801-U was analyzed in duplicate for ammonia, sulfide and nitrite. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-090810-U was collected as the field duplicate of sample SHM-10-10-090810-U. RPDs were within acceptance criteria		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-01-090810-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The ammonia result from sample SHM-10-05A-090810-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total and Dissolved Organic Carbon (TOC and DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is < 10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is < 10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD, TOC and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC/DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-090810-U was analyzed in duplicate by the laboratory for COD and TOC and sample SHM-10-10-090810-U for DOC. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090810-U was collected as the field duplicate of sample SHM-10-10-090810-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-01-090810-U. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample SHM-10-01-090810-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Dissolved Solids (TDS) by SM2540C and Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS and TDS were not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-01-090810-U was analyzed in duplicate by the laboratory for TDS. A sample from a different SDG was analyzed in duplicate for TSS. The RPDs were within acceptance criteria.		

November 11, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090810-U was collected as the field duplicate of sample SHM-10-10-090810-U. The % RPDs were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS and TDS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

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November 11, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 4 water samples (including 1 rinsate blank and 1 field duplicate) collected on September 09, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Analytical Laboratory in Westborough, MA (Alpha) on September 09, 2010 and assigned sample delivery group (SDG) number L1013958 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; hardness by USEPA Method 6010B; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; total and dissolved organic carbon (TOC/DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and, total dissolved solids (TDS) and total suspended solids (TSS) using SMs 2540C/2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level of data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1013958-01/02	09/09/2010	SHM-10-06A-090910-F/U	
L1013958-03/04	09/09/2010	SHM-10-07-090910-F/U	MS/MSD
L1013958-05	09/09/2010	RB-090910-U	Rinsate Blank
L1013958-06/07	09/09/2010	DUP-090910-F/U	Field Duplicate of SHM-10-06A-090910-F/U

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	One sample cooler was received on 09/09/2010 at a temperature of 3°C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1013958

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A, Hardness by 6010B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH< 2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total arsenic (0.46 µg/L), total lead (0.06 µg/L), and total manganese (0.25 µg/L) were detected in rinsate RB-090910-U. No analytes were detected in the method blanks.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results.	None
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-090910-U/F was collected as the field duplicate of sample SHM-10-06A-090910-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria, except for dissolved magnesium and dissolved sodium.	AMEC J qualified the dissolved magnesium and dissolved sodium from samples DUP-090910-F and SHM-10-06A-090910-F with an E (poor agreement between duplicate) reason code.	Non-Directional

November 11, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (59%MS), total calcium (78%MS), and total iron (0%MS) recoveries in the MS/MSD performed on sample SHM-10-07-090910-U were outside the QAPP specified limits. Dissolved arsenic (143%MS), dissolved calcium (143%MS), dissolved iron (730%/280%), and dissolved manganese (132%MS) recoveries in the MS/MSD performed on sample SHM-10-07-090910-F were outside QAPP-specified limits.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration with the follow exception: AMEC J qualified the dissolved manganese result from sample SHM-10-07-090910-F with a Q (MS/MSD recovery not within control) reason code.	High
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits with the following exceptions: dissolved arsenic (142%), dissolved iron (129%), and dissolved manganese (200%) on sample SHM-10-07-090910-F.	The background concentrations of all analytes that are outside QAPP-specified limits were more than 4x the spike concentration	None
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on SHM-10-07-090910-U/F were within acceptance criteria with the following exceptions: dissolved arsenic (11%), dissolved calcium (18%), dissolved iron (19%), dissolved magnesium (16%), dissolved manganese (18%), and dissolved potassium (16%).	AMEC J qualified the detected dissolved arsenic, dissolved calcium, dissolved iron, dissolved magnesium, dissolved manganese, and dissolved potassium from sample SHM-10-07-090910-F with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-06A-090910-U/F, SHM-10-07-090910-F/U and DUP-090910-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Lab Duplicate	4% ≤RPD. RPD >4% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-090910-U was analyzed in duplicate for total alkalinity. RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090910-U was collected as the field duplicate of sample SHM-10-06A-090910-U. RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MS was performed on sample SHM-10-07-090910-U. The % recovery was low at 42%.	AMEC J qualified the detected total alkalinity result from sample SHM-10-07-090910-U with a Q (MS recovery not within control) reason code	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

November 11, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes were detected in the method blank associated with the analysis of samples from this SDG.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-07-090910-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-090910-U was collected as the field duplicate of sample SHM-10-06A-090910-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample (Qualify results for samples collected at same location but differing depths as well)	MS/MSD was performed on sample SHM-10-07-090910-U. The recoveries were within acceptance criteria with the following exception: chloride (5%MSD).	The background concentration of chloride was more than 4x the spike concentration.	None
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-07-090910-U was analyzed in duplicate for ammonia, sulfide and nitrite. %RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-090910-U was collected as the field duplicate of sample SHM-10-06A-090910-U. RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-07-090910-U. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	No positive results reported between LOD and LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Total and Dissolved Organic Carbon (TOC and DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		

November 11, 2010 Total and Dissolved Metals by USEPA Method 6020A/7470A, Hardness by 6010B
Region I Data Review Worksheet Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation 4500S2-AD/5310C/2320B/2540C/D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD, TOC and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (TOC/DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-090910-U was analyzed in duplicate by the laboratory for COD and TOC, and sample SHM-10-06A-090910-U for DOC. The RPDs were within acceptance criteria, except for COD which had an elevated RPD of 22%.	AMEC J qualified the COD result from sample SHM-07-090910-U with an E (poor agreement between duplicate) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090910-U was collected as the field duplicate of sample SHM-10-06A-090910-U. RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-07-090910-U. The recoveries were within acceptance criteria with the following exception: DOC recovered high at 121%.	AMEC J qualified the DOC result from sample SHM-10-07-090910-U with a Q (MS/MSD recovery outside acceptance criteria) reason code.	High
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD results from samples SHM-10-06A-090910-U and DUP-090910-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified these results with a TR (trace level) reason code.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 8. Total Dissolved Solids (TDS) by SM2540C and Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤ 6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS and TDS were not detected in associated method blanks.		
Lab Duplicate	RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-07-090910-U was analyzed in duplicate by the laboratory for TDS. The RPD was within acceptance criteria. The laboratory performed duplicate analysis on a sample from a different SDG for TSS.	No qualifications are warranted.	None
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-090910-U was collected as the field duplicate of sample SHM-10-06A-090910-U. The RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS and TDS were reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

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INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on October 19, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were dropped off by Sovereign Consulting at Analytical Laboratory in Westborough, MA (Alpha) on October 19, 2010 and assigned sample delivery group (SDG) number L1016405 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1016405-01/02	10/19/2010	SHM-10-13-101910-F/U	
L1016405-03/04	10/19/2010	SHM-10-14-101910-F/U	MS/MSD
L1016405-05/06	10/19/2010	SHM-10-11-101910-F/U	
L1016405-07/08	10/19/2010	DUP-101910-F/U	Field Duplicate of SHM-10-13-101910-U/F
L1016405-09	10/19/2010	RB-101910-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 10/19/2010 at temperatures of 3 °C and 2.4 °C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1016405

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH 2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total and dissolved barium (0.1 µg/L) and total and dissolved silver (0.14 µg/L) were detected in the method blanks associated with the analysis of samples from this SDG. Total aluminum (2.53 µg/L), total antimony (0.23 µg/L), total arsenic (0.2 µg/L), total barium (0.11 µg/L), total calcium (30.1 µg/L), total chromium (0.23 µg/L), total copper (0.28 µg/L), total manganese (0.39 µg/L), total mercury (0.1177 µg/L), total nickel (0.21 µg/L), total sodium (41.2 µg/L), and total zinc (2.52 µg/L) were detected in rinsate RB-101910-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected total antimony from samples SHM-10-11-101910-U and SHM-10-14-101910-U; dissolved antimony from samples DUP-101910-F and SHM-10-11-101910-F; total chromium from sample SHM-10-11-101910-U; total copper from samples SHM-10-11-101910-U, SHM-10-13-101910-U and DUP-101910-U; dissolved copper from sample DUP-101910-F; total and dissolved zinc in samples DUP-101910-F U, SHM-10-11-101910-F U, and SHM-10-13-101910-F/U; and total and dissolved mercury from samples DUP-101910-F/U, SHM-10-11-101910-F/U, SHM-10-13-101910-F/U, and SHM-10-14-101910-F/U with a F (contamination in the equipment rinsate blank) reason code. The rinsate blank results have not been qualified due to method blank contamination.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010 6020 7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects. UJ qualify non detects. b) If one result > LOQ and other ND: J-detections. UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-101910-U/F was collected as the field duplicate of sample SHM-10-13-101910-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria. Dissolved copper was not detected in sample SHM-10-13-101910-F but was detected in DUP-101910-F above the LOQ.	The dissolved copper from sample SHM-10-13-101910-F was previously U qualified due to rinsate blank contamination and has not been further qualified.	Non-Directional
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (17%/MS), total iron (0%/40%), total manganese (66%/78%), and total mercury (124%/134%) recoveries in the MS/MSD performed on sample SHM-10-14-101910-U were outside the QAPP specified limits. Dissolved arsenic (267%/350%), dissolved iron (310%/550%), dissolved calcium (135%MSD), dissolved manganese (130%MSD), and dissolved mercury (122%MSD) recoveries in the MS MSD performed on sample SHM-10-14-101910-F were outside QAPP-specified limits.	The background concentrations of all analytes outside the QAPP-specified limits were more than 4x the spike concentrations or previously U qualified due to blank contamination and not further qualified.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects, R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits, except for total arsenic (2536%) and total manganese (1784%) on sample SHM-10-14-101910-U.	The background concentrations of all analytes outside the QAPP-specified limits were more than 4x the spike concentrations.	None
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on SHM-10-14-101910-U/F were within acceptance criteria with the following exceptions: total arsenic (20%), total barium (17%), total calcium (14%), total cobalt (17%), total iron (14%), total magnesium (14%), total manganese (16%), total potassium (17%), and total sodium (15%).	AMEC J qualified the detected total arsenic, total barium, total calcium, total cobalt, total iron, total magnesium, total manganese, total potassium, and total sodium results from sample SHM-10-14-101910-U with an A (SD % difference not within control limit) reason code.	None

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation
Overall Evaluation of Data	1) Appropriate method 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-13-101910-U/F, SHM-10-14-101910-U/F, SHM-10-11-101910-U/F, and DUP-101910-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed as litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total alkalinity was not detected in preparation blank.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on sample SHM-10-14-101910-U. The RPD was within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-101910-U was collected as the field duplicate of sample SHM-10-13-101910-U. The RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R < 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on a sample SHM-10-14-101910-U. The recovery was below acceptance criteria at 50%.	AMEC J qualified the alkalinity in sample SHM-10-14-101910-U with a Q (MS recovery outside acceptance criteria) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preservation not required (Chloride, Sulfate) (EPA Method 300.0) 2) 48 hours, preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate, chloride and sulfate were not detected in the method blank.		
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%; 2) Nitrate RPD <15%; 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-14-101910-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-101910-U was collected as the field duplicate of sample SHM-10-13-101910-U. The RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) No qualification required if recovery between 40-151% for chloride, 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	The MS/MSD was performed on sample SHM-10-14-101910-U. The % Rs were within acceptance criteria, except for nitrate in the MSD which recovered high at 130%. The RPD for nitrate was high at 16%.	AMEC J qualified the nitrate result from sample SHM-10-14-101910-U with a Q (MS/MSD recovery outside acceptance criteria) reason code.	High
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The sulfate results from samples SHM-10-14-101910-U and DUP-101910-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	No analytes detected in method blanks.		
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-14-101910-U was analyzed in duplicate for ammonia, nitrite and sulfide. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30%	Sample DUP-101910-U was collected as the field duplicate of sample SHM-10-13-101910-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-14-101910-U for ammonia, nitrite, and sulfide. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from samples SHM-10-14-101910-U, SHM-10-13-101910-U, and SHM-10-11-101910-U were detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative. QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%, RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-14-101910-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are >QL for water	Sample DUP-101910-U was collected as the field duplicate of sample SHM-10-13-101910-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-14-101910-U for COD and DOC. The recoveries were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD result from sample SHM-10-11-101910-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-13-101910-U, SHM-10-14-101910-U, SHM-10-11-101910-U, and DUP-101910-U have elevated detection limits for DOC due to the dilutions required by the sample matrices. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file: a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample SHM-10-14-101910-U. The RPD was within criteria.		

November 22, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-101910-U was collected as the field duplicate of sample SHM-10-13-101910-U. The RPDs were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	TSS was reported as detected above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

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November 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/4500S2-AD/5310C/2320B/2540D
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

INTRODUCTION

This data validation report covers 5 water samples (including 1 rinsate blank and 1 field duplicate) collected on October 20, 2010 from the Shepley's Hill Landfill at the former Fort Devens, in Ayer, Massachusetts. The samples were picked up by an Analytical Laboratory courier and brought to the laboratory in Westborough, MA (Alpha) on October 20, 2010 and assigned sample delivery group (SDG) number L1016506 upon receipt. Alpha analyzed the samples for the following: total and dissolved metals using United States Environmental Protection Agency (USEPA) Method 6020A and 7470A; total alkalinity using standard method (SM) 2320B; chloride, sulfate, and nitrate using USEPA Method 300.0; chemical oxygen demand (COD) using USEPA Method 410.4; dissolved organic carbon (DOC) using SM 5310C; ammonia using SM 4500NH3-BH; nitrite using SM 4500NO2-B; sulfide using SM 4500S2-AD; and total suspended solids (TSS) using SM 2540D. Alpha followed the Department of Defense (DoD) Quality Systems Manual (QSM), Version 4.1. The associated field sample identifications (IDs) and Alpha sample IDs are presented in Table 1.

AMEC reviewed the laboratory's analytical data package to assess adherence to acceptable laboratory practices and to the data validation requirements as specified in the Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan Compendium of Analytical Methods, in EM-200-1-10, the DoD QSM, and the applicable USEPA Methods outlined in Tables 3 through 8. The level o data validation specified in Table 2 was performed with reference to the Shepley's Hill Landfill Supplemental Investigation Quality Assurance Project Plan (QAPP).

EXECUTIVE SUMMARY

All data is generally usable and of good quality.

Table 1. Field Sample List

Lab Sample Number	Sample Date	Field ID	Comments
L1016506-01/02	10/20/2010	SHM-10-12-102010-F/U	
L1016506-03/04	10/20/2010	SHM-10-15-102010-F/U	MS/MSD
L1016506-05/06	10/20/2010	SHM-10-16-102010-F/U	
L1016506-07/08	10/20/2010	DUP-102010-F/U	Field Duplicate of SHM-10-12-102010-U/F
L1016506-09	10/20/2010	RB-102010-U	Rinsate Blank

Table 2. Sample Status

Data Validation Level	Matrix	Preservation	Sample Receipt Temperature	Laboratory	SDG Number
Data Quality Review using Automated Data Review (ADR)	Aqueous	As required by method	Two sample coolers were received on 10/20/2010 at temperatures of 2 °C and 2 °C.	Alpha Analytical 8 Walkup Drive Westborough, MA 01581	L1016506

DATA QUALITY OBJECTIVES AND VALIDATION FINDINGS

Table 3. Total and Dissolved Metals by USEPA 6020A and 7470A

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	1) Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C for soils. 3) Aqueous sample preserved to pH<2. 4) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. Samples were preserved with HNO_3 to pH<2. The Chain of Custody is intact. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Time	1) Aqueous sample 180 days if preserved to pH 2 2) Hg - 28 days to analysis	The samples were analyzed within holding time.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) Evaluate down to the LOD. 2) If sample result is <10x contaminant concentration: flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Total and dissolved silver (0.13 µg/L) were detected in the method blanks associated with the analysis of samples from this SDG. Total arsenic (15.0 µg/L), total barium (0.23 µg/L), total calcium (335 µg/L), total copper (0.14 µg/L), total iron (106 µg/L), total magnesium (62.6µg/L), total manganese (18.4 µg/L), total mercury (0.1199 µg/L), total nickel (0.25 µg/L), total sodium (714 µg/L), and total zinc (2.16 µg/L) were detected in rinsate RB-102010-U.	The associated sample concentrations were more than 10 times the blank concentrations; therefore, data usability is not adversely affected by the blank results with the following exceptions: AMEC U qualified the detected total copper from samples SHM-10-12-102010-U, SHM-10-15-102010-U, and DUP-102010; dissolved copper from sample SHM-10-16-102010-F; total and dissolved sodium in samples DUP-102010-F/U, and SHM-10-12-102010-F/U; total and dissolved mercury from samples DUP-102010-F/U, SHM-10-12-102010-F/U, SHM-10-15-102010-F/U, and SHM-10-16-102010-F/U; and dissolved zinc from sample SHM-10-16-102010-F with a J (contamination in the equipment rinsate blank) reason code. The rinsate blank results have not been qualified due to method blank contamination.	High
Laboratory Control Sample/ Laboratory Control Sample Duplicate (LCS/LCSD) Recovery	1) LCS acceptance limits 80-120%, method requirements (EPA Method 6010/6020/7470) a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R>120% flag detected results "J" c) %R<10% flag detected results "J" and nondetected results "R" Qualify all associated samples.	The LCS recoveries were within acceptance limits.		
Field Duplicate RPD	1) RPD ≤ 30% (waters); ≤ 50% (soils) a) If exceeds RPD limit: J qualify detects, UJ qualify non detects. b) If one result > LOQ and other ND: J-detections, UJ qualify non detects 2) ± LOQ for results ≤ 5x the LOQ	Sample DUP-102010-U/F was collected as the field duplicate of sample SHM-10-12-102010-U/F. The RPDs for analytes detected above the LOQ were within acceptance criteria.		

November 22, 2010
Region I Data Review Worksheet
Project: Shepley's Hill Landfill Supplemental Investigation
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Total and Dissolved Metals by USEPA Method 6020A/7470A
Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/ 4500S2-AD/5310C/2320B/2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
MS/MSD	1) MS/MSD acceptance limits are 80-120% (QAPP-Worksheet 12-1). 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <80% flag detected results "J" and nondetected results "UJ" c) Recoveries >120% flag detected results "J" 4) RPD ≤ 20%	Total arsenic (8.3%/MS), total iron (0%/140%), and total manganese (38%MS), and total mercury (127%/127%) recoveries in the MS/MSD performed on sample SHM-10-15-102010-U were outside the QAPP specified limits. Dissolved arsenic (0%/8.3%), dissolved iron (0%/40%), dissolved manganese (76%MS), and dissolved mercury (130%/125%) recoveries in the MS/MSD performed on sample SHM-10-15-1012010-F were outside QAPP-specified limits.	The background concentrations of all analytes outside the QAPP-specified limits were more than 4x the spike concentrations or previously U qualified due to blank contamination and not further qualified.	None
Post Digestion Spike (PDS)	1) Acceptance limits are 75-125%. 2) Qualify results in the batch or of similar type. 3) If background concentration is >4x spike concentration qualification is not required a) Recoveries <10% J qualify detects. R qualify non detects b) Recoveries <75% flag detected results "J" and nondetected results "UJ" c) Recoveries >125% flag detected results "J"	The PDS recoveries were within acceptance limits on sample SHM-10-15-102010-U.		
Serial Dilution	1) Once per digestion batch (EPA 6000 series) 2) ≤10% for analytes with concentration >50times LOQ 3) %D>10% flag detected results "J"	The %D for the SDs performed on SHM-10-15-102010-U/F were within acceptance criteria with the following exceptions: total sodium (15%).	AMEC J qualified the detected total sodium result from sample SHM-10-15-102010-U with an A (SD % difference not within control limit) reason code.	None
Compound Quantitation	1) Instrument level concentrations should be less than the linear dynamic range (LDR). a) Qualify detected results with concentrations greater than the LDR "J" 2) The reported DL (LOQ) should not be below the lowest ICAL standard concentration. a) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The laboratory J qualified metal results detected between the LOD and the LOQ.	AMEC J qualified these results with a TR (trace level) reason code, unless they were previously U qualified due to blank contamination.	Estimation

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times	Samples SHM-10-12-102010-U/F, SHM-10-15-102010-U/F, and DUP-102010-F/U have elevated detection limits for all analytes due to the dilutions required by the high concentrations of target analytes. The requested reporting limits were not achieved.	No qualification warranted.	None

Note: The laboratory is reporting the Method Detection Limit (MDL) as the Limit of Detection (LOD) and it is expressed ad litteram in the Electronic Data Deliverables (EDD) and the Laboratory Report.

Table 4. Total Alkalinity by Standard Method 2320B

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	14 days, preservation not required (Standard Method 2320B)	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Total alkalinity was not detected in preparation blank.		
LCS	No qualification if recovery between 80-115% a) %R<80% flag detected results "J" and nondetected results "UJ" b) %R >115% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recovery was within acceptance criteria.		
Lab Duplicate	4% ≤RPD, RPD >4% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on sample SHM-10-15-102010-U. The RPD was within acceptance criteria.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-102010-U was collected as the field duplicate of sample SHM-10-12-102010-U. The RPD was within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 86-116%. 2) If background concentration is greater than 4x the spike concentration qualification is not required %R< 86% flag detected results "J" and nondetected results "UJ" %R > 116% flag detected results "J" %R<10% flag detected results "J" and nondetected results "R" Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	A MS was performed on sample SHM-10-15-102010-U. The recovery was below acceptance criteria at 46%.	AMEC J qualified the alkalinity in sample SHM-10-15-102010-U with a Q (MS recovery outside acceptance criteria) reason code.	Low
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Total alkalinity was detected in all associated samples at concentrations above the LOQ of 2.0 mg/L.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 5. Nitrate, Chloride, and Sulfate by USEPA 300.0

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		

November 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Holding Times (HT)	1) 28 days. preservation not required (Chloride. Sulfate) (EPA Method 300.0) 2) 48 hours. preservation not required (Nitrate-N)(EPA Method 300.0)	The samples were analyzed and preserved as per EPA Method requirements.		
Blanks (Method. Field. Equipment. Rinsate. etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ. raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration: no qualification required.	Nitrate and chloride sulfate were not detected in the method blank. Sulfate was detected at a concentration of 0.16 mg/L in the method blank.	AMEC U qualified the detected sulfate results from samples DUP-102010-U and SHM-10-12-102010-U with a B (contamination in the method blank) reason code.	High
LCS	1) No qualification if recovery between 90-110% a) %R<90% flag detected results "J" and nondetected results "UJ" b) %R >110% flag detected results "J" c) %R <10% flag detected results "J" and nondetected results "R"	LCS recoveries were within acceptance criteria.		
Lab Duplicate	1) Chloride RPD <18%. 2) Nitrate RPD <15%. 3) Sulfate RPD <20%	The laboratory performed duplicate analysis on sample SHM-10-15-102010-U. The % RPDs were within acceptance criteria.		
Field Duplicates	1) RPD ≤ 30% when detects for both samples are ≥ LOQ for water	Sample DUP-102010-U was collected as the field duplicate of sample SHM-10-12-102010-U. The RPDs were within acceptance criteria		
MS/MSD	1) No qualification required if recovery between 40-151% for chloride. 80-122% for nitrate, and 60-140% for sulfate. 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample (Qualify results for samples collected at same location but differing depths as well)	The MS/MSD was performed on sample SHM-10-15-102010-U. The % RPDs were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	Nitrate. chloride and sulfate were detected in all associated samples at concentrations above the LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 6. Ammonia, Nitrite, and Sulfide by Standard Methods 4500NH3-BH/4500NO2-B/4500S2-AD

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory sample receipt and log in checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	1) 28 days, preserved with H2SO4 to pH<2 (Ammonia) 2) 48 hours, chemical preservation not required (Nitrite) 3) 7 days, preserved w/ zinc acetate and NaOH (Sulfide)	The samples were analyzed and preserved as per Standard Method requirements.		
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	Sulfide and nitrite were not detected in method blanks. Ammonia was detected at a concentration of 0.0203 mg/L in the method blank associated with the samples in this SDG.	The associated sample concentrations were more than 10 times the blank concentration; therefore, data usability is not adversely affected by the blank results.	None
LCS	No qualification if recovery between 80-120% for ammonia, 90-110% for nitrite, and 75-125% for sulfide.	LCS recoveries were within acceptance criteria		
Lab Duplicate	1) RPD≤20%	Sample SHM-10-15-102010-U was analyzed in duplicate for ammonia, nitrite and sulfide. The % RPDs were within acceptance criteria.		

Review Items	Acceptance Criteria	Samples affected	Qualifications	Bias
Field Duplicates	1) RPD ≤ 30%	Sample DUP-102010-U was collected as the field duplicate of sample SHM-10-12-102010-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120% (ammonia), 85-115% (nitrite), and 75-125% (sulfide). 2) If background concentration is greater than 4x the spike concentration qualification is not required Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-15-102010-U for ammonia, nitrite, and sulfide. The recoveries were within acceptance criteria.		
Compound Quantitation	Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The nitrite result from sample SHM-10-15-102010-U was detected and reported between the LOD and the LOQ. These results were J qualified by the laboratory.	AMEC J qualified this result with a TR (trace level) reason code.	Estimation
Overall Evaluation of Data	1) Appropriate method 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

Table 7. Chemical Oxygen Demand (COD) by USEPA 410.4 and Dissolved Organic Carbon (DOC) by SM 5310C

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	28 days, preserved with H2SO4 to pH<2	Samples were analyzed as per EPA and Standard Method requirements.		

November 22, 2010 — Total and Dissolved Metals by USEPA Method 6020A/7470A
Region I Data Review Worksheet — Other Inorganics by USEPA 300.0/410.4 and SM 4500NH3-BH/4500NO2-B/
Project: Shepley's Hill Landfill Supplemental Investigation — 4500S2-AD/5310C/2320B/2540D
Review Criteria: QAPP, MADEP MCP, USEPA Region I Tier I and II Guidance and DoD QSM

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Blanks (Method, Field, Equipment, Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U" 2) If sample result is <10x contaminant concentration and ≥ LOQ flag "U" 3) Sample result ≥10x contaminant concentration; no qualification required.	COD and DOC were not detected in associated method blanks.		
LCS	No qualification if recovery between 95-105% (COD) and 90-110% (DOC)	LCS recoveries were within acceptance criteria.		
Lab Duplicate	RPD ≤ 20%. RPD >20% flag detected results "J" and nondetected results "UJ"	Sample SHM-10-15-102010-U was analyzed in duplicate by the laboratory. RPDs were within acceptance criteria.		
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-102010-U was collected as the field duplicate of sample SHM-10-12-102010-U. The RPDs were within acceptance criteria.		
MS/MSD	1) No qualification required if recovery between 80-120%. 2) If background concentration is greater than 4x the spike concentration qualification is not required. Qualify only results in the spiked sample. (Qualify results for samples collected at same location but differing depths as well)	MSs were performed on sample SHM-10-15-102010-U for COD and DOC. The recoveries were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J" 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J"	The COD and DOC results were detected and reported above the LOQ.		
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	Samples SHM-10-12-102010-U, SHM-10-15-102010-U, SHM-10-16-102010-U, and DUP-102010-U have elevated detection limits for DOC due to the dilutions required by the sample matrices. The requested reporting limits were not achieved.	No qualification warranted.	None

Table 8. Total Suspended Solids (TSS) by SM2540D

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Data Completeness	Complete SDG file. a. Sample data package including case narrative, QC data and raw data. b. Shipping and receiving documents. c. All lab records of sample receipt, preparation and analysis.	All required deliverables were present in the data package.		
COC	1) Sample custody documentation. 2) Temperature ≤6°C 3) Sample delivery documentation.	Cooler temperatures upon arrival at Alpha were within acceptance criteria. The laboratory Sample Receipt and Log-in Checklist indicates that sample integrity was maintained during transport.		
Holding Times (HT)	7 days from sampling to analysis	Samples were analyzed as per Standard Method requirements.		
Blanks (Method, Field, Equipment Rinsate, etc.)	1) If sample result is <10x contaminant concentration and between LOD and LOQ, raise result to LOQ and flag "U". 2) If sample result is <10x contaminant concentration and <LOQ flag "U". 3) Sample result ≥10x contaminant concentration; no qualification required.	TSS was not detected in associated method blanks.		
Lab Duplicate	RPD <20% flag detected results "J" and nondetected results "UJ"	The laboratory performed duplicate analysis on a sample SHM-10-15-102010-U. The RPD was above acceptance criteria at 25%.	AMEC J qualified the TSS result from sample SHM-10-15-102010-U with an E (poor agreement between duplicate) reason code.	Non-Directional
Field Duplicates	RPD ≤ 30% when detects for both duplicates are ≥QL for water	Sample DUP-102010-U was collected as the field duplicate of sample SHM-10-12-102010-U. The RPDs were within acceptance criteria.		
Compound Quantitation	1) Instrument level concentrations should be less than the linear range. Qualify detected results with concentrations greater than the LOD "J". 2) The reported LOQ should not be below the lowest ICAL standard concentration. 3) Positive results reported above the LOD but below the LOQ should be considered estimated and be flagged "J".	TSS was reported as detected above the LOQ.		

Review Items	Acceptance Criteria	Samples Affected	Qualifications	Bias
Overall Evaluation of Data	1) Appropriate method. 2) Evaluate any analytical problems with laboratory results. 3) Evaluate sampling errors – field contamination, sample hold times.	No anomalies.		

If you have any questions or comments regarding this report, please contact the undersigned at (978) 392-5339.

Sincerely,

AMEC Earth & Environmental, Inc.

PREPARED BY:

Denise King

Denise King
Environmental Chemist

REVIEWED BY:

Alyson Fortune
Environmental Chemist

Attachment I

Attachment I

April 11, 2011

William J. Walker, Ph.D.
Sovereign Consulting
5333 SW Admiral Way
Seattle, WA 98116

RE: Draft Report of Findings, Shepleys Hill Landfill

Dear Bill:

This letter summarizes the bench scale tests that have been conducted to date for the Shepley's Hill Landfill located at Fort Devens, Massachusetts. Per your request, this is an overview, containing a basic description of protocols and results.

To date we have completed or are in the process of completing 4 of the original tasks. The status of each of the tasks is described below. Briefly, the 2 column studies have been completed. The first column flushing study was designed to assess the number of pore volumes it would take to achieve complete flushing of pore water arsenic from the aquifer sand under reducing conditions. The second column study was designed to flush arsenic from the pore water and then introduce reduced water to determine how arsenic might rebound or re-mobilize from aquifer sands. This column is still running but can be considered complete depending on your data needs. The carbon degradation study is also still in progress. While gas is clearly being formed in the reactors, not enough has been generated to analyze. We have consulted with several microbiologists on this problem and they believe we may have severely inhibited microbial growth by freezing the columns. As we discussed in the last few days, we may wish to re-think this part of the task possibly using a fresh, non-frozen section of core. The sequential extraction work has been completed as directed through step 2. As we discussed, these two steps are likely to be the most important reservoirs of arsenic in the different samples. Again if further analysis is warranted we can complete the final two steps. Finally as per your request we have not done the Kd study. We concur that the study should be performed on more than one type of sand in order to develop a range of Kd values for the site. The details of the various tests are described below and then plotted in the attachments. The attachments also contain all of the attendant data and column/bench-scale conditions.

Soil Core Samples Received by Prima from Sovereign Consulting

Eighteen soil cores were received on August 19, 2010 and August 20, 2010. All samples were cold with ice present. Samples were immediately placed in a freezer. Selected cores were used for the column tests and carbon balance tests below and were thawed prior to use. The sample IDs are listed in Table 1 (attached). Additional samples were received

on November 18, 2010 and used for sequential extraction tests. These samples were stored at room temperature. Sample IDs are given in Table 1 (attached).

Column Flushing using Synthetic Oxic Site Water and High TOC and High Arsenic Soil. Duplicate columns (2 in diam.) were run to determine how long it would take to flush arsenic from pore water (see Figure 1). Each column was filled with 180 g (2 in depth) of TOC-rich soil (SHM-10-14, 35-40ft) followed by 2.5 to 2.7 kg (21-2.15 in depth) arsenic-rich soil (SHM-10-14, 65-70 ft). Arsenic-free synthetic groundwater was pumped upflow at a flowrate of 0.3 mL/min (approximately 1.4 to 1.6 pore volumes/day in the arsenic-rich zone). Effluent samples were collected periodically and analyzed for dissolved arsenic, oxidation reduction potential (ORP), pH and other parameters. Results are shown in Tables 2a and 2b. Arsenic concentrations as high as 1.2 mg/L were seen for the first 2.1 to 2.5 pore volumes, after which concentrations declined. Arsenic was not detected in the 14-17 pore volume sample, and was detected sporadically (0.005 to 0.01 mg/L) in subsequent samples (up to 42 pore volumes). After 36 to 42 pore volumes, flow to the columns was turned off for 1 week. Effluent samples were collected upon resumption of flow, but arsenic concentrations were not significantly higher than before the shutdown. Effluent ORP typically ranged from -82 mV to -21 mV, though some positive readings (max 79 mV) were recorded. Effluent pH was typically near-neutral, ranging from 6.37 to 7.25.

Column Flushing using Reducing Water. Duplicate columns (2 in diam.) were run to determine whether reducing water contacting soil would mobilize arsenic (see Figure 2). Each column was filled with 2.0 kg (17.4 in bed depth) of soil SHM-10-14, 35-40ft. Deoxygenated, arsenic-free synthetic groundwater containing 2 g/L emulsified oil (to stimulate biological activity and generate reducing conditions within the bed) was pumped upflow at a flowrate of 0.08 to 0.09 mL/min (~ 0.5 pore volumes/day) for about 9 pore volumes. The columns were shut down for 1 week. Flow resumed using tap water as the influent. The tap water was passed through a column of zero-valent iron (ZVI) immediately prior to the soil column in order to establish reducing conditions in the water. Effluent samples were collected periodically and analyzed for dissolved arsenic, oxidation reduction potential, pH and other parameters. Results are shown in Table 3. Effluent arsenic from Column A varied from 0.031 to 0.074 mg/L As for the first 5 pore volumes, after which it began to increase, reaching 0.25 mg/L by 9.2 pore volumes. However, by 14.5 pore volumes, arsenic decreased to 0.0073 mg/L. Column B behaved similarly, though arsenic values were initially 0.049 mg/L, decreasing to 0.013 to 0.02 mg/L for the first 6 pore volumes. Effluent arsenic began to increase after about 6 pore volumes, eventually reaching 0.33 mg/L soon after the ZVI pre-column was added, then decreasing to below 0.005 mg/L . The increase in effluent arsenic at 5-6 pore volumes is probably due to reducing conditions created within the column by biological activity as evidenced by the darkening of the soil in the lower half of the bed by 16 days (about 8 pore volumes). The decrease at 14-15 pore volumes is apparently due to co-precipitation with iron since effluent tubing was discolored due to formation of iron oxides. Iron oxides are formed upon exposure of dissolved iron from the ZVI pre-column to atmospheric oxygen.

Sequential Extractions. Twelve soils were subjected to a two-step sequential extraction. In the first step, 5 g soil was extracted overnight with 100 mL 1M phosphate buffer (pH 5). In the second step, the same 5 g soil was extracted overnight with 100 mL 0.2 N hydroxylamine hydrochloride. The extraction apparatus is shown in Figure 3. Results are shown in Table 4. Dissolved arsenic was measured in each extraction fluid. Arsenic leached from all but one of the samples (Sample 14-27 ft). Up 49% of the arsenic initially present was leached by phosphate, while up to 13% of the initial arsenic was leached by hydroxylamine hydrochloride.

Carbon Balance. Nine reactors, each containing 100 g soil (SH-10-14, 35-40 ft), 212 mL DI water, and 1.9 g fertilizer (15:5:15) were prepared. Sterile controls containing soil, water, fertilizer, and 8 g/L sodium azide were also prepared. Reactors were connected to Tedlar bags to collect off-gases generated by microbial respiration as shown in Figure 4. However, except for one reactor, no off-gases have been generated as of 20 weeks despite adding a carbon source (emulsified vegetable oil) to jumpstart biodegradation (Week 3) and adjusting the pH from mildly acidic (pH 4.7-5.7) to near-neutral (week 6). The one reactor that generated off-gases produced less than about 50 mL between Weeks 6 and 15, but the volume did not obviously increase between Week 15 and Week 20. Lack of microbial activity in the non-sterile test reactors may be due to inadvertent sterilization when the soil was frozen after collection.

If you have any questions regarding this summary or need a more detailed report, please give me a call. Thank you for the opportunity to be of service.

Sincerely,
PRIMA Environmental, Inc.

Cindy G. Schreier, Ph.D.
President and Chief Scientist

Shepley's Hill Landfill – Bench Test Report

Figures

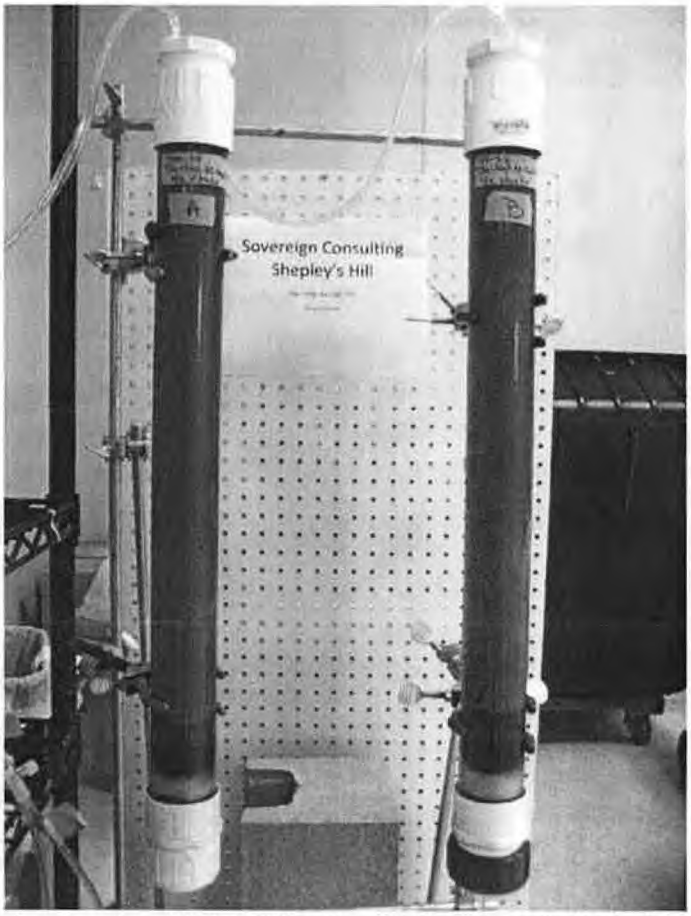

Figure 1. *Columns using High TOC soil and High Arsenic Soil. Dark band at the influent end is the high TOC soil (SH-10-14, 35-40 ft).*

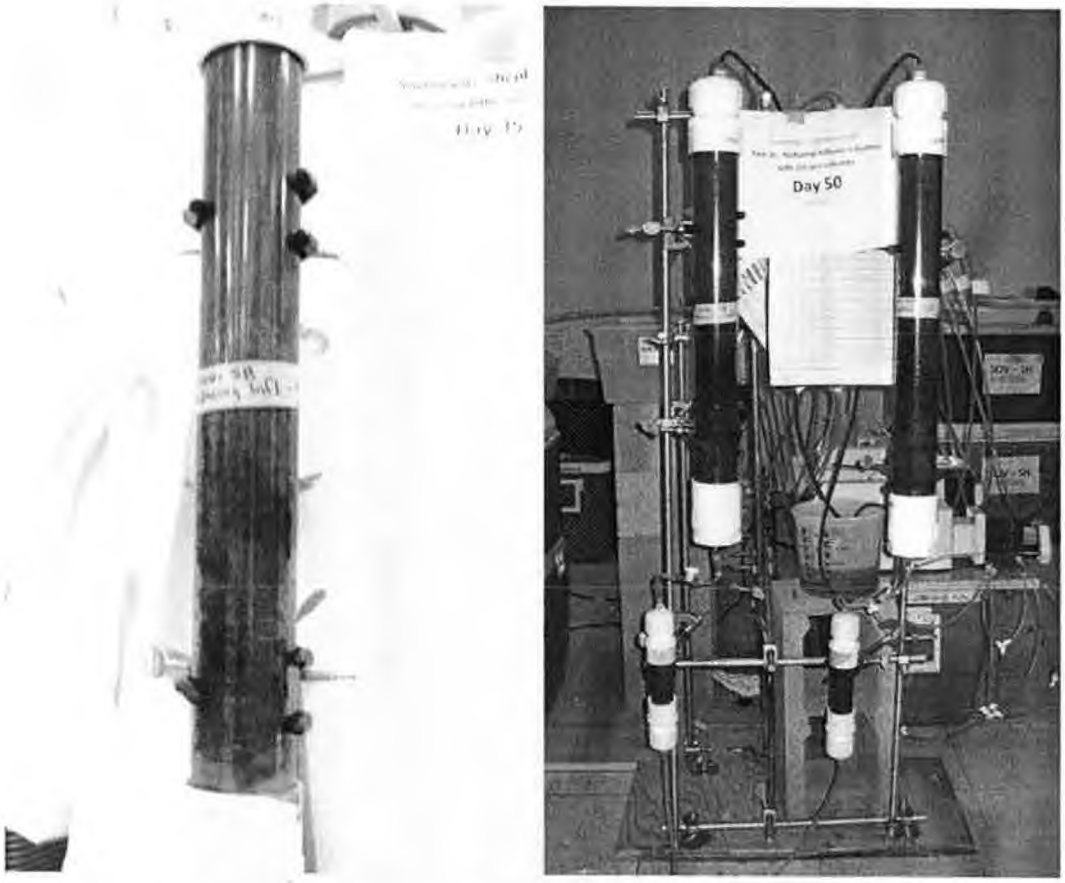

Figure 2. *Columns flushed with reducing water. Left: Before addition of ZVI-pre-columns. Note dark areas of soil in lower (influent) half of bed. (Brightness adjusted to show color difference.) Right: Columns with pre-ZVI columns. Note dark orange-brown discoloration on effluent tubing, which is indicative of iron oxidation.*

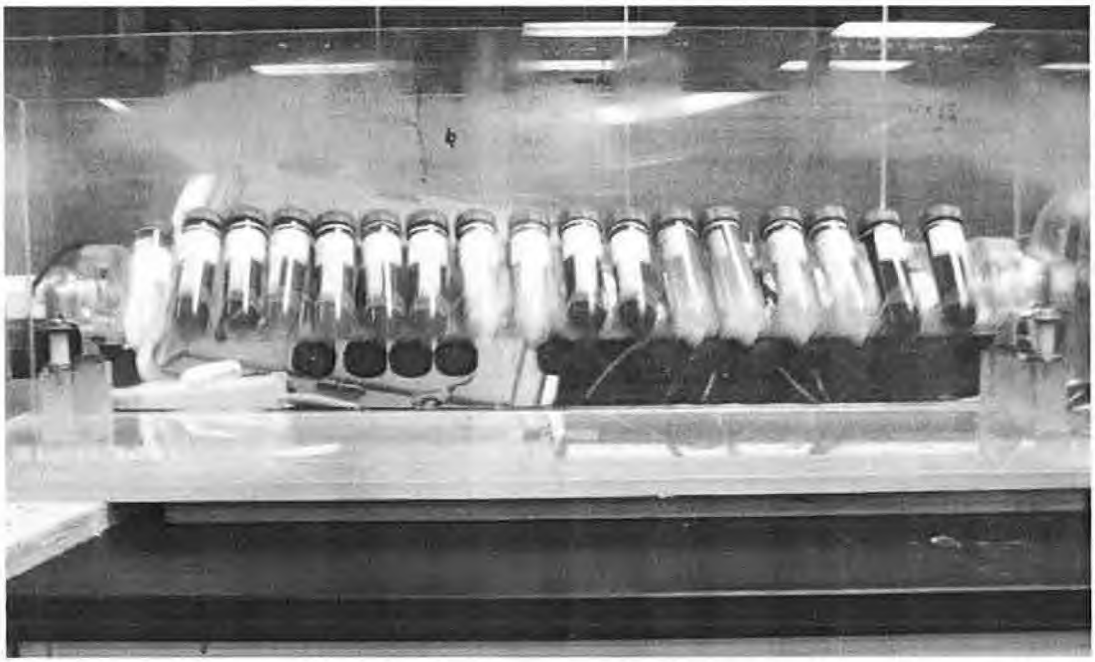

Figure 3. *Sequential Extraction Apparatus – end-over end rotator.*

Figure 4. *Example Carbon Balance Reactors at Day 20. Non-sterilized (no added azide) reactors are connected to Tedlar bags.*

Shepley's Hill Landfill – Bench Test Report

Tables

Table 1. Sample IDs.

Sample ID	Date received	Test Used In
SHM-10-11, 55-60'	8/19/2010	not used
SHM-10-12, B2, 25-30, 1 of 1	8/19/2010	not used
SHM-10-12, B2, 35-40', 1 of 2	8/19/2010	not used
SHM-10-12, B2, 35-40', 2 of 2	8/19/2010	not used
SHM-10-12, 45-55'	8/19/2010	not used
SHM-10-13, 65-70'	8/19/2010	not used
SHM-10-14- (30-32')	8/20/2010	not used
SHM-10-14, 35-40'	8/19/2010	Column Flushing using Synthetic Oxic Site Water; Carbon Balance
SHM-10-14, 40-45'	8/19/2010	not used
SHM-10-14-(45-50')	8/20/2010	not used
SHM-10-14, (B4), 65-70', 1 of 1	8/19/2010	column Flushing using Synthetic Oxic Site Water
SHM-10-15, B5, 25-28'	8/19/2010	not used
SHM-10-15, B5, 25-28', 2 of 2	8/19/2010	not used
B5-SHM-10-15, 30-35'	8/19/2010	not used
SHM-10-15'; B5, 30-35'	8/19/2010	Column flushing Reducing Influent
SHM-10-15, B5, 40-45'	8/19/2010	not used
SHM-10-15, B5, 40-45', 2 of 2	8/19/2010	not used
SHB-10-16 (65-70')	8/20/2010	not used
SHM-10-12-5'	11/18/201	sequential extraction
SHM-10-12-42'	11/18/201	
SHM-10-12-65'	11/18/201	
sHM-10-15-18'	11/18/201	
SHM-10-13-23'	11/18/201	
SHM-10-13-83'	11/18/201	
SHM-10-14-10'	11/18/201	
SHM-10-14-15'	11/18/201	
SHM-10-14-20'	11/18/201	
SHM-10-14-27'	11/18/201	
SHM-10-14-70'	11/18/201	
SHM-10-14-75'	11/18/201	

Notes:

Samples used for Sequential Extraction stored at room temperature upon receipt. All other samples frozen.

Table 2a. High TOC/High As Column Test. Influent Parameter.

Sample ID	Approx. Pore volumes^	Chloride	Arsenic	Total Dissolved Iron	Sodium	Magnesium	Potassium	Calcium	DOC	Alkalinity	DO	ORP	pH
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mV	--
Inf-1	0	14	< 0.0050	0.55	50	8.7	41	96	< 0.50	190	9.1	118	6.29
Inf-2	1.3	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
Inf-3	2.1	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.8	135	5.99
Inf-4	2.6	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
Inf-5	3.4	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.3	183	6.11
Inf-6	4.8	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.4	199	6.11
Inf-7	6.1	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	221	6.07
Inf-8	7.4	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	181	6.11
Inf-9	8.7	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.2	228	6.15
Inf-10	10	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.4	151	6.46
Inf-11	11	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	180	6.82
Inf-13	13	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.7	181	7.70
Inf-14	14	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.2	172	8.31
Inf-15*	14	15	< 0.0050	0.33	47	8.7	39	92	< 0.50	196	7.7	185	6.36
Inf-16	18	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	188	7.9	96	6.39
Inf-17	19	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	194	8.3	196	6.28
Inf-18	21	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	7.3	278	6.43
Inf-19	23	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	8.3	227	6.71
Inf-20	25	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	8.8	239	6.7
GW#5**	25	13	< 0.005	0.36	50	8.7	41	95		200			6.27
Inf-22	26	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	7.8	270	6.58
Inf-23	34	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	n.m.	215	6.56

n.m. - not measured.

Influent IDs in labbook number sequentially. However, to better see when influent sample was collected relative to effluent sample, Influents renaumed to have the same number as the effluent.

* New influent water prepared and started after sampling S14 (11/8/2010, Bk 337, p 9)

** New influent water (GW#5) started 11/19/2010, before collecting Effluent 21, Bk 337, p 12. This data is GW#5 influent immediately after preparation.

^ Influent samples typically collected immediately after collection of effluent samples"Approximate # Por eVolumes" represents the approximate number of pore volumes of water put through Column A at time of Influent Sample collection.

Table 2b. High TOC/High As Column Test. Effluent Parameters.

Total # Pore Vol. Collected		Arsenic, mg/L		Total Dissolved Iron, mg/L		Ferrous Iron, mg/L		DOC, mg/L		DO, mg/L		ORP, mV		pH		Effluent color	
Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B
Influent*		< 0.0050*		0.55*		< 0.01*		< 0.50*		9.1*		118*		6.29*		clear, colorless	
0.96	0.94	0.64	0.6	< 0.30	< 0.30	0.06	0.1	5.6	7.5	8.8	8.7	-46	-26	7.37	7.25	–	–
1.3	1.4	0.72	0.79	< 0.30	< 0.30	< 0.03	< 0.03	n.m.	n.m.	8.8	8.8	35	48	7.29	7.23	lt yel/orange	lt yellow
2.1	2.5	1.2	1.2	1.9	2.3	1.2	2.0	15	18	8.5	8.5	-46	-30	6.68	6.56	yel/orange	lt yel/orange
2.6	3.0	0.55	0.8	0.38	0.9	0.3	1.0	n.m.	n.m.	8.3	8.5	-65	-62	6.89	6.82	straw	straw
3.4	4.0	0.96	0.95	10	8.6	2.1	2.6	4.4	4.8	8	8.1	-82	-76	6.58	6.56	yellow	straw
4.8	5.5	n.m.	n.m.	n.m.	n.m.	1.7	5.9	n.m.	n.m.	7.8	8.2	-73	-70	6.53	6.47	yel/orange	med straw
6.1	7.1	0.29	0.58	8.6	10	8.9	10	n.m.	n.m.	8.7	8.5	-50	-49	6.37	6.37	yel/orange	yel/orange
7.4	8.6	n.m.	n.m.	n.m.	n.m.	9.8	10	n.m.	n.m.	8.2	8.3	-63	-59	6.31	6.34	lt straw	med. Straw
8.7	10	0.0082	0.18	3.9	7.2	2.3	4.5	2.2	2.6	7.5	7.8	-53	-49	6.47	6.51	aw/ slight orgar	straw
10	12	n.m.	n.m.	n.m.	n.m.	5.7	6.2	n.m.	n.m.	8	8.1	-50	-52	6.42	6.47	straw	straw
11	13	0.017	0.062	6.0	6.7	4.3	4.8	n.m.	n.m.	7.4	7.5	-60	-46	6.47	6.46	lt yel/orange	lt yel/orange
13	15	n.m.	n.m.	n.m.	n.m.	0.02	0.01	n.m.	n.m.	8.9	9.0	75	79	7.10	7.08	pale orange	pale orange
14	17	< 0.0050	< 0.0050	1.1	1.3	1.1	1.3	2.4	2.9	8.3	8.3	-53	-51	6.74	6.67	pale yellow	pale yellow
16	19	n.m.	n.m.	n.m.	n.m.	0.03	0.03	n.m.	n.m.	7.7	7.8	-36	-48	7.14	7.11	lt. yellow straw	lt. yellow straw
17	20	n.m.	n.m.	n.m.	n.m.	0.58	0.76	n.m.	n.m.	8.4	8.0	-57	-52	6.86	6.82	lt. yellow	lt. yellow
18	21	n.m.	n.m.	n.m.	n.m.	0.44	0.19	n.m.	n.m.	7.8	7.9	-58	-60	6.95	7.05	lt. yellow	lt. yellow
19	23	n.m.	n.m.	n.m.	n.m.	0.12	0.01	n.m.	n.m.	7.8	8.1	-60	-48	6.80	7.04	pale straw	pale straw
21	24	n.m.	n.m.	n.m.	n.m.	0.01	0.01	n.m.	n.m.	7	7.3	-55	-39	7.25	7.17	lt yellow	lt yellow
23	28	n.m.	n.m.	n.m.	n.m.	0.51	0.31	n.m.	n.m.	8.4	8.5	-45	-21	6.97	7.07	straw	straw
25	29	< 0.005	0.0087	1.9	1.4	0.9	1.17	1.2	1.4	8.5	8	-31	-39	6.79	6.81	straw	straw
26	31	n.m.	n.m.	n.m.	n.m.	1.09	1.03	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	med straw	med straw
32	38	n.m.	n.m.	n.m.	n.m.	n.m.	n.m	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
34	39	0.0069	< 0.005	0.9	0.78	0.24	0.01	1.6	1.6	7.8	7.5	52	60	7.20	7.29	v pale straw	v pale straw
36	42	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
columns shut down for 9 days																	
38	45	0.029	0.0053	1.3	1.7	0.93	1.37	2.2	2.9	n.m.	n.m.	-10	-25	6.75	6.77	v pale straw	v pale straw
39	46	< 0.005	< 0.005	1.1	1.8	0.91	1.45	2	1.7	n.m.	n.m.	-36	-31	6.77	6.59	v pale straw	v pale straw
41	48	0.0089	0.0066	1.1	1.3	0.68	1.16	1	1.3	n.m.	n.m.	-48	-36	6.94	6.80	pale straw	pale straw
42	49	on hold		on hold		0.34	0.71	on hold		n.m.	n.m.	-25	-39	7.02	6.89	pale yellow	pale yellow
43	51					0.22	0.43			n.m.	n.m.	-23	-30	7.03	7.01	pale straw	pale straw
44	52					0.12	0.6			n.m.	n.m.	-16	15	7.15	7.00	lt yellow	lt yellow
47	55					0.06	0.11			n.m.	n.m.	131	80	7.08	7.06	straw	straw

* Influent measurement made at the beginning of the test. See Table 1a for influent parameters over time.

Effluent color varied over time, no consistent pattern. Reported colors should be used as a guide to assess differences, not as exact colors.

Table 3. Column Flushing (Reducing Influent) Results.

Sample ID	Total # Pore Vol. Collected		Arsenic, mg/L		DO, mg/L		ORP, mV		pH	
	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B
Influent (start of test)	n.a.	n.a.	< 0.0050		2.9		182		6.49	
Influent (~ 2 pv put through)	n.a.	n.a.	n.m.		2.5		230		6.91	
Influent (~ 5 pore vol put through)	n.a.	n.a.	n.m.		4.1		232		6.74	
Effluent Samples										
S1	0.64	0.46	0.044	0.049	7.8	8.0	166	149	8.73	9.00
S2	1.1	1.0	0.031	0.043	n.m.	8.9	164	177	8.26	8.60
S3	1.5	1.4	0.041	0.019	8.0	n.m.	180	186	7.89	7.92
S4	1.9	1.8	0.059	0.016	8.7	8.2	190	165	7.97	7.77
S5	2.4	2.3	0.061	0.014	8.2	8.6	-45	184	7.78	8.04
S6	2.8	2.7	0.062	0.015	8.4	8.4	-85	7	7.64	7.63
S7	4.1	3.5	0.074	0.013	8.6	7.8	-55	175	7.70	7.58
S8	5.0	4.4	0.053	0.017	9.0	8.7	33	-32	7.85	7.72
S9	5.4	5.2	n.m.	0.019	n.m.	9.3	n.m.	62	n.m.	7.75
S10	5.9	5.7	< 0.0050	n.m.	7.8	n.m.	-48	n.m.	7.61	n.m.
S11	8.5	6.1	0.14	0.020	7.7	9.8	-55	27	7.25	7.70
S12	8.9	8.6	0.21	0.16	6.8	8.3	120	-35	8.18	7.29
S13	9.2	9.0	0.25	0.15	n.m.	8.3	-37	150	7.99	7.64
S14	12.5	9.4	hold	0.33	n.m.	n.m.	139	-28	n.m.	7.83
S15	14.5	13.0	0.0073	hold	7.9	n.m.	61	89	n.m.	n.m.
S16	n.a.	15	n.a.	< 0.005	n.a.	7.8	n.a.	65	n.a.	n.m.

Operational Notes:

--Flow to columns turned off after collection of S11 for Col A and S12 for Column B to try to establish reducing conditions.

--Flow resumed after 7 days (on 3/2/2011) in order to collect S12 for Col A and S13 for Col B. Flow stopped on 3/4/2011 once samples obtained.

--On 3/11/2011, flow resumed. Switch influent to tap water from PRIMA's facility. Water flows through 200 g ZVI prior to entering soil column in effort to chemically induce reducing conditions.

Samples S12 for Column A and Sample S13 for Column B are first effluent samples taken after addition of the ZVI pre-column.

-- 3/13/2011 - noticed effluent tubes for both columns clamped; water leaking from various places. Unclamped tubing.

-- 3/18/11 (after collection of S13 Col A and S14 Col B)- checked ORP post ZVI - only +35. Seemed high, so replaced ZVI with SMI (156g)

-- 3/22/11 - checked ORP post SMI - +200mV !! Swichted back to ZVI on 3/23/11 and collect S14 Col A and S15 Col B which should reflect effluent quality while SMI was on-line.

-- 3/25/11 @ 15:15. Turn off pump.

--4/1/2011 Resume flow to columns. As of 4/11/2011, columns still running. Effluent lines dark brown due to oxidation of dissolved Fe.

Table 4. Sequential Extraction Results.

Sample ID	Arsenic in Soil*	Arsenic in Phospahate Extract**		Arsenic in Hydroxylamine Extract^	
	mg/kg	mg/L	%#	mg/L	%#
12-5ft	12	0.14	24	0.076	13
12-42 ft	29	0.39	27	0.12	8.3
12-65ft	34	0.48	28	0.14	8.2
13-23ft	31	0.51	33	0.16	10
13-83ft	23	0.39	34	0.14	12
14-10ft	18	0.28	31	0.078	8.7
14-15ft	12	0.08	14	0.033	5.5
14-20ft	18	0.21	23	0.041	4.6
14-27ft	3.8	< 0.052	< 27	< 0.005	< 2.6
14-70ft	35	0.55	31	0.14	8.0
14-75ft	51	1.24	49	0.23	9.0
15-18ft	25	0.083	6.6	0.060	4.8
blank	n.a.	< 0.052	n.a.	< 0.005	n.a.

* data provided by Bill Walker - Sovereign

** Extracted on 11/19/2010

^ Extracted on 11/30/2010

percent of arsenic in soil that was extracted into the extraction fluid

Column Effluent

11/2/2010

Sample ID	Effluent volume, mL		Total # Pore Vol. Collected		Arsenic, mg/L		Total Dissolved Iron, mg/L		Ferrous Iron, mg/L		DOC, mg/L		DO, mg/L		ORP, mV		pH		Effluent color	
	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B	Col A	Col B
Inf-1	446				< 0.0050*		0.55*		< 0.01*		< 0.50*		9.1*		118*		6.29*		clear, colorless	
S1	328	282	0.96	0.84	0.64	0.6	< 0.30	< 0.30	0.06	0.1	5.8	7.5	8.8	8.7	-46	-26	7.37	7.25	–	–
S2	129	151	0.38	0.5033	0.72	0.79	< 0.30	< 0.30	< 0.03	< 0.03	n.m.	n.m.	8.8	8.8	35	48	7.29	7.23	lt yel/orange	lt yellow
S3	266	310	0.78	1.0333	1.2	1.2	1.9	2.3	1.2	2.0	15	18	8.5	8.5	-46	-30	6.68	6.56	yel/orange	lt yel/orange
S4	165	163	0.49	0.5433	0.55	0.8	0.38	0.9	0.3	1.0	n.m.	n.m.	8.3	8.5	-65	-62	6.89	6.82	straw	straw
S5	283	286	0.83	0.9533	0.96	0.95	10	8.6	2.1	2.6	4.4	4.8	8	8.1	-82	-76	6.58	6.56	yellow	straw
S6	450	465	1.32	1.55	n.m.	n.m.	n.m.	n.m.	1.7	5.9	n.m.	n.m.	7.8	8.2	-73	-70	6.53	6.47	yel/orange	med straw
S7	447	466	1.31	1.5533	0.29	0.58	8.6	10	8.9	10	n.m.	n.m.	8.7	8.5	-50	-49	6.37	6.37	yel/orange	yel/orange
S8	453	469	1.33	1.5633	n.m.	n.m.	n.m.	n.m.	9.8	10	n.m.	n.m.	8.2	8.3	-63	-59	6.31	6.34	lt straw	med. Straw
S9	450	468	1.32	1.56	0.0082	0.18	3.9	7.2	2.3	4.5	2.2	2.6	7.5	7.8	-53	-49	6.47	6.51	w/ slight org	straw
S10	449	472	1.32	1.5733	n.m.	n.m.	n.m.	n.m.	5.7	6.2	n.m.	n.m.	8	8.1	-50	-52	6.42	6.47	straw	straw
S11	456	478	1.34	1.5933	0.017	0.062	6.0	6.7	4.3	4.8	n.m.	n.m.	7.4	7.5	-60	-46	6.47	6.46	lt yel/orange	lt yel/orange
S12	450	476	1.32	1.5867	n.m.	n.m.	n.m.	n.m.	0.02	0.01	n.m.	n.m.	8.9	9.0	75	79	7.10	7.08	pale orange	pale orange
S13	459	479	1.35	1.5967	< 0.0050	< 0.0050	1.1	1.3	1.1	1.3	2.4	2.9	8.3	8.3	-53	-51	6.74	6.67	pale yellow	pale yellow
S14	585	613	1.72	2.0433	n.m.	n.m.	n.m.	n.m.	0.03	0.03	n.m.	n.m.	7.7	7.8	-36	-48	7.14	7.11	yellow stra	yellow stra
S15	379	398	1.11	1.32	n.m.	n.m.	n.m.	n.m.	0.58	0.76	n.m.	n.m.	8.4	8.0	-57	-52	6.86	6.82	lt. yellow	lt. yellow
S16	402	420	1.18	1.4	n.m.	n.m.	n.m.	n.m.	0.44	0.19	n.m.	n.m.	7.8	7.9	-58	-60	6.95	7.05	lt. yellow	lt. yellow
S17	440	460	1.29	1.5333	n.m.	n.m.	n.m.	n.m.	0.12	0.01	n.m.	n.m.	7.8	8.1	-60	-48	6.80	7.04	pale straw	pale straw
S18	443	466	1.30	1.5533	n.m.	n.m.	n.m.	n.m.	0.01	0.01	n.m.	n.m.	7	7.3	-55	-39	7.25	7.17	lt yellow	lt yellow
S19	891	932	2.62	3.1067	n.m.	n.m.	n.m.	n.m.	0.51	0.31	n.m.	n.m.	8.4	8.5	-45	-21	6.97	7.07	straw	straw
S20	445	468	1.31	1.5533	< 0.005	0.0087	1.9	1.4	0.9	1.17	pending	pending	8.5	8	-31	-39	6.79	6.81	straw	straw

* Influent measurement made at the beginning of the test. See Table X for influent parameters over time.

ORP somewhat unstable

Effluent color varied over time, no consistent pattern. Reported colors should be used as a guide to assess differences, not as exact colors.

Column Influent

Sovereign
Shepley Hill
Influent data
11/5/2010

Sample ID (per lab book)	Sample ID	Chloride	Arsenic	Total Dissolved Iron	Sodium	Magnesium	Potassium	Calcium	DOC	Alkalinity	DO	ORP	pH
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mV	-
Inf-1	Inf-1	14	< 0.0050	0.55	50	8.7	41	96	< 0.50	190	9.1	118	6.29
Inf-2	Inf-2	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
	Inf-3	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.8	135	5.99
	Inf-4	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.
Inf 3	Inf-5	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.3	183	6.11
Inf-4	Inf-6	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.4	199	6.11
Inf-5	Inf-7	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	221	6.07
Inf-6	Inf-8	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	181	6.11
Inif-7	Inf-9	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.2	228	6.15
nf-8	Inf-10	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.4	151	6.46
Inf-9	Inf-11	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.5	180	6.82
Inf -10	Inf-13	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.7	181	7.70
Inf-11	Inf-14	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	190	8.2	172	8.31
Inf-12	Inf-15*	15	< 0.0050	0.33	47	8.7	39	92	< 0.50	196	7.7	185	6.36
Inf 13	Inf-16	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	188	7.9	96	6.39
Inf-14	Inf-17	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	194	8.3	196	6.28
Inf-15	Inf-18	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	7.3	278	6.43
Inf-16	Inf-19	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	8.3	227	6.71
Inf-17	Inf-20	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	n.m.	200	8.8	239	6.7
	GW#5**	13	< 0.005	0.36	50	8.7	41	95					
Inf-18	Inf-21												
	Inf-21												

n.m. - not measured.

Influent IDs in labbook number sequentially. However, to better see when influent sample was collected relative to effluent sample, influents renaumed to have the same number as the effluent.

*New influent water prepared and started after sampling S14 (11/8/2010, Bk 337, p 9)

** New influent water (GW#5) started 11/19/2010, before collecting Effluent 21. Bk 337, p 12. This data is GW#5 influent immediately after preparation.

Attachment J

Attachment J

TABLE
ANALYTICAL RESULTS
COLUMN TEST 1
ARSENIC REMOVAL BENCH SCALE STUDY
SHEPLEY'S HILL LANDFILL, MA

	INFLUENT	COLUMN 1			COLUMN 3			COLUMN 5		
	SMH-10-15	10/21-19:00	10/21-20:00	10/21-20:45	10/21-19:00	10/21-20:00	10/21-20:45	10/21-19:00	10/21-20:00	10/21-20:45
Arsenic (dissolved)	1,560	3.0 U	3.0 U	3.0 U	3.0 U	3.9	9.6	1,330	1,530	1,630
Arsenic (total)	5,460	3.0 U	3.0 U	3.0 U	19.1	117	149	3,290	3,650	3,830
Iron (dissolved)	21,700	188	2,810	18,700	35,000	54,900	62,500	16,400	18,900	19,300
Iron (total)	47,000	4,160	60,500	68,400	79,300	123,000	118,000	30,600	35,500	34,700
Manganese (dissolved)	7,970	2,200	5,770	7,150	7,590	8,240	8,190	7,540	8,080	7,970
Manganese (total)	7,940	846	6,720	7,280	6,990	8,720	8,450	8,030	8,220	7,940
Alkalinity*	197	--	--	--	--	--	--	--	--	--
Sulfate*	10 U	87.6	--	--	38.3	--	--	11.4	--	--
Dissolved Organic Carbon*	2.8	4.8	--	--	3.1	--	--	3.4	--	--
% As (diss) change from influent	--	-100%	-100%	-100%	-100%	-99.8%	-99.4%	-14.7%	-1.9%	4.5%
% As (tot) change from influent	--	-100%	-100%	-100%	-99.7%	-97.9%	-97.3%	-39.7%	-33.2%	-29.9%
% Fe (diss) change from influent	--	-99.1%	-87.1%	-13.8%	61.3%	153%	188%	-24.4%	-12.9%	-11.1%
% Fe (tot) change from influent	--	-91.1%	28.7%	45.5%	68.7%	162%	151%	-34.9%	-24.5%	-26.2%

Notes:
All concentrations in ug/L unless noted
* - concentrations in mg/L
U - not detected, below reporting limit
Column 1 is 100% iron CC-1004
Column 3 is 50% iron CC-1004/50% silica sand
Column 5 is 100% silica sand

TABLE
ANALYTICAL RESULTS
COLUMN TEST 2
ARSENIC REMOVAL BENCH SCALE STUDY
SHEPLEY'S HILL LANDFILL, MA

	INFLUENT (SMH-10-12)		COLUMN 1				COLUMN 3				COLUMN 4				COLUMN 5			
	Sample 1	Sample 2	10/22-09:20	10/22-10:30	10/22-11:45	10/22-13:05	10/22-09:20	10/22-10:30	10/22-11:45	10/22-13:05	10/22-09:20	10/22-10:30	10/22-11:45	10/22-13:05	10/22-09:20	10/22-10:30	10/22-11:45	10/22-13:05
Arsenic (dissolved)	76	650	3.0 U	3.0 U	3.0 U	3.0 U	4.0	16.2	6.1	13.4	3.0 U	8.6	12.8	48.8	737	936	1,740	5,2
Arsenic (total)	2,890	2,730	3.0 U	4.2	3.0 U	3.1	240	310	206	292	86.4	100	241	390	2,020	2,190	1,470	1,840
Iron (dissolved)	55,800	52,100	11,100	187,000	146,000	141,000	1,900	228,000	166,000	186,000	106,000	188,000	136,000	154,000	53,600	61,100	74,700	46,800
Iron (total)	84,300	72,900	157,000	265,000	225,000	245,000	2,000	268,000	238,000	264,000	165,000	246,000	205,000	177,000	76,800	82,500	70,900	73,100
Manganese (dissolved)	5,800	5,900	7,220	10,000	7,970	7,570	5,280	9,290	7,250	6,990	7,950	8,290	7,280	7,190	6,410	5,910	6,080	5,710
Manganese (total)	6,140	5,220	13,600	9,690	7,960	7,540	10,600	7,820	7,670	7,320	9,530	8,630	7,950	6,540	6,150	6,200	6,170	6,190
Alkalinity*	218	--	279	--	--	--	310	--	--	--	224	--	--	--	200	--	--	--
Sulfate*	10 U	--	16.9	--	--	--	10 U	--	--	--	33.6	--	--	--	10 U	--	--	--
Dissolved Organic Carbon*	3.0	--	2.8	--	--	--	2.5	--	--	--	2.6	--	--	--	3.0	--	--	--
% As (diss) change from influent	--	--	-100%	-100%	-100%	-100%	-100%	-97.9%	-99.2%	-98.2%	-100%	-98.9%	-98.3%	-93.6%	-3.7%	22.4%	129%	-31.3%
% As (tot) change from influent	--	--	-100%	-99.9%	-100%	-99.9%	-91.7%	-89.3%	-92.9%	-89.9%	-97.0%	-96.5%	-91.7%	-86.5%	-30.1%	-24.2%	49.1%	-36.4%
% Fe (diss) change from influent	--	--	-80.1%	235%	162%	140%	-96.6%	409%	197%	233%	90.0%	237%	144%	176%	-3.9%	14.9%	33.9%	16.1%
% Fe (tot) change from influent	--	--	86.2%	214%	167%	191%	-223%	218%	182%	213%	95.7%	192%	143%	110%	8.9%	-2.1%	15.9%	-13.3%

Notes:
All concentrations in ug/L unless noted
* - concentrations in mg/L
U - not detected, below reporting limit
Column 1 is 100% iron CC-1004
Column 3 is 50% iron CC-1004/50% silica sand
Column 4 is 25% iron CC-1200/75% silica sand
Column 5 is 100% silica sand

Attachment K

Attachment K

SOVEREIGN CONSULTING INC.

19 April 2011

Ms. Ginny Lombardo
Remedial Project Manager
Region 1
United States Environmental Protection Agency (USEPA)
Five Post Office Square, Suite 100
Boston, MA 02109-3912

and

Mr. David Chaffin
Federal Facilities Project Manager
Bureau of Waste Site Cleanup
Massachusetts Department of the Environmental Protection (MassDEP)
One Winter Street
Boston, MA 02108

Re: Response to 4 March 2011 USEPA and 24 February 2011 MassDEP Comments Army Draft Final Focused Feasibility Study Report (FFS) and Army Draft Final Supplemental Groundwater and Landfill Cap Assessment for Long Term Monitoring and Maintenance – Addendum Report (SAR), December 2010 Shepley's Hill Landfill Site, Devens, MA

Dear Ms. Lombardo:

Sovereign Consulting Inc. (Sovereign) has reviewed both USEPA's 4 March 2011 Comments and the Massachusetts Department of Environmental Protection (MassDEP) 24 February 2011 Comments on the Army Draft Final FFS and Army Draft Final SAR for Shepley's Hill Landfill (SHL) in Devens, MA, and on behalf of the Army and prepared a response to the comments. A comment by comment response to both the EPA's and MassDEP comments on both the Draft Final SAR and Draft Final FFS are attached. In consideration of the comments and further discussions at the 17 March 2011 and 31 March 2011 BCT meetings, outlined in this letter is a broad presentation of salient issues that bear relevance to several USEPA and MassDEP comments.

Carbon Source and Reducing Conditions

The SAR discusses the role of carbon and resulting reducing conditions at the Shepley's Hill Landfill. The conclusions drawn from the recent data collection are:

(1) There are two sources of carbon at the landfill. One is from the landfill and the other from peat and wetlands that underlie a portion of the landfill;

(2) The peat presently appears to be a more significant source of carbon compared to the landfill; and

(3) The peat and wetlands have been a historic source of carbon and reducing conditions and will continue to be a source of carbon and reducing conditions into the future.

The USEPA and the MassDEP in reviewing the SAR have stated that they do not agree with the idea that the peat is the primary source of reducing conditions at the site. As the body of scientific literature addressing these issues throughout the region is extensive and well established it was not reproduced in the SAR or FFS. Based on data collection and analysis by both Army and USEPA contractors at this site as well as the supporting literature we disagree with the assertions made by both the EPA and MassDEP concerning the role of peat and former wetlands on present and future site reducing conditions. Our reasoning is outlined below.

The emplacement of landfill waste clearly has created its own carbon metabolism, degradation and anaerobic reducing conditions. Municipal landfills are known to behave in this manner and there is no dispute that the landfill comes with its own set of impacts to underlying groundwater. SHL is considered an older landfill (>20 years). By literature standards (El Fadel et al., 2001) leachate from these landfills have lower COD (<1000 mg/L), BOD (<50 mg/L), ammonia (<30 mg/L), TDS (<1000 mg/L) and other constituents compared to newer landfills. SHL groundwater falls within these ranges even with dilution considered. Since SHL has been capped, most of the waste (>80 %) is no longer in contact with groundwater. Over time, the landfill's role in maintaining reducing conditions will diminish and cease.

The wetlands and peat appear, from historic USGS maps, to encompass about 70% of the northern half of the landfill and possibly half of the southern part of the landfill (see attached map). These wetland areas formed shortly after or during the retreat of glaciers during the last Ice Age and typically date 13,000 yrs before present (BP). Formation of wetlands, and underlying peat, results in a number of important biogeochemical changes (Mitsch and Gosselink, 2007):

- Inundation of water into the surface soils in the wetlands results in anaerobic conditions. Low diffusion rates of oxygen under saturated conditions will result in anaerobic conditions typically within 12 weeks.
- Lack of oxygen leads to nitrate reduction, then iron reduction and sulfate reduction, and finally methanogenesis.

These biogeochemical changes will result in production of soluble iron as Fe (II), hydrogen sulfide which can off-gas and/or precipitate as a metal sulfide, production of ammonia and methane. Measured methane rates (Mitsch and Wu, 1995) have been found to range from 0.1 to 500 mg C m^{-2} d^{-1}. Global carbon emission rates from methane from peatlands are 150 mg C m^{-2} d^{-1} (Matthews and Fung, 1987).

Literature reviews and textbooks on wetlands and peatlands make it abundantly clear that the formation and maintenance of wetland and peatlands always result in anaerobic conditions and resulting biogeochemical conditions that will mobilize arsenic as explained in the SAR. To illustrate this we point to a paper (Ravenscroft et al., 2001) in which peat occurs extensively beneath arsenic affected areas of southwestern Bangladesh. The peat is thought to be Holocene aged, about 5,000 yr BP. In wells where peat was not encountered arsenic levels rarely exceeded 100 ug/L. In wells drilled through peat deposits, arsenic concentrations increased to over 1,000 ug/L. It is important to note that peat was encountered at various depths up to 60 meters below ground surface. The findings can be summarized as follows: The concentration of arsenic was not exceptional in much of the study area and the occurrence of reducing conditions was not enough to explain the degree and extent of arsenic pollution. High arsenic levels were attributed to biodegradation of buried peat deposits which drives the reductive dissolution of FeOOH supplying high amounts of arsenic to groundwater. The correlation of peat deposits to high arsenic has also been noted by others (Smedley and Kinniburg, 2002)

The fact that wetlands and peat underlie a significant portion of the landfill can only mean that additional sources of carbon and arsenic were introduced to an already dynamic anaerobic system via the landfill emplacement. Estimates of dissolved carbon from either landfill or wetland sources as noted in the SAR suggests that peat and wetlands have increased total carbon by 50 to 75% of that delivered by the landfill suggesting that removal of the landfill would only reduce the carbon input by 25 to 50%. Thus the peat and wetland areas are a major source of carbon and reducing conditions. With the landfill aging, the peat and buried wetlands will continue to act as a carbon source and hence maintain reducing conditions into the future.

MassDEP has suggested that the former wetlands was a discharge area for groundwater in the northern half of the landfill and therefore cannot be considered a source of carbon or reducing conditions. The statement implies that discharge of groundwater prevents downward movement of water and hence reducing conditions cannot be maintained. This assertion is in fact incorrect. The former wetlands was both a gaining and losing hydrologic feature depending on the season and ambient weather conditions. Many wetlands and peatlands are either discharge points of shallow groundwater or have streams moving through them. However, this does not prevent the peat or wetland soils from creating reducing conditions. If the wetland and peat were viewed on a cross-section only a small portion of groundwater discharges to the surface, while the remainder of the groundwater flow moves through the wetlands or underlying peat, adding dissolved carbon and low Eh water as it moves. During periods of low flow, meteoric water would have infiltrated the underlying peat. As with the landfill waste, capping has eliminated the meteoric water infiltration but not the contact with peat and high organic matter soils underlying the wetlands.

Finally, we believe that the comparison of groundwater carbon species for assessing the contribution of peat to total dissolved carbon to be a valid comparison though it is acknowledged that the comparison is limited by the number of samples. The locations and boring logs from the encountered subsurface material allows us to identify the nature of the subsurface matrix that the groundwater is in contact with in each location. We also believe that the groundwater encountered in each location reflects the nature of the solids through

which it is flowing. Thus if groundwater at a location is sampled in a boring that contains waste in contact with groundwater, then the water sample will reflect the water soluble components of the waste. As noted from the findings, the water samples from the borings containing both peat and waste had the highest carbon input, with peat alone having the second highest carbon input. The attempt by the USEPA to show that no correlation existed with peat and reducing conditions was misguided. In those plots COD or DIC/DOC were plotted against Eh (ORP). This analysis is rejected since Eh is not a reliable parameter and results in a measurement that often does not correlate to the calculated Eh based on measured redox species. This occurs because a reliable redox measurement requires that equilibrium be established at the electrode and also among the various redox couples. Furthermore this condition is often not fulfilled in natural waters, because most redox reactions have slow kinetics and occur only under the influence of microbial catalysis. If redox was calculated from known redox chemistry in the borings a different result may have been obtained. As it is, most of the redox measurements appear to be responding to the Fe (II)/Fe (III) couple since the reaction is relatively fast. However water chemistry indicates the formation of methane, ammonia and sulfide in most of the samples. Therefore, measured Eh likely underestimates the true extent of reducing conditions (Hem, 1961). COD is also a non-precise measurement and includes non-degradable material of unknown origin that will tend to skew results. DOC and DIC on the other hand are simple carbon compounds whose origin can be traced to degradation of organic matter under anaerobic conditions, although other sources of bicarbonate are possible.

Arsenic Source and Fate

Arsenic geochemistry has been studied extensively at the SHL. Early reports by Harding ESE, AMEC and Gannett Fleming and more recently by Sovereign have revealed: (1) the primary source of arsenic now mobilized in groundwater originates from the aquifer sands. Other sources such as landfill waste and bedrock contribute to dissolved arsenic but are not the primary source. Aquifer sands are rich in hydrous ferric oxide (HFO) which hosts surface adsorbed arsenic; (2) arsenic solubility is controlled by reducing conditions imposed by both landfill waste and pre-existing peat deposits within the wetlands over which waste was emplaced; (3) reducing (and anaerobic) conditions force reduction of Fe (III) to Fe (II) resulting in dissolution of HFO and concurrent release of sorbed arsenic; (4) This process has resulted in arsenic concentrations in groundwater that range up to 16,000 ug/L. The importance of HFO in controlling arsenic solubility is a widely accepted process and has been demonstrated to occur at other landfills.

In a review of the SAR and FFS documents, the USEPA contends that the source of arsenic in the waste is at least equally important as arsenic in the aquifer sands. To be accurate, the SAR does not state that the landfill does not contribute arsenic to the groundwater beneath the site. The SAR states that on a mass basis there is more arsenic inventory in the underlying aquifer sands than in the waste. Hence as an on-going source of arsenic, the aquifer sand is a more important source. On a mass basis the waste contains about 27,600 kg of As compared to 68,800 kg in the aquifer sand. If the amount of saturated waste is further taken into account, only 7,000 kg of As in the waste is possibly in contact with groundwater. The SAR does not attempt to estimate how much waste based arsenic has leached into the groundwater, it simply states the condition of the landfill as it now occurs. Capping and pumping have altered the distribution of arsenic from the previous uncapped condition.

It is further noted that if the landfill were to be removed from the site, sand bearing arsenic would continue to mobilize and impact groundwater. The source of aquifer sand arsenic has been presented in 2002 by Harding ESE and more recently by Gannett Fleming (personal communication). In their work, they describe the geological origin of arsenic as arsenopyrites whose weathering products have infiltrated the sands via groundwater flow from nearby and underlying bedrock containing arsenopyrite. We have confirmed these findings based on the RJ Lee Group work which clearly identified arsenopyrite in bedrock samples collected in 2010. The arsenic released from the weathering of the pyrites was then sorbed by HFO in the sands. Evolution of reducing conditions whether by the landfill or wetlands and peat mobilized the arsenic from the HFO. This process is still occurring as evidenced by the well oxygenated arsenic bearing water found at borings SH-10-13, SH-10-14, SH-10-15 and SH-10-16. This is the historic source of arsenic in the sands. Since the peat will continue to provide reducing conditions, arsenic mobilization will continue into the future.

It was also mentioned in the 17 March 2011 BCT meeting that borings advanced by the USEPA in the vicinity of Plow Shop Pond encountered peat at an unknown depth. It was further stated that despite the presence of peat, elevated arsenic was not observed. The EPA interpreted this as meaning the presence of peat did not cause sufficient reducing conditions to mobilize arsenic. Upon further inquiry it was determined that in fact strongly reducing conditions were also noted at these locations. It is therefore more likely that arsenic was not observed at high concentrations due to very different reasons than mentioned by the EPA. The SEM results indicate the presence of massive and especially framboidal pyrite in several of the samples inspected. The occurrence and morphology suggests further that these pyrite occurrences formed in-situ presumably due to the strong reducing conditions that also enable sulfate reduction to sulfide with the end effect of FeS precipitation. Based on a review of the literature, it is possible and even likely that some arsenic is removed from solution into the developing solid phase during this process (Craw et al. 2003). It is therefore possible that arsenic solubility is also then controlled by an As-Fe-S phase under reducing conditions. Gannett Fleming personnel have noted that strongly reducing conditions will allow the formation of pyrites containing arsenic that will limit its solubility. We therefore suggest that the USEPA has incorrectly interpreted its own data or at least should consider an alternate explanation.

Reducing Conditions in the North Impacted Area

Many studies performed by not only by the Army, but others including but not limited to the USGS, US EPA and MassDEP, to determine the background concentration in the regional groundwater and how this affected by reducing or oxidizing conditions have been performed. Under oxidizing conditions arsenic will typically be controlled by sorption to hydrous ferric oxide (HFO) and by the weathering of arsenic occluded within pyrite or true arsenopyrite minerals. Under these conditions typical groundwater concentrations may range from <10 ug/L (Appelo, 2006) to 1,500 ug/L (Vermooten, and Gunnink, 2006) depending on pH and bicarbonate concentrations. Near SHL, an EPA well has been found to contain about 400 ug/L in the bedrock, which contains arsenopyrite. Under reducing conditions, dissolution of HFO containing arsenic appears to be the most important control on arsenic concentrations. Ultimately the amount of arsenic found in groundwater in aquifers of this type will depend on the total solid phase arsenic in HFO, the extent of reducing conditions and the amount of dissolved sulfide which can precipitate soluble arsenic as well. Dissolution of HFO containing arsenic can result in ppm (>1000 ug/L) levels

of arsenic in solution (Appelo, 2006). A recent USGS (2011) report for arsenic in wells in bedrock units of central Massachusetts indicates background arsenic concentrations exceeding 1,500 ug/L. Given these fluctuations in background groundwater arsenic concentrations, a determination of the background to be used in the areas outside of the SHL will be based on a monitoring program that is instituted as part of the final remedy, and as agreed upon with USEPA and MassDEP.

One of the concerns for groundwater quality is the persistence and impact of on-going reducing waters to the north end of the site, referred commonly as the North Impacted Area (NIA). Presently we understand that reducing conditions at this end of the site have resulted from (1) migration of water with anaerobic degradation of carbon emanating from landfill waste and anaerobic degradation of peat, and (2) anaerobic degradation within the aquifer in the NIA likely from natural organic matter and possibly peat since this area was at least in part a former wetland. These conditions have allowed arsenic to be transported from the landfill area to the north end and presented sufficiently reducing conditions that arsenic has also been mobilized within the NIA aquifer sands. With no remediation or source control, this condition is expected to continue far into the future.

Regardless of whether a PRB or a containment remedy is installed for improving groundwater quality, the groundwater in the NIA will remain reducing until into the future. The reasons for this are listed below:

- A portion of the NIA is an extension of the same wetlands that is found beneath the landfill.
- The formation of these wetlands resulted in inundation of water into the surface soils which resulted in anaerobic conditions. The low diffusion rate of oxygen under saturated conditions has led to nitrate reduction, iron reduction, sulfate reduction, and methanogenesis.
- These biogeochemical changes result in production of soluble iron as Fe (II), hydrogen sulfide which can off-gas and or precipitate as a metal sulfide, and production of ammonia and methane.
- These geochemical changes have been observed in the recently completed field work. Ammonia production for example is noted to be occurring in-situ in all borings observed up to the brook and wetlands. This is noted even in borings with little or no soluble arsenic.
- The NIA, therefore generates reducing conditions in a manner similar to that observed in the landfill and peat layers.
- A containment wall or a PRB will allow arsenic free water to eventually flush pore water arsenic out of the NIA or if Eh is low enough and sufficient sulfide exists, arsenic maybe removed via pyrite or arsenic sulfide removal.
- Continued flushing with arsenic free water will eventually flush the pool of soluble arsenic from the NIA.

It is the Army's understanding that restoration of the aquifer to MCLs or background will take centuries regardless of the remedy chosen due to the naturally occurring arsenic sources and reducing conditions. However, while there may be disagreement over interpretation of the CSM, the Army hopes to move forward with the goal of implementing the most effective, efficient, economical, and sustainable remedy available given site conditions. This is believed to be the consensus objective from the 31 March 2010 BCT meeting.

The SAR, FFS, and the attached responses to comments were prepared within the context of the currently accepted understanding of the geochemical processes, conceptual site model, and objective summarized above. If you have any further questions please do not hesitate to contact Mr. William Walker or myself at 425-785-1550 and 973-219-3049, respectively.

If you have any further questions please do not hesitate to contact me at 973-219-3049.

Sincerely,
Sovereign Consulting Inc.

Marc Cicalese
Project Manager

cc: R. Simeone (BRAC Environmental Coordinator)
E. Iorio (USACE)
W. Walker (Sovereign)
B. Brandon (USEPA)
R. Ford (USEPA)
S. Acree (USEPA)

Attachments

References

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Response to 4 March 2011 USEPA Comments on
December 2010 Army Draft Final Focused Feasibility Study and
December 2010 Army Draft Final Supplemental Groundwater and Landfill Cap Assessment for Long Term Monitoring and Maintenance – Addendum Report
Shepley's Hill Landfill, Devens, MA

General Comments

General Comment 1: *Throughout the reports, it is stated that the primary source of arsenic in groundwater at SHL is solid-phase arsenic that is sorbed to aquifer sand and mobilized to groundwater by reducing conditions. Furthermore, the reports rank the relative importance of arsenic sources as: aquifer sand > landfill waste = peat > bedrock = till. It is suggested that the intent of statements of this nature be carefully reviewed and revised in both draft documents. Although it may be demonstrated that the mass of arsenic in the overburden soil is larger than the mass of arsenic in the landfill waste, the data in the Supplemental Report clearly show that the landfill waste contains arsenic, and the highest concentration of arsenic in the waste is equal to the highest concentrations found in the soil. Therefore, for purposes of decisions regarding responsibility and appropriate remedial alternatives, it must be assumed that landfill waste is contributing arsenic to site groundwater. Note that the groundwater distribution of arsenic depicted in Geological Cross Section A-A' (Figure 4 of Draft FFS) is the first comprehensive dataset available either prior to or subsequent to installation of the landfill cap. The data from boring location SHM-10-12 prevent ruling out landfill waste as a past and potential current contributor to elevated arsenic in groundwater within the landfill.*

Response to General Comment 1: The Army acknowledges EPA's need to assume that landfill waste is contributing arsenic to groundwater for purposes of the regulatory process. It is noted, that the Army has never taken the position that the landfill does not contribute arsenic to the groundwater beneath the site. The SAR simply states that on a mass basis there is more arsenic inventory in the underlying aquifer sands than in the waste, which is based on actual data collected from the site. Hence as an on-going source of arsenic, the aquifer sand is currently a more important source. On a mass basis the waste contains about 27,000 kg of As compared to 68,000 kg in the aquifer sand. If the amount of saturated waste is further taken into account, only 7,000 kg of As in the waste is possibly in contact with groundwater. The SAR does not attempt to estimate how much waste-based arsenic has leached into the groundwater, it simply states the condition of the landfill as it now occurs. Capping and pumping have altered the distribution of arsenic from the previous uncapped condition.

If the landfill were to be removed from the site, sand bearing arsenic would continue to mobilize and impact groundwater. The aquifer sands as a source of arsenic was presented in 2002 by Harding ESE and agreed to by Gannett Fleming. In their work, they describe the geological origin of arsenic in arsenopyrites whose weathering products have infiltrated the sands and formed hydrous ferric oxide with sorbed arsenic. This process is still occurring as evidenced by the well-oxygenated arsenic-bearing water found at borings SH-10-13, SH-10-14, SH-10-15 and SH-10-16. This is the historic source of arsenic in the sands. It is recognized that waste also leached an unknown quantity into the groundwater.

General Comment 2: *The draft reports state that naturally occurring peat deposits in the subsurface, within the landfill footprint, are the primary source of the reducing conditions responsible for mobilizing arsenic. However, the landfill is known to have been an additional source of organic carbon, and the relative contributions of carbon from landfill waste and peat deposits under historical, present, and future site conditions are unknown and cannot be determined from current information. It should be noted that the degree to which the released organic carbon is degradable is also an important factor to consider. The attached Figure 1 shows the relationship between organic carbon concentrations and indicators of carbon biodegradation for all depth-discrete groundwater samples collected at the five borings completed within the landfill (SHM-10-11, SHM-10-12, SHM-10-13, SHM-10-14, and SHM-10-15). There does not appear to be any clear relationship between the location of identified peat layers and the reducing conditions within the aquifer underlying the landfill footprint. Thus, conclusions that the peat deposits are the driving force for reducing conditions underneath the landfill are not supported to any degree of certainty. While it is likely that peat deposits are a contributor to the total mass of degradable organic carbon underneath the landfill, it appears premature to conclude that it controls reducing conditions throughout this portion of the aquifer. In addition, a site-specific degradation rate is unknown at this time; however, the rate of carbon degradation in peat is known to decrease with time (e.g., Kuhry and Vitt, 1996), just as the degradation rate of landfill-derived carbon also decreases with time. Also, the composition of the dissolved carbon due to the presence of the peat is unknown, so it is difficult to relate the aqueous concentration of carbon to its ability to serve as a substrate for an anaerobic microbial population. Because the peat is old, it is possible that most of the labile carbon is gone and under present-day conditions the peat is contributing very little to the current redox conditions. It should also be noted that reducing conditions similar in nature to those observed within the new landfill borings have been observed at well cluster locations RSK8-12 and RSK16-20, which are spatially segregated from the presumed impact of the peat deposits. Therefore, for purposes of decisions regarding responsibility and appropriate remedial alternatives, it must be assumed that the landfill is contributing to the reducing conditions that mobilize arsenic to site groundwater.*

Response to General Comment 2: As with the first comment, no attempt to rule out the landfill as a source of reducing conditions has been made. It is clear from the dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) data, that the landfill has been the most important recent driver for creating reducing conditions. Language clarifying this will be added to the revised SAR. The Draft SAR attempted to estimate what importance the peat plays in creating reducing conditions. This was done since any remediation that addressed only the landfill contribution would likely not achieve agreed upon arsenic goals if a continuing source of reducing conditions was not recognized in establishing those goals.

Given the weight of evidence, the pre-existing wetlands and underlying peat also caused arsenic mobilization prior to emplacement of the landfill. While we cannot know to what extent this occurred, there is no doubt it occurred. The scientific literature for similar peats and wetlands effect on reducing conditions in New England are well documented and only the rarest of peat deposits would not cause reducing conditions. Ignoring this contribution would contradict well-established scientific knowledge. A list of documents and supporting literature will be added to the revised SAR.

As far as carbon degradation is concerned, there is no doubt that age affects carbon production and metabolism. However, similar aged peat deposits (13,000 to 30,000 years) still produce methane and carbon dioxide. The discovery of peat effects on arsenic mobilization in Bangladesh establishes a clear indicator of the potential of this source of carbon in mobilizing arsenic.

Finally while we do acknowledge that the landfill is contributing to the reducing conditions, it also needs to be acknowledged by all, given the weight of evidence that the underlying peat is also a significant contributor to the reducing conditions.

General Comment 3: *The draft reports reference the 'observable and mapped redox front' in the vicinity of Nonacoicus Brook, and that it is this redox boundary that prevents arsenic from reaching the brook. Statements regarding the delineation of the redox front should be qualified. In general, some mixing of groundwater within the plume with clean water is expected to occur in the subsurface as the plume approaches a discharge area. However, the hydrologic data are not sufficient to fully define the discharge area for the plume or the long term stability of a redox boundary in the aquifer under various hydrologic conditions. Additional monitoring of temporal patterns of groundwater/surface water interactions in a similar fashion to the monitoring used to evaluate discharge to Red Cove would be needed to support this aspect of the conceptual model. None of the DPT profiles in the northern impacted area shows strongly oxidizing conditions at the depth in each profile at which dissolved As is at a maximum. While it is noted that GP-10-10, -10-22, -10-26, and -10-01 show significantly decreased As (maxima are 0.97 to 14.5 ug/L), the corresponding dissolved oxygen levels are less than 1 mg/L and ORPs are mildly to moderately reducing (-36.1 to 63.8 mV).*

Also, it must be acknowledged that the northern impacted area and any redox front that bounds it to the east (i.e., eastward of SHM-10-27) could not be identified due to access issues. Examination of data provided in the Supplemental Report indicates a zone at least several hundred feet wide discharges to the subsurface beneath the brook and has not yet been delineated in the horizontal dimension north of the line of borings SHM-10-21, SHM-10-20, SHM-10-18, SHM-10-24, SHM-10-23, SHM-10-25, and SHM-10-27 (see Figure 9 from the Supplemental Report). Along this transect, arsenic values at depth range from 146 ug/l (60' bgs) at SHM-10-21 on the west to over 1000 ug/l at SHM-10-23 (59' bgs) and SHM-10-27 (65' bgs). At no location along this impacted transect have the limits of the arsenic plume been delineated with respect to depth. It is important to note that the total depths penetrated by the direct-push drilling machines may be more shallow than actual bedrock depths. As such, the possibility of higher arsenic concentrations at greater depths in the locations cannot yet be ruled out.

Response to General Comment 3: The comments are noted. In general we concur that a clear redox boundary was not delineated, and therefore will modify the SAR accordingly. However, it is also evident from the DPT work that:

1) Clear identifiable changes in water chemistry did occur in some of the DPT points to the north and west. These will be described more clearly in the SAR.
2) The delineation to the east is not clear and the SAR will acknowledge this.
3) The bedrock study provides very good evidence that discharge will be prevented from moving under the brook and to the north.

4) Mixing with water from the north and east will provide an abrupt change in redox chemistry which will have the effect of precipitating iron and arsenic. This process is the reason that elevated arsenic has not been observed in the brook or at the McPherson Well.

With respect to direct push depth limitations, other data collected at the site during the drilling confirm that the direct push was able to, in general, achieve depths quite close to rock as observed with other drilling methods in the past where depth to rock was known.

General Comment 4: *Throughout the reports, conditional statements are made concerning the relative roles of "flushing" and "carbon inputs into the aquifer" on observed arsenic concentrations and the time to achieve cleanup goals in the North Impact Area. Given consistent trends in decreasing arsenic concentrations, subsequent to operation of the ATP, observed for some monitoring wells immediately downgradient of the ATP extraction wells (i.e., monitoring wells SHP-05-41B and SHM-93-22B), it appears premature to conclude that "flushing" in the North Impact Area will not be adequate to achieve restoration in this portion of the aquifer. For example, systematic decreases in arsenic concentrations at monitoring well SHM-93-22B from 3,440 ug/L in June 2006 down to 980 u/L in April 2010 (and similar decreases observed at SHP-05-41B) indicate that the flux of arsenic transported into the North Impact Area has been decreasing for the past four years. It is recommended that a more thorough analysis of historical and newly acquired groundwater monitoring data be conducted for the North Impact Area, rather than placing heavy reliance on estimates of presumed sources of "carbon inputs" into the aquifer. In addition, it should be noted that extensive portions of the aquifer downgradient from the ATP exist with arsenic concentrations at or below MCL. Since these data were not available prior to 2010, assessments of "flushing" or attenuation of arsenic in this portion of the aquifer will have significant uncertainty. Since the analysis of groundwater hydraulics in this portion of the aquifer has also been very limited, it seems premature to make conclusive statements about the ability to achieve aquifer restoration in a given timeframe. Relative to the analysis of "carbon inputs" to the aquifer, the aggregation of total inorganic carbon (TIC) concentrations with total organic carbon (TOC) concentrations to assess the potential for or longevity of reducing conditions is not clear. The technical basis for this analysis approach, preferably with examples where it has been applied to sites with similar groundwater conditions, needs to be provided before the adequacy of conclusions drawn from the analysis can be assessed. It should be noted that field chemistry data from the vertical profiling work demonstrate that portions of the aquifer are more reducing even though TOC+TIC concentrations are lower.*

Response to General Comment 4: While there have been declines in Arsenic concentrations in "select" wells they have not been accompanied by holistic changes in either arsenic concentration or redox chemistry in the area effected by the ATP, and consequently the Army disagrees with this comment. The impact on pumping has been to intercept the majority of arsenic mobilized in deep groundwater; however, the time required to flush residual COD such that oxidizing conditions can be restored is highly uncertain.

It is also possible that the decreases in arsenic as they are claimed may not be decreases for the reasons presumed. There may be other controls on arsenic solubility that have not been considered, which will be further discussed in the revised documents.

Any discussion of restoration to oxidizing conditions must bear the caveat that it is not practicable to attempt to restore such conditions where they did not occur naturally. Regardless, it is not possible to predict where and to what extent oxidizing conditions existed or may be restored or what ambient arsenic levels were in the impacted area with the existing database. That is to say that the "success" of the ATP, or other remedies with or without source control in aquifer restoration will have to be determined on the basis of long-term monitoring.

General Comment 5: *An arsenic concentration of 400 ug/L is referred to as a 'local baseline' value and is based on measurements from the SHL Bedrock Investigation and theoretical concentrations due to arsenopyrite solubility. Arsenic values up to ~400 ug/L have been reported from upgradient groundwater in the SHL Bedrock Investigation, but these concentrations are attributed to arsenopyrite oxidation and dissolution of subsequent alteration products. Data in the Supplemental Report support desorption and/or reductive dissolution of hydrous-ferric-oxide-sorbed arsenic as the primary mechanism(s) that mobilize arsenic to groundwater. It is not clear that 400 ug/L should be considered a 'local baseline' if the mechanisms responsible for generating dissolved arsenic in the landfill groundwater and in upgradient groundwater are different. Establishing a background number for SHL groundwater arsenic will require further BCT discussion and consensus.*

Response to General Comment 5: Duly noted. Also as discussed with the BCT, it is understood that establishing a background number for SHL groundwater arsenic will be determined based on a monitoring program that is instituted as part of the final remedy as well studies performed by others including but not limited to the USGS, EPA and MassDEP. The USGS (USGS Special Report 2011-5013), EPA and MassDEP have and are performing studies to determine the background arsenic concentration in the regional groundwater. A statement to this effect will be made in the FFS.

General Comment 6: *The site-specific partition coefficient (K_d) presented in the reports may be useful for predicting arsenic concentrations, but this parameter must be applied with qualifications. The data shown in the figure from which the site-specific K_d was derived (Figure 46 of the Supplemental Report) represent a limited range of soil and groundwater concentrations, a subset of the range of geochemical conditions present at SHL, and possibly a subset of the mechanisms controlling arsenic solubility. It is likely that more than one partition coefficient is relevant to any geochemical analysis of SHL soil and groundwater.*

Response to General Comment 6: This value and how it was obtained will be qualified in the revised SAR. It is agreed that K(d) is only one of many geochemical parameters controlling solubility of As in groundwater.

General Comment 7: *The draft Supplemental Report states that the column experiments are ongoing and results would be available in January 2011. It is understood that those results are not available at the time of this review but will soon be forthcoming. Until additional results have been reviewed, EPA cautions against overinterpretation of the results of the single column experiment that is described in this document. In particular, estimates of the time required for arsenic to flush out of a column of landfill soil to levels below the MCL are presented as of the order of 200 years but it is stated that this is based on preliminary data. However, the data reported in this document (Attachment 1) suggest that the*

experimental conditions may not be simulating in situ conditions accurately and different mechanisms that release arsenic may operate at different time scales under this set of conditions.

Response to General Comment 7: Agreed. The updated draft column study report is included as an attachment for review.

General Comment 8: *The draft Supplemental Report presents an assessment of the capture and confinement of the arsenic plume to the north and northeast of the Arsenic Treatment Plant (ATP). It is stated in the Executive Summary (p. vi) and elsewhere in the report that points SHM-10-06 and SHM-10-06A were installed for this purpose, and that data from these wells were used to refine particle-track modeling. The Executive Summary and later discussion of the cross-sections indicate that the ATP is successfully capturing arsenic and reducing arsenic mass on the northern and northeastern side of the plant. Support for this statement appears to be the difference in arsenic concentrations seen in monitoring wells SHM-10-06 (2710 ug/L) and SHM-10-6A (94.2 ug/L). However, these monitoring wells were sampled only twice (July and September) and in each well the more recent results were approximately 50% higher than the earlier results. EPA recommends continued monitoring of these wells. It is not detailed in this report how the groundwater data were used to refine the particle track modeling, but note that the very low As reported at depth (<1.13 to 1.17 J ug/L at 104 and 110 ft bgs, respectively) in the profile sampling at GP-10-06A correspond to very low ORPs (-352 mV to -392 mV); very low As concentrations may not indicate either oxidizing conditions or capture but may be consistent with sulfide precipitation.*

Response to General Comment 8: While the Army agrees that two rounds of data may not be sufficient to define temporal fluctuations and will consider inclusion of these wells in the monitoring program, the data to date supports the delineation of the eastern edge of the Arsenic plume which coincides with the predicted extent of the capture zone. Continued monitoring of a network of wells in this area will be proposed in future monitoring plans as part of the final remedial alternative.

We also agree that low Eh (<-300 mv) may result in either precipitation of arsenic sulfides or arsenic occluded within pyrites. Recent SEM data indicates the formation in-situ of framboidal iron sulfides that may contain arsenic. This sink for arsenic at low Eh has been noted by others as well (Craw, 2003).

General Comment 9: *The reports refer to predictions of the time required for the aquifer to attain pre-landfill conditions. The definition of 'pre-landfill conditions' is not clear. In the column experiment described in this document, oxygenated synthetic groundwater was used to flush arsenic from a column packed with landfill soil, and arsenic in the effluent was measured. The 'time to pre-landfill conditions' is based on the number of pore volumes required for the effluent arsenic concentration to decrease to values below the MCL. Elsewhere, the Report asserts repeatedly that the naturally occurring peat deposits are the primary source of reducing conditions beneath the landfill, implying that 'pre-landfill' groundwater was reducing, and arsenic was elevated prior to the existence of the landfill. In addition, it is not clear how an estimate of the time to attain 'pre-landfill conditions' is meaningful since the landfill has been capped permanently. Please clarify statements referring to 'pre-landfill conditions' and how the column experiment and estimated time replicate this condition.*

Response to General Comment 9: Comment duly noted. The SAR will be revised to more accurately depict the intent of the column experiment as well as the significance of the peat deposits. The term "pre-landfill" will be further defined to eliminate confusion.

General Comment 10: *The newly acquired bedrock information in the vicinity of Nonacoicus brook is based on little actual bedrock data (i.e., depths confirmed by collecting actual rock cores). Uncertainty is greatest in the broad region where the plume enters the Nonacoicus brook floodplain from the south. No seismic data was collected on the south side of the brook, and "refusal" depths from direct-push drilling cannot be considered as representative of actual bedrock depths without confirmatory work; they may simply represent "false" indications of bedrock, substantially above the actual bedrock surface. Confirmation of bedrock depths and deep glacial stratigraphy is needed in the north plume area, particularly along the southern side of the brook.*

Response to General Comment 10: Acknowledged, however other data collected at the site during the drilling confirm that the direct push was able to, in general, achieve depths quite close to rock as observed with other drilling methods in the past where depth to rock was known. Further, while no data is available directly under the brook the distribution of data points (which do include borings associated with the bridge footing) as shown on figure 29 is considered robust. Further, the interpretation accounts for the deepest bedrock directly under the brook, unsupported by any data, and therefore could be considered conservative.

General Comment 11: *The ARARs table included in the Draft FFS does not provide the necessary information for adequate legal review. There should be separate ARARs tables for the different remedial alternatives evaluated. The general ARARs table included contains incorrect citations (e.g., 40 C.F.R. § 6 has been rewritten and does not apply as indicated). The next version of the FFS must include complete ARARs tables for EPA review.*

Response to General Comment 11: The Army is amenable to revising the ARARs table so that it includes the necessary information required for *"adequate legal review"* as requested. Therefore, we respectfully request that EPA define the deficiencies and incorrect citations so that the table can be revised. Concerning the request for a separate ARAR table for the different remedial alternatives, we believe that it is most appropriate to evaluate the entire list of ARARs defined against each remedial alternative's applicability, relevance and attainment, as is performed in the analysis of alternatives sections.

Specific Comments on Army Draft Final Supplemental Groundwater and Landfill Cap Assessment for Long Term Monitoring and Maintenance – Addendum Report (SAR):

SAR Comment 1: *Executive Summary, Page ix: The last bullet in the summary of the conceptual site model (CSM) states that groundwater entering Red Cove likely traveled along a different path prior to capping the landfill, but asserts that the pre-landfill flow likely also carried elevated arsenic to the pond. What is the basis of this conclusion? If the pre-cap flow pattern is inferred from numerical model calculations, please state this. Do the inferred pre-cap path lines pass through a domain of known elevated groundwater arsenic under current conditions?*

Response to SAR Comment 1: The referenced bullet does not address post-landfill / pre-cap flux. Its point is that similar to the arsenic flux north of the site, the impact to Red Cove likely preceded the placement of the landfill. The landfill and the corresponding additional dissolved carbon associated with the reducing conditions certainly would have exacerbated that flux prior to capping.

SAR Comment 2: *Section 2.1, Page 4: In the sentence on NPL listing, revise "Shepley's Hill Landfill" to "Fort Devens".*

Response to SAR Comment 2: Edited as requested.

SAR Comment 3: *Section 3.2, Page 7: The text states, "Bedrock has a strong influence on groundwater flow patterns ... ." It would be useful to expand upon this statement in the interest of clarity. For an unconfined aquifer overlying a relatively low-conductivity bedrock surface, the geometry of the bedrock has little influence on the direction of groundwater flow, as heads tend to be near hydrostatic along any vertical section (i.e., the head is determined by the free surface elevation, rather than by the depth to bedrock). However, in the map plane, the vertically integrated groundwater flux is, of course, strongly influenced by the bedrock geometry, to the extent that a greater cross sectional area (per unit horizontal distance normal to the flow) will carry more flow under the same hydraulic gradient.*

Response to SAR Comment 3: The text will be expanded accordingly.

SAR Comment 4: *Section 3.4, Page 10: The second paragraph provides a brief description of the 'temporary' monitoring well construction. Please consider adding a table with the well coordinates (northing, easting) and screen depths/elevations. What is meant by 'temporary'? Please indicate whether these wells will be available for future sampling rounds and if so, when they will be sampled next.*

Response to SAR Comment 4: These wells were designated as "temporary" based on the fact that they were installed within the DPT location via the DPT, and not standard well construction practices, so that additional samples could be collected to confirm the concentrations of arsenic obtained by the DPT interval sampling. The results obtained from these wells will be evaluated and as part of the final remedy monitoring plan. Based on this evaluation new permanent monitoring wells will be installed to replace the temporary monitoring wells, were deemed appropriate. At this time all temporary wells will be abandoned in accordance with State and Federal requirements.

SAR Comment 5: *Section 3.5.3.1, 3.5.3.2 and 4.0, Page 13-14: References to Table 4 should be revised to Table 5.*

Response to SAR Comment 5: Edited as requested.

SAR Comment 6: *Section 5.3, Page 21: The text states that "... water levels in the N5 cluster are higher than those in the three new wells immediately surrounding it ... ." Further discussion of the inferred water levels at N5-P P1 and -P2 is warranted before speculating about this apparent anomaly. In particular, EPA has monitored water levels in these two piezometers for several years. Data were last downloaded at the end of September 2010; according to those data (which are tied to manual*

measurements at the time of deployment of the transducers), the water elevations at N5-P1 and -P2 at the end of September were about 218.1 ft msl and 218.25 ft msl, respectively, and had been falling monotonically since May. Given the relatively hot, dry summer in 2010, it is likely that water levels continued to fall through October. The water levels for P1 and P2 displayed on Figure 30 for October 2010 are 219.09 ft msl and 219.3 ft msl, respectively. Water levels for surrounding new wells (SHM-10-13, -15) are close to 218 ft msl, prompting the observation that the N5 piezometers appear to exhibit anomalously high water levels. However, the water levels recorded/calculated by EPA are more in line with those observed at the neighboring wells. There may be no anomalous behavior to explain at the N5 piezometers, if this discrepancy can be resolved. Note that the transducers are still in place in the N5 couplet, so that data spanning the time of the October manual measurements are available.

Response to SAR Comment 6: Agreed that synoptic data would be required to compare and request the latest N5 hydrographs, for evaluation and revisions as deemed necessary. It is also noted that the new monitoring wells have long screens completed deeper than the more discrete N5-P1 and -P2 screen intervals in bedrock and shallow overburden.

SAR Comment 7: *Section 5.3, Page 21: The text states that water levels at the N5 couplet "... are known to be periodically anomalous or 'flashy' ... ." This characterization should be discussed and revised, if appropriate. The term 'flashy' has been used in the past to characterize water levels in bedrock borings and/or wells on or near the recharge area on Shepley's Hill. The reference is to very large water-level changes (of the order of ten feet) in association with recharge events, lasting only a few days, and ascribed to the small porosity, but relatively high hydraulic diffusivity, of the fractured rock. Water levels at the N5 couplet, which have been monitored continuously for several years, vary slowly and smoothly over time scales of the order of many months. This, in turn, is attributed to the large distance to areas of water inputs, due to the presence of the landfill cap. The diffusive nature of groundwater head changes smooths out any 'flashiness' that is seen in the recharge area at distances of hundreds of feet, as at N5.*

Response to SAR Comment 7: Noted. The statement in the SAR also considered the observation that vertical gradient periodically reverses between the -P1 and P2 screen intervals.

SAR Comment 8. *Section. 5.3, Page 21 and Figure 30: While the equipotentials shown on Figure 30 generally represent a reasonable interpretation of the overburden potential surface, it seems likely that the equipotentials do not approach the recharge area of Shepley's Hill (close to) perpendicular to the western margin of the landfill or the "toe" of the slope as the hill descends toward the landfill. If the bedrock of the hill and the overburden aquifer to the east are coupled, as is assumed, for example, in the numerical groundwater flow model, then one would expect the equipotentials to bend more or less parallel to the topographic contours on the hill. The modeled equipotentials indeed do this (see, e.g., Figure 32). Please consider either terminating the equipotentials shown in Figure 30 in areas where available data constrain them (i.e., do not extend them to the hill on the west), or indicate schematically that they bend sharply to the north as they approach the hill (based on principle, rather than on measurements).*

Response to SAR Comment 8: The equipotentials will be terminated as suggested.

SAR Comment 9: *Section 5.4, Page 22: Revise reference to Figure 30 to Figure 29.*

Response to SAR Comment 9: Edited as requested.

SAR Comment 10: *Section 5.4, Page 22 and Figure 32: Please describe the procedure used to construct the particle tracks shown in Figure 32. Are these "backtracks" from the extraction wells? If so, were particles backtracked all the way to the points at which each particle enters the groundwater system? If so, why do a number of particle tracks terminate in the southwestern portion of the landfill (i.e., immediately north of the large warehouse), beneath the cap, where there is no recharge?*

Response to SAR Comment 10: The text will be revised to clarify a reverse particle tracking technique was used to define the capture zones under various extraction rates. Several reverse particles paths terminate along the boundary between steep eastward hydraulic gradients in the bedrock and gentler northward gradient in overburden at which the upper layers of the model effectively go dry.

SAR Comment 11: *Section 6.2.1.1, Page 25: The description of the column experiment in this section states only that the column was packed with soil taken from an area in the landfill where groundwater arsenic was relatively high (1,200 ug/L). Please provide a pointer to the soil data; if they are in Table 4, identify the soil interval that was used for this experiment. If the experimental soil is not listed in Table 4, but was analyzed independently (i.e., by the lab running the column tests) as indicated in the Work Plan Addendum (Sovereign, 2010), provide the data.*

Response to SAR Comment 11: Edited as requested.

SAR Comment 12: *Section 6.3.1.1, Page 27: The text on this page (second, third, and fourth bullets) appears to propose an arsenic concentration of 400 ug/L as a 'local baseline' or background value. Because establishing an acceptable background level for SHL has important implications for a target cleanup goal, this issue must be further discussed by the BCT. Candidate background data to consider:*

- *400 ug/L -- the maximum value from deep bedrock well on Shepley's Hill; this is upgradient and not landfill-impacted, but arsenic is likely due to sulfide oxidation and dissolution of alteration products, not reductive dissolution of HFO and release of sorbed As;*
- *a value calculated from a site-specific K_d and Devens soil background As (17.5 mg/kg), although it will be necessary to examine the derivation of the K_d = 7.6 mL/g and also the range of soil concentrations and redox conditions this represents;*
- *57.3 ug/L -- average of LTMP data from 2005 through 2009 for SHL-15, nominally an upgradient well;*
- *200 ug/L -- the maximum arsenic observed in the overburden at Grove Pond was 189 ug/L but this represents a different environment;*
- *other values to be considered?*

Response to SAR Comment 12: As discussed during the March 2010 BCT meetings, the ambient (pre-landfill) groundwater conditions in the area down gradient of SHL are unknown and cannot be agreed upon by all parties with the existing database, which includes many studies performed by not only by the Army, but others including but not limited to the USGS, US EPA and MassDEP, to determine the background concentration in the regional groundwater. These studies have demonstrated that arsenic concentrations vary depending on whether the groundwater is oxidizing or reducing. Under oxidizing conditions arsenic will typically be controlled by sorption to hydrous ferric oxide (HFO) and by the weathering of

arsenic occluded within pyrite or true arsenopyrite minerals. Under these conditions typical groundwater concentrations may range from <10 ug/L (Appelo, 2006) to 1,500 ug/L (Vermooten and Gunnink, 2007) depending on pH and bicarbonate concentrations. Near SHL, an EPA well has been found to contain about 400 ug/L in the bedrock which contains arsenopyrite. Under reducing conditions, dissolution of HFO containing arsenic appears to be the most important control on arsenic concentrations. Ultimately the amount of arsenic found in groundwater in aquifers of this type will depend on the total solid phase arsenic in HFO, the extent of reducing conditions and the amount of dissolved sulfide which can precipitate soluble arsenic as well. Dissolution of HFO containing arsenic can result in ppm (>1000 ug/L) levels of arsenic in solution (Appelo, 2006). A recent USGS (2011) report for arsenic in wells in bedrock units of central Massachusetts indicates background arsenic concentrations exceeding 1,500 ug/L. Given these fluctuations in background groundwater arsenic concentrations, a determination of the background to be used in the areas outside of the SHL will be based on a monitoring program that is instituted as part of the final remedy, and as agreed upon with USEPA and MassDEP.

SAR Comment 13: Section 6.3.1.1, Page 27: The sixth bullet on this page speculates that the observed vertical distribution of groundwater arsenic is due to processes mobilizing arsenic from the aquifer sands and 'infiltration of cleaner groundwater along the bedrock surface' and that this distribution is noted at other landfills. Please provide the relevant references to other landfills where this distribution has been observed.

Response to SAR Comment 13: After reviewing the statements in the SAR, we do not have specific examples for distribution of arsenic beneath landfills. Therefore we will amend this section to note that this distribution was first noted by Harding ESE in 2002 in their Supplemental Groundwater Investigation. Further, we will include recent work by Dutch researchers who have described in detail arsenic distributions in groundwater beneath and in contact with peat layers.

SAR Comment 14: Section 6.3.1.1, Page 27: The seventh bullet describes "the cap effect where waste and peat contact with infiltrating water…." This process is not clear as given. It is expected that the cap has eliminated infiltration through waste and peat above the water table, while horizontal groundwater flow still results in contact of water with waste and peat where they lie below the water table. Please clarify.

Response to SAR Comment 14: The text will be clarified as requested.

SAR Comment 15: Section 6.3.1.5, Page 29: In this discussion of findings along the transect F-F', note that the extent of elevated arsenic concentrations has not been bounded at the eastern end of this transect.

Response to SAR Comment 15: Noted.

SAR Comment 16: Section 6.3.4.2, Page 36: The first sentence in the first paragraph of this section states that PHREEQC2 was used to model the data from the column flushing experiment. Provide an appendix with the details of this modeling effort as well as the details of any simulations, using PHREEQC2 or other codes, of the remaining experiments.

Response to SAR Comment 16: An Appendix with the requested information will be provided as requested.

SAR Comment 17: *Section 6.3.4.2, Page 37 and Figure 45: The text in this section refers to Figure 45, which shows soil As concentration plotted against the As/Fe ratio from the same depth interval. The high value for the resulting correlation ($R^2 = 0.94$) is taken as evidence that 'only iron is needed to explain the occurrence of arsenic in the solid phase.' This argument appears to be offered in support of statements regarding arsenic sorbed onto hydrous ferric oxide (HFO) in the overburden as the primary source of arsenic to groundwater. The apparent strong correlation is due to the lack of independence of the As/Fe ratio and the soil As concentration. A more persuasive approach would be a plot of As vs. Fe concentrations; however, when all of the available soil data from the profile samples are plotted, the correlation is poor ($R^2 = 0.02$ but ranges from < 0.02 to > 0.9 when plotted by individual boring), suggesting that As/Fe ratios are spatially variable.*

Response to SAR Comment 17: This plot will be eliminated. Instead the spatial variability will be described. A better indicator of Fe control will be plotting the solid phase data with the groundwater data and literature values for HFO/As solids

SAR Comment 18: *Section 6.3.4.2, Page 37: The report should show (e.g., in a table or appendix) the co-located soil and groundwater data that were used to determine this K_d. The low-concentration end of the data shown on Figure 46 may represent a different mechanism than that controlling As behavior at the higher concentrations, as the low-concentration portion of the plot appears to have a steeper slope. Also, the linear regression tends to weight the higher-concentration end.*

Response to SAR Comment 18: The estimate of K_d for the site is questionable due to the high uncertainty used to determine the K_d. Therefore the text will be revised to provide a discussion in terms of controls on arsenic solubility, but a K_d will not be determined.

SAR Comment 19: *Section 6.4.1, Page 39: The third bullet states that "[A]rsenic in waste is always less than 25 mg/kg." Reconcile this value with other statements (e.g., ES, p. vii; p. 38, Sec. 6.4.1) that indicate waste contains As up to 60 mg/kg.*

Response to SAR Comment 19: Text shall be edited to read the highest waste As is 31 mg/kg. The 60 mg/kg is As found in peat.

SAR Comment 20: *Section 6.4.2.2, Page 42: The last paragraph in this section discusses studies that link biodegradation of peat to arsenic mobilization in Bangladesh and West India, noting that the distribution of peat deposits and their ages "...correlate to some degree..." with arsenic, and that TOC concentrations are similar to the range of TOCs reported from SHL borings. Until more data are available (e.g., the ongoing carbon degradation experiments), the solubility and reactivity of the peat recovered from SHL is unknown; also, the age of SHL peat is unknown so its reactivity cannot be estimated by comparison to the Bangladesh studies.*

Response to SAR Comment 20: Acknowledged, however the significance of this publication as an indicator remains.

SAR Comment 21: *Table 4: Why are two columns labeled "TOC %"?*

Response to SAR Comment 21: The table will be edited to provide clarification.

SAR Comment 22: *Figure 2 and Table 3: Note that As in SHL-10-16 is shown as 495 ug/L (measured 9/2/2010); however, when this well was re-sampled on 10/20/2010, the As concentration was 1090 ug/L.*

Response to SAR Comment 22: The table will be revised to note this for both sampling events.

Specific Comments on Army Draft Final Focused Feasibility Study (FFS)

FFS Comment 1: *Executive Summary, Page vii, 2nd paragraph and Section 1.6.4, Page 13: The report refers to reducing conditions found "...in areas upgradient and downgradient of the landfill." Provide documentation of the basis for the statement related to reducing conditions upgradient of the landfill. Monitoring well SHL-15, nominally an upgradient well, reports ORPs between -41 mV and +92 mV for the LTMP (an initial measurement in the 2005 baseline round was -473.9 but that appears to be an anomaly in comparison to successive rounds). Monitoring wells at AOC-32/43A are likely not hydraulically upgradient of SHL. SHL-1 is located at the southern end of the landfill but this well is usually dry, and is not part of the LTMP.*

Response to FFS Comment 1: Further discussion concerning and supporting the statement that reducing conditions are present in the areas upgradient of the landfill, will be added.

FFS Comment 2: *Executive Sum, Page iv, Last Bullet; Section 1.6.3, Pg 12; Section 1.6.4, Pg 13, 4th Bullet; Section 2.1,Pg 14, last Para: The text states: "Left unmitigated, the arsenic flux to Plow Shop Pond could accumulate to unacceptable levels" and has other comparable language. Section 1.6.3 summarizes the risk characterization included in the Draft RI for AOC 72, as prepared by the Army. As detailed in EPA's letters of July 12, 2006 (transmitting the Expanded Site Investigation for Grove and Plow Shop Ponds), October 2, 2008 (transmitting EPA ORD's Final Report on Arsenic Fate, Transport and Stability Study for the Red Cove Study Area), May 14, 2009 (Additional Work letter), April 29, 2010 (comments on the AOC72 Draft RI) and August 18, 2010 (follow-up to Army's responses to comments on the AOC72 Draft RI), the arsenic flux from the landfill to Red Cove has already resulted in unacceptable risks and EPA does not concur with the risk conclusions in the Draft RI.*

Response to FFS Comment 2: Acknowledging that the Army and EPA have not reached consensus on current risk levels, there is consensus that ongoing flux to Red Cove poses a threat to the environment and should be mitigated to the extent practicable.

FFS Comment 3: *Section 1.3, Page 3: In the 1st paragraph, last sentence, revise to read "...concentrations, primarily arsenic, ~~did not meet~~ met risk-based performance standards..."*

Response to FFS Comment 3: Edited as requested.

FFS Comment 4: *Section 1.6.1, Page 9: The assertions regarding pre-landfill ground water flow patterns are speculative and are likely incorrect. The 1950 USGS 7.5 minute map of the Ayer quadrangle*

clearly shows a N-S band of wetlands along the western side of the area which is now capped. As shown on the map, the wetlands drained to the north via a surface water stream which is now buried by the landfill. These observations suggest that discharge was not to Red Cove at that time, but rather to the north.

Response to FFS Comment 4: As shown on the map the wetlands were associated with a local, shallow flow regime fed primarily by the surrounding kame deposits and deeper flow was to the primary sink represented by the pond (and its predecessor stream). The wetlands likely were both gaining and losing, and even when gaining, only some groundwater would discharge while subsurface flow through the peat underlying the wetlands would have occurred historically allowing dissolved carbon to be delivered to and transported with groundwater.

FFS Comment 5: *Section 2.2.2, Page 15: In order to ensure that institutional controls prohibiting groundwater extraction within the impacted area can be adequately incorporated into the planned ESD or ROD Amendment, EPA urges the Army to initiate discussions with the appropriate parties within the Town of Ayer immediately. Army should also provide copies or web links to the referenced Subdivision Control Regulations, Board of Health well construction regulations, and Building Department permitting regulations. Clarify (1) whether the Board of Health regulations only require the description of potential sources of contamination within 400 feet or prohibit installation of a well if there is a contamination source within 400 feet and (2) whether the regulations provide instructions on where to find information on sources of contamination. In addition, the Army should provide a figure that includes the location of public water systems within the impacted area and that shows whether any areas within the impacted area are 400 feet or more beyond the location of public water systems. The figure should also illustrate whether all existing residences and commercial properties over the impacted area are within 400 feet of the landfill. EPA expects that the Army will work with the Town of Ayer to revise its well construction regulations to prohibit the use of groundwater within the impacted area and that the Army would supply the Town with a map delineating the impacted area for inclusion in the regulation. EPA is willing to participate in these discussions.*

Response to FFS Comment 5: Comment noted. The Army will initiate implementation of institutional controls for this site.

FFS Comment 6: *Sections 2.4.2.2 and 2.4.2.3, Page 18, and Figures 6 and 7: Sufficient information concerning the construction of the numerical groundwater flow model was not available to allow a complete review. Provide details of the numerical groundwater flow model setup and input parameters, as well as a detailed description of the current model construction, boundary conditions, parameterization, calibration, and supporting data. Although the current version of the model appears to better replicate hydraulic gradients in the immediate vicinity of Red Cove than several of the previous versions, there still appear to be significant uncertainties in the ability of the model to simulate site conditions sufficient to adequately support remedial design. This uncertainty is demonstrated by the differences between the predicted and observed hydraulic gradients under parts of the landfill and what appears to be lack of discharge of particles moving under Plow Shop Pond in Figures 6 and 7. Therefore, care should be exercised in the use of the modeling results. It is recommended that the model only be used to provide insight into potential differences in the flow field due to various remedial options and not be relied upon as a primary line of evidence in remedial decisions. The report should also provide some measure(s) of the convergence of the calculations, so that the accuracy of the numerics (e.g., measures of*

overall water balance, maximum head change at the last iteration, etc.) can be evaluated. Outstanding comments on the model need to be resolved, and a technical session should be convened to reach consensus on the steps needed to improve the model.

Response to FFS Comment 6: The development, calibration and refinement of the model has been reported in numerous reports to date, most recently the *AOC 72 Remedial Investigation Report* (AMEC, 2011) and the 2009 Annual Report (ECC, 2010). The latest revisions were focused strictly on the bedrock surface, integrating data from drivepoints, borings, and geophysical studies. The calibration to water levels and mass balance was largely unaffected relative to that reported previously, and therefore were not restated here. It should be noted that there is considerable uncertainty in the integration and interpretation of the field data as it comes from a range of sources with different levels of quality, and that the model is merely a tool for considering all available information.

It also should be understood that the modeling results were not used as a primary line of evidence in remedial decisions, but were used to provide insight into potential effects on the flow field by various alternatives.

FFS Comment 7: *Section 2.4.2.4, Pg 19; Appendix B; Figure 8; Section 3.2.3, Pg 34-35: EPA is uncertain whether the proposed groundwater containment and recirculation remedy is an acceptable alternative. Alternative 3 proposes to replace the current water treatment system with more limited treatment and reinjection beneath the landfill. From a hydraulic perspective, reinjection of all of the extracted water would likely result in both reduction in plume capture by the extraction wells and, possibly, an increase in the discharge of water to Plow Shop Pond. Figure 8 does not demonstrate that the groundwater is contained at the north end of the landfill. In order to increase clean water flow beneath the landfill and maintain capture, extraction rates would need to be increased and only a portion of the treated water reinjected. In addition, reinjection of treated water using wells is often relatively difficult and expensive to maintain due to well fouling and other issues. Fouling of the treatment system components and the necessary O&M to keep things running properly, including equipment replacement, appears to have been underestimated.*

Response to FFS Comment 7: Comment duly noted. Text will be revised to include a discussion of the aforementioned concerns with the issues identified in the proposed groundwater containment and recirculation remedy.

FFS Comment 8: *Section 2.4.3.1, Page 25: The FFS does not include an evaluation of a groundwater extraction system located upgradient of Red Cove to control discharge to the pond in this area. The document does not clearly state the reasons for this exclusion but infers incompatibility with potential alternatives for the north plume, the need to upgrade the treatment plant, and other issues. In general, it appears that the issues may be largely related to costs. The report states that an extraction system at this location would capture water from the pond. This is an issue for all extraction systems near surface water bodies and can be optimized through proper design. In addition, demonstration of a minor degree of capture of water from the pond is excellent evidence of the effectiveness of the system in terms of plume control. An evaluation of this remedial alternative should be incorporated into the FFS. In addition, efforts should be made to assess a number of pumping locations and extraction rates which attempt to minimize extraction of pond water, while achieving an effective hydraulic barrier.*

In addition, the elimination of groundwater injection due to concerns of creating a "seepage face" near Red Cove warrants additional discussion. This concern has merit, but the use of the model to evaluate injection may lead to inappropriate conclusions. An evaluation of this remedial alternative should be incorporated into the FFS. According to 'hard-data' (i.e., contoured synoptic water levels) presented on Figure 30 of the Supplemental Report, flow-lines discharging to Red Cove originate in the vicinity of N6-P1 and SHM-10-11. This region contains significant buried former wetlands and waste, and therefore may be the origination point of flow lines which ultimately discharge to Red Cove. As such, additional injection scenarios should be considered with injection points at a variety of locations between the cove and the upgradient "source area" in order to evaluate whether there is a location to inject which causes the necessary hydraulic divide yet avoids creation of a seepage face.

Response to FFS Comment 8: Your issues and points are noted, however as noted that the basis for screening out these alternatives is presented in Section 2.4.3.1, Page 25, 1st paragraph states *"During the development process several technologies were screened out. No technologies were retained that could potentially have a negative impact on the geochemistry in Red Cove. As such, previously considered alternatives such as groundwater extraction, groundwater reinjection, in-situ sparging, and chemical oxidation injections were not retained."* Given these concerns as well as the others described in this section, these alternatives will not be retained for further evaluation.

FFS Comment 9: *Section 2.4.3.2, Page 26: Bench scale tests confirm that ZVI can be used for arsenic removal from groundwater, as has been observed for pilot- and field-scale applications. In general, reaction of groundwater with ZVI will maintain reducing conditions and may lead to alkaline pH conditions (i.e., pH>9) during ZVI corrosion within and downgradient of the barrier material. This elevated pH is unfavorable for adsorption of arsenic onto aquifer/sediment minerals and/or newly precipitated iron oxides, which may counteract overall remedy objectives for the Red Cove discharge area. The uncertainty associated with potentially unfavorable geochemical conditions induced by ZVI corrosion suggests that flow containment or diversion is a more appropriate strategy to mitigate plume discharge into Red Cove.*

Response to FFS Comment 9: There is data (Johnson, 2003; Nefte, 2008; and Ajes, 2004) that shows that ZVI under reducing conditions will result in slight increases in pH (6.8 to 7.5), decreases in alkalinity (about 25%) and decreases in Eh (-150mv to -231 mv). The permanence of these changes is unknown but certainly do not appear to significantly alter downgradient water quality compared to current conditions. Additionally, pH adjustment can be achieved by adding media (e.g. sand) after the ZVI to buffer the pH. The ability of the aquifer to buffer these constituents as they exit the ZVI or PRB will require monitoring to determine how long-lived they are and to what extent they affect downgradient water. The behavior of the ZVI under field conditions will be determined from planned pilot experiments conducted over longer periods of time.

FFS Comment 10: *Sections 2.4.3.3, Page 28; Section 3.3.2, Page 38; Section 3.4.1.2, Page 40; Section 3.5, Page 43: A slurry wall keyed into bedrock is proposed for reduction of contaminated groundwater flux to Red Cove under Alternative B. Based on the existing data, this alternative appears to be a viable approach. The technology required for implementation exists and the depths of emplacement are within the range of implementations at other sites. It is recommended that evaluations performed during*

remedial design should include consideration of hydraulic gradients observed during periods of increased recharge (e.g., seasonal wet spring conditions) in addition to the current assessment of average hydraulic gradients. This may result in relatively minor extensions of the wall to insure plume control under various hydrologic scenarios.

Response to FFS Comment 10: Comment noted. Seasonal hydraulic gradients will be considered, during the remedial design, if this alternative is advanced.

FFS Comment 11: *Section 3.2.3, Page 34: Reinjection of water at the proposed locations or in areas south of Red Cove could result in some increase in flux of contaminated water to the cove in the absence of other controls, such as the slurry wall (Red Cove Alternative B) or extraction near the cove. If water injection is implemented in these areas, the slurry wall may need to be extended somewhat to prevent water migration to the pond. However, additional evaluations would be needed to determine the most appropriate length for the wall under this scenario.*

Response to FFS Comment 11: Comment duly noted.

FFS Comment 12: *Appendix C: The basis for the costs and the assumptions used to develop the cost estimates should be provided with the next revision of the FFS.*

Response to FFS Comment 12: Further description of the basis for the costs and the assumptions used to develop the cost estimates shall be provided in revised FFS.

FFS Comment 13: *Appendix C, Table C-4: This table has a format error in the cost columns for Contingency. The actual Contingency cost is grossly understated which impacts the overall cost of the alternative. Also, the Quantity and Unit cost values for Installation are oddly presented in square feet rather than cubic yards and the basis for the quantity of 42,800 sq ft is not apparent; i.e., it does not match with the barrier dimensions. The value 42,800 divided by the 400 foot length results in a sidewall depth of 107 feet, which does not match the depth to bedrock or the actual depth of the barrier, which is shorter than the length of sheet piles needed to reach bedrock. This value should be reviewed and clarified or corrected. The unit cost for iron is dependent on the type of iron used. The source for the cost of the iron should be explained. The cost for redevelopment of the PRB wall every five years appears to be very low - less than 1% of the stated original cost for iron. This cost should be reviewed and clarified.*

Response to FFS Comment 13: The table will be edited to provide clarification.

FFS Comment 14: *Appendix C, Tables C-A and C-B: The unit cost for iron is dependent on the type of iron used. The source for the cost of the iron should be explained.*

Response to FFS Comment 14: Supporting information shall be provided.

FFS Comment 15: *Appendix C, Table C-A: The cost for redevelopment of the PRB wall every five years appears to be very low - less than 1% of the stated original cost for iron. This cost should be reviewed and clarified.*

Response to FFS Comment 15: Costs for wall redevelopment included only conditioning to increase permeability, not replacement of the iron. The basis for the costs and items included will be further clarified in the cost tables and text.

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Craw, D., Falconer, D., and J.H. Youngson. 2003. Environmental arsenopyrite stability and dissolution: theory, experiment, and field observations. Chemical Geology 199 71-82.

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Response to 24 February 2011 MassDEP Comments on
December 2010 Army Draft Final Supplemental Groundwater and Landfill Cap Assessment for Long Term Monitoring and Maintenance – Addendum Report
Shepley's Hill Landfill, Devens, MA

Comment 1 - Section 5.0: *The results from the 2010 investigation provided significant new information concerning the topography of the bedrock surface in the vicinity of Nonacoicus Brook and the geometry of the overlying aquifer. Assuming this new interpretation can be confirmed (refer to Comment 9), these results indicate that the contaminant plume emanating from the landfill is confined in the area north of West Main street by a narrow bedrock valley that underlies Nonacoicus Brook, rather than the extending northward under the brook. The downgradient extent of the plume in the bedrock valley is less certain; however, it now appears that a significant portion of the plume may discharge into the brook along the reach extending downstream of the impacted groundwater sampled in wells located north of West Main Street.*

Response to Comment 1: Existing data suggests some of the plume enters the area of the wetlands and brook. However, to indicate that it enters and discharges to the Brook may not be accurate. Arsenic is found typically at 30 ft or deeper in the wells and given the elevation relative to the brook and wetlands it is discharging deep into the shallow bedrock or stream bed at 20 ft bgs. There is no evidence of elevated arsenic in stream water or sediments from the landfill water. While the shallow groundwater discharges to the stream based on elevations, the depth of the measurable As impacts are below the stream and are attenuated before discharge.

Comment 2 - Section 6.3: *MassDEP believes the conclusion that a "redox boundary" that causes arsenic in the contaminant plume to precipitate from solution into the aquifer matrix in the vicinity of Nonacoicus Brook is speculative"*

- *Data that could confirm the presence of precipitated arsenic in the aquifer matrix (e.g., samples of aquifer solids) were not collected during the supplemental investigation.*
- *Existing data are not sufficient to determine groundwater flow directions (horizontal and vertical) in the immediate vicinity of the brook.*
- *The suggested "counter flow" from the north side of the brook is inconsistent with the interpretation that Nonacoicus Brook is a groundwater divide.*
- *The presence of non-impacted groundwater south of the brook, suggested by the water quality analysis presented here, could be interpreted to result from the laterally and vertically discontinuous character of the plume as it approaches the brook. The situation in the brook and adjacent wetland may be similar to the situation in Red Cove, where contaminated groundwater discharges to irregularly distributed hot spots. Also, as indicated by the indicated by the results from groundwater samples collected in wells SHM-06 and SHM-06A and wells SHM-05 and SHM-05A, sharp plume boundaries are possible.*

- *While complex and dynamic groundwater flow patterns would be expected in the vicinity of the brook (e.g., transition from horizontal to vertical flow, lateral and vertical migration of flow lines due to seasonal variations and storm events), a turbulent process that could mix groundwater from opposite sides of the brook sufficiently to redistribute oxygen and trigger precipitation of arsenic is unlikely in an aquifer where laminar flow at estimated velocities of less than 1 foot/day are predicted; and*
- *Results from previously collected samples indicate that a portion of the plume does discharge to Nonacoicus Brook; elevated concentrations of arsenic were reported in surface water and sediment samples collected from Nonacoicus Brook immediately downstream of the expected plume discharge area.*

Rather than undertaking additional investigations to confirm or refute the redox boundary hypothesis, a technically uncertain effort given the complex hydraulic regime in the vicinity of the brook, we would recommend that future remedial actions simply include provisions to monitor surface water quality in the portion of the brook where groundwater discharge may occur and groundwater quality in the narrowest part of the underlying bedrock valley near temporary well SHM-10-08, where the plume would be encountered if it extended significantly beyond the vicinity of well SHM-10-17. These measures would provide data that could be used to endure that the plume does not pose unacceptable risks via surface water in the brook or groundwater that could be captured by the MacPherson well.

Response to Comment 2:

- We believe that both groundwater modeling and bedrock topography show that flow is to the north and then to the west at the area of the brook. Flow in any other direction is not possible given well elevations and bedrock topography.
- In terms of the process groundwater discharge at Nonacoicus Brook, use of the term "groundwater divide" is a better description of the process than "counter flow". However there is evidence of mixing with clean water entering the brook from upgradient.
- With respect to the "discontinuous nature of the plume", we don't expect sharp plume boundaries and in fact don't agree with the use of the term plume to describe arsenic impacted water from the landfill. However, water in some of the wells is clearly less impacted by the landfill based on lower bicarbonate contents and higher sulfate contents. Landfill leachate tends to decrease sulfate and increase bicarbonate.
- The flow characteristics in the vicinity of the brook (i.e. turbulent flow or laminar flow) are not the cause of the precipitation of arsenic from groundwater. Rather intrusion of landfill water into clean water or vice versa results in mixing of the waters due to diffusion and other factors. Water in front of the arsenic impacted water is not displaced as in piston displacement but mixes to an extent allowed

by porosity, flow velocities, etc. Even in the column studies many pore volumes are required to remove or add dissolved oxygen. Mixing of waters in groundwater aquifers is a common occurrence.

- The elevated concentrations of arsenic reported in surface water and sediment samples downstream of the expected plume discharge area occurred due to historic discharge from Plow Shop Pond, not SHL.

Comment 3 - Section 6.4.2.2: *While the carbon source assessment results indicate that the peat layer that underlies the landfill is a significant source of dissolved carbon in groundwater, the suggestion that it was a carbon source long before the landfill was created is doubtful. The pre-construction site topography indicates that the associated wetland was a groundwater discharge area into which groundwater discharged and flowed northward in a stream, rather than groundwater recharge area from which impacted water flowed downward into the underlying aquifer. Thus, the peat did not become a source of dissolved carbon or other groundwater contamination until it was buried by construction of the landfill. In addition, as shown in Figure 6, elevated concentrations of arsenic appear in groundwater hundreds of feet upgradient of the peat, indicating that conditions not attributable to the peat contribute substantially to the formation of the contaminant plume.*

Response to Comment 3: The speculation that groundwater discharged to wetlands is an incomplete picture of the wetlands and underlying peat. As shown on the USGS topographic maps the wetlands were associated with a local, shallow flow regime fed primarily by the surrounding kame deposits and deeper flow was to the primary sink represented by the pond (and its predecessor stream). The wetlands likely were both gaining and losing, and even when gaining, only some groundwater would discharge while subsurface flow through the peat underlying the wetlands would have occurred historically allowing dissolved carbon to be delivered to and transported with groundwater. The most complete boring logs through the peat area (SHM-10-14) encountered the top of the peat layer at approximately 215 feet elevation and the bottom of the peat at approximately 195 feet elevation. The groundwater elevation at SHM-10-14 was measured at approximately 216 feet elevation. As the peat is assumed to have underlain the wetlands and given the similarity in elevation of the top of the peat and the groundwater, it can be assumed that the former wetlands was both gaining and loosing as the groundwater elevation temporally fluctuated.

The peat on Figure 6 is shown only where encountered in borings in that line of section. Peat is associated with the pre-landfill wetlands. A comparison of the location of the wetlands on the USGS topographic maps with the arsenic distribution shown on SAR Figure 55 is a clear demonstration of the relationship.

Given the weight of evidence, the pre-existing wetlands and underlying peat caused arsenic mobilization prior to emplacement of the landfill. While we cannot know to what extent this occurred, there is little doubt it occurred. The scientific literature for similar peats and wetlands

effect on reducing conditions in New England are well documented and only the rarest of peat deposits would not cause reducing conditions. Ignoring this contribution would contradict well-established scientific knowledge. A list of documents and supporting literature will be added to the revised SAR.

As far as carbon degradation is concerned, there is no doubt that age affects carbon production and metabolism. However, similar aged peat deposits (13,000 to 30,000 years) still produce methane and carbon dioxide. The discovery of peat effects on arsenic mobilization in Bangladesh establishes a clear indicator of the potential of this source of carbon in mobilizing arsenic.

To suggest that the peat was not a source of carbon is incorrect. Peat forms due to accumulation and degradation of organic matter wherein accumulation gradually exceeds degradation due to slow degradation generated under anaerobic conditions. This means that in order to have peat, anaerobic conditions had to exist. Therefore, reducing conditions would have mobilized arsenic prior to emplacement of the landfill. The landfill exacerbated the condition. The literature on this subject is exhaustive and will be summarized in the revised SAR.

Finally while we do agree that the landfill is contributing to the reducing conditions, it also needs to be acknowledged, given the weight of evidence, that the underlying peat is a significant contributor to the reducing conditions.

Comment 4: *Figures 2, 3, and 29 should identify the locations of borings SHM-10-05 and SHM-10-09.*

Response to Comment 4: The figures will be modified to identify the boring locations.

Comment 5 - Figure 6: *The vertical distribution of arsenic at boring SHM-10-24 should agree with that showing in Figure 11, and the interpreted extent of the arsenic plume north of boring SHM-10-18 should be consistent with the northward distribution of iron, manganese, and ORP shown in Figures 12, 17, 20, and 21.*

Response to Comment 5: The figures will be updated as necessary for consistency.

Comment 6 - Figure 17: *The manganese results from boring SHM-10-24 should be integrated into this cross-section (e.g., refer to Figure 20).*

Response to Comment 6: The results will be included in the cross-section.

Comment 7 - Figure 25, Figure 6: *The vertical ORP distribution at boring SHM-10-24 should agree with that shown in Figure 21.*

Response to Comment 7: The figures will be updated as necessary for consistency.

Comment 8 - Figure 55: *Should show that the arsenic plume extends beneath West Main Street to Nonacoicus Brook.*

Response to Comment 8: The figure will be updated as necessary.

Comment 9 - Attachment A: *The bedrock depths shown in Figure 29 are inconsistent with the information presented in the logs for borings SHM-10-02, SHM-10-05A, and SHM-10-09, where groundwater profiling reached significantly greater depths than shown in Figure 29. The report should include a defensible explanation or a more reliable drilling method should be use to confirm the interpretation presented in the report. Similarly, the report should explain why well screens were not placed in borings SHM-10-02, SHM-10-04, and SHM-10-09 across the depth intervals proposed in 2010 based on the groundwater profile borings.*

Response to Comment 9: The borings SHM-10-02, 10-05A and 10-09 were installed with a direct push drill machine which does have several limitations when determining depth to bedrock. While the drilling method was helpful for vertical profiling, direct push drill strings are subject to significantly more bending off vertical during deep probing work. With boring SHM-10-02, the sampler refusal occurred at a depth of approximately 78 feet below grade surface (bgs), corresponding to an elevation of approximately 142 feet above mean sea level, consistent with the plot of Figure 29. It is noted that the probe for SHM-10-02 achieved a depth of 102 feet bgs. We speculate that the drill string bent and/or was able to penetrate into saprolitic rock resulting in the deeper refusal depth. Boring SHM-10-09 encountered string advancement refusal at a depth of approximately 70 feet bgs and larger diameter casing refusal at a depth of approximately 60 feet bgs. Using the 70 foot refusal depth, this corresponds to a refusal elevation of approximately 164 feet bgs, consistent with the bedrock contour elevation presented in Figure 29. The surface elevation of boring SHM-10-09 is approximately 200-215 feet above mean sea level and the boring refusal depth was approximately 65 feet bgs, corresponding to a rock elevation of approximately 135 to 150 feet above mean sea level, consistent with Figure 29.

Language will be added to the SAR related to the uncertainty of bedrock depth confirmation using direct push drilling methods. The SAR will be revised to explain the placement depths of well screens for these borings. Well screen depths were adjusted in the field based on the results of the field As profiling results, which at times differed from the expected depths proposed in the 2010 scope of work.

Comment 10 - Attachments D, E, and F: *To minimize paper volumes in the future, please use CDs or DVDs to submit laboratory reports.*

Response to Comment 10: Comment duly noted. This request will be included in future document distribution lists to ensure its execution.

Response to 24 February 2011 MassDEP Comments on
December 2010 Army Draft Final Focused Feasibility Study
Shepley's Hill Landfill, Devens, MA

Comment 1 - Section 1.6: *As explained in separate comments on the Supplemental Assessment Report Addendum, MassDEP does not accept the following conceptual site model assumptions:*

A. *Peat and associated wetlands that underlie that landfill were historic causes of arsenic mobilization: USGS topographic mapping (Ayer 7.50 minute quadrangle, 1951) indicated these features were located in groundwater discharge areas prior to construction of the landfill; therefore, they did not became [sic] a source of dissolved carbon or other groundwater contamination until buried by construction of the landfill (also refer to Section 2.0 of Appendix A).*

Response to Comment 1-A: As shown on the map the wetlands were associated with a local, shallow flow regime fed primarily by the surrounding kame deposits and deeper flow was to the primary sink represented by the pond (and its predecessor stream). The wetlands likely were both gaining and losing, and even when gaining, only some groundwater would discharge while subsurface flow through the peat underlying the wetlands would have occurred historically allowing dissolved carbon to be delivered to and transported with groundwater.

B. *A "redox boundary" that causes arsenic in the containment plume to precipitate from solution into the aquifer matrix prior to discharge to Nonacoicus Brook: the data obtained during the supplemental site assessment were not sufficient to demonstrate that such a boundary exists, and alternative hypotheses could explain the observed arsenic distribution (e.g., as observed in Red Cove, complex and dynamic flow paths in the vicinity of the brook that could not be resolved with the data obtained during the supplemental assessment). As noted in the comments on the supplemental site assessment addendum, the question of whether or not a redox boundary exists need not be answered to support future remedial actions because both conditions (precipitation to aquifer and discharge to brook) can be addressed by implementing a monitoring program that includes periodic sampling of surface water and sediment in Nonacoicus Brook and periodic sampling of groundwater in the underlying aquifer.*

Response to Comment 1-B: The comments are noted. In general we agree that a clear redox boundary was not delineated. We will modify the SAR accordingly. It is also true from the DPT work that:

1.) Clear identifiable changes in water chemistry did occur in some of the DPT points to the north and west. These will be described more clearly in the SAR.
2.) The delineation to the east is not clear and the SAR will acknowledge this.
3.) The bedrock study provides very good evidence that discharge will be prevented from moving under the brook and to the north.

Mixing with water from the north and east will provide an abrupt change in redox chemistry which will have the effect of precipitating iron and arsenic. This process is the reason that elevated arsenic has not been observed in the brook or at the McPherson Well.

C. *Arsenic flux to Red Cove likely preceded construction of the landfill: this assumption is speculative; conditions prior to the construction of the landfill were not determined during the supplemental site assessment.*

Response to Comment 1-C: We believe that the weight of evidence supports the fact that the pre-existing wetlands and underlying peat also caused arsenic mobilization prior to emplacement of the landfill. The scientific literature for similar peats and wetlands effect on reducing conditions in New England are well documented and only the rarest of peat deposits would not cause reducing conditions. Ignoring this contribution would contradict well-established scientific knowledge. A list of documents and supporting literature will be added to the revised SAR. Given these facts and the site conditions, while we cannot know to what extent the pre-existing wetlands and underlying peat caused arsenic mobilization prior to emplacement of the landfill, there is no doubt it occurred, and therefore respectfully disagree and request that the State reconsider its position in light of these facts and supporting literature.

Comment 2 - Section 2.2.1: *The recommendation to classify the site-impacted Potentially Productive Aquifer (PPA) as a Non-Potential Drinking Water Source Area (NPDWSA) is inconsistent with the state's groundwater classification approach. Although, as noted here, portions of the PPA meet the definition of a Potential Drinking Water Source Area PDWSA and portions of the PPA have been designated as a NPDWSA, the data obtained during the supplemental site assessment indicate that the site-impacted area is hydraulically connected to and part of the Zone II area associated with the MacPherson Well. Thus, these results indicate that some or all of the impacted area is part of a Current Drinking Water Source Area that should not be classified as a NPDWSA (refer to 310 CMR 40.0932).*

The concern that it may not be feasible to meet the applicable groundwater standards should not be addressed by changing the groundwater classification to justify less conservative cleanup standards. Instead, in accordance with CERCLA, the appropriate approach when it is not feasible to attain an ARAR is to prepare a Technical Impracticability submittal that demonstrates it is not feasible to achieve the ARAR of concern and develop an acceptable alternative cleanup approach with the regulatory agencies (refer to Summary of Key Existing EPA CERCLA Polices for Groundwater Restoration, OSWER Directive 9283.1-33, June 29, 2009). However, before deciding to seek a TI Waiver, MassDEP recommends that the Army confer with regulatory agencies and other stakeholders to assess the bounds of "reasonable timeframe" for the specific conditions at the site. CERCLA provides considerable flexibility in determining what is reasonable; with sufficient exposure pathway controls and oversight, a reasonable timeframe might be long enough to achieve groundwater ARARs at this site.

Response to Comment 2: We stand by our recommendation to classify the PPA beneath and downgradient of SHL as a NPDWSA, which we believe is not only appropriate but consistent

with the MCP criteria and policy for determining NPDWSA (i.e., the area in question, including the areas shown as Potentially Productive Aquifer (Medium Yield) per MassGIS guidance are in fact NPDWSA by definition, as indicated below). Review of Groundwater Use and Value as part of this remedy is consistent with CERCLA guidance (OSWER Directive 9283.1-09); reclassification is not requested "to justify less conservative cleanup standards" as asserted by MADEP.

We further disagree with the MADEP assessment that "portions of the PPA meet the definition of a Potential Drinking Water Source Area PDWSA" as defined in 310 CMR 40.0006 (i.e., the groundwater is *within* 500 feet of a public water supply distribution pipeline and *not* located within a local Aquifer Protection District). Therefore, the WSC-97-701 policy for determining NPDWSAs within PPAs would apply and the criteria for defining NPDWSAs within a PPA based on land use and the 100 acre rule also applies to this site. At present, the area of the landfill (approximately 84 acres) contiguously bounds to the north approximately 13 acres of land used as a warehouse industrial park (defined as Urban Transportation land in WSC-97-701 and already classified as a NPDWSA), in addition to approximately 37 acres of commercial land on the north and south side of West Main Street, also designated as a NPDWSA. This total area measures approximately 134 acres in size, thereby exceeding the 100 acre minimum size outlined in WSC-97-701. An area measuring approximately 9.6 acres of wooded land is situated immediately north of SHL, to the west of the Urban Transportation land and to the east of the West Main Street commercial land. Per Example 4.3 of the WSC-97-701, this wooded area, surrounded by NPDWSA lands to the east, west and north, and the SHL to the south, should also be deemed a NPDWSA per MassDEP policy. As stated in WSC-97-701, Section 3.2, "Waste Disposal is <u>not</u> included in the NPDWSA definition. However, because of the 100 acre rule, landfills and sewage lagoons that are less than 100 acres in size and are surrounded by other land uses that meet one or more of the NPDWSA criteria will automatically be included in the exemption from meeting GW-1 standards."

The MADEP assertion that because the site is hydraulically connected to the Zone II area and thus part of a Current Drinking Water Source Area is incorrect per 310 CMR 40.0006 (i.e. the Impacted Area is not within the Zone II for a public water supply; not within the Interim Wellhead Protection Area for a public water supply; not within the Zone A of a Class A surface water body used as a public water supply; and not within 500 feet of a private water supply well). The Zone II area has NOT been impacted by groundwater from SHL, as documented by the extent of As impacts outlined in the SAR report. Further the suggestion that the mere hydraulic connection of a potential NPDWSA to a Zone II as the basis for dismissing the MassDEP WSC-97-701 guidance is inconsistent with past MassDEP precedent and present MassDEP aquifer designation in this location (i.e., both the commercial land strip along West Main Street and the warehouse park northeast of SHL are mapped NPDWSAs).

Comment 3 - Alternative 1 (Extraction and Treatment): *If the existing extraction system is not expected to stop the migration of contaminated groundwater from the landfill by fully capturing or containing the containment plume, this alternative should include enhancements (e.g., additional extraction wells) that would fully capture and/or contain the plume.*

Response to Comment 3: The effectiveness of this remedy is evaluated annually in the *Annual Report -Shepley's Hill Landfill and Treatment Plant Long-Term Monitoring and O&M Services* by ECC and was further explored in the 2009 *Remediation System Evaluation and Green Remediation*

Evaluation by GeoTrans. The 2009 Annual Report concludes that the ATP contains the majority of arsenic mass being mobilized by landfill-induced reducing conditions, and therefore, the system is considered to be operating as designed. If selected, implementation of this remedy would include evaluating recommendations and data from these reports to optimize the effectiveness of the remedy.

Comment 4 - Alternative 2 (Monitored Natural Attenuation):

- *The performance of this alternative would essentially be equivalent to the first remedy implemented at the site, which was determined to be inadequate, and the subsequently implemented contingency remedy is expected to be more protective of human health and environment and timelier in achieving compliance with ARARs than a MNA remedy. Consequently, MassDEP recommends that this alternative be deleted from the feasibility study.*

- *If this alternative is retained, it should include performance of a comprehensive investigation sufficient in scope to demonstrate the existence and effectiveness of the redox boundary assumed to exist adjacent to Nonacoicus Brook, or include a long-term monitoring component that could be used to confirm that impacts to surface water, sediment, and groundwater in and under Nonacoicus Brook are not significant or otherwise address those impacts (refer to Comment 1).*

Response to Comment 4: It is acknowledged that this alternative would include a robust monitoring program for a period of several years to demonstrate the effectiveness of this remedy and continue elevated monitoring as necessary. The monitoring results would be evaluated at a minimum of every five years within the Five Year Review process. As part of the Five Year Review Process the results will be assessed to determine whether changes in the monitoring (i.e., increased frequency and/or locations) or contingency remedial measures should be considered. Language will be added to the FFS to further describe this aspect of the alternative.

Comment 5 - Alternative 3 (Extraction and Recirculation): *If this alternative is not expected to stop the migration of contaminated groundwater from the landfill by fully capturing or containing the arsenic plume (as indicated by Figure 8), then it should be enhanced sufficiently (e.g., additional extraction and injection wells) to fully capture and/or contain the plume.*

Response to Comment 5: As noted in the FFS, further investigations are required to evaluate the effectiveness and design of this remedy and would be addressed in the Remedial Design if this alternative is selected. While we recognize this weakness, we believe it appropriate to retain this alternative for comparison to the other proposed alternatives.

Comment 6 - Alternative 4 (Permeable Reactive Barrier): *As noted in Section 2.4.2.5., previous studies indicate that ZVI would not weaken the reducing power of influent groundwater. Further, based on the results from site-specific column study results (Appendix B), a ZVI PRB might strengthen the reducing power of groundwater, potentially enhancing the mobilization of arsenic and other metals north of the landfill. Consequently, Alternative 4 should be eliminated from consideration unless it can be modified to treat the reducing condition along with reducing arsenic concentrations.*

Response to Comment 6: The comments are noted and similar concerns are presented in the Draft FFS. The purpose of the wall is to remove arsenic in groundwater flowing from the

landfill. There is data (Johnson et al., 2003; Naftz, 1999; and Zolla et al, 2007) that shows that ZVI under reducing conditions will result in slight increases in pH (6.8 to 7.5), decreases in alkalinity (about 25%) and decreases in Eh (-150mv to -231 mv). The permanence of these changes is unknown but certainly do not appear to significantly alter downgradient water quality compared to current conditions. Additionally, pH adjustment can be achieved by adding media (e.g. sand) after the ZVI to buffer the pH. It is also necessary to understand that reducing conditions exist outside of and downgradient of the landfill, that affect the fate and transport of arsenic. The ability of the aquifer to assimilate these parameters downgradient of the ZVI or PRB will require monitoring to determine how long-lived they are and to what extent they affect downgradient water. The behavior of the ZVI under field conditions will be determined from planned pilot experiments conducted over longer periods of time. Given this understanding and that the purpose of the FFS is to point out the strengths and weaknesses of alternatives selected for detailed evaluation, the alternative will be retained.

Comment 7 - Alternative 5 (Reconsolidation):

- *Shorter clean up times and further reduction of groundwater impacts due to peat and upgradient waste might be possible if a portion of the wetland area that existed beneath the north side of the landfill prior to construction could be restored to function as a discharge area. Assuming rapid precipitation of arsenic from groundwater upon contract with oxygenated surface water, it might be possible to design a restored wetland that would capture arsenic rather than mobilizing arsenic within the underlying aquifer. Such a design would also be expected to substantially reduce the currently projected restoration integrating this component into this alternative should be considered.*
- *In accordance with the state solid waste regulations, slopes on the piggy-back cell should fall within the range of 5 to 33 percent [310 SMR 19.112(2)].*

Response to Comment 7: The option to restore the wetland in the north side of the landfill was mentioned in this alternative and would be addressed during the Remedial Design phase of the alternative, if selected. However, concerns that the ability of the wetlands to help mitigate the reducing conditions, discussed in the response to Comment 1, would be an issue with a constructed wetlands alternative. Additionally, there is the strong likelihood that constructing a wetland may create an ecological receptor for arsenic that precipitates in the wetland, resulting in an increase in risk.

The slopes on the piggy-back cell will be noted in this alternative.

Comment 8 - Red Cove Alternative A (Containment Wall and PRB): *As noted in Section 2.4.3.2, ZVI would not weaken the reducing power of the groundwater passing through the PRB, maintaining or enhancing the potential for mobilization of arsenic in the portion of the aquifer between the PRB and Red Cove, and it would not reduce concentrations of ammonia discharging to Red Cove. Further, the column study results (Appendix B) indicate that a ZVI PRB might strengthen the reducing power of influent groundwater, potentially enhancing the mobilization of arsenic and other metals east of the landfill. Consequently, Alternative A should be eliminated from consideration unless it can be modified to treat the reducing condition and address the containments of concern.*

Response to Comment 8: Please see the response to Comment 6.

Comment 9 – Figure 2: *USGS topographic mapping (Ayer 7.5- minute quadrangle, 1951) indicated that the topography presented here does not represent pre-landfill conditions.*

Response to Comment 9: As noted this figure was obtained from the accepted *Shepley's Hill Landfill Supplemental Groundwater Investigation* dated 2/11/2002. The Ayer 7.5-minute quadrangle map from 1951 will be included in the revised FFS.

Comment 10 – Figure 3: *Available groundwater data (e.g., Figure 4) indicate that the plume limits depicted here should extend northward to Nonacoicus Brook.*

Response to Comment 10: Figure 3 and Figure 4 will be modified to include consistent data in both figures.

Comment 11 – Table 1: *Table 1 should list Massachusetts Drinking Water Standards and Guidelines (310 CMR 22.00).*

Response to Comment 11: Table 1 will be modified to include the Massachusetts Drinking Water Standards and Guidelines (310 CMR 22.00).

Comment 12 – Table 2: *MassDEP recommends deletion of this table; there are numerous errors and inaccuracies, and the level of detail provided by Table 1 is sufficient for the purposes of the report.*

Response to Comment 12: Sovereign respectfully requests that the MassDEP advise us of the proper corrections required to Table 2. Based on the corrections required a decision with the BCT can made on whether to delete this table or not.

References

Johnson, R.L., R.B. Thomas., R. Obrien Johnson, J.T. Numi and P.J. Tretnyek. 2003. *Mineral Precipitation Upgradient from a Zero Valent Iron Permeable Reactive Barrier.* Groundwater Monitoring and Remediation, 28 p56-64.

Naftz, D.L. Naftz, J.A. Davis, C.C. Fuller, S.J. Morrison, G.W. Freethey, E.M. Feltcorn, R.G. Wilhelm, M.J. Piana, J. Joye, and R.C. Rowland. *Field Demonstration of Permeable Reactive Barriers to Control Radionuclide and Trace-Element Contamination in Ground Water from Abandoned Mine Lands.*

Valerio Zolla, Rajandrea Sethi, Antonio Di Molfetta. 2007. *Performance Assessment and Monitoring of a Permeable Reactive Barrier for the Remediation of a Contaminated Site.* American Journal of Environmental Sciences 3 (3): 158-165.

Response to February 18 2011 PACE Comments on
December 2011 Army Draft Final Supplemental Groundwater
and Landfill Cap Assessment for Long Term Monitoring
and Maintenance – Addendum Report
Shepley's Hill Landfill, Devens, MA

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1) As shown on the attached map, the study area is near and/or partially within an Area of Critical Environmental Concern (ACEC), a Potentially Productive Aquifer (PPA) and the Zone II of the MacPherson water supply well. We believe that the boundaries of each of these areas need to be shown on appropriate figures in the report, and that the relevance of these areas to the study need to be discussed. In particular, the report should state whether or not arsenic concentrations attributable to the landfill are present in either the PPA or the Zone II at concentrations above Maximum Contaminant Levels (MCLs). If landfill-related MCL exceedances occur in the Zone II, then the report's conclusion in the Executive Summary and Section 9.0 that "arsenic impact to the MacPherson well is not anticipated" should be revised.

   Comment: A MassGIS map will be added to the report, and a discussion presented. Presently, there is no evidence that the arsenic impacts to groundwater related to SHL extend to the MacPherson Well. The groundwater sampling results associated with the most downgradient locations, which include points SHM-10-02, SHM-10-03, SHM-10-04, and SHM-10-08, do not show elevated As concentrations. Survey location data indicates that these wells are located within a high yield acquired, but not within the boundary of the MacPherson Zone II.

2) Well locations shown on Figure 3 are not consistent with those shown on Figure 5. For example, SHM-10-21 is shown south of SHM-10-19 on Figure 3 and west of SHM-10-19 on Figure 5. Also, SHM-10-10 is shown west of SHM-10-19 on Figure 3 and south of SHM-10-19 on Figure 5. The relative location of these wells is critical to the interpretation of site data. In the preparation of our comments we have assumed that Figure 3, which shows the locations of the transects, shows the correct well locations.

   Comment: The Figure will be revised and re-issued.

3) Transect A-A' (Figure 6) contains several inaccuracies that affect the conclusions drawn from the figure. The 445 parts per billion (ppb) arsenic value at SHM-10-16 (64 foot depth) is shown in blue, indicating a concentration of less than 100 ppb. This value should be shown in green, and the yellow area that terminates at SHM-10-24 should begin at the 64-foot depth of SHM-10-16 rather than below the 74-foot depth. The effect of these corrections is that the center of mass of the arsenic plume travels a more horizontal path than that currently shown in Figure 6.

   Comment: The Figure will be revised and re-issued.

4) Transect A-A' (Figure 6) shows yellow and green areas in the upper portions of the SHM-10-12 and SHM-10-15 borings, indicating lower arsenic concentrations at and near the groundwater surface. Low arsenic concentrations at the groundwater surface are cited as supporting evidence for the report's contention that the landfill is not the source of arsenic. However, what data support the delineation of these areas as being low in arsenic? At both borings, no samples were taken in the areas shown in yellow and green. Because the study is lacking data at these elevations, we believe it is more accurate to show these areas with no coloration (i.e., in white, similar to Figure 18).

Comment: The Figure will be revised and re-issued. With regard to *Transect A-A - 10-12 and 10-15, the first sample intervals at the water table (which, are about 10 feet below the top of water) contained elevated As. The contours were drawn to interpret the plume at the top 10 feet of the water table. The comment is correct in that there are no data to confirm lower impacts at shallower depths. It may be assumed that the impacts at the top of the water table are lower in concentration. That said, an equal argument can be made opposite that. To be conservative, we will revise impact cross section Figure 6 to show the red zone extending upward to the water table surface.*

5) Spot checks indicate that the depth to bedrock shown on several transects appears to be lower than that indicated on the boring logs. For example, transect A-A' (Figure 6) indicates that bedrock occurs nearly 30 feet below the deepest soil sample taken at SHM-10-14; however, the corresponding boring log indicates bedrock was found 10 feet below the deepest sample. At SHM-10-15, Figure 6 indicates that bedrock is found 15 feet below the deepest sample, while the boring log indicates bedrock only one foot below the deepest sample. For borings SHM-10-17 through SHM-10-27, Section 3.3.3 indicates that these points were advanced to refusal. However, several of these borings are shown on the transects as terminating well above bedrock. For example, Figure 6 shows over 10 feet of overburden beneath the bottom sample taken at SHM-10-24. Comparison of the SHM-10-24 area bedrock elevation shown on Figure 6 with that shown on Figure 29 indicates good agreement with the documented refusal depth, but poor agreement with the bedrock depth shown on the transect. We offer similar comments for the overburden shown beneath other wells (e.g., SHM-10-18 on Figures 6 and 7). We request that these and other locations be checked and that the transects be modified to better reflect the current understanding of bedrock elevation. This is an important consideration because, as stated in Section 6.3.1.3 of the report, the bedrock surface appears to control arsenic migration.

Comment: There is some discrepancy with bedrock refusal depths with the direct push advanced work due to the nature of the two-stages of probe work. Profiling was completed by S2C2 advancing narrow diameter drive points. Temporary wells were installed later by GeoSearch using larger diameter tools to install the temporary well. In many cases, GeoSearch encountered refusal at shallower depths than S2C2. There are three explanations for this – the first that the larger diameter tools from GeoSearch could not advance through the till zones above the rock. The second is that the S2C2 narrower diameter tools did not advance on true vertical, so the depth to refusal could be artificially deeper. The third is that the narrow diameter S2C2 tools may have also penetrated the saprolitic rock and the depth to the rock surface is shallower than denoted. The only way to verify absolutely is through rotosonic advancement and visual coring/confirmation of rock. That said, the DTR on all boring logs, cross sections and rock maps will be verified and crosschecked.

6) We request that bedrock elevations be added to those transects that are currently lacking this information (e.g., Figures 8, 9, 14, 15, etc.). Approximate bedrock elevations should be readily obtainable from boring logs and/or from Figure 29.

Comment: We will revise and add this information accordingly.

7) The selection of wells for inclusion in transects A-A' and B-B' (Figures 6 and 7, respectively) is puzzling. Why was well SHM-10-24 chosen instead of SHM-10-17, which lies closer to the line of cross-section? Data from SHM-10-17 indicate that it is closer to the center of mass of the arsenic plume, which would seemingly allow more accurate conclusions to be drawn. The inclusion of SHM-10-16 in both cross-sections is less questionable because other new wells are not located nearby; however, this well appears to be east of the center of mass of the plume. Previously-installed well SHM-05-40X, located northwest of SHM-10-16, is further from the landfill than SHM-10-16 but appears closer to the plume's center of mass. Arsenic concentrations over 4,900 ppb were found at SHM-05-40X in 2008. Incorporation of recent data from SHM-05-40X would provide a more accurate picture of the configuration of the arsenic plume, while use of the SHM-10-16 data results in the misleading depiction of a zone of lower arsenic concentration downgradient of the landfill.

Comment: Figures 2 and 3 will be revised to show the orientation of the original cross-sections. The conditions reflected by SHM-10-17 are shown in cross-sections D-D' and F-F'. We would not recommend the inclusion of SHM-05-40X, since they are reported as "total" and not "dissolved" concentrations, and represent conditions at an isolated sampling depth of 32-34 feet below ground surface. The intent of these cross-sections was to provide a snapshot of the conditions during the profiling program. The transect analysis also attempted to use only the 2010 sampling event which included soil and groundwater profiling. Addition of other wells, sampled for differerent purposes are not part of this SAR.

8) The discussion of Figure 6 in Section 6.3.1.1 contains several inconsistencies with the Figure and with data from nearby wells. The highest arsenic concentration at SHM-10-12 occurs at 39 feet below grade surface (bgs) according to the text and 44 feet bgs according to the figure. The paragraph also states that arsenic concentrations are less than 300 ppb at the Brook/wetlands boundary; however, the figure shows arsenic up to 615 ppb at SHM-10-24 and up to 390 ppb at SHM-10-18. The omission of SHM-10-17 data from Figure 6 removes arsenic values up to 1,900 ppb from the discussion. These data call into question the paragraph's conclusion that arsenic concentrations at the Brook/wetland boundary are "much lower."

Comment: The 39 ft arsenic was an estimate from field data and will be changed to reflect the 44 ft section (As = 3880 ug/L). The arsenic at SH-10-18 should be less than 400 ug/L (390 ug/L). The data from SH-10-17 has not been omitted but rather discussed in later in the redox boundary as noted in the text under the section in question (see last sentence in paragraph 1 of section 6.3.1.1). A decrease from 1900 ug/L at SH-10-17 to <400 ug/L immediately north (50ft) and in the flow path is in fact a significant decrease in arsenic concentration. Similar decreases are noted to the west of these locations as also described in the text.

9) In Section 6.3.1.1, the first bulleted paragraph correctly states that the highest arsenic concentrations are found at depth. However, the conclusion that this observation is inconsistent with a landfill source of arsenic is, in our opinion, poorly supported. The report states that "A significant landfill source of arsenic would result in either higher arsenic at the surface of the groundwater or more uniform distribution beneath the source in the landfill." We disagree with this statement. High arsenic at the groundwater surface would not necessarily be expected given the age of the landfill (i.e., arsenic would have had decades to migrate vertically) and the virtual certainty that significant infiltration of rainwater occurred in the years prior to placement of the cap. A non-uniform distribution of arsenic is also not surprising given the history of placement of wastes in a non-uniform manner (e.g., in trenches) and the heterogeneity of the wastes disposed.

Comment: We will revise this section. However, 3 of the 5 borings in the landfill show higher concentrations of arsenic with depth. We will revise the text to indicate that several explanations are possible. It will also be noted that only 11% of the waste is in contact with groundwater, so the statement that the landfill does not appear to be a significant source of arsenic is still true, but for different reasons.

10) The statement is made in Section 6.3.1.1 that the observed arsenic distribution "is similar to distributions noted at other landfills." Further support is requested to support this statement, including the identity and location of the similar landfills, and whether or not observed concentrations at these landfills are as high as those seen at the site. For example, the Saco landfill in Maine has been mentioned in previous discussions; however, USGS information indicates that the maximum arsenic concentrations in groundwater at this location are only 700 ppb, more than an order of magnitude below maximum values seen at SHL.[1] [Note 1 - Landfill Leachate Mobilizes Arsenic Bound in Aquifer Sediments: Saco, Maine, USGS Toxics Substances Hydrology Program, http://toxics.usgs.gov/topics/rem_act/saco.html.]

Comment: Distribution profiles for other landfills cannot be found that have been capped. This discussion is more relevant to the peat layer and arsenic distribution where literature supports our findings. For this case, we will simply note the distribution, possible reasons and if literature is available it will be added.

11) Figure 7 (transect B-B') does not display the 84-foot arsenic result of 249 ppb for boring SHM-10-16. Furthermore, the scaling of the boring appears incorrect, with a 30-foot gap shown between the 34 and 54-foot sample. The color coding of the arsenic concentrations should be corrected after these changes are made, and conclusions revised as needed.

Comment: We will revise this information accordingly.

12) In Section 6.3.1.2, the statement is made that arsenic concentrations at SHM-10-11 were less than 300 ppb. Figure 7 indicates a concentration of 396 ppb at 49 feet bgs at SHM-10-11.

Comment: We will revise this information accordingly. This will be corrected to note that arsenic is less than <400 ug/L in this well.

13) Transects C-C' and D-D' (Figures 8 and 9, respectively) are important because Section 6.3.1.3 of the text indicates that these transects are in the vicinity of a redox boundary. However, the discussion of these transects in Section 6.3.1.3 is inconsistent with what is shown in the figures. For example, the text states that transect D-D' is similar to transect C-C' except for the inclusion of SHM-10-18 and SHM-10-24. In fact, SHM-10-24 is shown in both transects, and well SHM-10-20 is added to transect D-D' but not mentioned in the text. The significant fact that SHM-10-10 is substituted for SHM-10-19 in transect D-D' is also not mentioned. This substitution makes the down-gradient transect (D-D') appear to contain less arsenic, but it is noted that these two wells are very close to each other (as shown on Figure 2), and SHM-10-10 appears to be cross-gradient rather than down-gradient of SHM-10-19. Therefore, the lower arsenic at SHM-10-10 could be the result of its being outside the arsenic plume rather than the result of a redox boundary preventing down-gradient migration. Lastly, the inclusion of well SHM-10-21 in the downgradient transect D-D' is puzzling because, according to Figure 2, it lies upgradient of the C-C' transect wells. The cross-section lines on Figure 3 do not indicate that this well is included in any of the cross-sections. Placement of SHM-10-21 in the upgradient transect (C-C') and SHM-10-19 in the down-gradient transect (D-D') appears appropriate, and would facilitate a more accurate interpretation of the data. These changes should be made to other figures that show data along the C-C' and D-D' transects

Comment: We will revise the plans accordingly and conclusions revised. We are currently revising the discussion on the redox boundary due to discussions with the EPA. While there is no doubt that conditions change as the plume approaches the wetlands we do not have definitive information to allow us to demarcate the most important changes in arsenic geochemistry. One agreed upon strategy for this end of the site is to monitor it carefully moving forward in the future.

14) Section 6.3.1.3 states that comparison of transects C-C' and D-D' shows that arsenic concentrations decrease to less than 300 ppb at the "very edge of the wetlands." The basis for this statement is unclear because arsenic values at two of the wells closest to the wetlands (SHM-10-18 and SHM-10-20) exceed 300 ppb.

Comment: Need to revise, since the concentrations within SHM-10-18 and SHM-10-20 are 390 (47-ft) and 429-ug/l (39-ft), respectively. See comment 8

15) The report repeatedly makes the point that the peat layer observed in the center of the landfill acts to increase the solubility of arsenic. However, groundwater profiling data (shown on Figure 6) indicate lower arsenic concentrations directly below the peat, and increasing concentrations in deeper zones apparently fed from upgradient of the peat. These results appear highly relevant to evaluating the role of the peat in arsenic solubility, but are not discussed in the report. The report indicates that low arsenic concentrations at the water table may be caused by infiltration of precipitation along the sides of the cap, but the data from beneath the peat layer were collected 15 to 20 feet below the water table.

Comment: The data do not necessarily suggest that the higher arsenic concentrations noted below the peat layer (>10,000ppb) originate from upgradient of the peat layer. The >10,000 ppb arsenic is documented at depth below the peat, but as the comment notes, at least 20 feet below the peat. We will depict the limits of the former wetlands on Figure 2, and revised the applicable areas. The peat as explained in the text is a major source of reducing conditions that then mobilize arsenic. In several of the borings underlying peat (13, 14 and 15, sands and till at depth have higher arsenic concentrations at depth in the solid phase that may be being mobilizied by the reducing conditions from the peat. Capping and water extraction from the ATP have likely altered the arsenic distribution in some of the profiles.

16) The identification of a "strong redox boundary" to the north and west of SHM-10-17 is an important conclusion of the report. However, it is our opinion that insufficient justification is provided to support this conclusion. Section 6.3.1.1 uses data from transects C-C' and D-D' in the discussion of the redox boundary. Comparison of dissolved arsenic, dissolved oxygen (DO), and oxidation-reduction potential (ORP) data from three well pairs discussed in Section 6.3.1.3 is shown in the table below. These pairs were selected to provide an approximate comparison of conditions in the vicinity of upgradient transect C-C' and downgradient transect D-D'.

Location	Maximum Arsenic Concentration (ppb)	Depth of Maximum Arsenic Concentration (in Feet)	DO at Maximum Arsenic Depth	ORP at Maximum Arsenic Depth
SHM-10-17 (upgradient)	1860	39	0.26	-138.2
SHM-10-18 (downgradient)	390	47	0.45	-80.7
SHM-10-19 (upgradient)	810	29	0.53	-111
SHM-10-20 (downgradient)	429	39	0.37	-38.8
SHM-10-23 (upgradient)	1,100	57	0.86	-100.2
SHM-10-24 (downgradient)	615	55	0.77	-95.3

The fact that each of the three well pairs shows a decrease in dissolved arsenic is not surprising given that arsenic generally decreases with distance from the landfill. Review of the dissolved oxygen data taken at the depth of maximum arsenic shows a decrease in two of the three well pairs, which does not support the existence of a redox boundary in the area. Review of the ORP data does show an increase in each well pair, but not to levels that would support the existence of a "strong redox boundary."

Comment: We are modifying the redox boundary discussion. However, it should be noted that evidence of a redox boundary as now defined in the revised SAR does occur in some locations at the confluence of landfill impacted water and the Brook and associated wetlands. See response to comment 17 also. ORP is not a good indicator of water quality changes since it is unknown as to what redox couple the system is responding to. We will assess all water quality parameters to determine if conclusive results are possible at this end of the site.

17) The concentration reductions in the vicinity of the purported redox boundary could also be interpreted to represent the leading edge of an arsenic plume that can continue to expand with time. The capacity of soils for the adsorption of arsenic, as well as the supply of dissolved oxygen at the impacted depths, is limited, and years of data indicate that the dissolved arsenic concentrations emanating from the landfill are not decreasing significantly with time. What assurance can be given that the arsenic plume will not move further from the landfill over the projected 150 to 200-year time period as additional reduced groundwater containing dissolved arsenic enters the area from upgradient? Based on the discussion in the report, the anticipated response to this comment is that "mixing" of groundwater from north of the Brook is occurring; however, as discussed further below, we find that the report does not adequately justify this claim.

Comment: A review of the groundwater testing results provided in the Annual Report indicates a stable or downward trend in the majority of the wells located down gradient of the landfill. Only monitoring well SH-05-41C exhibited and upward trend. Thus, expansion of the plume does not appear likely. Further mixing with clean water is in fact a redox boundary. The idea of intrusion of clean water and mixing was described in the report.

18) Section 6.3.1.6 theorizes that mixing of groundwater from the north side of the Brook with water emanating from the landfill is occurring in the vicinity of SHM-10-10, resulting in a redox zone that will prevent arsenic from "ever" appearing in detectable concentrations in the wetlands or the Brook. However, the groundwater elevation map shown on Figure 30 clearly indicates flow to the northwest in this area (i.e., towards the brook), contradicting the contention that groundwater from the north of the Brook is reaching the SHM-10-10 area.

Comment: The language in the report will be expanded and clarified and uncertainties will be discussed. Groundwater from the other side of the brook does in fact follow bedrock into this area allowing mixing with water impacted by the landfill.

19) This and previous studies have identified the Brook as the presumed discharge point of arsenic-impacted groundwater traveling north from the landfill. However, as shown in the above table, data from the three well pairs does not indicate that significant upwelling is occurring even in the areas closest to the Brook. In fact, data from the SHM-10-17/SHM-10-18 and SHM-10-19/SHM-10-20 well pairs indicate that the zone of maximum arsenic appears to be deepening as the Brook is approached. Data from the remaining well pair indicate no significant upwelling, with the depth of greatest arsenic remaining over 50 feet below the surface.[1] These data indicate that the possibility of dissolved arsenic continuing to travel past or beneath the Brook (possibly toward the MacPherson well) should be further considered. (Note 1: These conclusions do not change when elevation differences between the wellheads are considered.)

Comment: The brook is not a discharge point in the sense that groundwater from the landfill is discharging into surface water. Rather groundwater containing arsenic generally follows the bedrock contour and weak upward gradients that discharges into baseflow beneath the brook. This

coupled with the intrusion of groundwater from the north and east dilutes and precipitates arsenic. Continued monitoring of this area is proposed for the protection of the well.

20) Section 6.3.1.3 states that the bedrock surface appears to control arsenic migration. The revised bedrock contours shown in Figure 29 represent a significant improvement in understanding of the bedrock surface in the area. However, we question the basis for connecting the eastern and western portions of the 140-foot bedrock contour at the top of Figure 29. The location of the geophysical survey points does not appear to provide any justification for making this connection. What data are available to confirm that a bedrock trough does not extend further to the north? The discussion in Section 6.3.1.6 assumes that water in this "structural trough" would flow toward the Brook; however, we do not believe that this conclusion is supported.

Comment: Where new data were not available the previous interpretation of the bedrock surface was retained, as is the case with the areas east and west of the geophysical survey transects. It is noted that bedrock outcrops are plotted on the USGS bedrock map to the north of Nonacoicus Brook, just beyond the short segment of 220' contour. Further, the eastern extent of Transect B supports this systematic shallowing of the bedrock surface in a northeasterly direction. These observations preclude the possibility of a deepening trough between the end of Transect B and the mapped outcrops.

21) Transects E-E' and F-F' (Figures 10 and 11 respectively) purport to display dissolved arsenic concentrations; however, according to Table 2, data shown for SHM-10-03 are total arsenic concentrations, and data shown for SHM-10-08 are a mixture of dissolved and total concentrations. If this was done in error, we suggest that other values on the transects and tables be cross-checked as well.

Comment: Values, transections and table will be cross checked with the original data set and verified.

22) Transect F-F' (Figure 11) initially appears to make a convincing case that the arsenic plume is migrating upward toward the brook, and diminishes significantly as the brook is approached. However, the orientation of the transect is neither parallel nor perpendicular to the direction of groundwater flow. This can be seen by comparing the orientation of transect F-F' on Figure 2 with the particle tracks on Figure 33. In our opinion, the orientation of this transect presents a distorted visualization of site conditions. Finally, the text in Section 6.3.1.5 states that the transect is a "north to south view;" however, it is in fact east-west as shown on Figure 2.

Comment: We respectively disagree as shown in Figure 30, groundwater within the landfill flows in a general northeast direction toward Plow Shop Pond. At this point groundwater is shown to curve to run in a northwesterly direction by the time it nears Nonacoicus Brook. Figure 30 would appear to indicate that this cross-section runs perpendicular to groundwater and surface water flow.

23) Figure 11 (transect F-F') and the discussion in Section 6.3.1.5 and subsequent sections highlight the difference in arsenic concentrations between SHM-10-10 and nearby wells such as SHM-10-17, SHM-10-19 and others. From inspection of Figure 2 (well locations) and Figure 33 (particle tracks), it appears that SHM-10-10 is cross-gradient of the wells to which it is compared. The low arsenic concentrations at SHM-10-10 therefore may be due to its being outside (i.e., cross-gradient) of the arsenic plume rather than due to a redox barrier preventing downgradient migration.

Comment: See comment 22. Actual groundwater contouring would show that SHM-10-10 is downgradient of SHM-10-17 and SHM-10-19. Sovereign stands by its stated assessment.

24) Section 6.3.1.6 cites arsenic concentrations that are rounded down to the hundreds of ppb, except for SHM-10-19, which is rounded down from 810 ppb to 700 ppb. We believe the analysis would be better served by using the actual maximum values.

Comment: The values will be unrounded except to indicate < than or > than.

25) The mixing analysis presented in Section 6.3.1.6 uses data from wells SHM-10-14 and SHM-10-10. The analysis concludes that approximately 47% mixing is occurring between landfill water and water emanating from the north side of the brook (see Section 8.3 of the report.) However, the origin of the values used in the analysis for the various ion concentrations is unclear. As shown in the table below, some values used in the analysis lie outside the range seen in profile samples (e.g., potassium in SHM-10-14), while others lie outside the range seen in samples from monitoring wells (e.g., magnesium in SHM-10-10). In one case (potassium in SHM-10-14), the selected value is outside both ranges. Given the wide ranges seen in ionic concentrations from both well and profile samples, the use of these data to provide a quantitative estimate of mixing appears inappropriate.

Well	Analyte	Value from Profile Data (mg/L)	Value used in Analysis (mg/L)	Value from Well Data (mg/L)
SHM-10-10	Ca	8.36 – 113	95	83.8 – 101
	Mg	1.2 – 14.9	14	22 – 25.8
	Na	12.5 – 88.0	26	26.1 – 28.5
	K	2.49 – 8.25	4	3.41 – 3.61
	Cl	17 – 120	20	17 – 23
SHM-10-14	Ca	30.5 – 62.7	55	55.3 – 57.9
	Mg	3.02 – 7.01	4	3.72 – 4.15
	Na	5.18 – 17.8	15	8.08 – 15.2
	K	3.78 – 7.14	17	17.6 – 101
	Cl	3.3 – 11.0	6	4.8 – 6.3

Comment: These values came from the sampling event after the wells were developed and is correct as stands. We will note origin in report.

26) Figure 19 (manganese concentrations along transect C-C) shows most of the transect area shaded in blue, indicating concentrations below 100 ppb. However, the four wells on the left of the transect were apparently not tested for manganese, and the rightmost well (SHM-10-27) has manganese data for only one of five sampling depths. The assignment of concentrations to untested areas is in contrast to the preceding figure (Figure 18) where untested areas are shown in white to indicate a lack of data.

Comment: Figure 19 will be adjusted accordingly. However, Mn is a poor indicator of landfill conditions or reducing conditions since it can be mobilized even under oxidizing conditions. Thus it is not particularly useful to use for landfill leachate plume delineation.

27) In Section 6.3.2.3 it is stated that Dissolved Organic Carbon (DOC) data parallel other redox sensitive species. However, comparison of DOC data shown on Figure 26 (Transect A-A') appears to correlate relatively poorly with Transect A-A' data for arsenic (Figure 6), dissolved iron (Figure 12) and dissolved manganese (Figure 17). The latter three figures appear to correlate relatively well with each other, but not with DOC data, which appear to be highest at the bottom of the overburden aquifer. It is also noted that Figure 26 should show the bottom sample from SHM-10-12 in red because it exceeds 6 parts per million (ppm).

Comment: Figure 26 will be adjusted accordingly. The significance of DOC is not apparanet in these cross-sections. We are modifying this discussion to more clearly explain the distribution of DOC and its significance.

28) Section 6.3.4.2 and Figure 46 present the calculation of a site specific Kd value. In this and other sections of the report, the derived value of 7.62 is presented as though it were unitless; however, as can be seen from Figure 46 and the equation presented in Section 6.3.4.2, the actual unit is liters per kilogram.

Comment: Appropriate correction will be made. However, the discussion of Kd will be modified since we do noy believe that a site wide Kd has significance for SHL.

29) As discussed in Section 6.3.4.2, Figure 45 purports to show a "highly significant" correlation between arsenic in samples of sandy soils and the arsenic/iron ratio in the same samples. Based on the high degree of correlation between these two variables, it is concluded that iron likely controls arsenic solubility. However, doesn't the figure simply present the obvious conclusion that, as arsenic increases, the ratio of arsenic to iron will also tend to increase? Please explain how this analysis supports the conclusion that iron solids control arsenic solubility. We suggest that the analysis might better be presented by directly plotting concentrations of arsenic vs. iron rather than using a ratio that increases as arsenic itself increases.

Comment: This data discussion will be reworked. It should be recognized that Fe and As are not always correlated since oxyhydroxides that dissolve will have vastly different arsenic contents location to location. Based on new SEM data we can classify the solids Fe/As into more meaningful ranges of arsenic content.

30) Section 6.4.1 states that no landfill waste other than a "small layer of ash" was encountered at SHM-10-13, located near the center of the landfill. Section 6.4.2.2 states that "only a trace of ash" was found in this boring. These statements are contradicted by the boring log which indicates wood mixed with ash from 8 to 10 feet below grade, and glass mixed with ash from 23 to 25 feet below grade.

Comment: This will be corrected, however, the ash and glass made up only a trace amount of the interval within which they were found compared to the 10 ft of solid peat underlying these layers.We will however correct the text to note these characteristics.

31) The arsenic ranges presented in Table 7 contain three values that are contradicted by higher values in Table 4. Assuming the more extensive data presented in Table 4 are correct, the following corrections should be made: (1) at SHM-10-11, the low value in the stated depth range should be 10 mg/kg, not 6; (2) at SHM-10-13, the high value should be 7 mg/kg, not 5.9; and (3) at SAHM-10-14, the low value in the stated depth range should be 6.0 mg/kg, not 3.8. Values for other metals in Table 7 were not checked but may contain errors as well.

Comment: We will review the table against the laboratory reports to verify the tabulated concentrations. Some data from above the stated range was used.

32) In the summary portion of Section 6.4.1, it is stated that "Arsenic in waste samples is always less than 25 mg/kg." We have two comments on this statement: (1) a reading of 31 mg/kg was obtained from the sample taken at 23 feet below grade in SHM-10-13, where ash and glass were observed, and (2) given the highly heterogeneous nature of landfilled wastes, it appears inappropriate to make a broad statement that implies that all wastes will have concentrations below the maximum value observed in a limited number of samples.

Comment: We will revise the listed concentrations. In addition, the general comment will be qualified by saying "in the samples and borings examined"

33) Section 6.4.2.2 presents an analysis of data from five wells advanced within the landfill footprint. At each location, landfill waste and/or peat was found. The analysis uses Dissolved Organic Carbon (DOC) and Dissolved Inorganic Carbon (DIC) data from the five wells to evaluate the relative "reducing strength" of the landfill waste vs. the peat. The analysis concludes that the peat layer supplies roughly twice as much carbon to the groundwater than the waste does. This analysis might have merit if the carbon data were obtained from wells screened within the waste and/or peat layers; however, as shown in the table below, the wells are in fact screened in sand layers that lie at least 17 to 36 feet below the bottom of the layers in question.

Location	Waste/Peat Layer Depth (ft)	Screened Interval of well (ft)
SHM-10-11	5 – 20 (waste)	50-60 (medium sand)
SHM-10-12	5-9 (ash/debris)	45-55 (medium –coarse sand)
SHM-10-13	8-10 (wood/ash) 23-25 (ash/glass) 27-33 (peat)	60-70 (fine sand)
SHM-10-14	8-25 (ash/waste) 25-29 (peat)	60-80 (fine sand)
SHM-10-15	2-28 (waste/ash)	45-55 (medium sand)

What is the basis for assuming that dissolved carbon data from these underlying layers are representative of conditions in layers that exist tens of feet above? Groundwater flow directions in these areas cannot be expected to be vertically downward, particularly given that these wells are located in an area beneath an impermeable cap. Groundwater profiling data from these locations could potentially be of greater value, but, as shown on Table 2, collection of profiling data did not begin until depths of 39 feet or more were reached, which is below the deepest extent of peat and/or waste in each of the five locations. The closest that profile data come to the layers in question is at SHM-10-14, where the 39-foot sample was taken just below the bottom of the peat layer. This result yields a combined dissolved carbon value of 84.1 mg/L, which does not support the report's conclusion that peat is contributing roughly twice as much carbon as landfill waste.

Comment: The USEPA and the MassDEP in reviewing the SAR have also stated that they do not agree with the idea that the peat is the primary source of reducing conditions at the site. As the body of scientific literature addressing these issues throughout the region is extensive and well established it was not reproduced in the SAR or FFS. Based on data collection and analysis by both Army and USEPA contractors at this site as well as the supporting literature we disagree with the assertions made by both the USEPA and MassDEP concerning the role of peat and former wetlands on present and future site reducing conditions. Our reasoning is outlined below.

The emplacement of landfill waste clearly has created its own carbon metabolism, degradation and anaerobic reducing conditions. Municipal landfills are known to behave in this manner and there is no dispute that the landfill comes with its own set of impacts to underlying groundwater. SHL is considered an older landfill (>20 years). By literature standards (El Fadel et al., 2001) leachate from these landfills have lower COD (<1000 mg/L), BOD (<50 mg/L), ammonia (<30 mg/L), TDS (<1000 mg/L) and other constituents compared to newer landfills. SHL groundwater falls within these ranges even with dilution considered. Since SHL has been capped, most of the waste (>80 %) is no longer in contact with groundwater. Over time, the landfill's role in maintaining reducing conditions will diminish and cease.

The wetlands and peat appear, from historic USGS maps, to encompass about 70% of the northern half of the landfill and possibly half of the southern part of the landfill (see attached map). These wetland areas formed shortly after or during the retreat of glaciers during the last Ice Age and typically date 13,000 yrs before present (BP). Formation of wetlands, and underlying peat, results in a number of important biogeochemical changes (Mitsch and Gosselink, 2007):

- *Inundation of water into the surface soils in the wetlands results in anaerobic conditions. Low diffusion rates of oxygen under saturated conditions will result in anaerobic conditions typically within 12 weeks.*

- *Lack of oxygen leads to nitrate reduction, then iron reduction and sulfate reduction, and finally methanogenesis.*

These biogeochemical changes will result in production of soluble iron as Fe (II), hydrogen sulfide which can off-gas and/or precipitate as a metal sulfide, production of ammonia and methane. Measured methane rates (Mitsch and Wu, 1995) have been found to range from 0.1 to 500 mg C m^{-2} d^{-1}. Global carbon emission rates from methane from peatlands are 150 mg C m^{-2} d^{-1} (Matthews and Fung, 1987).

Literature reviews and textbooks on wetlands and peatlands make it abundantly clear that the formation and maintenance of wetland and peatlands always result in anaerobic conditions and resulting biogeochemical conditions that will mobilize arsenic as explained in the SAR. To illustrate this we point to a paper (Ravenscroft et al., 2001) in which peat occurs extensively beneath arsenic affected areas of southwestern Bangladesh. The peat is thought to be Holocene aged, about 5,000 yr BP. In wells where peat was not encountered arsenic levels rarely exceeded 100 ug/L. In wells drilled through peat deposits, arsenic concentrations increased to over 1,000 ug/L. It is important to note that peat was encountered at various depths up to 60 meters below ground surface. The findings can be summarized as follows: The concentration of arsenic was not exceptional in much of the study area and the occurrence of reducing conditions was not enough to explain the degree and extent of arsenic pollution. High arsenic levels were attributed to biodegradation of buried peat deposits which drives the reductive dissolution of FeOOH supplying high amounts of arsenic to groundwater. The correlation of peat deposits to high arsenic has also been noted by others (Smedley and Kinniburg, 2002)

The fact that wetlands and peat underlie a significant portion of the landfill can only mean that additional sources of carbon and arsenic were introduced to an already dynamic anaerobic system via the landfill emplacement. Estimates of dissolved carbon from either landfill or wetland sources as noted in the SAR suggests that peat and wetlands have increased total carbon by 50 to 75% of that delivered by the landfill suggesting that removal of the landfill would only reduce the carbon input by 25 to 50%. Thus the peat and wetland areas are a major source of carbon and reducing conditions. With the landfill aging, the peat and buried wetlands will continue to act as a carbon source and hence maintain reducing conditions into the future.

34) Section 8.3 makes the claims that the peat layer acted as a carbon source long before the landfill existed, and that the peat provides roughly twice the carbon input of the landfill wastes. To provide a more balanced summary, the report should also note in this section that dissolved arsenic in locations upgradient of the peat reaches 3,880 ug/L (see SHM-10-12 profile data), and that therefore the role of the landfill wastes is significant. The SHM-10-12 arsenic result of 3,880 ug/L also contradicts the initial leaching tests' conclusion (presented in Section 9.0) that the waste "potentially could deliver up to 500 ug/L arsenic to the underlying groundwater."

Comment: A plan showing the layout of the former wetlands indicate the presence of peat at points upgradient of point SHM-10-12. Figure 2 will be revised to include the location of former wetlands. Sovereign stands by its opinion on the contribution of peat as a significant carbon source.

35) The Executive Summary and the Conceptual Site Model section (Section 9.0) both contain the following statement: "Placement of the cap has likely eliminated leaching of arsenic and any other constituents from landfill wastes to the underlying groundwater, although recent estimates suggest that only 11% of the waste is in contact with groundwater or saturated." Results from annual monitoring (e.g., spikes in arsenic concentrations seen at wells after the placement of the cap) and from this study (e.g., the presence of 3,880 ppb of arsenic at SHM-10-12, upgradient of the peat and immediately below the "landfill bottom" shown on Figure 6) directly contradict the conclusion that arsenic leaching has been eliminated by placement of the cap. This statement also fails to consider the acknowledged fact that placement of the cap has caused the underlying groundwater to become more reduced than it otherwise would have been, thereby increasing the potential for arsenic leaching.

Comment: The waste above the water table containing arsenic does not appear to be acting as a source since it is not in contact with the groundwater table, or subject to flushing from surface drainage. Revise Figure 2 to include the location of peat areas near and upgradient of SHM-10-12. As for fluctuating arsenic results, a review of arsenic data associated with SHL-15 (upgradient well) indicated concentrations varying between 16 and 93-ug/l.

36) Section 9.0 states that "An evaluation of methane determined that the dissolved concentration within groundwater does present an explosive hazard." Based on previous statements and the data summarized in Section 4.4, this statement appears to be in error.

Comment: This will be revised. The statement should have read "An evaluation of methane determined that the dissolved concentration within groundwater does ***not*** *present an explosive hazard."*

37) The Executive Summary and Section 9.0 state that "the impact to red cove likely preceded the placement of the landfill." No direct evidence, such as aerial photos or historical reports, is provided to support this claim. It is assumed that the rationale for this statement is related to the presence of peat in the central portion of the landfill. However, review of groundwater flow maps, including the one shown in Figure 30, indicates that groundwater flow through the peat area travels northward, not eastward towards Red Cove. Are the authors claiming that groundwater flowed eastward from the peat area at one time, or that peat formerly existed upgradient of Red Cove and was removed to another location? The advancement of an opinion stating that Red Cove was impacted prior to landfilling operations should be supported by strong evidence, and in our opinion such evidence is lacking in the report.

Comment: Figure 2 will be revised showing the limits of the wetland areas. Based on this information, and the strong evidence of arsenic in the underlying soils, there is a carbon source available to mobilize the As within the sands.

Attachment L

Attachment L

Investigation of Arsenic and Lead
Shepley's Hill Landfill Site

Project TLH009830

Report Date: January 2011

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Investigation of Arsenic and Lead
Shepley's Hill Landfill Site

1.0 Purpose

RJ Lee Group, Inc. (RJLG) was retained by Sovereign Consulting, Inc. to characterize the arsenic and lead occurrences in bulk samples collected from borings in the vicinity of Shepley's Hill Landfill. Characterization was performed using X-ray diffraction (XRD) and scanning electron microscope with energy dispersive spectrometer (SEM/EDS) techniques. The primary objective of the characterization was to understand the nature of the solid arsenic occurrences. The secondary objective was to understand the nature of the solid lead occurrences. Because the presence and characteristics of pyrite may be informative relative to the chemical environment, it was documented as well.

2.0 Summary

Eleven samples were analyzed to characterize the arsenic and lead phases present. Coarse particles larger than 2 mm were removed by sieving and were then archived. The fine fraction was analyzed by computer controlled scanning electron microscopy (CCSEM) and XRD techniques. Only one arsenic particle was observed. It was a 12 um particle in the form of arsenopyrite. Anthropogenic lead in the form of solder and paint was observed. Lead-rich and lead/sulfur-rich particles were observed. Pyrite was observed as a minor component in five of the 11 samples and as an abundant component in one.

3.0 Samples

It is our understanding that samples related to this project were collected under the direction of Sovereign Consulting, Inc. Bulk chemistry analyses were performed by Alpha Analytical Labs. All samples were then provided to Dr. William Walker, an independent contractor. RJLG received a subset of 11 samples from Dr. Walker on November 18, 2010. The sample containers were labeled with an Alpha and a Sovereign Consulting sample ID number. The Sovereign ID was in the form of S-10-xx-yy where xx indicates the core location and yy indicates the sample depth in cm. RJLG also received bulk chemistry data for 77 samples consisting of a sample "type" and the concentrations of 24 analytes, including arsenic and lead. The 11 samples we received were assigned an RJLG laboratory ID. The sample identifications, type and arsenic and lead content information that were provided to RJLG are shown in Table 1.

Table 1. Sample Identification and Bulk Arsenic and Lead Data.

RJLG ID	Sovereign ID	Alpha ID	Type	As (ppm)	Pb (ppm)
3075275	S-10-12-05	Alpha L1012501-02X	sand/ash	12	510
3075276	S-10-12-42	Alpha L1012501-09X	sand	29	4.4
3075277	S-10-12-65	Alpha L1012501-11X	NP*	NP	NP
3075278	S-10-13-23	Alpha L1012502-09X	sand/ash	31	49
3075279	S-10-13-83	Alpha L1012501-16X	till/bdrck	23	49
3075280	S-10-14-10	Alpha L1012787-02B	sand	18	180
3075281	S-10-14-15	Alpha L1012787-03B	waste/sand	12	150
3075282	S-10-14-20	Alpha L1012787-04B	waste/sand	18	42
3075283	S-10-14-27	Alpha L1012787-06B	sand	3.8	10
3075284	S-10-14-70	Alpha L1012787-15B	sand	35	4.9
3075285	S-10-14-75	Alpha L1012787-16B	sand	51	5.3

* NP – Data Not Provided

4.0 Methods – XRD

A representative fraction of the fines (< 2 mm) with a known amount of calcium fluoride internal standard added was ground in methanol to pass a 45 micrometer sieve. The powder was placed in an XRD mount and scanned from 4 to 64 degrees 2 theta at 3 degrees per minute. The resulting diffraction pattern was compared to the ICDD database to identify the crystalline phases present in the sample.

5.0 Methods – SEM/EDS

5.1 Sample Preparation

A representative fraction of the samples that had previously been sieved (< 2 mm samples) was mounted in epoxy in a 1-inch form and polished, exposing the particle interiors to examination. These samples were documented (imaged) using a light microscope. The mounts were then given a thin coat of carbon to prevent charging while under the electron beam.

5.2 Sample Analysis

The fine soil particle mounts were analyzed by CCSEM analysis. This analysis takes advantage of the relative brightness of compositional phases in the backscattered electron image. A backscattered electron image brightness threshold value was established such that occurrences of phases with an atomic number (Z) of iron or higher were examined, and the more common soil phases such as silicates and carbonates were ignored. When a bright (high-Z) particle was detected, its size was determined and an EDS spectrum was collected and the individual elements identified. For each particle, the physical dimensions and elemental compositions were saved in a file along with location coordinates. Potential arsenic and lead-bearing particles were imaged and the entire EDS spectrum was also saved.

The CCSEM analysis was performed at two magnifications. The first magnification was 80X and particles larger than 10 μm were characterized. The entire area of the 1-inch mount was examined. The second magnification was 1600X and particles less than 10 μm but larger than 0.5 μm were characterized. The fields were selected randomly and the analysis continued for 3 hours.

After the CCSEM run was complete, particles of interest (arsenic- and lead-bearing phases as well as pyrite) were relocated for analysis in the manual SEM mode to confirm size and composition and to characterize other phases if the particle was compositionally complex. For example, lead in paint may be associated with non-lead phases that assist in or confirm particle identification.

6.0 XRD Results

The results of the XRD analysis are presented in Appendix 2 and summarized in Table 2. Quartz, feldspars and clays with trace undifferentiated ferromagnesian mineral are present.

Table 2. XRD Phase Identification by Sample

Sample ID							
RJLG ID	Sovereign ID	Quartz	Na Spar	K Spar	Chlorite	Mica/illite	Fe/Mg phase
3075275	S-10-12-05	Major	Minor	Minor	Minor /Trace	Trace	Trace
3075276	S-10-12-42	Major	Minor	Minor	Trace	Trace	-
3075277	S-10-12-65	Major	Minor	Minor	Trace	Trace	-
3075278	S-10-13-23	Major	Minor	Minor	Trace	Trace	-
3075279	S-10-13-83	Major	Minor	Minor	Trace	Minor /Trace	-
3075280	S-10-14-10	Major	Minor	Minor	Trace	Trace	Trace
3075281	S-10-14-15	Major	Minor	Minor	Trace	Trace	-
3075282	S-10-14-20	Major	Minor	Minor	Minor /Trace	Minor /Trace	Trace
3075283	S-10-14-27	Major	-	-	-	-	-
3075284	S-10-14-70	Major	Minor	Minor	Trace	Trace	-
3075285	S-10-14-75	Major	Minor	Minor	Trace	Trace	-

Major >25% Minor 5-25% Trace <5%

7.0 SEM/EDS Results

Sample S-10-12-05 (3075275)

No arsenic was observed in this sample. In the low magnification analysis, three occurrences of lead associated with tin (possible solder) were observed. One lead-rich phase associated with copper and sulfur was observed. Four Pb-rich occurrences which appeared to be liberated clusters of finer particles were also observed. Two occurrences of framboidal pyrite and one massive pyrite enclosed in a rock fragment were observed. Small occurrences of lead with phosphorus and calcium were observed in the high magnification analysis.

Sample S-10-12-42 (3075276)

No arsenic or lead occurrences were observed in this sample. One massive pyrite enclosed in quartz was observed.

Sample S-10-12-65 (3075277)

No arsenic or lead occurrences were observed in this sample. One micron-size pyrite in an internal mineral void was observed.

Sample S-10-13-23 (3075278)

No arsenic or lead occurrences were observed in this sample. Approximately 150 occurrences of pyrite were observed. Pryite occurred as framboidal (often displaying a rimming morphology), as liberated particles, and infilling voids.

Sample S-10-13-83 (3075279)

One occurrence of liberated 12 μm diameter arsenopyrite was observed. Two occurrences of a liberated 10-15 μm diameter lead/sulfur phase was observed. A lead-bearing calcium manganese phase (interpreted as leaded kutnohorite) was observed. One internet site (http://www.springerlink.com/content/r7265661864j3574/) shows kutnohorite to occur in the same environment as pyrite. One framboidal pyrite, and one massive pyrite, as well as two small (< 4 um) liberated pyrites were observed in this sample.

Sample S-10-14-10 (3075280)

No arsenic occurrences were observed in this sample. One lead-bearing paint particle and one possible lead-bearing paint was observed in this sample. Two occurrences of massive pyrite and one massive pyrite surrounded by small pyrite crystals were observed in this sample.

Sample S-10-14-15 (3075281)

No arsenic occurrences were observed in this sample. Five occurrences of Pb/S were observed as liberated occurrences. One paint particle with Pb/S was also observed. Small lead occurrences were observed in the high magnification analysis as well. No pyrite was observed in this sample.

Sample S-10-14-20 (3075282)

No arsenic or lead occurrences were observed in this sample. One massive pyrite enclosed in a mineral and one massive liberated pyrite was observed. Two small (< 1 μm) occurrences of pyrite were also observed.

Sample S-10-14-27 (3075283)

No arsenic or lead occurrences were observed in this sample. No pyrite was observed in this sample.

Sample S-10-14-70 (3075284)

No arsenic or lead occurrences were observed in this sample. . No pyrite was observed in this sample.

Sample S-10-14-75 (3075285)

No arsenic or lead occurrences were observed in this sample. . No pyrite was observed in this sample.

8.0 Summary

Eleven samples from various depths of three sediment cores were analyzed by X-ray diffraction for general mineralogy of crystalline phases, and by CCSEM for the characterization of arsenic- and lead-bearing phases and pyrite. As shown in Table 1, arsenic and lead concentrations were low ranged from 3.8 to 51 ppm and from 4.4 to 510 ppm, respectively.

The gross mineralogy of all the samples was similar in that quartz was the major mineral in all samples and the only quantifiable mineral in sample 3075283. Sodium and potassium feldspars were minor phases in the other samples. Chlorite and mica/illite were observed in minor or trace amounts in all the other samples. Trace amounts of possible suspected amphibole was found in three samples.

Arsenic, in the form of arsenopyrite, was only observed in one sample. Anthropogenic sources including lead associated with tin (solder) and lead-bearing paint was observed. Lead-rich not associated with sulfur was observed in the 5 cm sample at core location 12. Lead associated with sulfur was observed in the 83 cm sample at core location 13 and in the 15 cm sample at core location 14. The oxidation state of this association is not known.

Pyrite observed was liberated massive, framboidal and enclosed in other minerals. The framboidal form is likely a result of in situ chemical reactions. The massive form may be in situ as well. The enclosed pyrite bears no relation to the in situ water chemistry.

Massive and framboidal pyrite were minor occurrences in two of the three samples of core location 12. Massive and framboidal pyrite was observed in both samples in core location 13, but was very abundant in the 23 cm depth sample. Massive pyrite (and one possible framboidal pyrite) were minor components in two of the six samples in core location 14 and absent in the other 4 samples.

Appendix 1

Representative Backscattered Electron SEM Images and EDS Spectra

S-10-12-05 (3075275) – Plates 1 and 2

S-10-12-42 (3075276) – Plate 3

S-10-12-65 (3075277) – Plate 4

S-10-13-23 (3075278) – Plate 5

S-10-13-83 (3075279) – Plate 6

S-10-14-10 (3075280) – Plate 7

S-10-14-15 (3075281) – Plate 8

S-10-14-20 (3075282) – Plate 9

S-10-14-27 (3075283) – No Plate

S-10-14-70 (3075284) – No Plate

S-10-14-75 (3075285) – No Plate

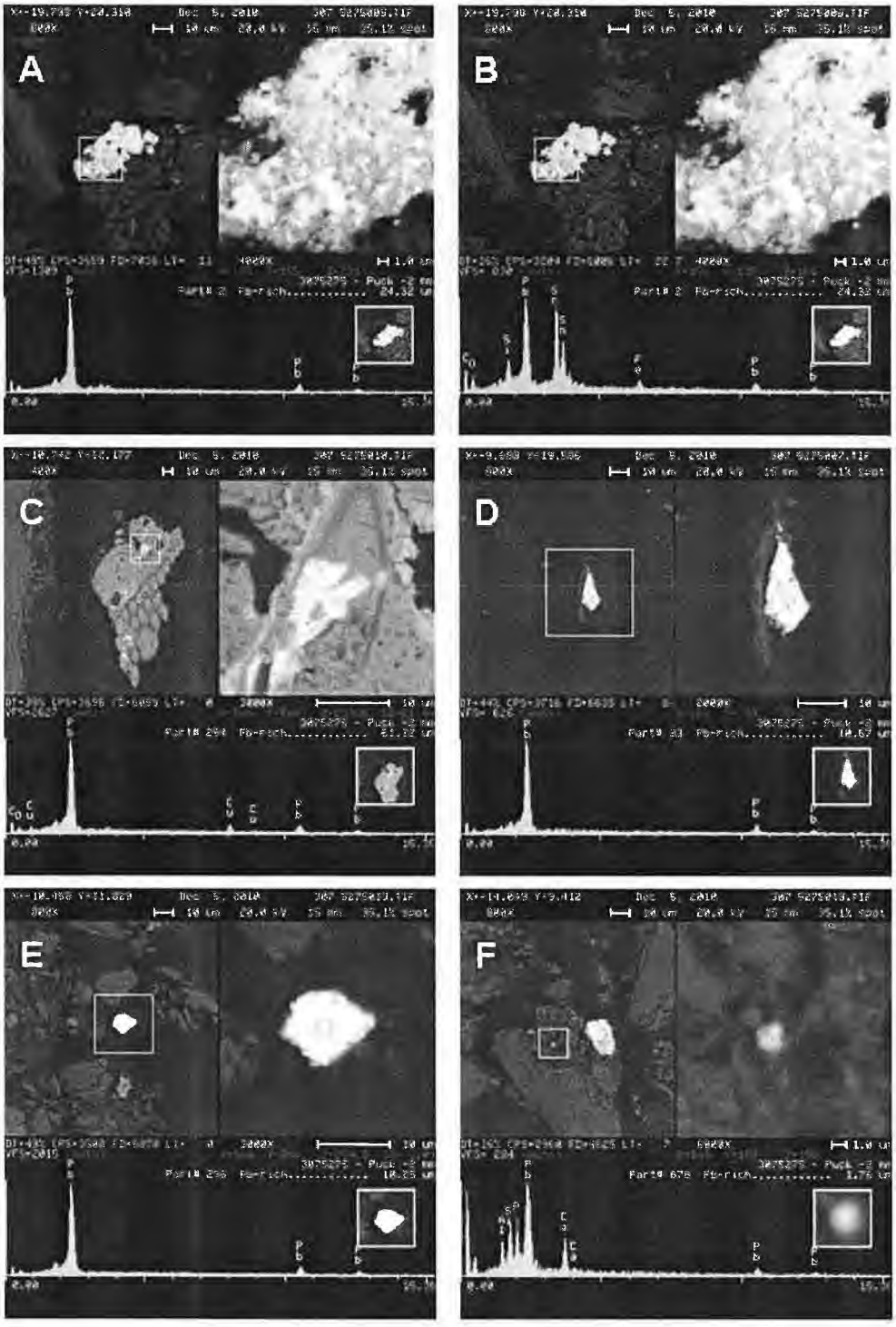

Plate 1, S-10-12-05 (3075275) A and B) Lead-rich and lead with tin. C) Lead-rich enclosed in copper phase. D and E) Liberated lead-rich. F) Leaded calcium phosphorus.

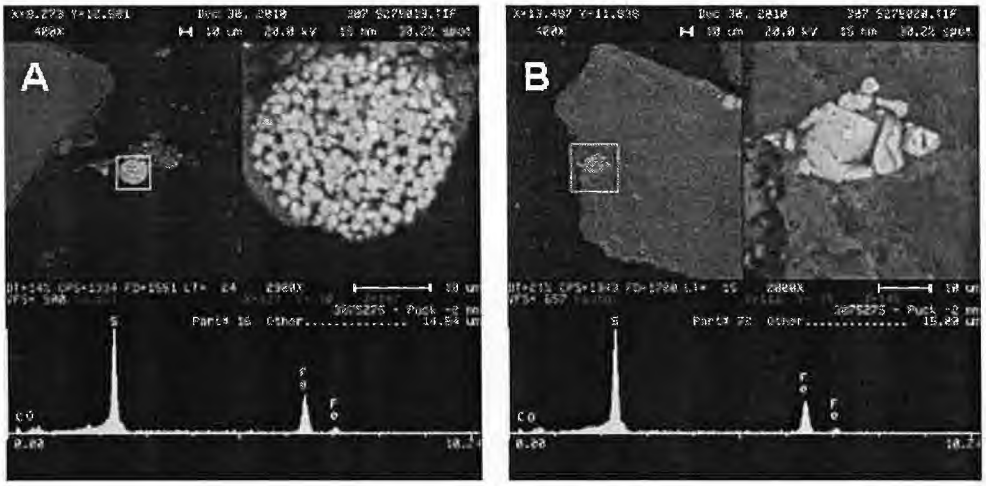

Plate 2 - S-10-12-05 (3075275) A) Framboidal pyrite. B) Pyrite enclosed in rock fragment.

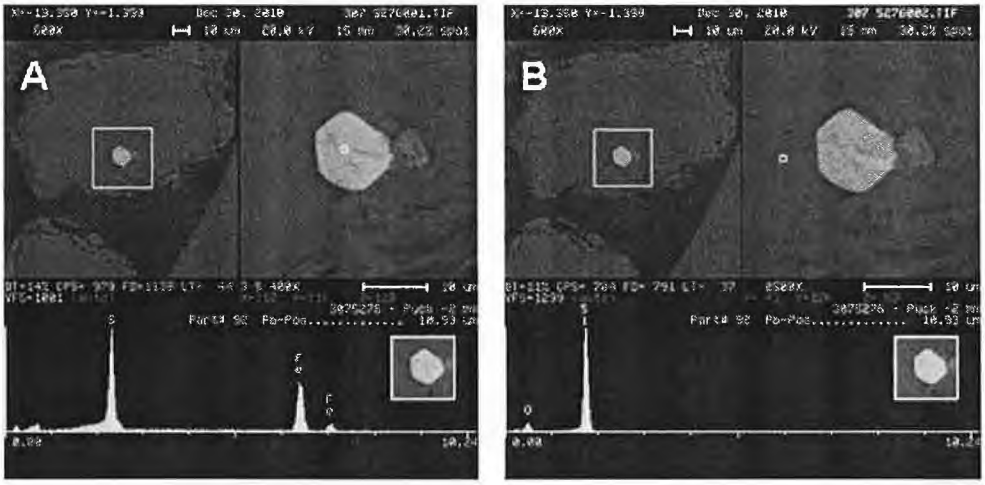

Plate 3 - S-10-12-42 (3075276) A and B) Pyrite enclosed in quartz.

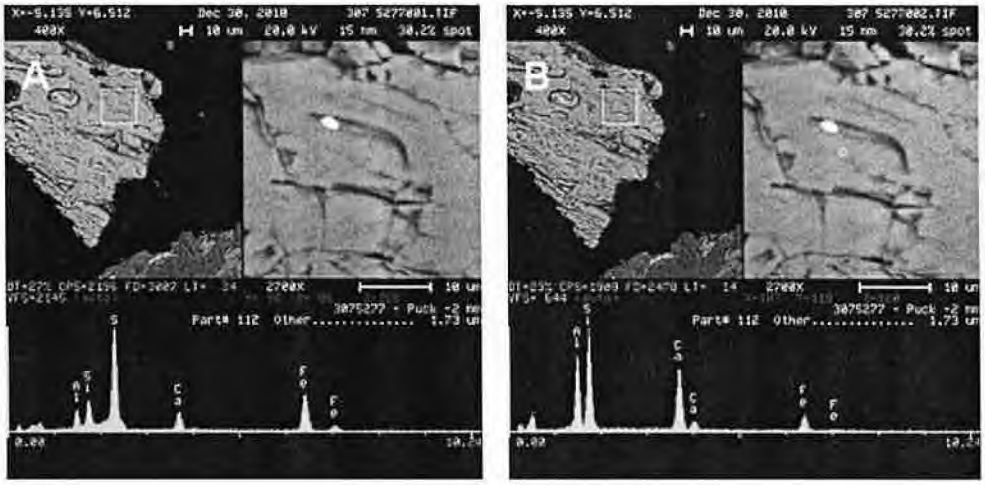

Plate 4 - S-10-12-65 (3075277) A and B) Pyrite in void space within an alumino-silicate mineral.

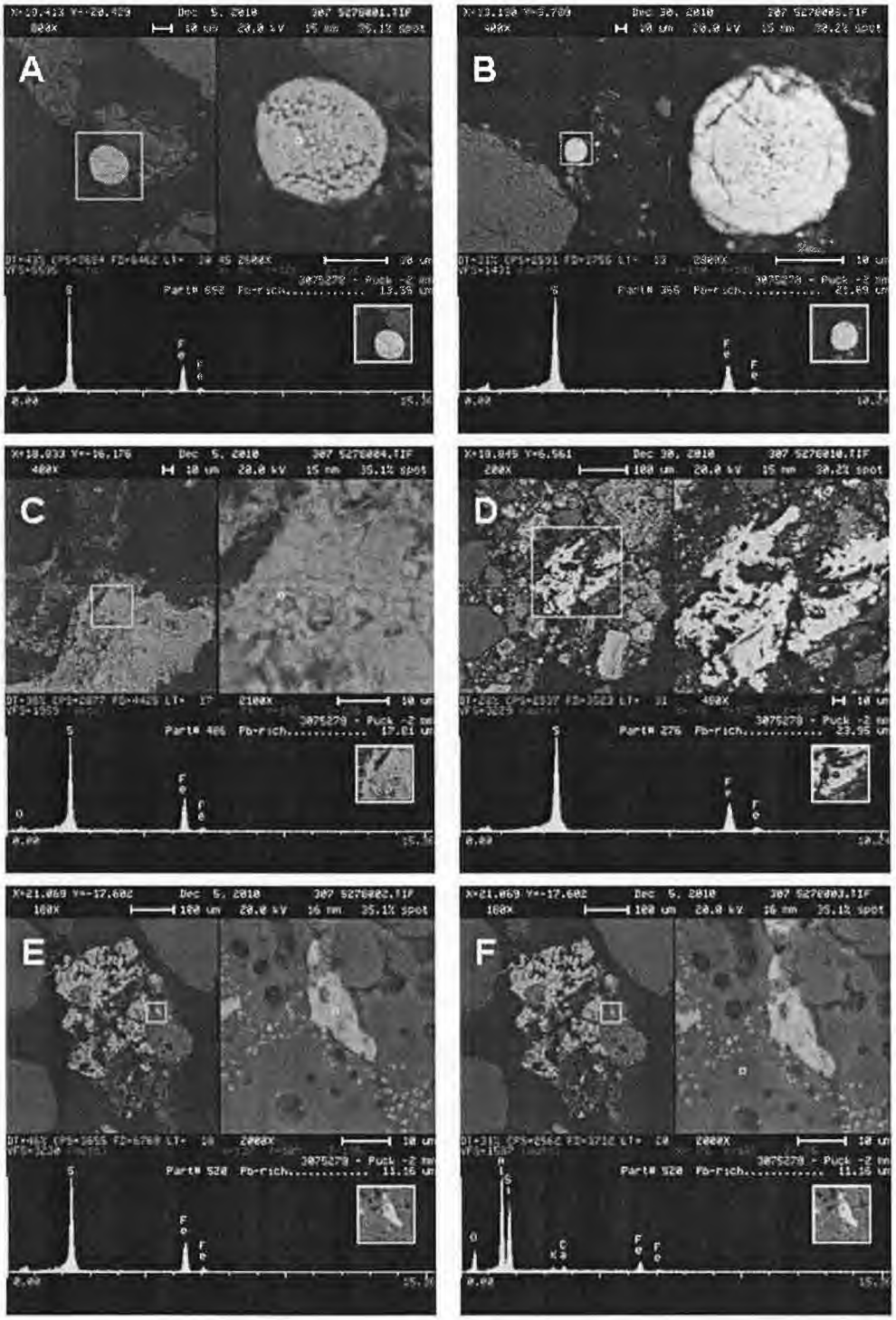

Plate 5 - S-10-13-23 (3075278) A and B) Framboidal pyrite with rim morphology. C and D) Massive pyrite. E and F) Pyrite enclosed in ash.

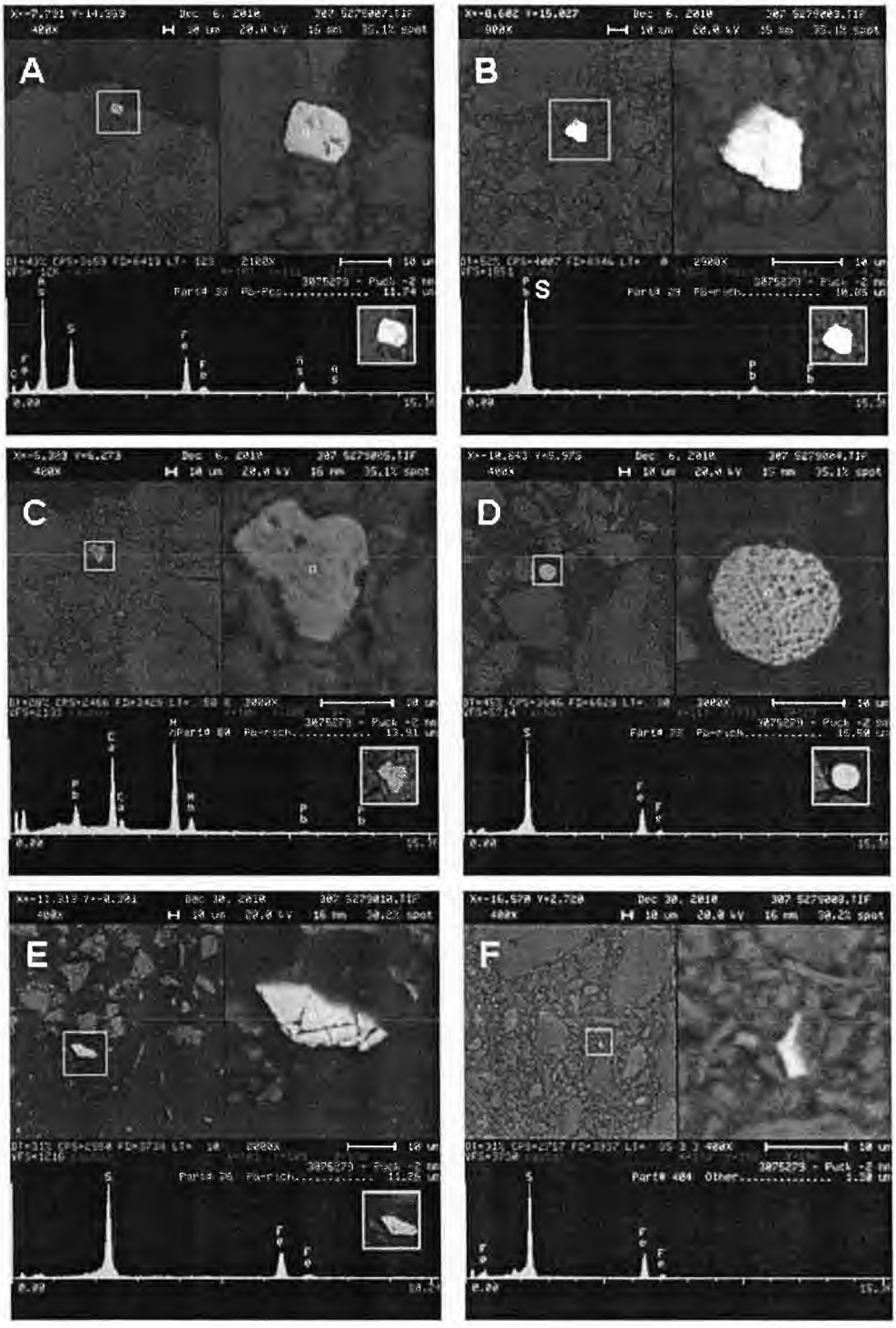

Plate 6 - S-10-13-83 (3075279) A) Liberated arsenopyrite particle. B) Lead/sulfur-rich C) Leaded calcium magnesium carbonate. D) Framboidal pyrite. E) Liberated massive pyrite. F) Fine pyrite.

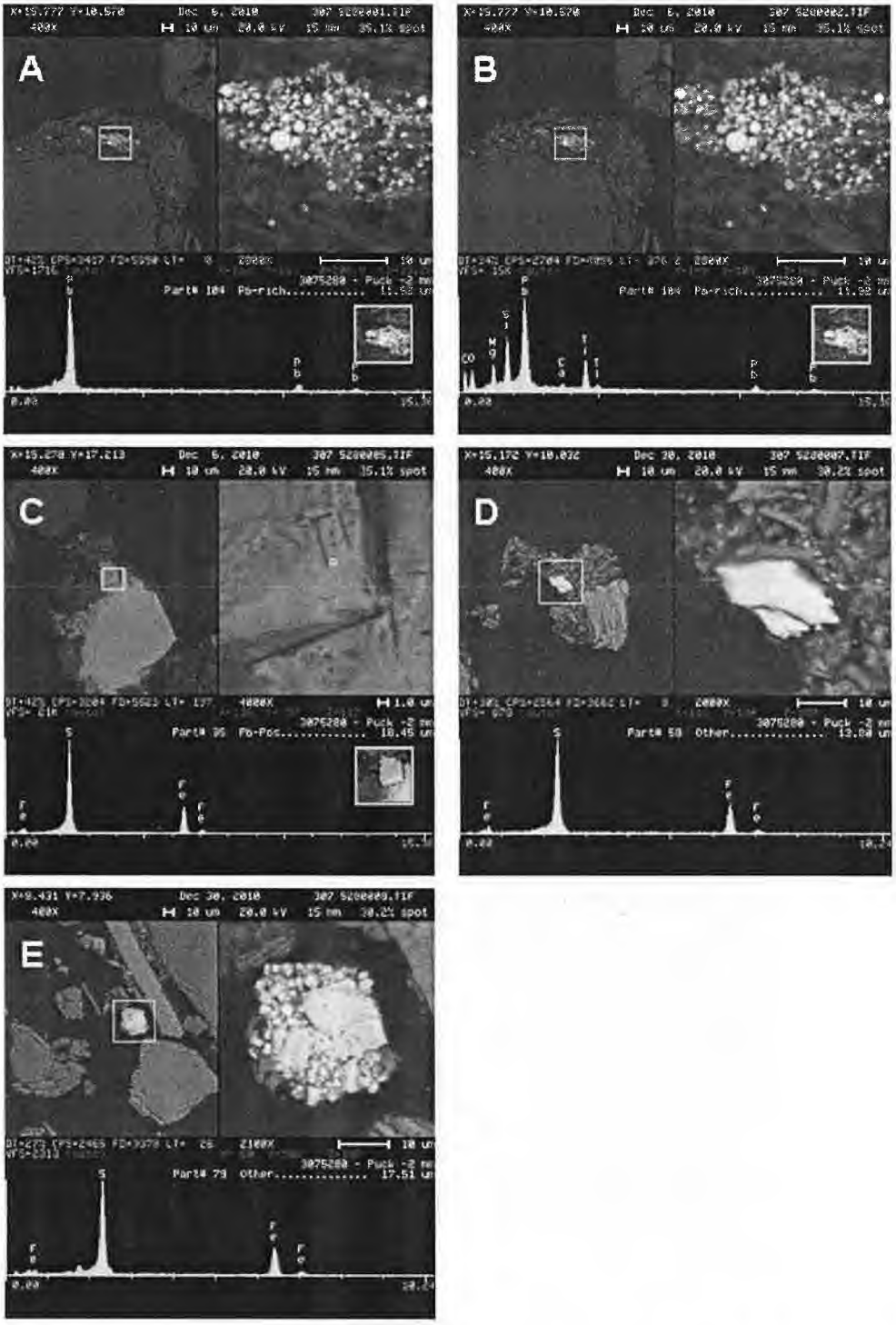

Plate 7 - S-10-14-10 (3075280) A and B) Lead-bearing paint. C and D) massive liberated pyrite, E) Massive pyrite with fine crystalline pyrite.

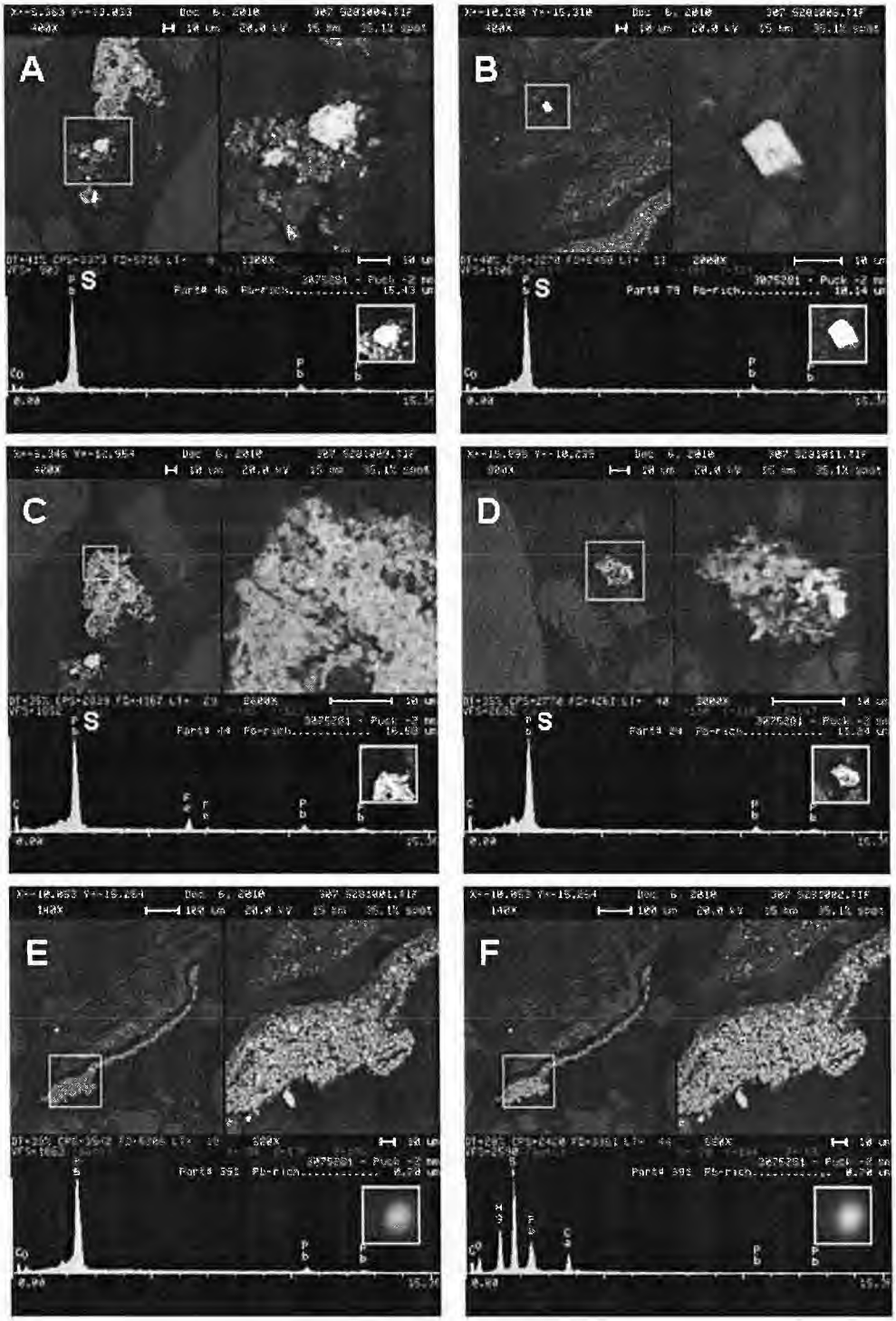

Plate 8 - S-10-14-15 (3075281) A – D) Liberated lead/sulfur rich. E and F) Lead-bearing paint.

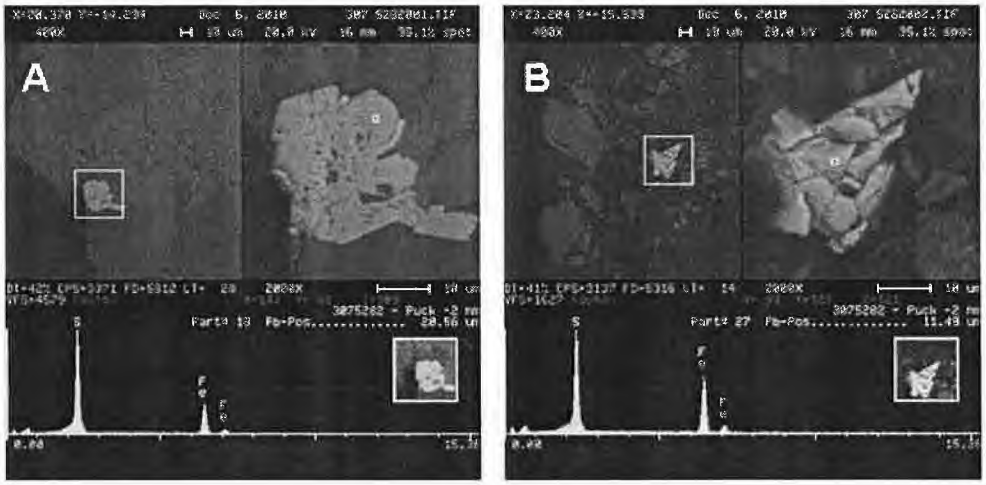

Plate 9 - S-10-14-20 (3075282) A) Enclosed pyrite. B) Liberated massive pyrite.

Appendix 2

XRD Crystalline Phases Identified

RJ Lee Group, Inc.
350 Hochberg Road, Monroeville, PA 15146
Tel: (724) 325-1776 | Fax: (724) 733-1799

LABORATORY REPORT

RJ Lee Group, Inc.		Report Date:	December 9, 2010
350 Hochberg Rd		Samples Received:	December 3, 2010
Monroeville, PA 15146		RJ Lee Group Job No.:	TLH009830
ATTENTION:	Dr. Stephen Kennedy	Client Job No.:	N/A
Telephone:	724-325-1776	Purchase Order No.:	N/A

ANALYSIS: X-ray diffraction (XRD) for crystalline phases

A portion of the sample was ground and mounted into a standard XRD holder for analysis. The sample was run on a PANalytical X'Pert Pro diffractometer using copper radiation. The resulting diffraction pattern was then analyzed using the X'Pert HighScore program utilizing the ICDD database.

Client Sample No.: S-10-12-05
RJ Lee Group Sample No.: 3075275

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Minor-Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Amphibole*	$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Trace
Unknown(s)	-	Trace

**Further testing is necessary to confirm phase.*

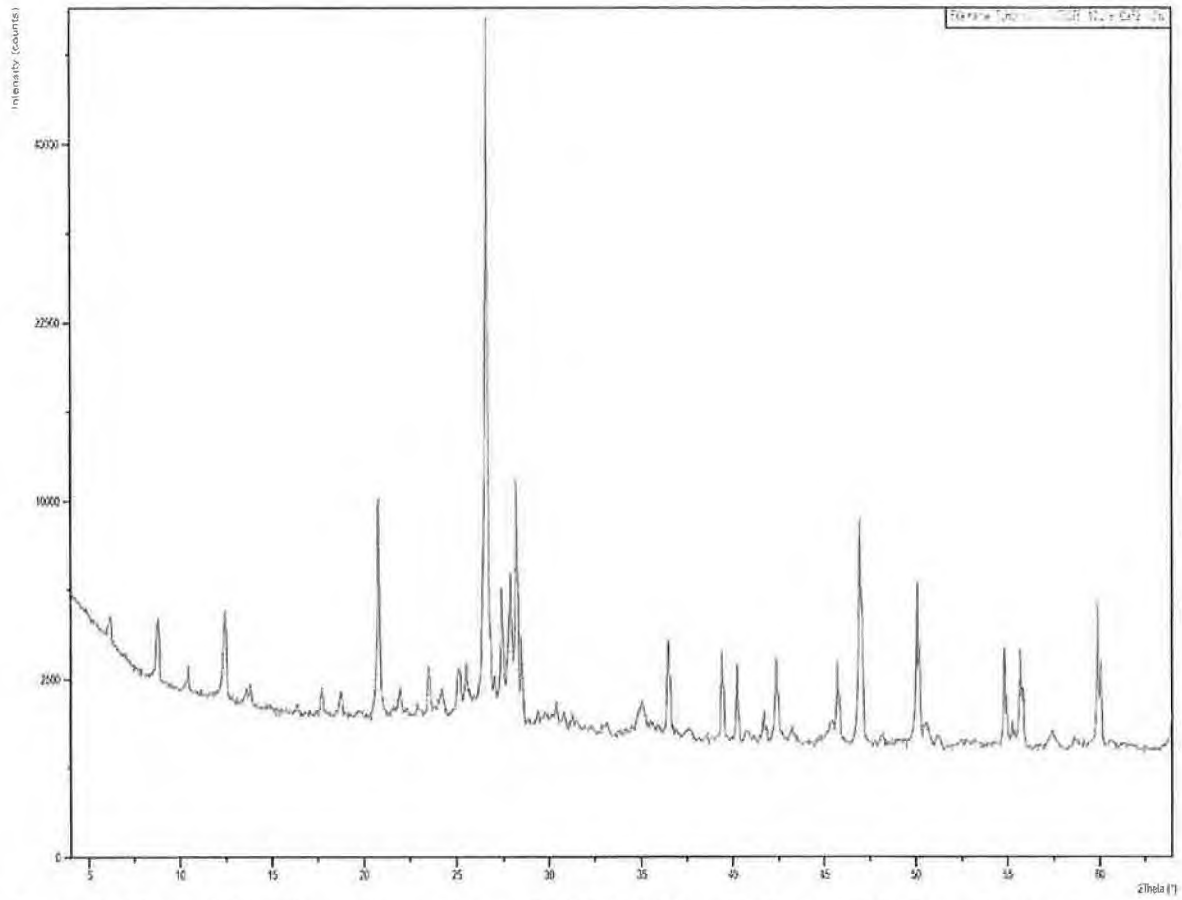

Figure 1 –X-ray diffraction pattern of sample *"3075275"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-12-42
RJ Lee Group Sample No.: 3075276

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Unknown(s)	-	Trace

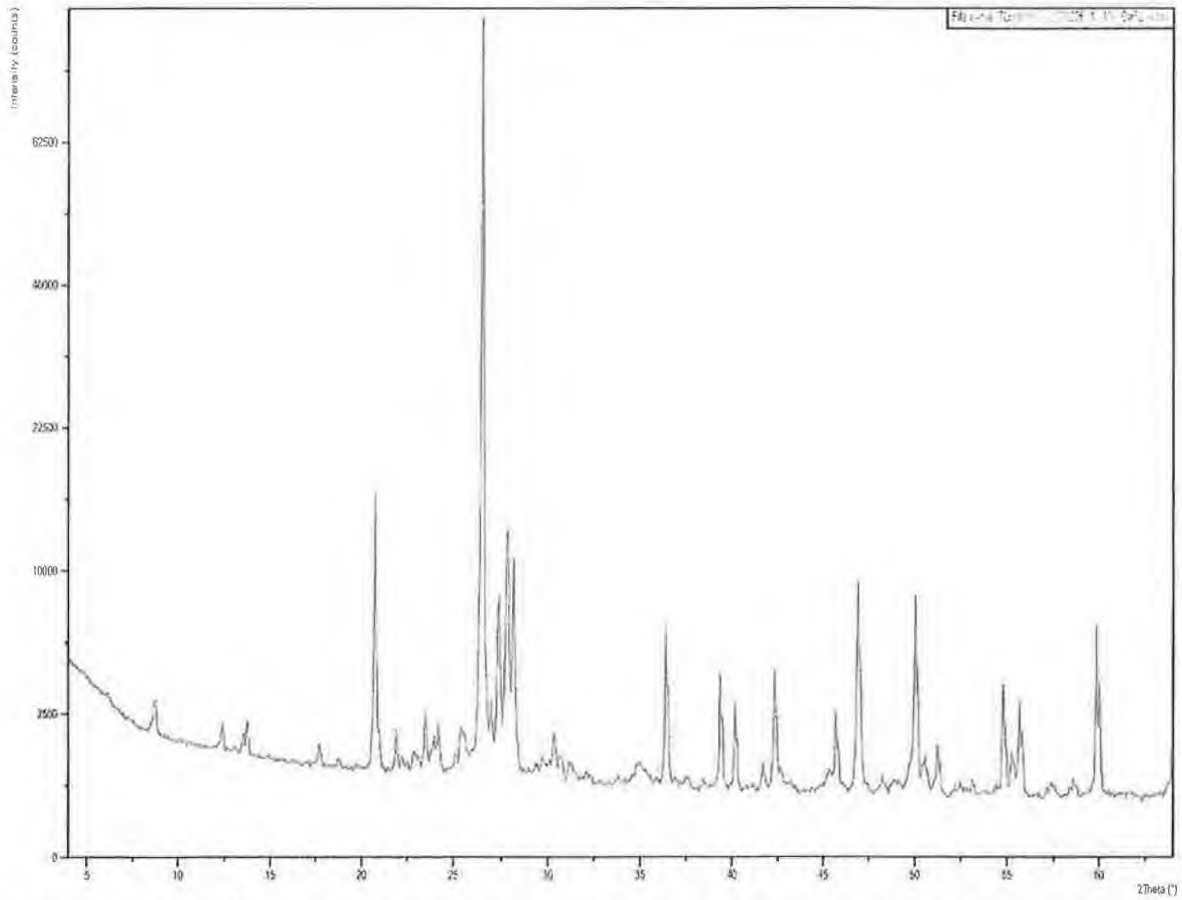

Figure 2 –X-ray diffraction pattern of sample *"3075276"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-12-65
RJ Lee Group Sample No.: 3075277

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Unknown(s)	-	Trace

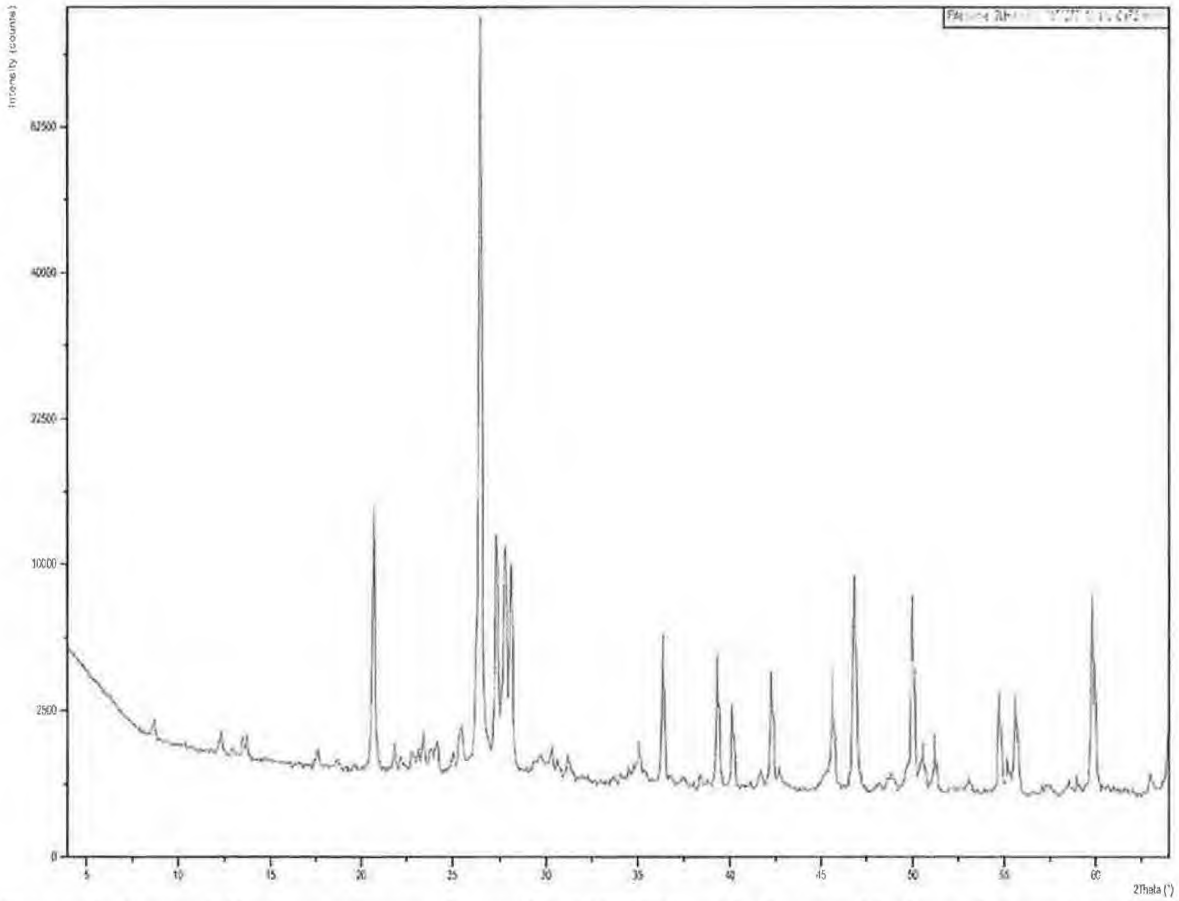

Figure 3 –X-ray diffraction pattern of sample *"3075277"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-13-23
RJ Lee Group Sample No.: 3075278

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Unknown(s)	-	Trace

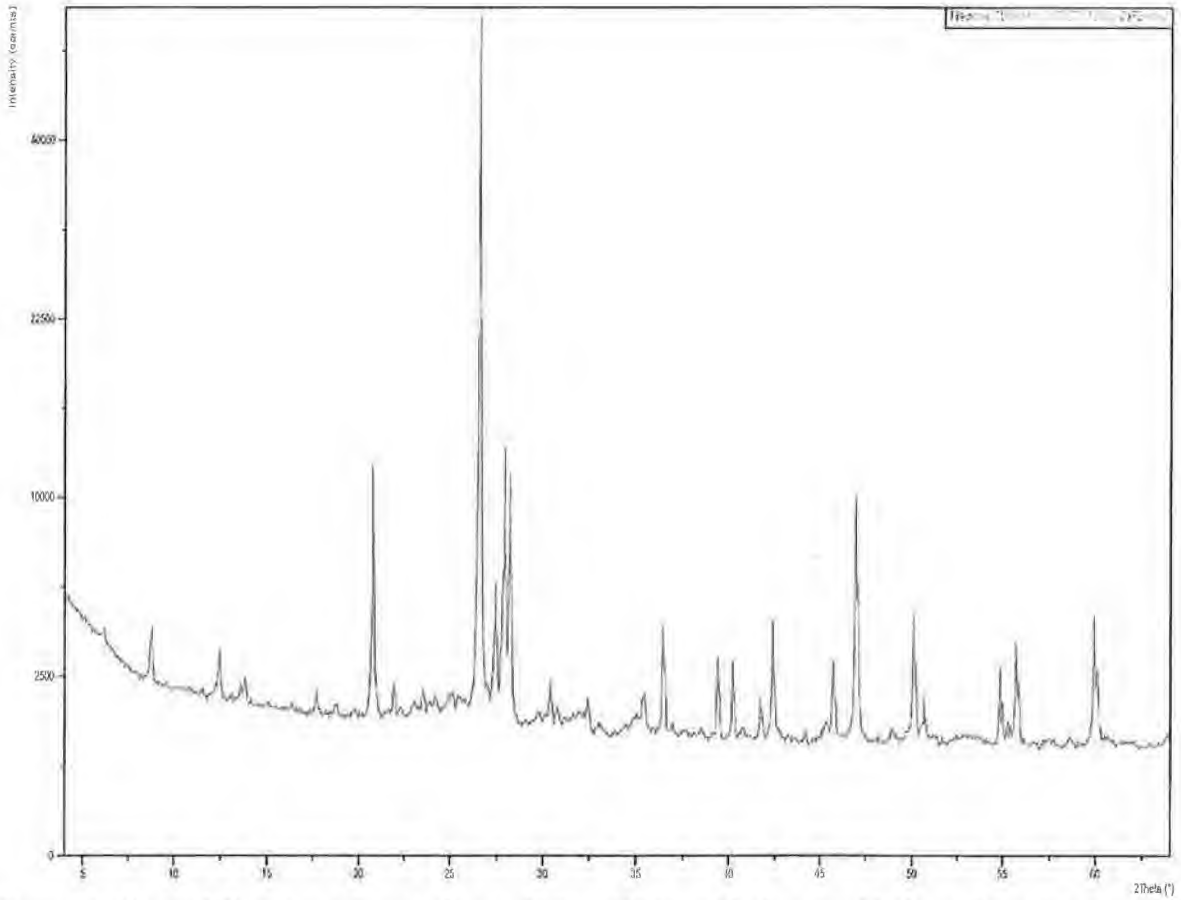

Figure 4 –X-ray diffraction pattern of sample *"3075278"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-13-83
RJ Lee Group Sample No.: 3075279

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Minor-Trace
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Unknown(s)	-	Trace

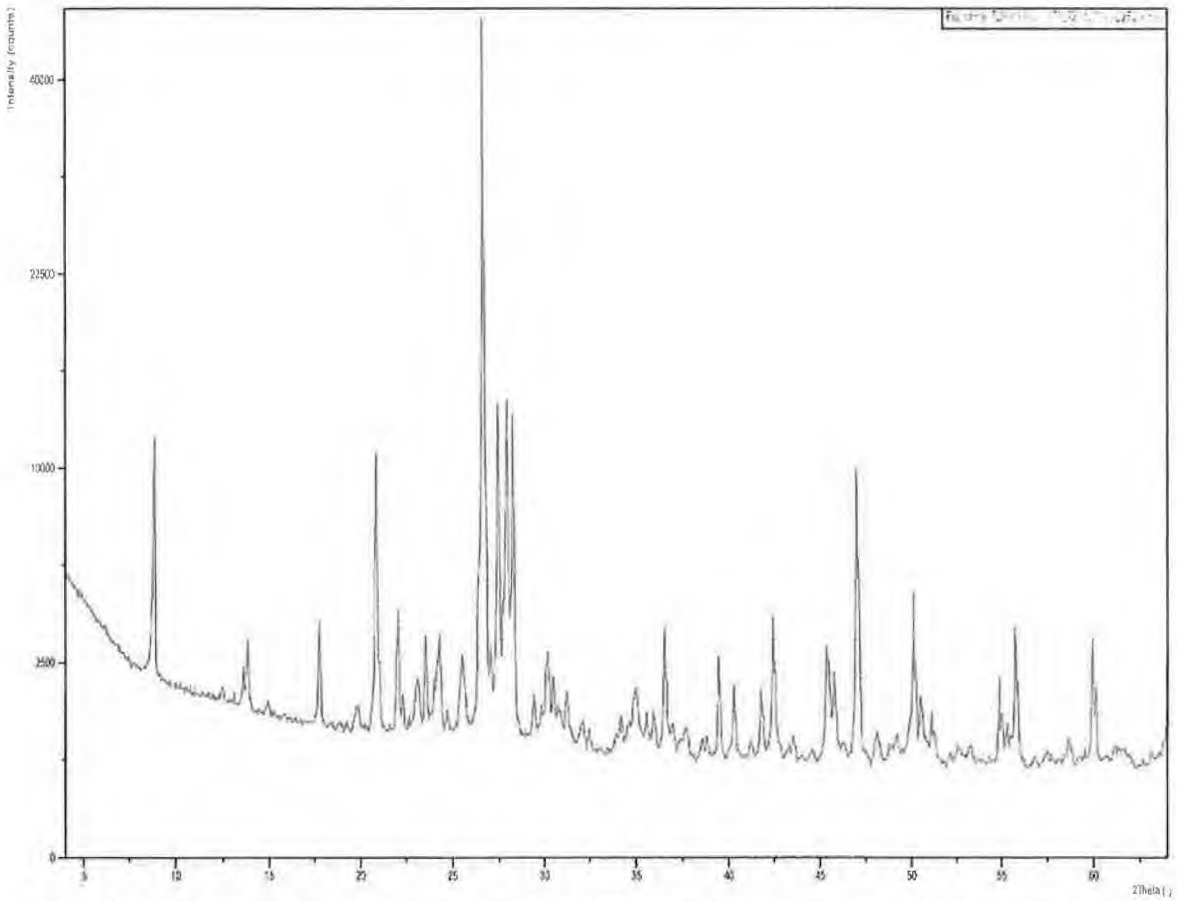

Figure 5 –X-ray diffraction pattern of sample *"3075279"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-14-10
RJ Lee Group Sample No.: 3075280

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Amphibole*	$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Trace
Unknown(s)	-	Trace

**Further testing is necessary to confirm phase.*

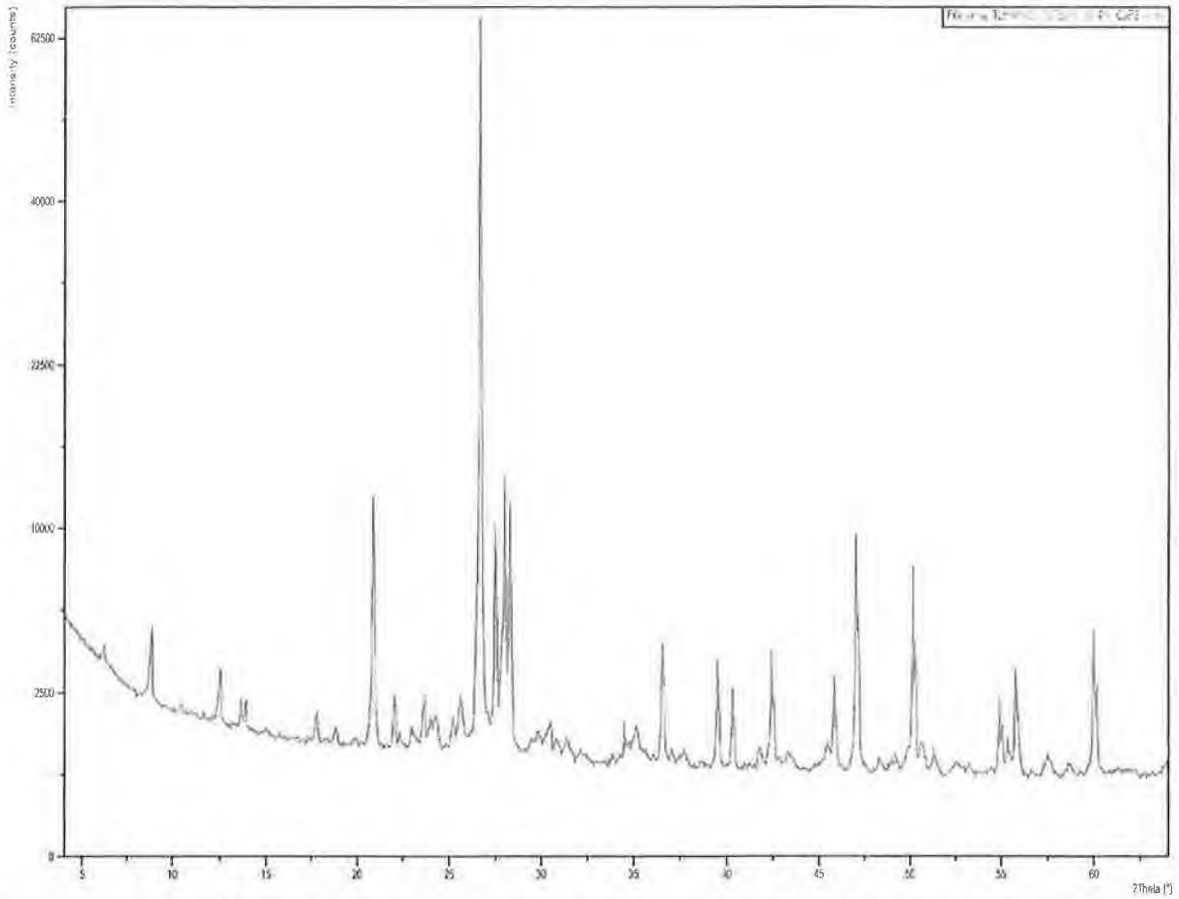

Figure 6 –X-ray diffraction pattern of sample *"3075280"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-14-15
RJ Lee Group Sample No.: 3075281

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Unknown(s)	-	Trace

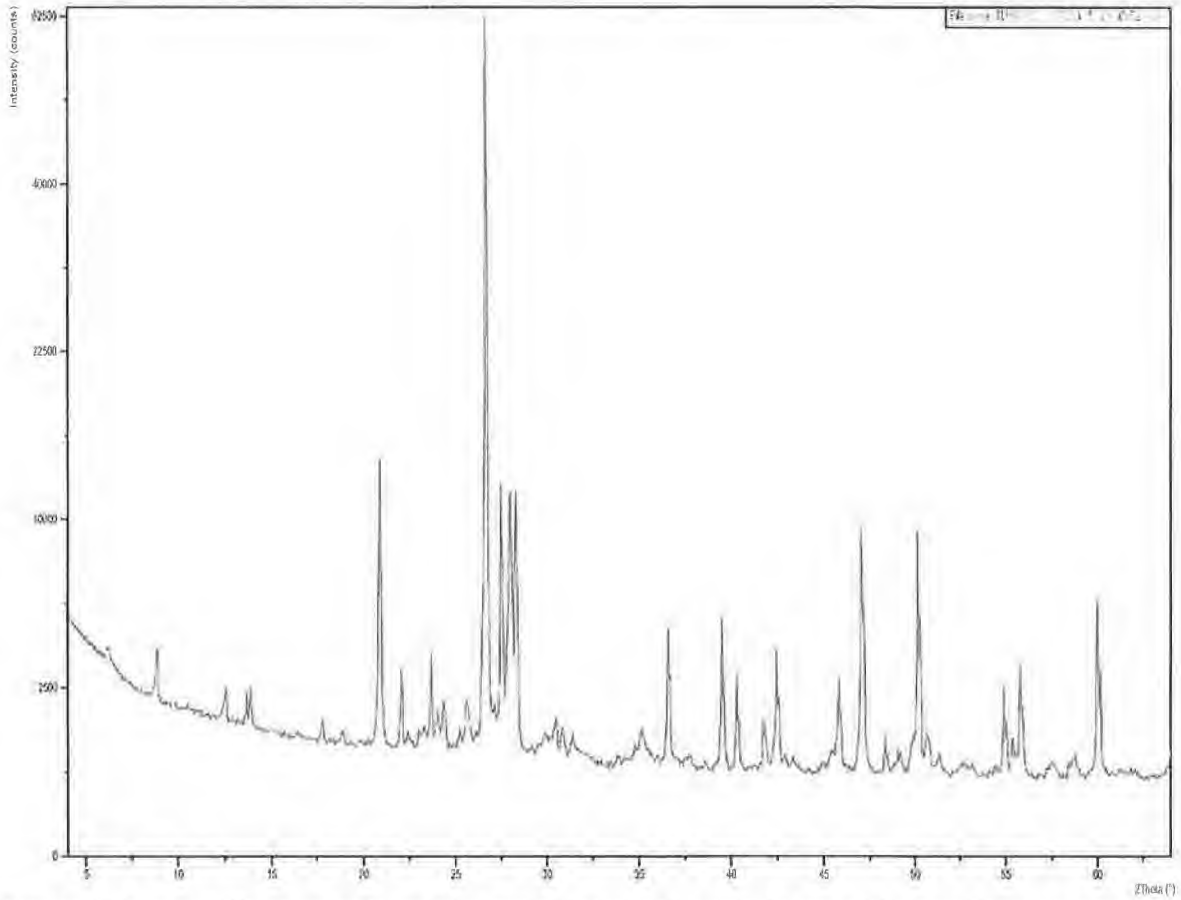

Figure 7 –X-ray diffraction pattern of sample *"3075281"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-14-20
RJ Lee Group Sample No.: 3075282

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Minor-Trace
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Minor-Trace
Amphibole*	$Ca_2(Fe,Mg)_5Si_8O_{22}(OH)_2$	Trace
Unknown(s)	-	Trace

**Further testing is necessary to confirm phase.*

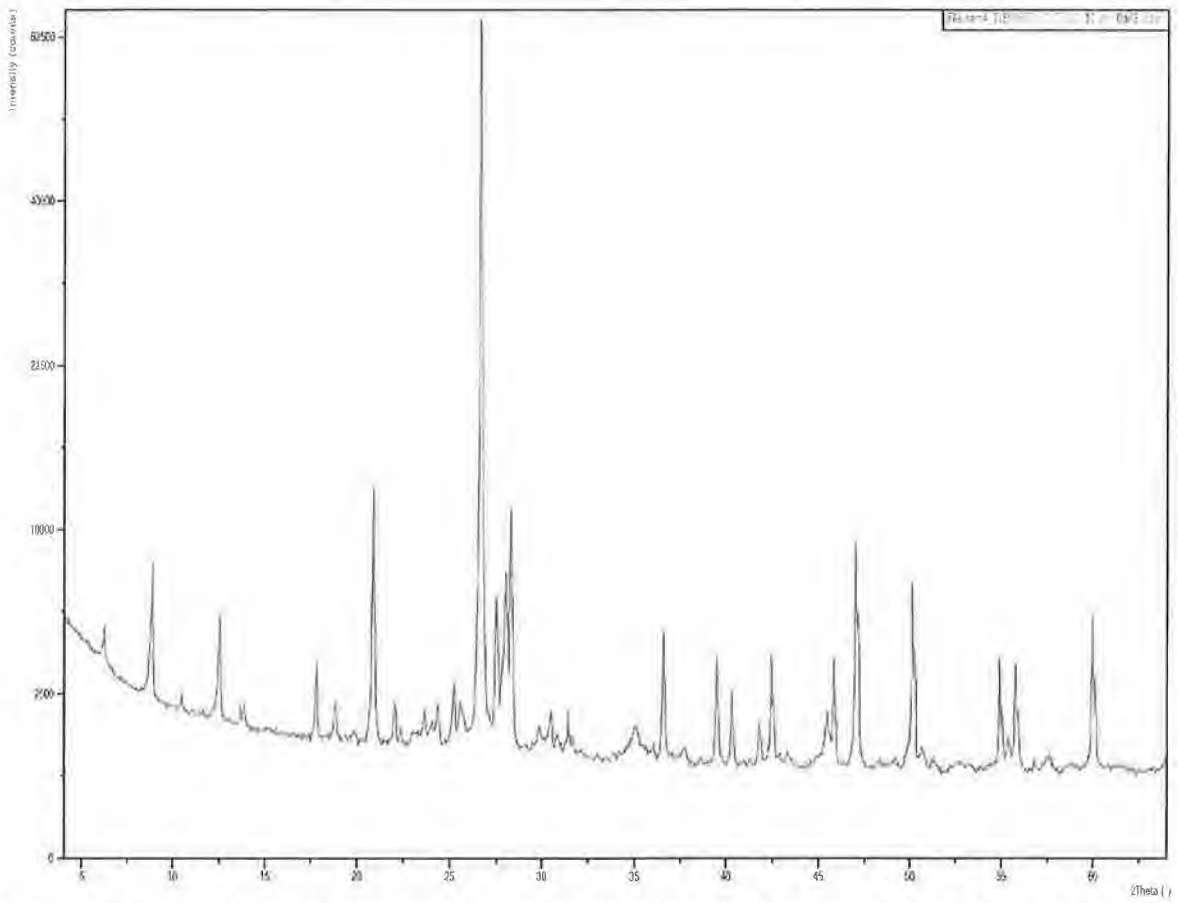

Figure 8 –X-ray diffraction pattern of sample *"3075282"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-14-27
RJ Lee Group Sample No.: 3075283

Phase	Composition	Concentration
Quartz	SiO_2	Major

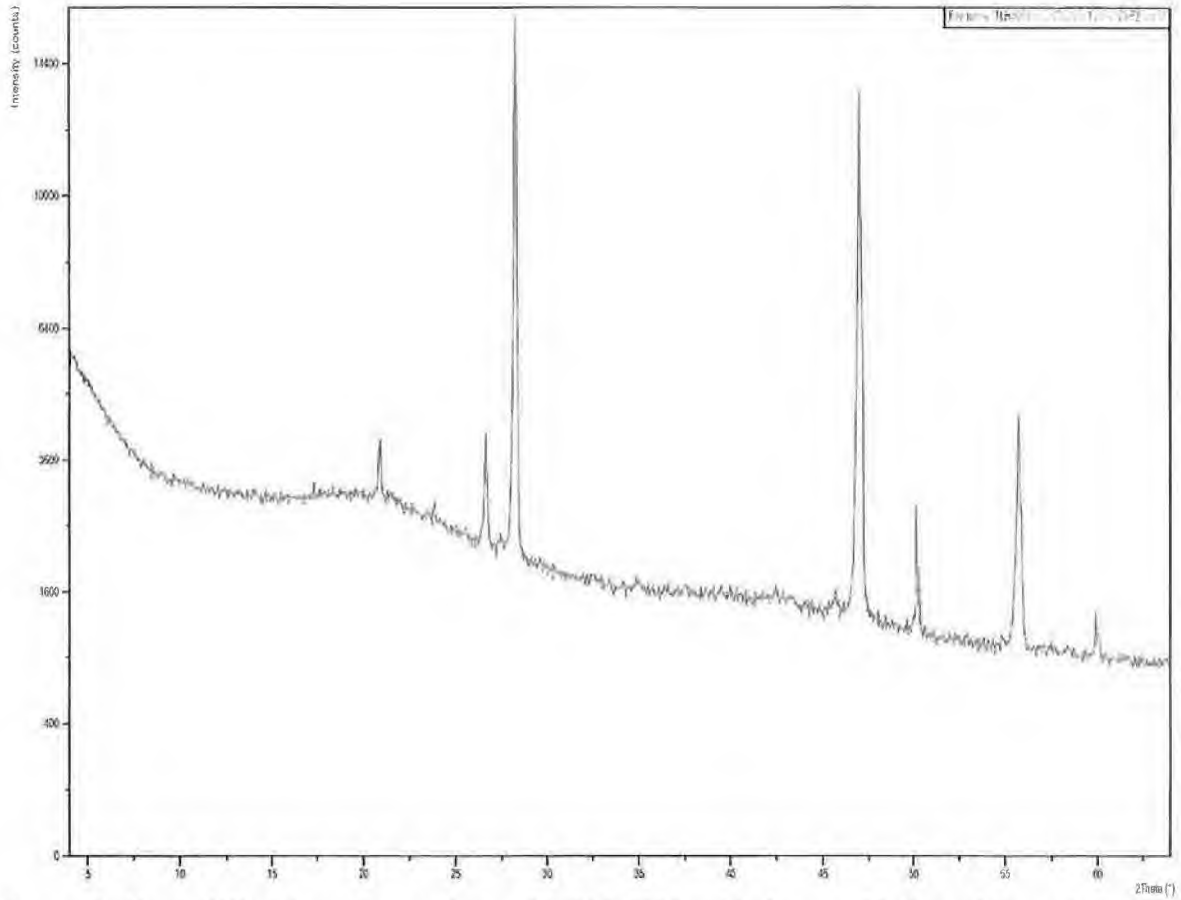

Figure 9 –X-ray diffraction pattern of sample *"3075283"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Client Sample No.: S-10-14-70
RJ Lee Group Sample No.: 3075284

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Unknown(s)	-	Trace

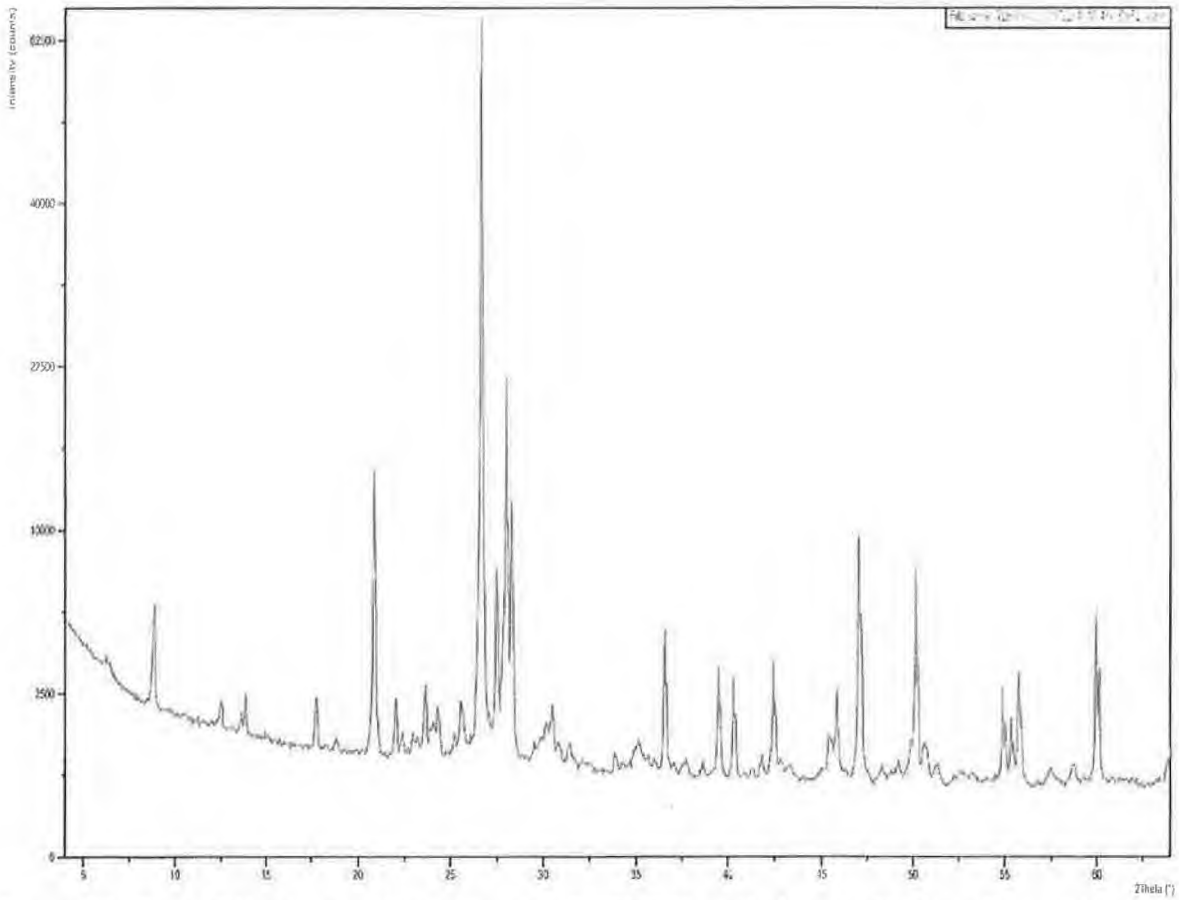

Figure 10 –X-ray diffraction pattern of sample *"3075284"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

ient Sample No.: S-10-14-75
RJ Lee Group Sample No.: 3075285

Phase	Composition	Concentration
Quartz	SiO_2	Major
Na Feldspar	$NaAlSi_3O_8$	Minor
K Feldspar	$KAlSi_3O_8$	Minor
Mica/Illite	$KAl_2(Si_3Al)O_{10}(OH)_2$	Trace
Chlorite	$(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$	Trace
Unknown(s)	-	Trace

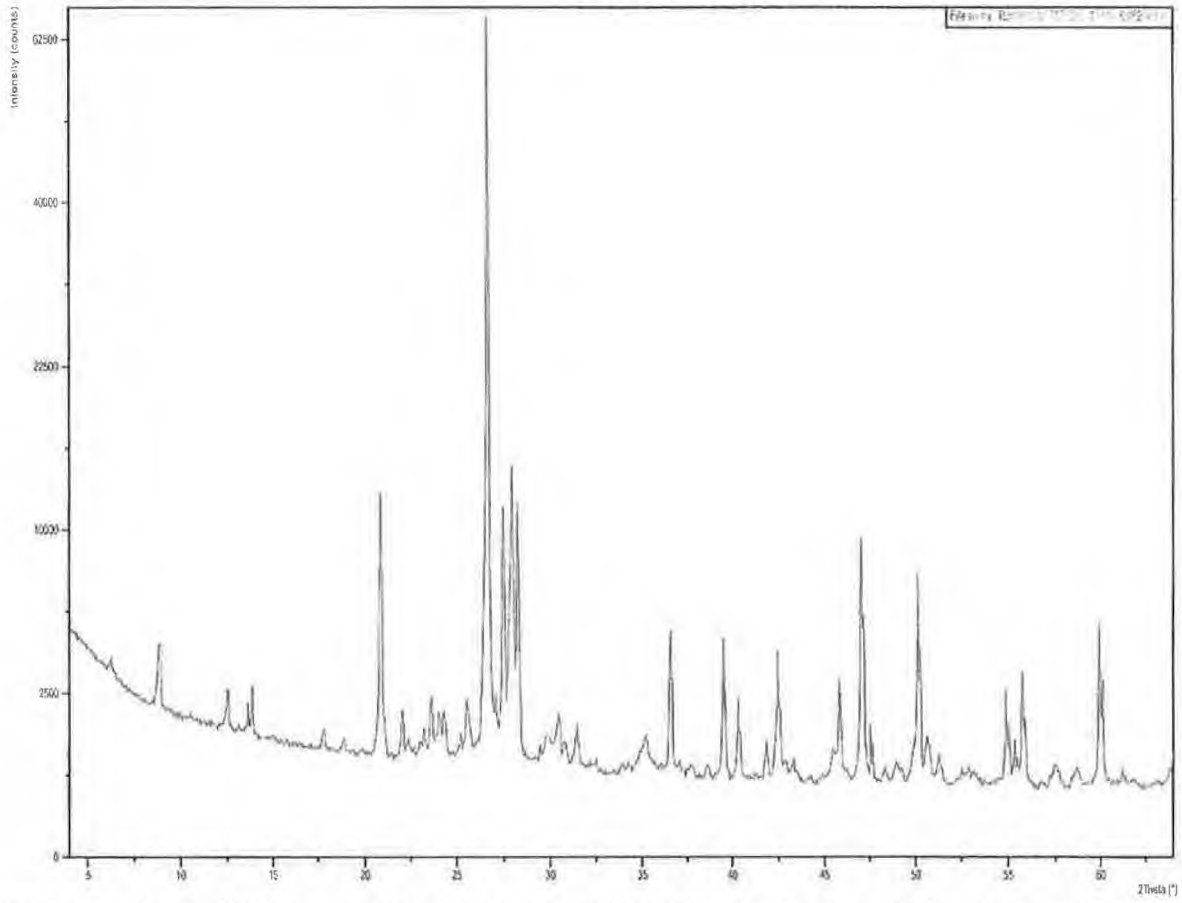

Figure 11 –X-ray diffraction pattern of sample *"3075285"*, with degrees 2θ along the x-axis and intensity (counts) along the y-axis.

Authorized Signature Heather L Adamson Date 12/9/10

Heather L. Adamson
Scientist, X-ray Diffraction Group