U.S. Army Environmental Center

FORT DEVENS
GROUP 1B SITES

FINAL
RADIOLOGICAL SURVEY
AND REMEDIATION REPORT
DRMO YARD

CONTRACT DACA31-94-D-0061
DELIVERY ORDER NUMBER 0003

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND

November 1996

PRINTED ON RECYCLED PAPER

FINAL
RADIOLOGICAL SURVEY AND REMEDIATION REPORT FOR DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) YARD FORT DEVENS, MASSACHUSETTS

CONTRACT DACA31-94-D-0061
DELIVERY ORDER NUMBER 0003

Prepared for:

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

Prepared by:

Radiation Science, Inc.
Cranbury, New Jersey

Oversight by:

ABB Environmental Services, Inc.
Wakefield, Massachusetts

NOVEMBER 1996

FINAL
RADIOLOGICAL SURVEY AND REMEDIATION REPORT
FOR
DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) YARD
FORT DEVENS, MASSACHUSETTS

Table of Contents

EXECUTIVE SUMMARY

This Radiological Survey Report has been prepared in accordance with the U.S. Army Environmental Center (USAEC) scope of work for Contract No. DACA31-94-D-0061, Delivery Order No. 0003, Modification 1. The scope of work modification sets forth the requirements for performing a radiological survey at the Defense Reutilization and Marketing Office (DRMO) Yard, Fort Devens, Massachusetts.

The DRMO Yard is currently undergoing environmental restoration as Area of Contamination (AOC) 32 in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The pavement and surface soils have been contaminated primarily with inorganics and polychlorinated biphenyls (PCBs) from yard operations. In addition to these findings, the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) conducted a preliminary survey to establish the history of radioactive sources at Fort Devens. The locations of sources, the activity of those sources, and the uses, accidents, and leaks that may have contaminated any areas at Fort Devens are presented by USACHPPM in an industrial radiation historical data review report entitled "Industrial Radiation Historical Data Review No. 27-43-E3QX-95 Fort Devens, Massachusetts" and dated November 7, 1994.

One of the outdoor sites identified in the report is the DRMO Yard which is located at the north end of the Main Post on the corner of Cook Street and Market Street in the town of Ayer. The DRMO Yard is comprised of three fenced enclosures. These fenced yards are identified in this report as the west yard, east yard and the tire recycling yard. According to the historical data review report by USACHPPM, there was a potential for radium contamination from jeep crushing activities that occurred within these yards. For an undetermined period of time, jeeps were crushed without removal of speedometer, fuel, temperature, battery and oil pressure gages with radium faces. Based on a record search, crushing potentially occurred within the north end of the east yard, the tire recycling yard, and on a 40- by-100-foot concrete pad (former building slab) east of Building 204. No crushing was reported to be performed within the west yard.

As a result of the preliminary survey by USACHPPM, the USAEC contracted ABB Environmental Services, Inc. (ABB-ES) to perform a radiological survey at the DRMO Yard to investigate for potential contamination from radium 226 (Ra-226) in soils and on paved surfaces. The Army identified the following areas as "affected" areas as defined by NUREG/CR-5849 *Manual for Conducting Radiological Surveys in Support of License Termination*, (NRC, 1992):

- The tire recycling yard (an approximate 2,915 square meter [m^2] unpaved area).

total beta/gamma measurements measured 28,623 ± 1303 beta/gamma disintegrations per minute (dpm)/100 square centimeters (cm^2) and 55 total alpha dpm/100 cm^2. The survey discovered no surface contamination on paved areas at any of the yards and no soil contamination within the tire recycling yard, the concrete pad area east of Building T-204, and the south portion of the east yard.

Following the radiological site survey, Radiation Science, Inc. returned to the site to excavate through the pavement and investigate/remediate the hot spot areas detected during the site survey at the north end of the east yard. Hot spot areas were found to be predominantly contaminated soil (only one fully intact dial was found below the pavement). Contaminated soil was containerized in five 55-gallon drums and relinquished to the Army for disposal. Composited samples were collected for each drum for laboratory analyses of Ra-226, PCBs, and Toxicity Characteristic Leaching Procedure (TCLP) Lead. Maximum concentrations were 89 picocuries per gram (pCi/g) above background Ra-226, 1,800 micrograms per kilogram (μg/kg) PCBs (Aroclor 1254), and 107,000 microgram per liter (μg/L) TCLP Lead. TCLP lead concentrations in two of the five drums exceeded the TCLP regulatory limit of 5,000 μg/L.

Upon soil removal, a composite soil sample was collected from the walls and bottom of each of the 10 hot spot excavations and from around the radium dial indicator and gage. All samples revealed Ra-226 concentrations below the release limit of 3.75 pCi/g. The average Ra-226 concentration of the 12 soil samples was 1.13 pCi/g, above background. This average value is approximately 30 percent of the release limit. Based upon the initial site survey and the remedial results, the east yard, tire recycling yard, and concrete pad area east of Building T-204 meet the release criteria established for total alpha contamination and Ra-226 concentrations in soil.

1.0 INTRODUCTION

The U.S. Army Environmental Center (USAEC) has directed ABB Environmental Services, Inc. (ABB-ES), under Contract No. DACA31-94-D-0061, Delivery Order No. 0003 Modification 1, to conduct radiological survey work at the Defense Reutilization and Marketing Office (DRMO) Yard, Fort Devens, Massachusetts.

The U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) conducted a preliminary survey to establish the history of radioactive sources at Fort Devens. The locations of sources, the activity of those sources, and the uses, accidents, and leaks that may have contaminated any areas at Fort Devens are presented by USACHPPM in an industrial radiation historical data review report (USACHPPM, 1994). One of the outdoor sites identified in the report is the DRMO Yard which is located at the north end of the Main Post on the corner of Cook Street and Market Street in the town of Ayer. The DRMO Yard is comprised of three fenced enclosures on both sides of Cook Street (Figure 1). These fenced yards are identified in this report as the west yard, east yard and the tire recycling yard. According to the historical data review report by USACHPPM, there was a potential for radium contamination from jeep crushing activities that occurred within these yards. For an undetermined period of time, jeeps were crushed without removal of speedometer, fuel, temperature, battery and oil pressure gages with radium faces. As a result of the preliminary survey by USACHPPM, the USAEC contracted ABB-ES to perform a radiological survey within the DRMO Yard to investigate for potential contamination from radium 226 (Ra-226) in surface soils and on paved surfaces.

USAEC also requested that ABB-ES search and review historical information to define more precisely where jeep crushing may have occurred within the DRMO Yard. The search for historical information involved interviewing Fort Devens personnel; reviewing historical aerial photographs, Fort Devens record vault drawings, and Department of Defense (DoD) regulations; and visiting the site to inspect topography and other site conditions (ABB-ES, 1995). The following information regarding site background and crushing operations was derived from this background research.

1.1 Site History

Formerly, the Army cut jeeps (in half or quarter following a predetermined and precise procedure) in the DRMO yard so that they could not be resold for use by the general public. Later, the Army discovered that buyers who bought the jeeps for "scrap metal" were welding the frames back together and selling them as operable jeeps. For liability purposes, the Army began to crush the jeeps. Army personnel crushed the jeeps using tank retrievers and other tracked vehicles. Later, contractors hired by the buyer crushed the jeeps by using the clam shell bucket of the crane as the jeeps were loaded to be

1.2 Surface Conditions

The west yard was constructed and paved in August 1979 when DRMO took over the property west of Cook Street and constructed Building P-213 (warehouse). Record drawings for Building P-213 and the west yard show that there was a layer of approximately 10 inches (in) of coal that remained from a former coal pile over the area prior to construction of the west yard.

Aerial photographs show that the entire east yard was completely paved sometime between 1969 and 1972. Based on conversations with DRMO personnel, jeep crushing was believed to have started after the east yard was paved. Between the fence that surrounds the east yard and the paved surface is an approximate 10-ft-wide perimeter that is covered with sporadic vegetation, gravel, and sand. There are two unpaved spots (approximately 20 to 30 feet [ft] in diameter) located in the northern portion of the east yard where pavement has been removed (believed to be associated with PCB spill cleanup). The yard most recently used for tire recycling at the north end of the east yard is totally unpaved.

During a site visit, ABB-ES noted the presence of coal fragments intermixed with the sand and gravel along the west fence of the east yard. In an aerial photograph taken in 1965, approximately 25 percent of the east yard (southwest side) appears noticeably stained (black), presumably with coal from the coal pile which, at the time, was located directly across Cook Street. Coal ash was also formerly hauled down Cook Street, past the DRMO Yard, for disposal in the Shepley's Hill landfill. The presence of coal and coal ash in the east yard (and perhaps the tire recycling yard) could influence the results of a radiological survey due the potential presence of naturally occurring radioactive uranium, radium or potassium. As a result, a background survey was performed in consideration of these possible influences (refer to Section 3.0, Survey Methods).

The concrete pad located east of Building T-204 is surrounded by pavement on the west end and vegetation on the remaining three sides.

1.3 Other Contaminants

The DRMO Yard is also currently undergoing environmental restoration as Area of Contamination (AOC) 32 in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The pavement and surface soils have been contaminated primarily with inorganics and PCBs from yard operations.

2.0 RELEASE CRITERIA

The release criteria for this project are based on NUREG-1500, "Working Draft Regulatory Guide on Release Criteria for Decommissioning". A discussion of the release criteria and their derivation is provided in the Radiological Work Plan (ABB-ES, 1995). These release criteria are 1,020 disintegrations per minute (dpm)/100 square centimeters (cm^2) total surface alpha contamination, and 3.75 picocuries (pCi) of Ra-226 per gram (g) of soil, above locally determined background levels.

3.0 SURVEY METHODS

The site survey was conducted as described in the Radiological Survey Work Plan (ABB-ES, 1995) and follows the recommendations provided in NUREG-5849, "Manual for Conducting Radiological Surveys in Support of License Termination" (NRC, 1992). Table 1 summarizes the type and frequency of survey that was performed in each area.

Ten locations (Figure 2) approximately 300 to 500 ft west of the site survey area were used to determine background levels for dose rates, gamma count rate, and Ra-226 concentration in soil. This area included both paved and unpaved surfaces, as well as areas where coal was stored previously. Background for each type of surface, as well as soil concentrations were determined and results are reported in Appendix B.

The DRMO Yard was divided into four survey units: (1) tire recycling yard (unpaved), (2) east yard north (paved with unpaved areas), (3) east yard south of the concrete barriers (paved with unpaved areas), and the concrete pad east of Building T-204 (concrete surface and unpaved perimeter). Only the east yard south of the concrete barriers was designated an "unaffected unit". A 10-m-by-10-m grid was established over all areas, as depicted in Figure 3. All survey results are keyed to those grid identification numbers.

Each grid was scanned with a 2- by-2-inch sodium iodide (NaI) crystal, with the meter in ratemeter mode. Using the audio output to identify hotspots, the detector was held 3 inches above ground level and was moved over the area at a slow pace. Any location exhibiting elevated count rates was identified for further investigation. The range of count rates detected in each grid is reported.

Measurements of the total alpha and total beta/gamma surface activity were made at any hotspots identified during the gamma scan. In addition 30 random locations were selected for measurement in each paved survey unit, the east yard (north and south of the concrete barrier) and the concrete pad.

Dose equivalent measurements were obtained at waist level with a Bicron tissue

tools. The pieces of pavement were scanned and disposed as radioactive or non-radioactive based on the scan results. Five 55-gallon drums of waste were generated and relinquished to the Army for disposal at an approved disposal facility as directed by the Radiation Waste Division of the Industrial Operations Command (IOC), Rock Island, Illinois. Hot spot areas were found to be predominantly contaminated soil (only one fully intact dial was found below the pavement). Composited samples were collected for each drum for laboratory analyses of Ra-226, PCBs, and Toxicity Characteristic Leaching Procedure (TCLP) Lead. Maximum concentrations were 89 pCi/g above background Ra-226, 1,800 micrograms per kilogram (μg/kg) PCBs (Aroclor 1254), and 107,000 microgram per liter (μg/L) TCLP Lead. TCLP lead concentrations in two of the five drums exceeded the TCLP regulatory limit of 5,000 μg/L. Drum characterization results are summarized in Table 2. PCB and TCLP Lead QC Summaries and Chain of Custody documentation for Drums 1 through 5 are provided in Appendix E. Data quality review for Ra-226 analyses is summarized in Section 5.0. The results of radiological dose rate and smear surveys performed on the drums for staging and transportation purposes are included in Appendix F.

At the end of each phase of remediation, a soil sample was obtained from the bottom and sides of the excavation for each hotspot. The average value from the 12 soil samples obtained in the excavated hotspots was 1.13 pCi/g of Ra-226, above background. This is approximately 30 percent of the release limit.

5.0 DATA QUALITY REVIEW

Providing quality data for a remediation project is based on certain key elements as discussed in EPA guidance documents (EPA 504/G-93/071). These are known as PARCC (precision, accuracy, representativeness, completeness, and comparability) parameters. In addition, the sensitivity of measurements, expressed as the Minimum Detectable Activity (MDA) must be sufficiently low to detect contamination that is less than or equal to 25 percent of the release criteria (NRC, 1992). The process for assessing these parameters, as well as the project specific results, are discussed below.

Field measurements and quality control were provided by RSI. Laboratory measurements and quality control were provided by PACE, ESE and Quanterra, with the data quality review conducted by RSI.

5.1 Field Measurements

Precision. Precision is a test of how closely a measurement can be replicated. Replicate measurements for total alpha and beta contamination were made by obtaining two one-minute counts in sequence at the same location. Slightly more than 4 percent of the total measurements were duplicated in this manner. The formula below was used to

For this project the data is 100 percent representative. All hotspots identified during the scanning survey were subsequently proven to be hotspots based on the samples obtained during the remediation phase.

Completeness. Completeness is a measure of the amount of valid data obtained compared to the amount that was specified. For the purposes of evaluation, data defined as invalid through a QA review is subtracted from the complete data set to determine the number of valid data points. Generally, completeness greater than 95 percent is desirable. For the field measurements of dose rate, alpha, and beta contamination, all data obtained was valid, thereby providing 100 percent completeness.

Comparability. Comparability is a non-quantitative evaluation of the agreement between different types of data sets which should be, intuitively, related to each other. For example, on this project, all locations exhibiting elevated dose rates, also exhibited elevated gamma count rates, illustrating total comparability of these two data sets. Although the beta contamination has a relatively short range, it too is comparable with the gamma data. The alpha results are not comparable with any other data, as its range of affect is limited to several centimeters.

Sensitivity. To determine the suitability of a meter for a measurement, the MDA is compared with the project specific release limits. The minimum detectable activity was calculated using an equation from NUREG-5849, and the average of the daily background and source checks. The MDA for total alpha measurements (55 dpm/100 cm^2) was 5.4 percent of the fixed contamination release limit (1,020 dpm/100 cm^2). Therefore, the instrumentation employed was suitable for detecting contamination at the release limit and distinguishing it from background. MDA calculations are presented in Appendix D, as well as calibration certificates for field instrumentation.

5.2 Laboratory Analysis

For the initial survey, PACE analyzed 210 soil samples by gamma spectroscopy to determine the Ra-226 concentration. In the next phase, 18 soil samples were analyzed by Quanterra and ESE to confirm the efficacy of remediation. The first contract laboratory, PACE, was no longer in business at the time of the data review.

Precision. To assess the precision, (reproducibility) of laboratory analysis, PACE re-analyzed 20 samples out of 210, roughly 10 percent. The re-analysis was an immediate recount of a sample on the same detector. The average RPD was 6 percent with a range of zero to 14 percent. However, an error was discovered in the reporting of QA data. A duplicate analysis was reported as 0.75 pCi/g for both counts, yet the raw data provides two different values, 0.73 pCi/g and 0.75 pCi/g. This is merely a transcription error and does not affect the quality of the data.

Completeness. For the first phase of laboratory analysis, conducted by PACE, 210 soil samples were specified. Chain of custody forms and analytical results indicate all 210 samples were received, prepared, analyzed, and reported, with no losses or rejections. Therefore, the laboratory data for this phase was 100 percent complete.
In the second phase, a minimum of one sample from each remediated hotspot was expected, and a minimum of one sample from each hotspot was obtained. All samples collected were received by the laboratories intact and subsequently analyzed. Those results, as reported here, are acceptable and provide 100 percent completeness of the laboratory data for this project.

Comparability. Because this parameter relates two data sets, and the laboratory data only produced a single data set (Ra-226 in soil) it is difficult to compare the results within a laboratory. However, comparability between the laboratory and field data was high. That is, hotspots identified in the field produced soil samples with elevated Ra-226 concentrations.

Sensitivity. MDA calculations were provided by all laboratories as part of the computer generated data report. The counting error due solely to random statistical fluctuations, expressed as sigma, was evaluated as part of the analytical sensitivity. NUREG-5849 recommends the 2 sigma error be less than 20 percent of the reported value.

The MDA values for PACE (pre-remediation) were on the order of 0.2 to 0.3 pCi/g, less than 10 percent of the Ra-226 release criteria of 3.75 pCi/g. The statistical counting error at the 95 percent level, (2 sigma) was generally less than 20 percent of the reported value.

Quanterra results were reported with MDAs at an average value of 1.2 pCi/g, approximately 32 percent of the release criteria. In addition, the two sigma errors are on the order of 40 to 50 percent of the reported results. This may be due to the small sample size (45 g), and the inhomogeneity of the contaminant, as previously discussed in the paragraph entitled "Precision".

ESE counted all samples for a sufficient length of time to ensure all results were above their minimum detectable activity.

5.3 Overall Data Evaluation

The data is suitable for use, and adequately characterizes the contamination levels on site. Comparing the 95 percent confidence level upper limit of the measured values (i.e. result $\pm$ 2 sigma) to the release criteria provides an added margin of safety in assuring compliance with the release criteria.

References

ABB Environmental Services, Inc. (ABB-ES), 1995 "Final Radiological Survey Work Plan, Defense Reutilization and Marketing Office (DRMO) Yard, Fort Devens, Massachusetts"; August 4, 1995

ABB Environmental Services, Inc. (ABB-ES), 1995. Memorandum entitled "Historical Data Search and Radiological Survey Implications AOC 32 (DRMO Yard), Fort Devens, Massachusetts"; June 16, 1995.

ABB Environmental Services, Inc. (ABB-ES), 1996 "Final Radiological Survey Work Plan Addendum, Defense Reutilization and Marketing Office (DRMO) Yard, Fort Devens, Massachusetts"; February 14, 1996.

U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM), 1994. "Industrial Radiation Historical Data Review No. 27-43-E3QX-95 Fort Devens Massachusetts"; November 7, 1994.

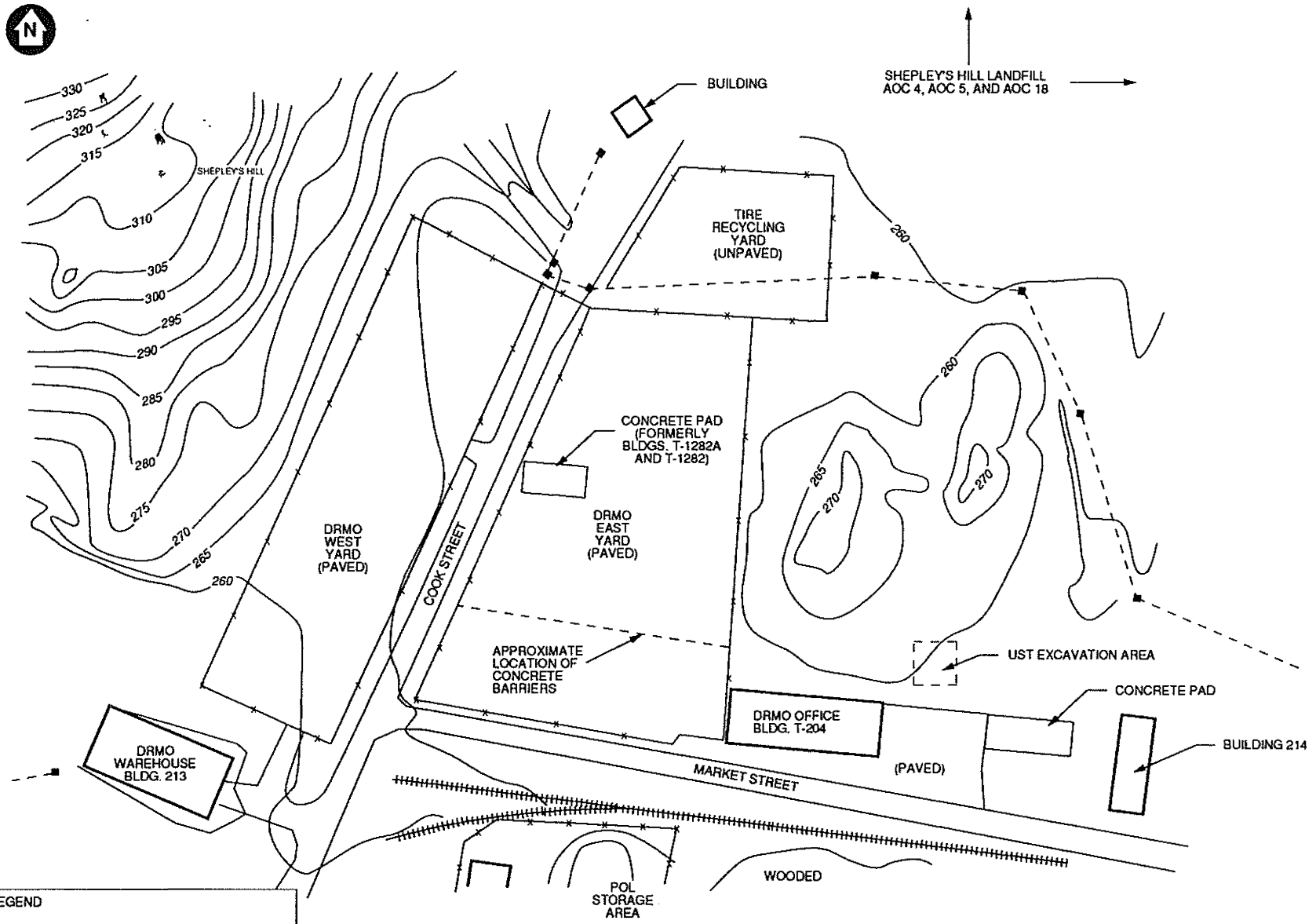
U.S. Environmental Protection Agency (EPA), 1994 EPA 540/G-93/071 Data Quality Objectives Process for Superfund. Washington, DC 1994.

U.S. Nuclear Regulatory Commission (NRC), 1994. "NUREG-1500 Working Draft Regulatory Guide on Release Criteria for Decommissioning: NRC Staff's Draft for Comment". Draft Report for Comment, August, 1994.

U.S. Nuclear Regulatory Commission (NRC), 1992. "NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination", Prepared by J. D. Berger, Environmental Survey and Site Assessment Program, Energy/Environmental Systems Division, Oak Ridge Associated Universities, Oak Ridge, TN; Prepared for U.S. Nuclear Regulatory Commission; Draft Report for Comment, June 1992.

U.S. Nuclear Regulatory Commission (NRC), 1995 NUREG-1506 Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria. Draft Report for Comment, August 1995.

U.S. Nuclear Regulatory Commission (NRC), 1995a NUREG-1507 Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. Draft Report for Comment, August 1995.

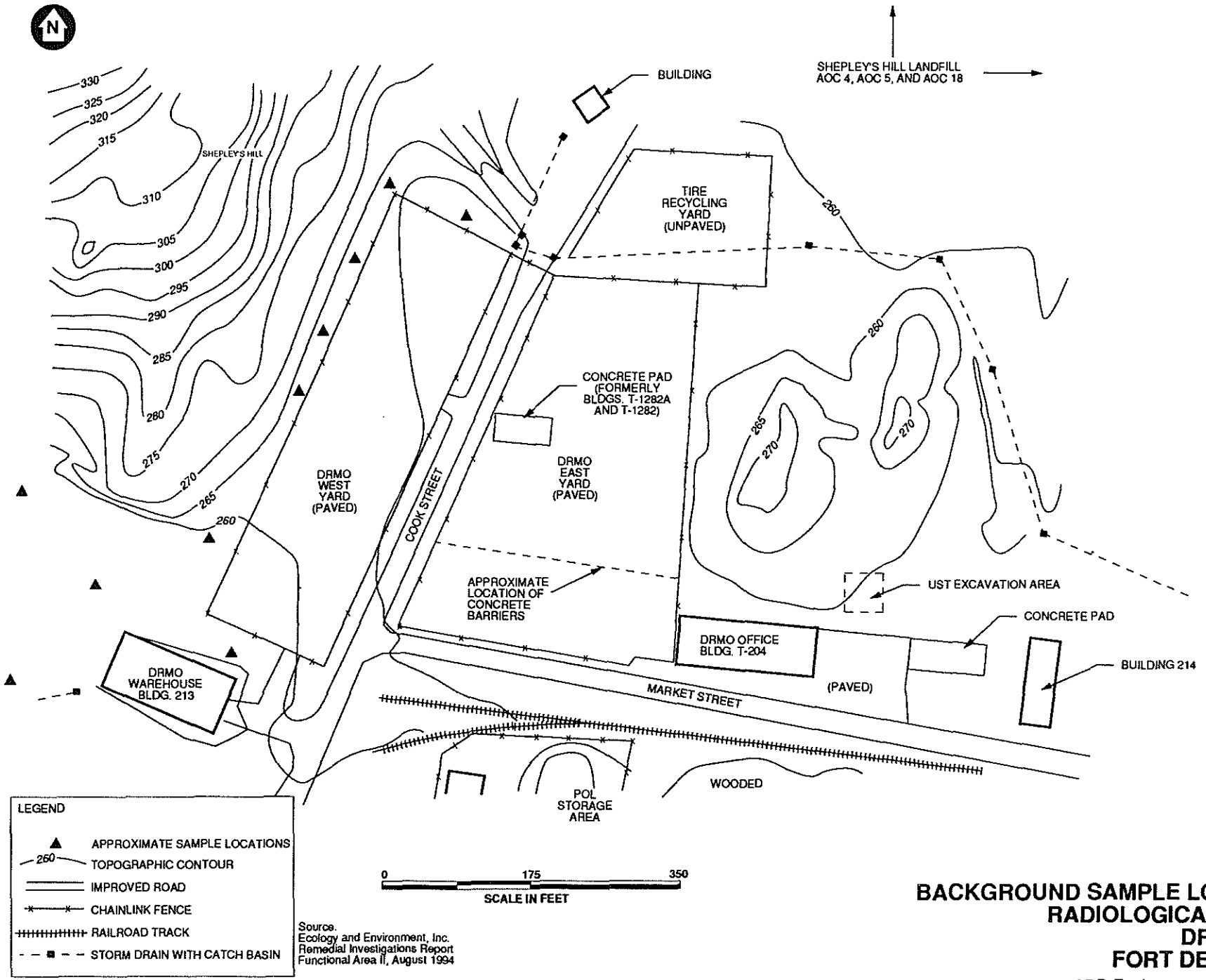


Source:
Ecology and Environment, Inc.
Remedial Investigations Report
Functional Area II, August 1994.

FIGURE 1
YARD LOCATIONS
RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MA

ABB Environmental Services, Inc.

9376-01 A



Source:
Ecology and Environment, Inc.
Remedial Investigations Report
Functional Area II, August 1994

FIGURE 2
BACKGROUND SAMPLE LOCATIONS
RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MA

ABB Environmental Services, Inc.

9376-01 A

DRMO Grid Identification Map

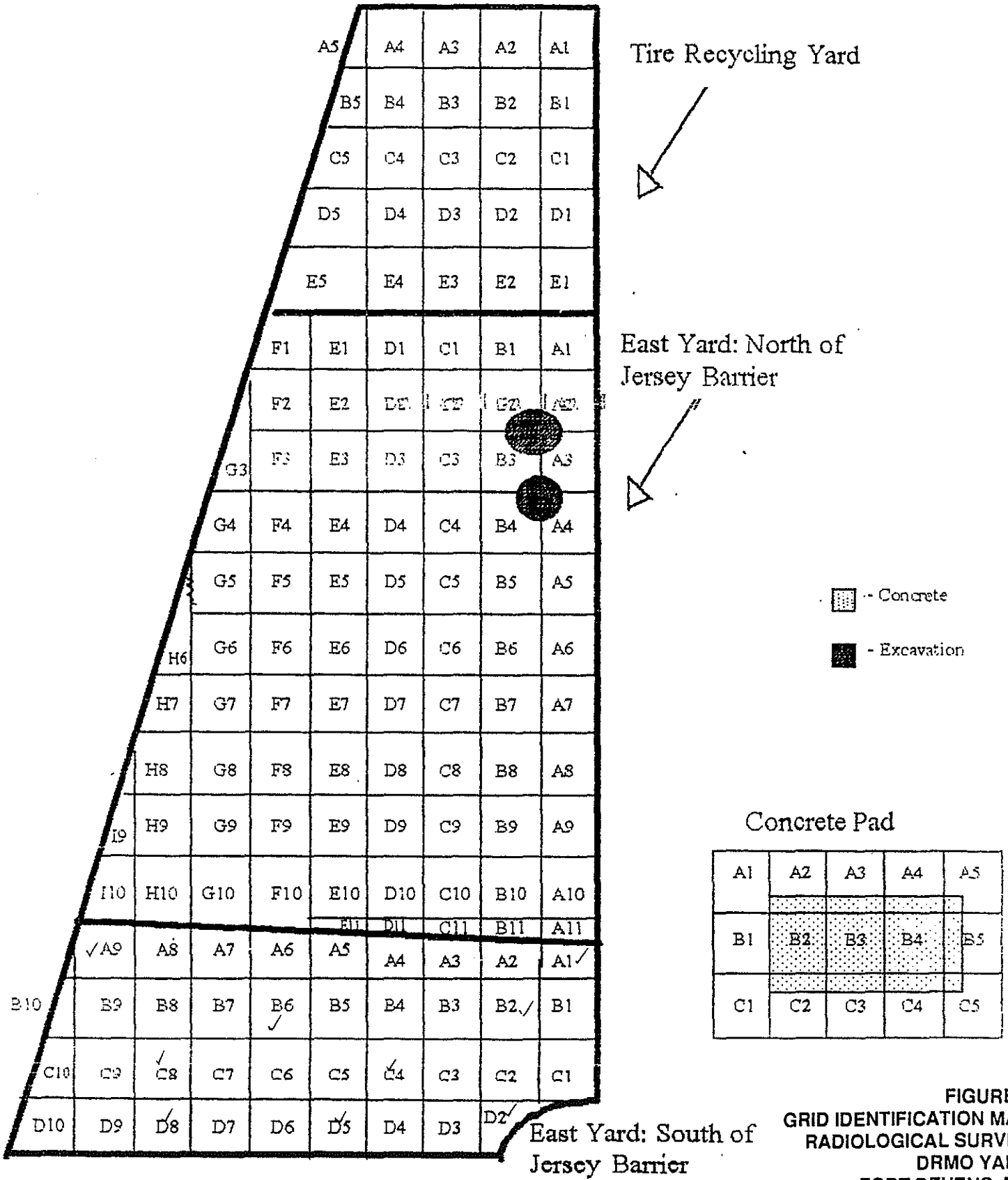
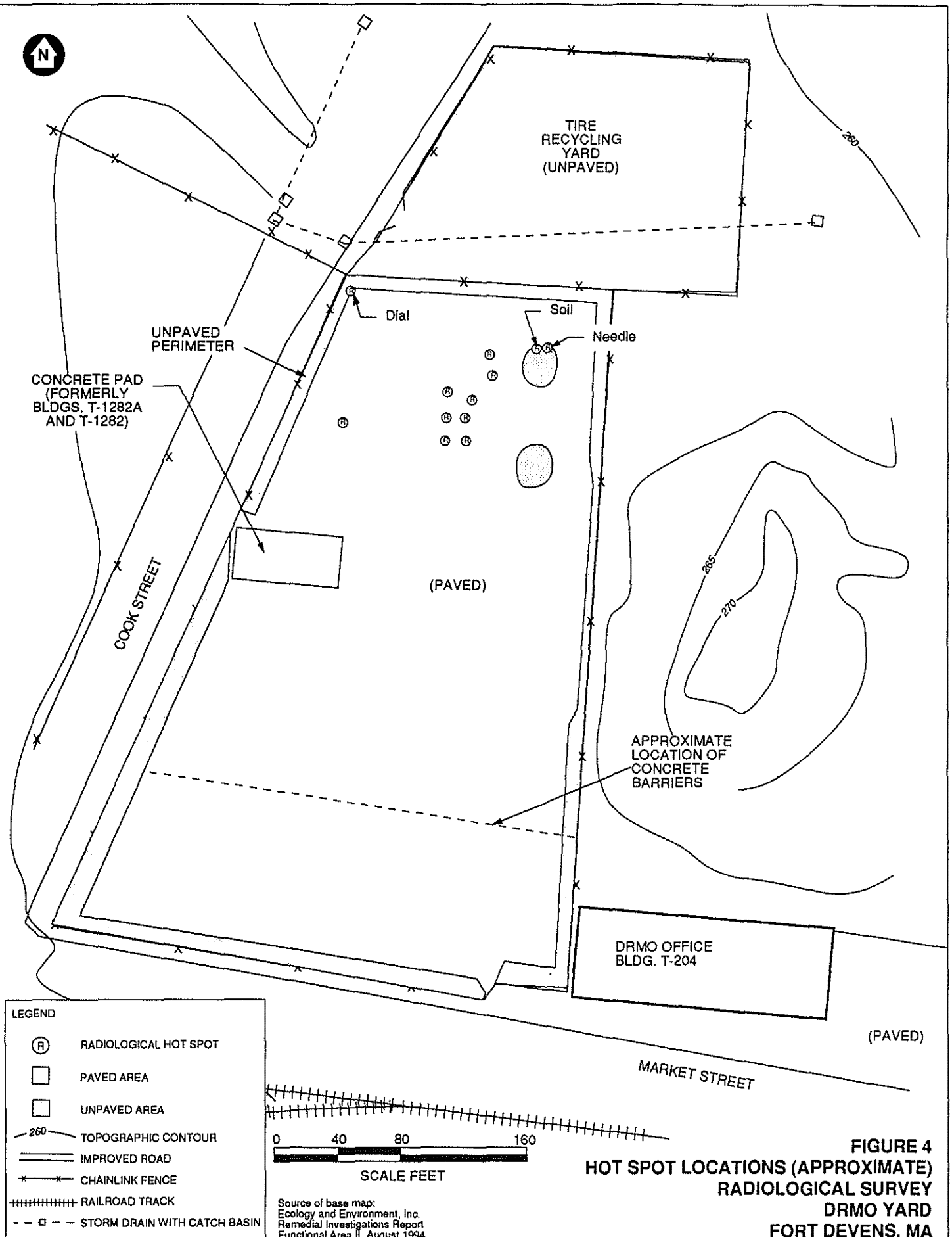


FIGURE 3
GRID IDENTIFICATION MAP
RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MA



Source of base map:
Ecology and Environment, Inc.
Remedial Investigations Report
Functional Area II, August 1994.

FIGURE 4
HOT SPOT LOCATIONS (APPROXIMATE)
RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MA
ABB Environmental Services, Inc.

9376-01 B

TABLE 1
RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MASSACHUSETTS

SITE AREA	AREA CLASSIFICATION	SURVEY ELEMENTS	MEASUREMENT/SAMPLING FREQUENCY
East Yard - North of Jersey Barriers (6,980 m^2 paved; 690 m^2 unpaved)	Affected Area; Paved surface w/ unpaved perimeter	(1) Gamma surface scan (cpm); (2) Direct measurements for: a) Surface activity (dpm/100cm^2); b) Dose rate (μR/hr); and (3) Soil sampling at unpaved perimeter.	(1) scanning 100% of paved and unpaved area (7,670 m^2); (2a) 30 randomly selected locations (paved area); (2b) 1 measurement/100 m^2 of paved and unpaved areas; and (3) 4 samples every 100 m^2 within unpaved borders (690 m^2)
East Yard - South of Jersey Barriers (2,330 m^2 paved; 500 m^2 unpaved)	Unaffected Area; Paved surface w/ unpaved perimeter	(1) Gamma surface scan (cpm); (2) Direct Measurements of: a) Surface activity (dpm/100cm^2); b) Dose rate (μR/hr); and (3) Soil sampling at unpaved perimeter.	(1) scanning 10% of paved and unpaved areas (283 m^2); (2a) 30 randomly selected locations (paved area); (2b) 30 randomly selected locations (paved and unpaved area); and (3) 30 randomly selected samples within unpaved areas.
Tire Recycling Yard (2,915 m^2 unpaved)	Affected Area; Unpaved surface	(1) Gamma surface scan (cpm); (2) Direct measurements of dose rate (μR/hr); and (3) Soil sampling of surface soils	(1) scanning 100% of area (2,915 m^2); (2) 4 measurements every 100 m^2; and (3) 4 samples every 100 m^2.
Concrete Pad (east of Bldg T-204) (370 m^2 concrete; and 1,000 m^2 unpaved and 220 m^2 paved perimeter area	Affected Area; Concrete surface w/ grass and paved perimeter	(1) Gamma surface scan (cpm); (2) Direct measurements of: a) Surface activity (dpm/100cm^2); b) Dose rate (μR/hr); (3) Soil sampling at unpaved perimeter of concrete pad.	(1) scanning 100% of concrete area and 10 meter wide perimeter area (approx. 1,600 m^2); (2a) 30 (total) randomly selected locations (concrete pad and paved perimeter area); (2b) 1 measurement/100 m^2 of entire area; and (3) 4 samples every 100 m^2 within 10 m unpaved perimeter of pad.
Background	____	(1) Gamma surface scan (cpm); (2) Direct measurements 1 meter above the surface for dose rate (μR/hr); and (3) Soil sampling.	(1,2,& 3) 10 off-site locations representative of coal pile/coal ash areas.

TABLE 2
DRUM CHARACTERIZATION RESULTS

RADIOLOGICAL SURVEY
DRMO YARD
FORT DEVENS, MASSACHUSETTS

DRUM	TOTAL PCBs (μg/kg)	TCLP LEAD (μg/L)	RA-226[g] (pCi/g)
1	1,800[a]	107,000[d]	89.3
2	380[b]	71,000[d]	56.7
3[c]	480[a]	2,290	10.6
4	ND[e]	471	4.4
5	259[f]	29,900[d]	1.1

(a) Concentrations reported are for Aroclor 1254. Aroclor 1016, 1221, 1232, 1242, 1248, and 1260 were below the detection limit (< 33 μg/kg
(b) Concentration reported is for Aroclor 1260. Aroclor 1016, 1221, 1232, 1242, 1248, and 1254 were below the detection limit (< 33 μg/kg).
(c) Drum 3 also contains dials and needles (separated from the soil in a container) located during the August and February radiological work
(d) TCLP lead concentrations exceed the TCLP regulatory limit of 5,000 μg/L.
(e) Below detection limits (<32 μg/kg except Aroclor 1254; <490 μg/kg for Aroclor 1254).
(f) Concentration reported is for Aroclor 1254. Aroclor 1016, 1221, 1232, 1242, 1248, and 1260 were below the detection limit (< 15.1 μg/kg)
(g) Concentrations are above site background (0.77 pCi/g) at 95% confidence level.

Analysis was by the following analytical methods:

PCBs - Method 8080
TCLP Lead - Method 1311 (extraction) and Method 6000/7000 (analysis)
Ra-226 Gamma Spectroscopy - Method 901.1

Appendix A

Field Measurements

CONTAMINATION MEASUREMENT RESULTS September 11, 1995

Location: Fort Devens, MA, Background Area

Location	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)		
1	6	9.8	-	10.9
2	6	10.0	-	11.5
3	5	9.9	-	11.2
4	7	9.6	-	11.0
5	6	11.4	-	12.0
6	7	11.3	-	15.0
7	7	10.2	-	12.8
8	5	10.6	-	13.7
9	6	11.4	-	14.0
10	7	10.8	-	12.2

Radiation Science, Inc.

Approved by: Thomas P. Ruda Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 13, 1996**

Location: Fort Devens, MA, East Yard- North

Grid ID *hotspot	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (μRem / hr)	Gamma Scan Range (cpm x 10^3)
A1	l.t. 55	3626 ± 708	8	10.3 - 12.5
A2			8	10.5 - 12.4
A3	l.t. 55	2592 ± 672	7	11.5 - 12.5
A4			6	11.3 - 12.6
A5	l.t. 55	2567 ± 672	7	11.5 - 12.6
A6			8	11.5 - 12.7
A7	l.t. 55	2629 ± 674	7	11.3 - 12.7
A8			6	11.4 - 12.6
A9	l.t. 55	4137 ± 725	5	11.0 - 12.6
A10			7	11.0 - 12.7
A11			6	10.9 - 12.6
B1			7	11.2 - 12.4
B2*			15	10.9 - 28.2
B2*			25	10.9 - 43.7
B2*	l.t. 55	28623 ± 1303	55	10.9 - 112.3
B3			7	11.2 - 12.6
B4			6	11.0 - 12.6
B5			8	10.8 - 12.4
B6	l.t. 55	4436 ± 735	8	11.3 - 12.6
B7			7	11.4 - 12.5
B8	l.t. 55	l.t. 995	7	11.6 - 12.7
B9			8	11.4 - 12.6
B10			6	11.5 - 12.7
B11	l.t. 55	3240 ± 695	6	11.5 - 12.8
C1			6	11.7 - 12.6

Radiation Science, Inc.

Approved by: Thomas P. Pasko Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 13, 1996**

Location: Fort Devens, MA, East Yard- North

Grid ID *hotspot	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (μRem / hr)	Gamma Scan Range (cpm x 10^3)
C2*	l.t. 55	19551 ± 1124	45	11.4 - 71.8
C3*	l.t. 55	21009 ± 1155	30	11.3 - 83.6
C4	l.t. 55	3738 ± 712	6	11.4 - 12.9
C5			5	11.4 - 12.7
C6	l.t. 55	3352 ± 699	5	11.5 - 12.8
C7			5	11.2 - 12.6
C8			7	11.3 - 12.7
C9			7	11.3 - 12.8
C10	l.t. 55	4349 ± 732	7	11.5 - 12.5
C11			7	11.5 - 12.5
D1	l.t. 55	3614 ± 708	8	11.6 - 13.2
D2			7	11.6 - 13.1
D3*	l.t. 55	8847 ± 867	30	11.4 - 37.0
D4*	l.t. 55	11639 ± 941	18	11.6 - 42.4
D4*	l.t. 55	6143 ± 789	10	11.6 - 20.7
D4*	l.t. 55	5433 ± 738	10	11.6 - 22.3
D4*	l.t. 55	4536 ± 867	10	11.6 - 21.0
D5			7	11.3 - 12.9
D6			5	11.1 - 12.8
D7	l.t. 55	3364 ± 699	7	11.5 - 12.7
D8			7	11.4 - 12.6
D9			5	11.4 - 12.7
D10			6	11.3 - 12.8
D11	l.t. 55	3751 ± 712	6	11.4 - 12.8
E1			8	11.4 - 13.2

Radiation Science, Inc.

Approved by: Thomas Royle Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS September 13, 1996

Location: Fort Devens, MA, East Yard- North

Grid ID *hotspot	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (µRem / hr)	Gamma Scan Range (cpm x 10^3)
E2	l.t. 55	3713 ± 711	7	11.5 - 12.9
E3			7	11.4 - 12.8
E4			7	11.4 - 12.9
E5	l.t. 55	3477 ± 703	7	11.4 - 12.7
E6			6	10.0 - 12.7
E7			5	11.1 - 12.6
E8	l.t. 55	3265 ± 696	6	11.3 - 12.5
E9	l.t. 55	3938 ± 719	6	11.0 - 12.5
E10	l.t. 55	3427 ± 702	7	11.2 - 12.6
E11			6	11.1 - 12.5
F1*	l.t. 55	3389 ± 700	20	11.2 - 37.4
F2			7	11.4 - 12.5
F3	l.t. 55	3614 ± 708	6	11.5 - 12.9
F4*	l.t. 55	4673 ± 743	13	11.5 - 21.3
F5	67 ± 42	4012 ± 721	6	11.2 - 12.7
F6			6	10.6 - 11.9
F7	l.t. 55	3601 ± 707	6	11.4 - 12.8
F8			6	11.3 - 12.7
F9	l.t. 55	3813 ± 715	7	11.4 - 12.8
F10			7	11.3 - 12.6
G3			6	11.4 - 12.7
G4	l.t. 55	3290 ± 697	6	11.5 - 12.7
G5			6	11.5 - 14.7
G6	97 ± 47	2069 ± 654	7	9.3 - 12.1
G7			6	11.4 - 12.5

Radiation Science, Inc.

Approved by: Thomas P. Rocke Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 13, 1996**

Location: Fort Devens, MA, East Yard- North

Grid ID *hotspot	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (µRem / hr)	Gamma Scan Range (cpm x 10^3)
G8			7	11.3 - 12.7
G9			6	11.4 - 12.6
G10	l.t. 55	3664 ± 710	7	11.4 - 12.5
H6			5	11.3 - 12.6
H7			6	11.4 - 12.9
H8	l.t. 55	3826 ± 715	7	11.4 - 12.8
H9			6	11.2 - 12.7
H10			5	11.4 - 12.8
I8			6	11.3 - 12.8
I9			6	11.2 - 12.7
I10			6	11.4 - 12.8

Radiation Science, Inc.

Approved by: Thomas P Rocke Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 11, 1996**

Location: Fort Devens, MA, East Yard- South

Grid ID	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
A1	-	-	-	-
A2	l.t. 55	3664 ± 710	5	-
A3	l.t. 55	3900 ± 717	6	-
A4	l.t. 55	1981 ± 650	6	-
A5	l.t. 55	3738 ± 712	6	-
A6	l.t. 55	3489 ± 704	7	-
A7	l.t. 55	4100 ± 724	7	-
A8	l.t. 55	3763 ± 713	6	-
A9	-	-	-	-
A10	l.t. 55	3801 ± 714	7	-
B1	l.t. 55	3165 ± 393	7	-
B2	-	-	-	-
B3	l.t. 55	2766 ± 679	6	-
B4	l.t. 55	3514 ± 704	7	-
B5	l.t. 55	3551 ± 706	6	11.3 - 12.7
B6	-	-	-	-
B7	l.t. 55	2717 ± 677	7	-
B8	l.t. 55	3364 ± 699	6	-
B9	l.t. 55	3913 ± 718	7	-
B10	l.t. 55	3776 ± 713	7	-
C1	l.t. 55	3713 ± 711	7	-
C2	l.t. 55	3477 ± 703	6	-
C3	l.t. 55	3265 ± 696	6	11.2 - 12.6
C4	-	-	-	-

Radiation Science, Inc.

Approved by: Thomas Rooke Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS

September 11, 1996

Location: Fort Devens, MA, East Yard- South

Grid ID	Total Alpha (dpm /100 cm^2)	Total Beta/Gamma (dpm /100 cm^2)	Dose Rate (µRem /hr)	Gamma Scan Range (cpm x 10^3)
C5	l.t. 55	3938 ± 719	6	-
C6	l.t. 55	3427 ± 702	7	-
C7	l.t. 55	3389 ± 700	8	-
C8	-	-	-	11.6 - 13.1
C9	l.t. 55	3614 ± 708	7	-
C10	l.t. 55	3776 ± 713	6	-
D1	-	-	-	-
D2	-	-	-	-
D3	l.t. 55	4100 ± 724	6	-
D4	l.t. 55	4137 ± 725	6	-
D5	-	-	-	-
D6	l.t. 55	3065 ± 689	7	-
D7	l.t. 55	2766 ± 679	7	-
D8	-	-	-	-
D9	l.t. 55	3601 ± 707	7	-
D10	l.t. 55	3676 ± 710	6	-

Radiation Science, Inc.

Approved by: Thomas J. Rade Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 13, 1996**

Location: Fort Devens, MA, Concrete Pad

Grid ID	Total Alpha (dpm /100 cm^2)	Total Beta (dpm /100 cm^2)	Dose Rate (µRem / hr)	Gamma Scan Range (cpm x 10^3)
A1	l.t. 55	3315 ± 698	5	11.4 - 12.9
A2	l.t. 55	1358 ± 627	7	11.6 - 13.0
A3	l.t. 55	2642 ± 674	7	11.7 - 13.0
A4	l.t. 55	2143 ± 656	7	12.0 - 14.4
A5	l.t. 55	1969 ± 650	5	11.8 - 14.5
B1-1	l.t. 55	3352 ± 699	6	10.5 - 11.9
B1-2	l.t. 55	2679 ± 676		
B1-3	l.t. 55	2928 ± 684		
B1-4	l.t. 55	2642 ± 674		
B2-1	l.t. 55	1732 ± 641	5	11.0 - 12.1
B2-2	l.t. 55	1682 ± 639		
B2-3	l.t. 55	1994 ± 651		
B2-4	l.t. 55	1919 ± 648		
B3-1	l.t. 55	2019 ± 652	6	10.9 - 11.7
B3-2	l.t. 55	2330 ± 663		
B3-3	l.t. 55	2081 ± 654		
B3-4	l.t. 55	2143 ± 656		
B4-1	59 ± 40	1570 ± 635	5	11.0 - 11.7
B4-2	l.t. 55	1371 ± 627		
B4-3	l.t. 55	1782 ± 643		
B4-4	l.t. 55	1595 ± 636		
B5	l.t. 55	1894 ± 647	6	11.3 - 13.6

Radiation Science, Inc.

Approved by: Thomas P. Reardon Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 13, 1996**

Location: Fort Devens, MA, Concrete Pad

Grid ID	Total Alpha (dpm /100 cm^2)	Total Beta (dpm /100 cm^2)	Dose Rate (µRem / hr)	Gamma Scan Range (cpm x 10^3)
C1-1	l.t. 55	2654 ± 675	6	10.6 - 11.7
C1-2	l.t. 55	2530 ± 670		
C1-3	l.t. 55	2941 ± 685		
C1-4	l.t. 55	2492 ± 669		
C2	l.t. 55	1894 ± 647	6	11.1 - 13.5
C3	l.t. 55	2405 ± 666	7	11.2 - 14.0
C4	l.t. 55	2729 ± 677	6	11.2 - 13.7
C5	l.t. 55	1682 ± 639	6	10.8 - 14.0

Radiation Science, Inc.

Approved by: Thomas P. Beale Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS

September 11, 1995

Location: Fort Devens, MA, Tire Yard

Grid ID	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
A1-1	6	11.2 - 12.3
A1-2	6	
A1-3	6	
A1-4	7	
A2-1	7	11.4 - 12.0
A2-2	6	
A2-3	6	
A2-4	6	
A3-1	7	11.5 - 12.0
A3-2	7	
A3-3	6	
A3-4	6	
A4-1	5	11.8 - 13.4
A4-2	7	
A4-3	7	
A4-4	6	
A5-1	7	11.6 - 14.1
A5-2	7	
A5-3	6	
A5-4	8	
B1-1	6	11.2 - 12.6
B1-2	8	
B1-3	7	
B1-4	6	

Radiation Science, Inc.

Approved by:  Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS **September 11, 1995**

Location: Fort Devens, MA, Tire Yard

Grid ID	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
B2-1	7	11.0 - 12.3
B2-2	7	
B2-3	6	
B2-4	6	
B3-1	7	11.6 - 12.8
B3-2	6	
B3-3	6	
B3-4	7	
B4-1	7	11.7 - 13.7
B4-2	5	
B4-3	7	
B4-4	7	
B5-1	5	11.5 - 13.8
B5-2	7	
B5-3	6	
B5-4	6	
C1-1	6	10.9 - 11.7
C1-2	6	
C1-3	7	
C1-4	6	
C2-1	6	11.5 - 12.3
C2-2	6	
C2-3	6	
C2-4	7	

Radiation Science, Inc.

Approved by: Thomas J. Rucle Date: 9/15/95

Location: Fort Devens, MA, Tire Yard

Grid ID	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
C3-1	7	11.3 - 12.8
C3-2	8	
C3-3	7	
C3-4	7	
C4-1	6	11.7 - 13.7
C4-2	8	
C4-3	7	
C4-4	7	
C5-1	6	11.8 - 14.2
C5-2	7	
C5-3	7	
C5-4	7	
D1-1	6	11.3 - 12.5
D1-2	7	
D1-3	7	
D1-4	6	
D2-1	6	11.3 - 12.2
D2-2	8	
D2-3	6	
D2-4	6	
D3-1	6	11.2 - 12.5
D3-2	7	
D3-3	7	
D3-4	7	

Radiation Science, Inc.

Approved by: Thomas P. Royle Date: 9/15/95

CONTAMINATION MEASUREMENT RESULTS

September 11, 1995

Location: Fort Devens, MA, Tire Yard

Grid ID	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
D4-1	7	11.4 - 14.0
D4-2	5	
D4-3	6	
D4-4	7	
D5-1	8	11.6 - 14.2
D5-2	8	
D5-3	7	
D5-4	7	
E1-1	7	11.4 - 12.6
E1-2	7	
E1-3	8	
E1-4	6	
E2-1	7	11.2 - 12.6
E2-2	6	
E2-3	7	
E2-4	7	
E3-1	6	11.3 - 12.5
E3-2	8	
E3-3	6	
E3-4	7	
E4-1	7	11.4 - 13.9
E4-2	7	
E4-3	7	
E4-4	8	

Radiation Science, Inc.

Approved by: Thomas J. Beale Date: 9/15/95

Location: Fort Devens, MA, Tire Yard

Grid ID	Dose Rate (μRem /hr)	Gamma Scan Range (cpm x 10^3)
E5-1	6	11.2 - 14.0
E5-2	8	
E5-3	7	
E5-4	8	

Radiation Science, Inc.

Approved by: Thomas Poole Date: 9/15/95

Appendix B

Pre-Remediation Soil Analysis Results

Ft. Devens Bkgd

PACE ID	Location	Ra-226	2 sigma
69699	Bckgd 1	0.75	0.13
69702	Bckgd 2	0.47	0.12
69710	Bckgd 3	0.56	0.11
69729	Bckgd 4	0.77	0.15
69737	Bckgd 5	0.68	0.14
69745	Bckgd 6	1.1	0.21
69753	Bckgd 7	0.89	0.16
69761	Bckgd 8	0.87	0.17
69800	Bckgd 9	0.93	0.17
69818	Bckgd 10	0.75	0.14

Mean	0.777
Standard Error	0.05787055
Median	0.76
Mode	0.75
Standard Devia	0.18300273
Variance	0.03349
Range	0.63
Minimum	0.47
Maximum	1.1
Count	10

East DRMO Yard North

PACE ID	Location	Ra-226 pCi/g	2 sigma
69770	1	0.81	0.16
69788	2	0.76	0.14
69796	3	0.88	0.16
69966	4	0.78	0.12
69974	5	0.68	0.1
69982	6	0.86	0.14
69990	7	0.97	0.16
70000	8	0.96	0.15
70026	9	0.89	0.15
70034	10	1	0.18
70069	11	1.3	0.17
70077	12	0.96	0.16
70085	13	0.93	0.16
70093	14	1.1	0.2
70107	15	1	0.18
70115	16	0.71	0.11
69826	17	0.87	0.14
69834	18	0.79	0.12
69842	19	0.7	0.1
69850	20	1.2	0.15
69869	21	0.9	0.12
69877	22	0.86	0.12
69885	23	0.8	0.12
69893	24	0.57	0.1
69907	25	0.72	0.11
69915	26	0.61	0.11
69923	27	0.78	0.13
69931	28	1.2	0.16
73904	HS1	287	15
73912	HS2	1.9	0.22

With hotspots	
Mean	10.4496667
Standard Error	9.53632933
Median	0.875
Mode	0.78
Standard Devi	52.2326269
Variance	2728.24731
Range	286.43
Minimum	0.57
Maximum	287
Count	30

Without hotspots	
Mean	0.87821429
Standard Error	0.03319038
Median	0.865
Mode	0.78
Standard Devi	0.17562699
Variance	0.03084484
Range	0.73
Minimum	0.57
Maximum	1.3
Count	28

East DRMO Yard South

PACE ID	Location	Ra-226	2 sigma
69940	1	0.9	0.15
70255	2	0.6	0.11
70263	3	1.1	0.18
70271	4	0.77	0.11
70280	5	0.8	0.11
70298	6	0.74	0.14
70301	7	0.59	0.09
70310	8	0.54	0.12
70328	9	0.68	0.14
70336	10	0.69	0.1
70344	11	0.75	0.14
70352	12	0.59	0.14
70360	13	0.71	0.11
70379	14	0.76	0.22
70123	15	0.63	0.1
70131	16	0.71	0.12
70140	17	0.72	0.12
70158	18	0.62	0.1
70166	19	0.76	0.16
70174	20	0.56	0.1
70182	21	0.64	0.09
70190	22	0.73	0.17
70204	23	0.72	0.14
70212	24	0.66	0.13
70220	25	0.62	0.09
70239	26	0.71	0.1
70247	27	0.63	0.1
71880	28	0.56	0.1
71898	29	0.82	0.14
71901	30	0.9	0.14

Mean	0.707
Standard Error	0.02166702
Median	0.71
Mode	0.71
Standard Devia	0.11867516
Variance	0.01408379
Range	0.56
Minimum	0.54
Maximum	1.1
Count	30

Concrete Pad

PACE ID	Location	Ra-226	2 sigma	
71910	A1-1	0.7	0.1	
71928	A1-2	0.61	0.11	
71936	A1-3	0.56	0.1	
71944	A1-4	0.66	0.1	
71952	A2-1	0.74	0.12	
71960	A2-2	0.81	0.25	
71979	A2-3	0.5	0.1	ND
71987	A2-4	0.81	0.13	
71995	A3-1	0.86	0.14	
72002	A3-2	0.83	0.17	
71324	A3-3	0.87	0.16	
71332	A3-4	0.87	0.2	
71340	A4-1	1.3	0.24	
71359	A4-2	0.68	0.14	
71367	A4-3	0.7	0.13	
71375	A4-4	0.88	0.14	
71383	A5-1	0.77	0.13	
71391	A5-2	0.66	0.12	
71405	A5-3	0.67	0.13	
71413	A5-4	0.58	0.12	
71421	B5-1	0.73	0.13	
71430	B5-2	0.61	0.13	
71448	B5-3	0.76	0.14	
71456	B5-4	0.55	0.09	
71464	C2-1	0.57	0.09	
71472	C2-2	0.52	0.13	
71480	C2-3	0.67	0.09	
71499	C2-4	0.62	0.1	
71502	C3-1	0.7	0.12	
71510	C3-2	0.68	0.1	
71529	C3-3	0.81	0.11	
71537	C3-4	0.71	0.12	
71545	C4-1	0.72	0.12	
71533	C4-2	0.57	0.09	
71561	C4-3	0.53	0.09	
71570	C4-4	0.65	0.1	
71588	C5-1	0.54	0.09	
71596	C5-2	0.45	0.08	
71863	C5-3	0.71	0.12	
71871	C5-4	0.79	0.13	

Mean	0.69875
Standard Error	0.02346899
Median	0.69
Mode	0.7
Standard Devia	0.1484309
Variance	0.02203173
Range	0.85
Minimum	0.45
Maximum	1.3
Count	40

Ft. Devens Tire Yard

PACE ID	Location	Ra-226	2 sigma
71731	A1-1	0.95	0.17
71740	A1-2	0.072	0.013
71758	A1-3	0.92	0.17
71766	A1-4	0.86	0.16
71774	A2-1	0.85	0.15
71782	A2-2	0.99	0.15
71790	A2-3	1	0.17
71804	A2-4	0.99	0.18
71812	A3-1	0.7	0.13
71820	A3-2	0.75	0.14
71839	A3-3	0.64	0.12
71847	A3-4	0.82	0.13
74048	A4-1	0.55	0.19
74056	A4-2	0.5	0.09
74064	A4-3	0.57	0.08
74072	A4-4	0.48	0.09
74080	A5-1	0.53	0.09
74099	A5-2	0.62	0.08
74102	A5-3	0.67	0.21
74110	A5-4	0.63	0.11
71855	B1-1	0.68	0.14
72010	B1-2	0.7	0.15
72029	B1-3	0.76	0.14
72037	B1-4	0.58	0.11
72045	B2-1	0.84	0.16
72053	B2-2	0.89	0.17
72061	B2-3	1.2	0.17
72070	B2-4	0.7	0.14
72088	B3-1	0.56	0.1
72096	B3-2	0.59	0.12
72100	B3-3	0.86	0.13
72118	B3-4	0.64	0.12
74129	B4-1	0.9	0.11
74137	B4-2	0.77	0.11
74145	B4-3	0.57	0.1
73696	B4-4	0.95	0.18
73700	B5-1	0.62	0.13
73718	B5-2	0.54	0.12
73726	B5-3	1.1	0.18
73734	B5-4	0.64	0.12
72126	C1-1	0.85	0.19
72134	C1-2	0.72	0.16
72142	C1-3	0.67	0.14
72150	C1-4	0.73	0.15
71600	C2-1	0.82	0.12

Mean	0.75172
Standard Error	0.02082609
Median	0.72
Mode	0.64
Standard Devia	0.20826091
Variance	0.04337261
Range	1.528
Minimum	0.072
Maximum	1.6
Count	100

Ft. Devens Tire Yard

71618	C2-2	0.99	0.16
71626	C2-3	0.91	0.12
71634	C2-4	0.93	0.15
71642	C3-1	0.74	0.11
71650	C3-2	0.72	0.11
71669	C3-3	0.75	0.1
71677	C3-4	0.72	0.1
73742	C4-1	0.75	0.13
73750	C4-2	0.78	0.15
73769	C4-3	1.1	0.2
73777	C4-4	0.64	0.14
73785	C5-1	1.1	0.16
73793	C5-2	1	0.17
73807	C5-3	1	0.17
73815	C5-4	1.2	0.18
71685	D1-1	0.67	0.01
71693	D1-2	0.8	0.12
71707	D1-3	0.79	0.13
71715	D1-4	0.79	0.13
71723	D2-1	0.76	0.12
71170	D2-2	0.59	0.12
71189	D2-3	0.7	0.12
71197	D2-4	0.36	0.08
71200	D3-1	0.57	0.12
71219	D3-2	0.65	0.12
71227	D3-3	0.55	0.011
71235	D3-4	0.58	0.12
73823	D4-1	0.68	0.12
73831	D4-2	0.66	0.12
73920	D4-3	0.73	0.1
73939	D4-4	0.68	0.11
73947	D5-1	0.65	0.11
73955	D5-2	0.63	0.1
73963	D5-3	0.68	0.1
73971	D5-4	0.77	0.11
71243	E1-1	1	0.17
71251	E1-2	1.2	0.17
71260	E1-3	0.66	0.11
71278	E1-4	0.6	0.13
71286	E2-1	0.47	0.1
71294	E2-2	0.55	0.12
71308	E2-3	0.63	0.11
71316	E2-4	0.53	0.11
74005	E3-1	0.47	0.09
74013	E3-2	0.47	0.09
74021	E3-3	0.64	0.1

Ft. Devens Tire Yard

74030	E3-4	0.64	0.11
73980	E4-1	0.74	0.11
73998	E4-2	0.95	0.14
73840	E4-3	1.6	0.2
73858	E4-4	0.98	0.13
73866	E5-1	0.86	0.12
73874	E5-2	0.92	0.13
73882	E5-3	0.82	0.11
73890	E5-4	0.85	0.12

Appendix C

Post-Remediation Soil Analysis Results

Post Remediation Samples

Sample ID	Location	Ra-226	2 sigma
10427-001	Hotspot 1	2.07	0.9
DVRAD*1	Hotspot 2	0.924	0.065
DVRAD*3	Hotspot 3	0.886	0.067
10427-004	Hotspot 4	2.7	0.88
10427-005	Hotspot 5	3.15	0.97
10427-006	Hotspot 6	3.49	0.97
DVRAD*3	Hotspot 7	1.66	0.142
10882-001	Hotspot 8	1.85	1.04
10427-009	Hotspot 9	2.38	0.82
DVRAD*4	Hotspot 10	0.908	0.065
650073912	Hotspot 11	1.9	0.22
DVRAD*5	Hotspot 12	0.841	0.065

Mean	1.89658333
Standard Error	0.26308451
Median	1.875
Standard Devia	0.91135149
Variance	0.83056154
Range	2.649
Minimum	0.841
Maximum	3.49
Count	12

Appendix D

Calibration Certificates

HARSHAW BICRON RADIATION MEASUREMENT PRODUCTS

BICRON • 6801 Cochran Road • Solon, Ohio 4413

Phone: (216) 248-7400 • Fax: (216) 349-658

Instrument Calibration Certificate

 # 1689

Customer RADIATION SCIENCE Order Number 14002

Instrument MICRO REM S/N B260U - NEW

Calibration Data

Range	Exposure Rate uR/h	Instrument Reading uR/h	% Error	Exposure Rate uR/h	Instrument Reading uR/h	% Error
X1000	160,000.0	160,000.0	0.0	40,000.0	40,000.0	0.0
X100	16,000.0	16,000.0	0.0	4,000.0	4,000.0	0.0
X10	1,600.0	1,600.0	0.0	400.0	400.0	0.0
X1	160.0	160.0	0.0	40.0	40.0	0.0
X0.1	16.0	16.0	0.0	4.0	4.0	0.0

Calibration Source Intensity at 1 meter= 227 mR/H Date 06/13/95 Source to Detector Geometry PERPENDICULAR

Zero Check OK HV Check OK Threshold Set N/A

Battery Ok OK Scaler Rate N/A Geotropic Check OK

Checkband Response +/- 1% +/- 2%

Reproducibility OK (Checked 3 times, identical conditions +/- 10%)

Check Source N/A Check Source Reading N/A

Quality Assurance Review By: TB Date 07/26/95

Calibrated By RC Date 07/26/96

Re-Cal Due 07/26/96

INSTRUMENT FIELD CHECK LOG

Meter: Bicron Micro Rem meter **Serial #** B260U
Source: Cesium-137 **Activity:** 5 microcuries **Serial #** Cs-7A

Meas #	Date	Time	BAT (OK)	HV (OK)	Background (µR)	Source dose rate (mR)	Initials	Meas #	Date	Time	BAT (OK)	HV (OK)	Background (µR)	Source dose rate (mR)	Initials
1	8/7/95	8:40	✓	✓	5-7 µR	10 mR	SMD	17	8/17/95	1900	✓	✓	5-7 µR	10 mR	MA
2	8/7/95	1400 hrs	✓	✓	5-7	10	SMD	18	8/18/95	0930	✓	✓	5-7 µR	10 µR	MA
3	8/8/95	1400 hrs	✓	✓	5-7	10 mR	[illegible]	19	8/18/95	1530	✓	✓	5-7 µR	10 µR	MA
4	8/9/95	07:00	✓	✓	5-7	10 mR	[illegible]	20	8/22/95	1000	✓	✓	5-7 µR	10 µR	MA
5	8/9/95	1530	✓	✓	5-7	10 µR	MA	21	8/22/95	1430	✓	✓	5-7 µR	10 µR	MA
6	8/10/95	0730	✓	✓	5-7	10 µR	MA								
7	8/10/95	1500	✓	✓	5-7	10 µR	MA								
8	8/11/95	0730	✓	✓	5-7	10 µR	MA								
9	8/11/95	1530	✓	✓	5-7	10 µR	MA								
10	8/14/95	0830	✓	✓	5-7	10 µR	MA								
11	8/14/95	1530	✓	✓	5-7	10 µR	MA								
12	8/15/95	0800	✓	✓	5-7	10 µR	MA								
13	8/15/95	1900	✓	✓	5-7	10 µR	MA								
14	8/16/95	0830	✓	✓	5-7	10 µR	MA								
15	8/16/95	1730	✓	✓	5-7	10 µR	MA								
16	8/17/95	0830	✓	✓	5-7	10 µR	MA								

Did Not use

INSTRUMENT FIELD CHECK LOG

Meter: Ludlum Model 2223 Scaler Ratemeter Serial #: 102933
Detector: Ludlum Model 43-1-1 Phoswich detector Serial #: 010421
Source: Thorium-230 Activity: 6,410 DPM Serial #: S-3689B
Source: Technecium-99 Activity: 15,000 DPM Serial #: 1699-94

CMT - placed in column, corrected immediately 8/29/95

Meas. #	Date	Time	BAT (OK)	HV (Vdc)	Δt (min)	Bckgrnd Beta	Source Beta	Net Beta (cpm)	Bckgrnd Alpha	Source Alpha	Net Alpha	Initials
1	8/8/95	15:00	✓	650	2	257	3077	2920	0	3329	3329	MA
2	8/9/95	07:00	✓	650	2	268	2985	2717 ~~2977~~	8	3548	3540	CMT
3	8/9/95	1530	✓	620	2	248	2591	2348 ~~2563~~	8	3015	3007	MA
4	8/10/95	0730	✓	650	2	278	2813	2535 ~~2800~~	7	2909	2902	MA
5	8/10/95	1500	✓	650	2	258	2634	2378 ~~2629~~	5	3064	3059	MA
6	8/11/95	0730	✓	650	2	297	2667	2370 ~~2666~~	1	2975	2974	MA
7	8/11/95	1530	✓	650	2	276	2558	2282 ~~2554~~	4	2953	2949	MA
8	8/14/95	0800	✓	650	2	272	2907	2635 ~~2901~~	6	2996	2990	MA
9	8/14/95	1530	✓	650	2	261	2711	2450 ~~2705~~	6	3156	3150	MA
10	8/15/95	0800	✓	650	2	293	2821	2528 ~~2815~~	6	3052	3046	MA
11	8/15/95	1900	✓	650	2	302	2888	2586 ~~2879~~	9	3026	3015	MA
12	8/16/95	0830	✓	650	2	228	2718	2490 ~~2713~~	5	2943	2938	MA
13	8/16/95	1730	✓	650	2	251	2490	2239 ~~2489~~	1	3012	3011	MA
14	8/17/95	0830	✓	650	2	279	2796	2517 ~~2792~~	4	3101	3097	MA
15	8/17/95	1900	✓	650	2	301	2802	2501 ~~2797~~	5	3066	3061	MA
16	8/18/95	0930	✓	650	2	303	2773	2470 ~~2768~~	5	2993	2988	MA

Meter: Ludlum Model 2223 Scaler Ratemeter — Serial #: 102933
Detector: Ludlum Model 43-1-1 Phoswich detector — Serial #: 010421
Source: Thorium-230 — **Activity:** 6,410 DPM — Serial #: S-3689B
Source: Technecium-99 — **Activity:** 15,000 DPM — Serial #: 1699-94

Meas. #	Date	Time	BAT (OK)	HV (Vdc)	Δt (min)	Bckgrnd Beta	Source Beta	Net Beta (cpm)	Bckgrnd Alpha	Source Alpha	Net Alpha	Initials
17	8/18/95	1300	✓	650	2	285	2582	2297	3	2947	2944	MA
18	8/22/95	1000	✓	650	2	275	2611	2336	6	3008	3002	MA
19	8/22/95	1430	✓	650	2	289	2590	2301	6	2986	2980	MA
20	9/19/95	1220	✓	650	1	227	3125	~~3125~~	5	1758		MA
21	9/19/95	1600	✓	650	1	252	2633		22	1690		MA

Designer and Manufacturer of Scientific and Industrial Instruments

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CERTIFICATE OF CALIBRATION

CUSTOMER RADIATION SCIENCE, INC. ORDER NO. 208285

Mfg. Ludlum Measurements, Inc. Model 2223 Serial No. 102933

Mfg. Ludlum Measurements, Inc. Model 43-1-1 Serial No. RN 010421

Cal. Date 09/13/94 Cal Due Date 09/13/95 Cal. Interval 1 Year Meterface 202-601

heck mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 75 °F RH 45 % Alt 707.8 mm Hg

☐ New Instrument Instrument Received ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair

☑ Mechanical ck. ☑ Meter Zeroed ☐ Background Subtract ☐ Input Sens. Linearity
☐ F/S Resp. ck ☐ Reset ck. ☑ Window Operation
☑ Audio ck. ☐ Alarm Setting ck. ☑ Batt. ck. (Min. Volt) 2.2 VDC

strument Volt Set 725 V Input Sens. Comments mV Det. Oper. 725 V at Comments mV Threshold Dial Ratio = mV

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2000 / 2000 V

COMMENTS:
lpha threshold = ~~120~~ 170mV
eta threshold = 3.5 mV.
eta window =30 mV.
V set with det. connected

mma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*

*Uncertainty within ± 10% C.F. within ± 20%

Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*		REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
tal idout	500 K cpm	500 K-3	500K3	Log Scale	500 K cpm	500k	500k
	50 K cpm	500 K	500K		50 K cpm	50k	50k
	5 K cpm	5001	5001		5 K cpm	5K	5K
	500 cpm	500	500		500 cpm	500	500
	50 cpm	50	50		50 cpm	50	50

m Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of international Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. alibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978. State of Texas Calibration License No. LO-1963

ference Instruments and/or Sources:

137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ Neutron Am-241 Be S/N T-304

☑ Alpha S/N Pu239 #8743 ☑ Beta S/N C-14 Sr-90 ☐ Other

☑ m 500 S/N 63893 ☐ Oscilloscope S/N ☑ Multimeter S/N 57770262

alibrated By: Michael Moore Date 9-13-94

viewed By: Jimmie Fleming Date 9-13-94

LM C22A 02/04/94

TMA
Thermo Analytical Inc.

TMA/Eberline Albuquerque Laboratory
7021 Pan American Hwy. NE
Albuquerque, NM 87109
(505) 345-3461 • FAX # (505) 761-5416

CERTIFICATE OF CALIBRATION

Electroplated Beta Standard

S.O.# S-02780
P.O.# 94001

Description of Standard:

Model No. DNS-12 Serial No. 1699-94 Isotope Technetium-99

Electroplated on polished Stainless Steel disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2 pi beta emission rate was measured using an internal gas flow proportional chamber. Absolute counting of beta particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated beta source S/N 2393/91.

Measurement Result:

The observed beta count rate from the surface of the disc per minute (cpm) on the calibration date was

9,340 ± 467

The total disintegration rate (dpm) assuming 25 % backscatter of beta particles from the surface of the disc, was

15,000 ± 748 (0.00673 μCi)

The uncertainty of the measurement is 5 % which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: Arlene Gutierrez Reviewed by: Charles Landon

Calibration technician: Arlene Gutierrez A. Representative: Kathy Burnham

Calibration date: 1/10/94 Reviewed date: 1-12-94

TMA
Thermo Analytical Inc.

TMA/Eberline Albuquerque Laboratory
7021 Pan American Hwy. NE
Albuquerque, NM 87109
(505) 345-3461 • FAX # (505) 761-5416

CERTIFICATE OF CALIBRATION

Electroplated Alpha Standard

S.O.# S-02780
P.O.# 94001

Description of Standard:

Model No. DNS-11 Serial No. S-3689B Isotope Thorium-230

Electroplated on polished Stainless Steel disc, 0.79 mm thick.

Total diameter of 4.77 cm and an active diameter of 4.45 cm.

The radioactive material is permanently fixed to the disc by heat treatment without any covering over the active surface.

Measurement Method:

The 2 pi alpha emission rate was measured using an internal gas flow proportional chamber. Absolute counting of alpha particles emitted in the hemisphere above the active surface was verified by counting above, below and at the operative voltage. The calibration is traceable to NIST by reference to an NIST calibrated alpha source S/N 2393/91.

Measurement Result:

The observed alpha particles emitted from the surface of the disc per minute (cpm) on the calibration date was

3,210 ± 128

The total disintegration rate (dpm) assuming 1.5% backscatter of alpha particles from the surface of the disc, was

6,410 ± 256 (0.00289 μCi)

The uncertainty of the measurement is 4 % which is the sum of random counting error at the 99% confidence level, and the estimated upper limit of systematic error in this measurement.

Calibrated by: Arlene Gutierrez Reviewed by: Charles Lawlow

Calibration technician: Arlene A. Gutierrez Q.A. Representative: Kathy Burnham

Calibration date: 1/10/94 Reviewed date: 1-12-94

Appendix E

PCB/TCLP Lead QC Summaries and Chain of Custody Records

PCB QC SUMMARY

Drums 1, 2 + 3

609.05
10427

2F
PCB SURROGATE RECOVERY

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Level: (low/med) LOW

	EPA SAMPLE NO.	S1 (DCB) #	S2 (TCMX) #
01	PBLK01	136	114
02	PSPK01	143	116
03	DRUM#1	125	103
04	DRUM#1DL	137	
05	DRUM#1MS	123	101
06	DRUM#1MSDL	131	
07	DRUM#1MSD	120	101
08	DRUM#1MSDDL	146	
09	DRUM#2	132	96
10	DRUM#3	140	105
11			
12			
13			
14			
15			
16			
17			
18			

ADVISORY QC LIMITS

S1 (DCB) = Decachlorobiphenyl
S2 (TCMX) = Tetrachlorom-m-xylene (10-267)

Column to be used to flag recovery values

* Values outside of QC limits

D Surrogates diluted out

3F

SOIL PESTICIDE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: QUANTERRA, MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Matrix Spike - EPA Sample No.: DRUM#1 Level: (low/med) LOW

COMPOUND	SPIKE ADDED (ug/kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMITS REC.
Aroclor-1016	170	0	360	216 *	50-114
Aroclor-1260	170	0	360	215 *	8-127

COMPOUND	SPIKE ADDED (ug/kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD	QC LIMITS RPD	QC LIMITS REC.
Aroclor 1016	170	210	127 *	52		50-114
Aroclor 1260	170	230	138 *	44		8-127

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: _____ out of _____ outside limits

Spike Recovery: 4 out of 4 outside limits

COMMENTS: _____

FORM III PEST-2

0002

3F

SOIL PCB SPIKE BLANK(LCS) RECOVERY

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Spike Blank No.: SPK92640

COMPOUND	SPIKE ADDED (ug/kg)	SPIKE CONCENTRATION (ug/kg)	SPK % REC #	QC LIMITS REC.
Aroclor-1016	170	150	92	50-114
Aroclor-1260	170	170	107	8-127

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

ND: not determined

Spike Recovery: 0 out of 2 outside limits

COMMENTS:

FORM III PEST-2

4C
PCB METHOD BLANK SUMMARY

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Lab Sample ID: BLK92640 Lab File ID:

Matrix:(soil/water) SOIL Level(low/med) LOW

Date Extracted: 02-28-96 Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed (1): 02-28-96 Date Analyzed (2):

Time Analyzed (1): 14:59 Time Analyzed (2):

Instrument ID (1): GCA Instrument ID (2):

GC Column ID (1): DB-5MS GC Column ID (2):

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED 1	DATE ANALYZED 2
01	PSPK01	SPK92640	02-28-96	
02	DRUM#1	10427-012	02-28-96	
03	DRUM#1DL	10427-012DL	02-29-96	
04	DRUM#1MS	10427-012MS	02-28-96	
05	DRUM#1MSDL	10427-012MSDL	02-29-96	
06	DRUM#1MSD	10427-012MSD	02-28-96	
07	DRUM#1MSDDL	10427-012MSDDL	02-29-96	
08	DRUM#2	10427-013	02-28-96	
09	DRUM#3	10427-014	02-28-96	
10				
11				
12				
13				
14				

COMMENTS:

METHOD BLANK

Drums 1, 2+3

1D

PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.: PBLK01

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: _____ SAS No.: _____ SDG No.: 10427

Matrix: (soil/water) SOIL Lab Sample ID: BLK92640

Sample wt/vol: 30.0 (g/ml) G Lab File ID: _____

Level: (low/med) LOW Date Sampled: _____

% Moisture: not dec. _____ dec. _____ Date Extracted: 02-28-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 02-28-96

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2	Aroclor-1016	33	U
11104-28-2	Aroclor-1221	33	U
11141-16-5	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12672-29-6	Aroclor-1248	33	U
11097-69-1	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

FORM I PEST

```
Software Version: 3.3 <4811>
Sample Name  : BLK 92640                Time         : 02/28/96  15:14
Sample Number: 27                       Study        :
Operator     :

Instrument   : GC_A(DB-5MS,DB-1701)     Channel : A     A/D mV Range : 1000
AutoSampler  : HP 7673A
Rack/Vial    : 0/0

Interface Serial # : 8116920948   Data Acquisition Time: 02/28/96  14:59
Delay Time     : 1.00   min.
End Time       : 15.00  min.
Sampling Rate  : 2.9412   pts/sec

Raw Data File  : G:\USERS\ACQUIRE\GC1\AA18992.RAW
Result File    : G:\USERS\ACQUIRE\GC1\AA18992.RST
Instrument File: g:\users\acquire\method\A8080.ins
Process File   : AAPCB
Sample File    : AA1660
Sequence File  : G:\USERS\ACQUIRE\METHOD\A960228.seq

Inj. Volume    : 0 ul                  Area Reject      : 200.000000
Sample Amount  : 30.0000               Dilution Factor  : 10.00

Noise Threshold: 10          Area Threshold   : 100      Bunch Factor: 1
Multiplier     : 1.0000      Divisor  : 1.0000       Adder  : 0.0000

Instrument Conditions:
/GCA,,,,;
Instrument: GC A    -
  Column     Ch A :DB-5MS 30M X .32mm X 1.0um
             Ch B :DB-608 30M X .32mm X 0.5um
  Carrier Gas     :H (12 ml/min)
  Temperature     :170C-->20C/min-->220c-->4c/min.-->250C(2min)
  Notes           :Inj. Vol is 2.0 ul split into 1.0ul/col
                   Divisor = % Solids/100
                   Dil. Factor = Final Vol X Any Dilutions

Total Number of Peaks Detected: 27
```

PCB REPORT

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
	1.96	385907.5	SURR. Group	73.77	1e+03	221.32
	2.83	2310.0	AR 1016 Group	0.77	11.62	2.32
		388217.4		74.55		

Group Report For : AR 1016 Group

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
10	2.50	337.6	AR 1016 (1-3)	0.11	1.70	0.34
11	2.83	1972.3	AR 1016 (2-3)	0.66	9.92	1.98
0	3.60	0.0	AR 1016 (3-3)	0.00	0.00	0.00
		2310.0		0.77		

Group Report For : AR 1260 Group

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
0	7.03	0.0	AR 1260 (1-4)	0.00	0.00	0.00
0	7.16	0.0	AR 1260 (2-4)	0.00	0.00	0.00
0	7.61	0.0	AR 1260 (3-4)	0.00	0.00	0.00
0	8.38	0.0	AR 1260 (4-4)	0.00	0.00	0.00
		0.0		0.00		

Group Report For : SURR. Group

Peak	Time	Area	Component	Conc.	%REC.	%REC.

0148

Result File : AA18992.RST, Printed On 02/28/96 15:14

#	[min]	[uV*sec]	Name	ppb	TCMX	DBC
6	1.96	184159.3	TCMX	7.60	113.98	22.80
24	8.64	575.3	DBC	0.05	0.69	0.14
27	14.00	201172.9	DCB	9.08	136.17	27.23
		385907.5		16.72		

Types and reasons for Manual Analysis if perfprmed on this sample:
1. Manual Identification: RT shift, Wrong peak, Interference from...
2. Manual Integration: Incorrect integration, Interference from...
3. Other _____
4. No Manual Analysis were performed on this sample.

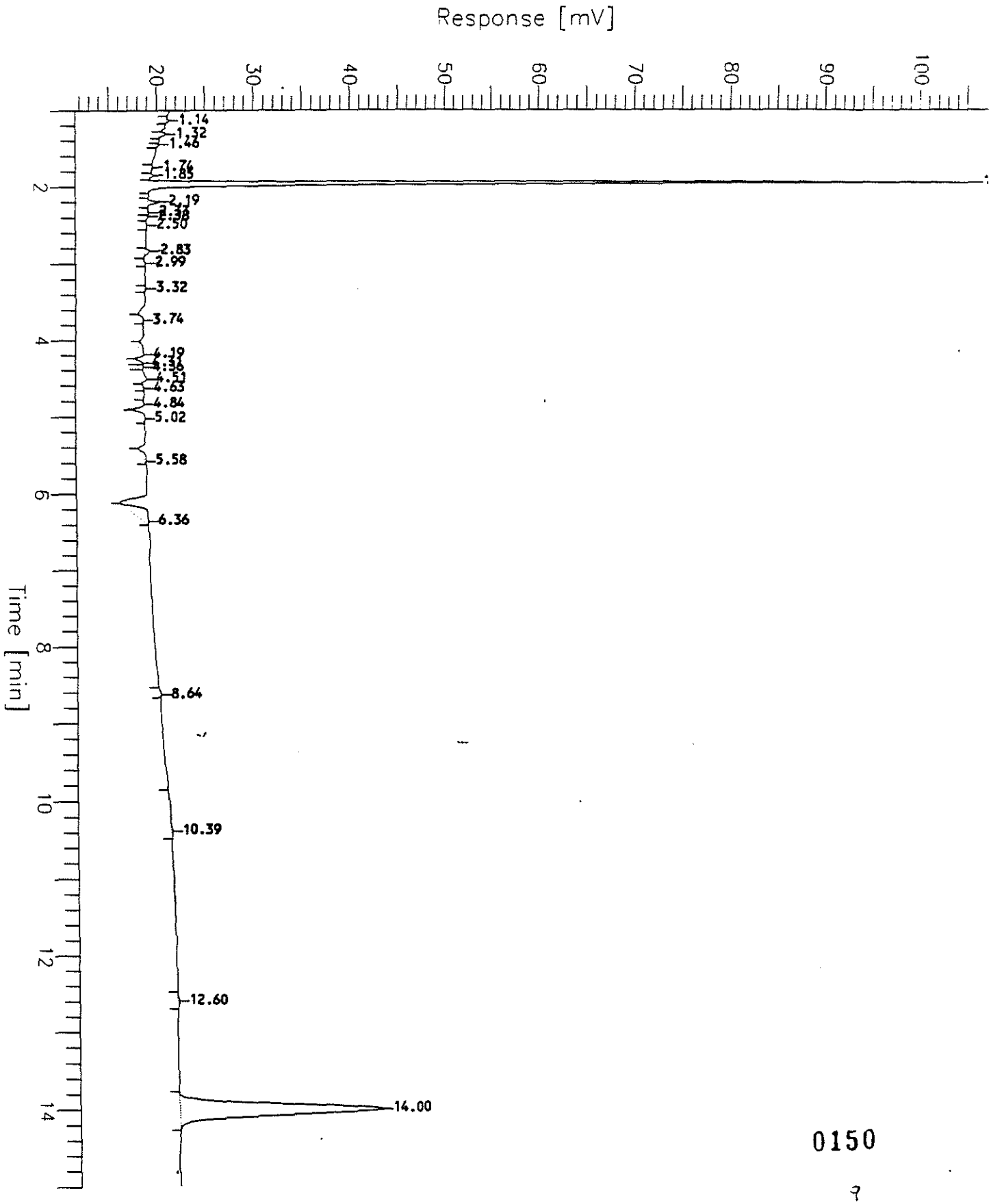
Analyst: [signature] 02/29/96

0149

PCB

Sample Name : BLK 92640
FileName : g:\users\acquire\gc1\AA18992.raw
Method : A8080.ins
Start Time : 1.00 min End Time : 15.00 min
Scale Factor: 1.0 Plot Offset: 12 mV

Sample #: 27 Page 1 of 1
Date : 02/28/96 15:14
Time of Injection: 02/28/96 14:59
Low Point : 11.56 mV High Point : 105.58 mV
Plot Scale: 94.0 mV



0150

INORGANIC SAMPLE DATA

Drums 1, 2 & 3

609.05
10427

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

SOW No.: SW846

EPA Sample No.	Lab Sample ID
DRUM#1_____	_P10427-012___
DRUM#2_____	_P10427-013___
DRUM#3_____	_P10427-014___
_PBT92922_____	_PBT92922_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

_____

_____

_____

_____

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

DRUM #1

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Matrix (soil/water): WATER Lab Sample ID: P10427-012

Level (low/med): LOW Date Received: 02/26/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	107000			P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

DRUM #2

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Matrix (soil/water): WATER Lab Sample ID: P10427-013

Level (low/med): LOW Date Received: 02/26/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	71000			P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

DRUM #3

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Matrix (soil/water): WATER Lab Sample ID: P10427-014

Level (low/med): LOW Date Received: 02/26/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	2290			P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

PBT92922

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10427

Matrix (soil/water): WATER Lab Sample ID: PBT92922

Level (low/med): LOW Date Received: 03/04/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	34.3	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Initial Calibration Source: SOL/L/SPX/IC

Continuing Calibration Source: SOL+/LL/SPX_

Concentration Units: ug/L

Analyte	Initial Calibration True	Found	%R(1)	Continuing Calibration True	Found	%R(1)	Found	%R(1)	M
Lead	4000.0	3966.82	99.2	4000.0	4045.47	101.1	3967.26	99.2	P

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Initial Calibration Source: SOL/L/SPX/IC

Continuing Calibration Source: SOL+/LL/SPX_

Concentration Units: ug/L

Analyte	Initial Calibration True	Found	%R(1)	Continuing Calibration True	Found	%R(1)	Found	%R(1)	M
Lead				4000.0	3990.00	99.8			P

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

U.S. EPA - CLP

2B
CRDL STANDARD FOR AA AND ICP

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

AA CRDL Standard Source: SPX/SOL+/LL_

ICP CRDL Standard Source: SOL+/SPX____

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
	True	Found	%R	True	Initial Found	%R	Final Found	%R
Lead				200.0	186.48	93.2		

FORM II (PART 2) - IN

TCLP

U.S. EPA - CLP

3
BLANKS

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Lead	34.3	U	34.3	U	34.3	U	34.3	U	34.300	U	P

FORM III - IN

TCLP

U.S. EPA - CLP

4
ICP INTERFERENCE CHECK SAMPLE

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: _____ SAS No: _____ SDG No.: 10427

ICP ID Number: TJA1100 ICS Source: SOL+/SPX

Concentration Units: ug/L

Analyte	True Sol. A	True Sol. AB	Initial Found Sol. A	Initial Found Sol. AB	Initial Found %R	Final Found Sol. A	Final Found Sol. AB	Final Found %R
Lead	0	1000	-2	886.4	88.6	36	911.0	91.1

FORM IV - IN TCLP

0010

U.S. EPA - CLP

7

LABORATORY CONTROL SAMPLE

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Solid LCS Source: _____

Aqueous LCS Source: SOL+/CHEMPUR

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Lead	1000.0	1073.69	107.4						

FORM VII - IN

TCLP

10
Instrument Detection Limits (Quarterly)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

ICP ID Number: TJA1100_____ Date: 01/01/96

Flame AA ID Number : _____

Furnace AA ID Number : _____

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Lead	220.35		100	34.3	P

Comments:

U.S. EPA - CLP

11A

ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

ICP ID Number: TJA1100____ Date: 10/01/95

Analyte	Wave-length (nm)	Interelement Correction Factors for : Al	Ca	Fe	Mg	AS_
Lead	220.35	0.0013200	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

FORM XI (Part 1) - IN TCLP

U.S. EPA - CLP

11B
ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

ICP ID Number: TJA1100_____ Date: 10/01/95

Analyte	Wave-length (nm)	Interelement Correction Factors for : NA_	TH_	U__	___	___
Lead	220.35	0.0000000	-0.0017600	0.0009690		

Comments:

FORM XI (Part 2) - IN TCLP

U.S. EPA - CLP

12
ICP LINEAR RANGES (QUARTERLY)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

ICP ID Number: TJA1100_____ Date: 01/01/96

Analyte	Integ. Time (sec.)	Concentration (ug/L)	M
Lead	5.00	50000.0	P

Comments:

FORM XII - IN TCLP

U.S. EPA - CLP

13
PREPARATION LOG

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: _____ SAS No.: _____ SDG No.: 10427

Method: P_

EPA Sample No.	Preparation Date	Weight (gram)	Volume (mL)
DRUM #1	03/01/96		100
DRUM #2	03/01/96		100
DRUM #3	03/01/96		100
LCSW93089-1	03/01/96		100
PBT92922	03/01/96		100
PBW93089	03/01/96		100

FORM XIII - IN TCLP

0016

U.S. EPA - CLP

14

ANALYSIS RUN LOG

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Instrument ID Number: TJA1100_____ Method: P_

Start Date: 03/01/96 End Date: 03/01/96

EPA Sample No.	D/F	Time	% R	Analytes PB
S0	1.00	1535		X
S	1.00	1538		X
S	1.00	1541		
S	1.00	1545		
ICV	1.00	1548		X
ICB	1.00	1551		X
CRI	1.00	1554		X
S	1.00	1557		X
ICSA	1.00	1600		X
ICSAB	1.00	1604		X
PBW93089	1.00	1607		X
LCSW93089-1	1.00	1610		X
ZZZZZZ	1.00	1613		
CCV	1.00	1616		X
CCB	1.00	1620		X
ZZZZZZ	1.00	1623		
ZZZZZZ	1.00	1626		
ZZZZZZ	1.00	1629		
ZZZZZZ	5.00	1632		
ZZZZZZ	1.00	1635		
ZZZZZZ	1.00	1639		
ZZZZZZ	1.00	1642		
CCV	1.00	1645		X
CCB	1.00	1648		X
DRUM #1	1.00	1651		X
DRUM #2	1.00	1655		X
DRUM #3	1.00	1658		X
ZZZZZZ	1.00	1701		
PBT92922	1.00	1704		X
ICSA	1.00	1707		X
ICSAB	1.00	1710		X
CCV	1.00	1714		X

FORM XIV - IN TCLP

0017

U.S. EPA - CLP

14
ANALYSIS RUN LOG

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10427_____

Instrument ID Number: TJA1100_____ Method: P_

Start Date: 03/01/96 End Date: 03/01/96

EPA Sample No.	D/F	Time	% R	Analytes PB																									
CCB	1.00	1717		X																									

FORM XIV - IN TCLP

CHAIN OF CUSTODY
SAMPLE LOG-IN/RECEIPT RECORDS

Drums 1, 2 & 3

Quanterra February 26, 1996 04:19 pm
Account: 11084 Project: 609.05 ABB QAS No. 609.05 Rev. 0
Master Sample Login: 10427

Project Manager: A. Field

Draft: (Final:) Entered and Reviewed by: S Fournier PM Review: Allen McNeil

Sample Header Template:

Sample No. / Comments / # Container Type / Data:	Client ID / Analysis	C-Matrix / Class	Date: Collected / Preservative	Received / Anal. Due Date	Due / Hold Date	Shipper / Site	Rad Category	Rad Sample No. / (Container Numbers:% Filled)
10427-001	SOIL #1	Soil	21-FEB-96 15:00	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-001
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	21-AUG-96	R14B		(216339:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216339:100)
10427-002	SOIL #2	Soil	21-FEB-96 15:00	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-002
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	21-AUG-96	R14B		(216340:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216340:100)
10427-002DUP	SOIL #2 REPLICATE	Soil	23-FEB-96 10:10	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4730-001
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B		(216341:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216341:100)
10427-003	SOIL #3	Soil	23-FEB-96 10:00	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-003
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B		(216342:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216342:100)
10427-004	SOIL #4	Soil	23-FEB-96 10:00	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-004
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B		(216343:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216343:100)
10427-005	SOIL #5	Soil	23-FEB-96 10:10	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-005
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B		(216344:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216344:100)
10427-006	SOIL #6	Soil	23-FEB-96 10:20	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-006
GAMMA=Radium 226 only								
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B		(216345:100)
1	RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B		(216345:100)

3*=Sample has not been rad screened.

30

Quanterra February 26, 1996 04:19 pm
Account: 11084 Project: 609.05 ABB QAS No. 609.05 Rev. 0
Master Sample Login: 10427

Project Manager: A. Field

Draft: Final: Entered and Reviewed by:_____ PM Review:_____

Sample Header Template: _____

Sample No. / #	Client ID / Container Type	C-Matrix / Analysis	Class	Preservative	Date: Collected / Anal. Due Date	Received / Hold Date	Due / Site	Shipper	Rad Category	Rad Sample No. (Container Numbers:% Filled)
10427-007	SOIL #7	Soil			23-FEB-96 10:25	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-007
	GAMMA=Radium 226 only									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216346:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216346:100)
10427-008	SOIL #8	Soil			23-FEB-96 10:30	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-008
	GAMMA=Radium 226 only									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216347:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216347:100)
10427-009	SOIL #9	Soil			23-FEB-96 10:35	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-009
	GAMMA=Radium 226 only									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216348:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216348:100)
10427-010	SOIL #10	Soil			23-FEB-96 10:40	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-010
	GAMMA=Radium 226 only									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216349:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216349:100)
10427-011	SOIL #12	Soil			23-FEB-96 10:45	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-011
	GAMMA=Radium 226 only									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216350:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216350:100)
10427-012	DRUM #1	Soil			23-FEB-96 08:00	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-012
	GAMMA=Radium 226 only//TCLP METALS=Pb Only.									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216351:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B			(216351:100)
1	AN - Amber Glass-250ML	EXTMETAL/TCLP/Q4	S	COLD	11-MAR-96	22-MAR-96	R14B			(216352:100)
1		ICAP/TCLP/Q4	S	COLD	11-MAR-96	21-AUG-96	R14B			(216352:100)
1		PCB/8080/Q4	S	COLD	11-MAR-96	08-MAR-96	R14B			(216352:100)
10427-013	DRUM #2	Soil			23-FEB-96 10:55	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-013
	GAMMA=Radium 226 only//TCLP METALS=Pb Only.									
1	PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B			(216353:100)

3*=Sample has not been rad screened.

Quanterra February 26, 1996 04:19 pm
Account: 11084 Project: 609.05 ABB QAS No. 609.05 Rev. 0
Master Sample Login: 10427

Project Manager: A. Field

Draft: Final: Entered and Reviewed by:_____ PM Review:_____

Sample Header Template: _____

Sample No.	Client ID	C-Matrix	Date: Collected	Received	Due	Shipper	Rad Category	Rad Sample No.
Comments								

#	Container Type	Analysis	Class	Preservative	Anal. Due Date	Hold Date	Site	(Container Numbers:% Filled)
Data:								
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B	(216353:100)
1	AN - Amber Glass-250ML	EXTMETAL/TCLP/Q4	S	COLD	11-MAR-96	22-MAR-96	R14B	(216354:100)
1		ICAP/TCLP/Q4	S	COLD	11-MAR-96	21-AUG-96	R14B	(216354:100)
1		PCB/8080/Q4	S	COLD	11-MAR-96	08-MAR-96	R14B	(216354:100)
10427-014	DRUM #3	Soil	23-FEB-96 11:10	26-FEB-96 09:00	18-MAR-96	FED EX	3*	R4731-014
GAMMA=Radium 226 only//TCLP METALS=Pb Only.								
1	PM - Plastic-1L	RAD/GAMMA/Q4	S	COLD	11-MAR-96	23-AUG-96	R14B	(216355:100)
1		RAD/SCREEN/Q4	S	COLD	11-MAR-96	24-AUG-96	R14B	(216355:100)
1	AN - Amber Glass-250ML	EXTMETAL/TCLP/Q4	S	COLD	11-MAR-96	22-MAR-96	R14B	(216356:100)
1		ICAP/TCLP/Q4	S	COLD	11-MAR-96	21-AUG-96	R14B	(216356:100)
1		PCB/8080/Q4	S	COLD	11-MAR-96	08-MAR-96	R14B	(216356:100)

0076

32

3*=Sample has not been rad screened.

ieme 6L CUR# 6456

Chain of Custody Record

Quanterra Environmental Services

QUA 4124

Client	ABB Environmental Services, Inc
Address	Corp. Place 128, 107 Audubon Rd.
City / State / Zip Code	Wakefield, MA 01880
Project Name	DRMC Yard Rad Survey
Contract/Purchase Order/Quote No.	
Project Manager	Herb Colby
Telephone Number (Area Code)/Fax Number	(617) 245-6606 / (617) 246-5060
Site Contact	Jake Jacobsen
Carrier/Waybill Number	FedEx #4978717634
Date	2/23/96
Lab Number	
Chain Of Custody Number	11557
Page	1 of 1

#	Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: Ra226/Gamma spec	Analysis: PCB, TCLP Pb
1	Soil #1	2/2?/96	1500	Soil	1 L	plastic [illegible]	1	ice	100%	1	
2	Soil #2	2/2?/96	1500			plastic [illegible]	1	ice		1	
10	Soil #2 Replicate	2/23/96	1010				1	ice		1	
3	Soil #3	2/23/96	1000				1	ice		1	
4	Soil #4	2/23/96	1000				1	ice		1	
5	Soil #5	2/23/96	1C?0				1	ice		1	
6	Soil #6	2/23/96	1020				1	ice		1	
7	Soil #7	2/23/96	1025				1	ice		1	
8	Soil #8	2/23/96	1030				1	ice		1	
9	Soil #9	2/23/96	1035				1	ice		1	
[illegible]	Soil #10	2/23/96	1040				1	ice		1	
[illegible]	Soil #12	2/23/96	1045				1	ice		1	
12	Drum #1	2/23/96	0800		1L + 250ml	plastic/250ml	2	ice	X2	1	1
13	Drum #2	2/23/96	1055		1L + 250ml	[illegible]	2	ice		1	1
14	Drum #3	2/23/96	1110		1L + 250ml	[illegible]	2	ice		1	1

Special Instructions

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return To Client ☒ Disposal By Lab ☐ Archive For ____ Months

Turn Around Time Required: ☐ Normal ☒ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]			1. Received By: [signature]	2-26-96	0900
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

0077

33

Quanterra

C.C. ~~Environmental~~ Services
COPIED TO: BW+AF
DATE: 2-26-96
TIME: 09:30
BY: JM

Login No.: 10427

Condition Upon Receipt Variance Report
St. Louis Laboratory

Client: AAB
Project No: 609.05
Shipper/No: FedEX 497 8717 634

Date: 2-26-96 Time: 0900
Initiated by: [signature]
RFA/COC Numbers: 11557

Condition/Variance (Check all that apply):

1. ☐ Sample received broken/leaking.
2. ☐ Sample received without proper preservative.
   - ☐ Cooler temperature not within 4°C ± 2°C
     Record temperature: _____
   - ☐ pH _____
   - ☐ other: _____
3. ☐ Sample received in improper container.
4. ☐ Sample received without proper paperwork. Explain: _____
5. ☐ Paperwork received without sample.
6. ☐ No sample ID on sample container.
7. ☐ Custody tape disturbed/broken/missing.
8. ☐ Sample ID on container does not match sample ID on paperwork. Explain: _____
9. ☐ All coolers on airbill not received with shipment.
10. ☐ Other (explain below): _____

☑ No variances were noted during sample receipt. Cooler Temperature Upon Receipt: 6 °C

Notes: _____

Corrective Action:

- ☐ Client's Name: _____ Informed verbally on: _____ By: _____
- ☐ Client's Name: _____ Informed in writing on: _____ By: _____
- ☐ Sample(s) processed "as is". _____
- ☐ Sample(s) on hold until: _____ If released, notify: _____

Sample Control Supervisor Review: (or designee) [signature] Date: 2-26-96
Project Management Review: [signature] Date: 2-26-96

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE

SL-ADMIN-0004, Revised 11/24/95

0078

PCB QC SUMMARY

Drum 4

609.05
10882

2F
PCB SURROGATE RECOVERY

Lab Name: QUANTERRA, MO Contract: 609-05

Lab Code: ITMO Case No.: _____ SAS No.: ____ SDG No.: 10882

Level: (low/med) LOW

#5 Sample (#4 Drum) →

	EPA SAMPLE NO.	S1 (DCB) #	S2 (TCMX) #
01	PBLK01		116
02	PSPK01		126
03	#5 WASTE DRUM	141	117
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			

		ADVISORY QC LIMITS
S1 (DCB)	= Decachlorobiphenyl	(58-205)
S2 (TCMX)	= Tetrachlorom-m-xylene	(48-180)

Column to be used to flag recovery values

* Values outside of QC limits

D Surrogates diluted out

3F

SOIL PCB SPIKE BLANK(LCS) RECOVERY

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10882

Spike Blank No.: SPK98205

COMPOUND	SPIKE ADDED (ug/kg)	SPIKE CONCENTRATION (ug/kg)	SPK % REC #	QC LIMITS REC.
Aroclor-1016	170	160	94	50-114
Aroclor-1260	170	160	99	8-127

Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

ND: not determined

Spike Recovery: 0 out of 2 outside limits

COMMENTS:

FORM III PEST-2

4C
PCB METHOD BLANK SUMMARY

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10882

Lab Sample ID: BLK98205 Lab File ID:

Matrix:(soil/water) SOIL Level(low/med) LOW

Date Extracted: 04-24-96 Extraction: (SepF/Cont/Sonc) SONC

Date Analyzed (1): 04-25-96 Date Analyzed (2):

Time Analyzed (1): 14:54 Time Analyzed (2):

Instrument ID (1): GCA Instrument ID (2):

GC Column ID (1): DB-5MS GC Column ID (2):

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED 1	DATE ANALYZED 2
01	PSPK01	SPK98205	04-25-96	
02	#5 WASTE DRUM	10882-005	04-26-96	
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				

COMMENTS:

METHOD BLANK

1D

PCB ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

PBLK01

Lab Name: QUANTERRA,MO Contract: 609-05

Lab Code: ITMO Case No.: _____ SAS No.: _____ SDG No.: 10882

Matrix: (soil/water) SOIL Lab Sample ID: BLK98205

Sample wt/vol: 30.0 (g/ml) G Lab File ID: _____

Level: (low/med) LOW Date Sampled: _____

% Moisture: not dec._____ dec._____ Date Extracted: 04-24-96

Extraction: (SepF/Cont/Sonc) SONC Date Analyzed: 04-25-96

GPC Cleanup: (Y/N) N pH: _____ Dilution Factor: 1

CAS NO.	Compound	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
12674-11-2	Aroclor-1016	33	U
11104-28-2	Aroclor-1221	33	U
11141-16-5	Aroclor-1232	33	U
53469-21-9	Aroclor-1242	33	U
12672-29-6	Aroclor-1248	33	U
11097-69-1	Aroclor-1254	33	U
11096-82-5	Aroclor-1260	33	U

U: Concentration of analyte is less than the value given.

FORM I PEST

Software Version: 3.3 <4811>
Sample Name : BLK 98205 Time : 04/25/96 15:10
Sample Number: 24 Study :
Operator :

Instrument : GC_A(DB-5MS,DB-608) Channel : A A/D mV Range : 1000
AutoSampler : HP 7673A
Rack/Vial : 0/0

Interface Serial # : 8116920948 Data Acquisition Time: 04/25/96 14:54
Delay Time : 1.00 min.
End Time : 15.00 min.
Sampling Rate : 2.9412 pts/sec

Raw Data File : G:\USERS\ACQUIRE\GC1\AA20235.RAW
Result File : G:\USERS\ACQUIRE\GC1\AA20235.RST
Instrument File: g:\users\acquire\method\A8080.ins
Process File : AAPCB
Sample File : AA1660
Sequence File : G:\USERS\ACQUIRE\METHOD\A960425.seq

Inj. Volume : 0 ul Area Reject : 200.000000
Sample Amount : 30.0000 Dilution Factor : 10.00

Noise Threshold: 10 Area Threshold : 100 Bunch Factor: 1
Multiplier : 1.0000 Divisor : 1.0000 Adder : 0.0000

Instrument Conditions:
/GCA,,,,;
Instrument: GC A -
Column Ch A :DB-5MS 30M X .32mm X 1.0um
Ch B :DB-608 30M X .32mm X 0.5um
Carrier Gas :H (12 ml/min)
Temperature :170C-->20C/min-->220c-->4c/min.-->250C(2min)
Notes :Inj. Vol is 2.0 ul split into 1.0ul/col
Divisor = % Solids/100
Dil. Factor = Final Vol X Any Dilutions

Total Number of Peaks Detected: 32

PCB REPORT

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
	1.96	399106.6	SURR. Group	76.30	1e+03	228.89
	2.82	3352.9	AR 1016 Group	1.12	16.87	3.37
	8.20	23946.2	AR 1260 Group	4.58	68.67	13.73
		426405.7		82.00		

Group Report For : AR 1016 Group

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
13	2.49	451.9	AR 1016 (1-3)	0.15	2.27	0.45
14	2.82	2901.1	AR 1016 (2-3)	0.97	14.59	2.92
0	3.60	0.0	AR 1016 (3-3)	0.00	0.00	0.00
		3352.9		1.12		

Group Report For : AR 1260 Group

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
0	7.02	0.0	AR 1260 (1-4)	0.00	0.00	0.00
0	7.16	0.0	AR 1260 (2-4)	0.00	0.00	0.00
0	7.61	0.0	AR 1260 (3-4)	0.00	0.00	0.00
29	8.20	23946.2	AR 1260 (4-4)	4.58	68.67	13.73
		23946.2		4.58		

00123

Group Report For : SURR. Group

41 :

Peak #	Time [min]	Area [uV*sec]	Component Name	Conc. ppb	%REC. TCMX	%REC. DBC
8	1.96	188053.3	TCMX	7.76	116.39	23.28
30	8.65	734.7	DBC	0.06	0.89	0.18
32	14.02	210318.6	DCB	9.49	142.36	28.47
		399106.6		17.31		

Types and reasons for Manual Analysis if perfprmed on this sample:
1. Manual Identification: RT shift, Wrong peak, Interference from...
2. Manual Integration: Incorrect integration, Interference from...
3. Other _____
4. No Manual Analysis were performed on this sample.

Analyst: J. Forsythe 043026

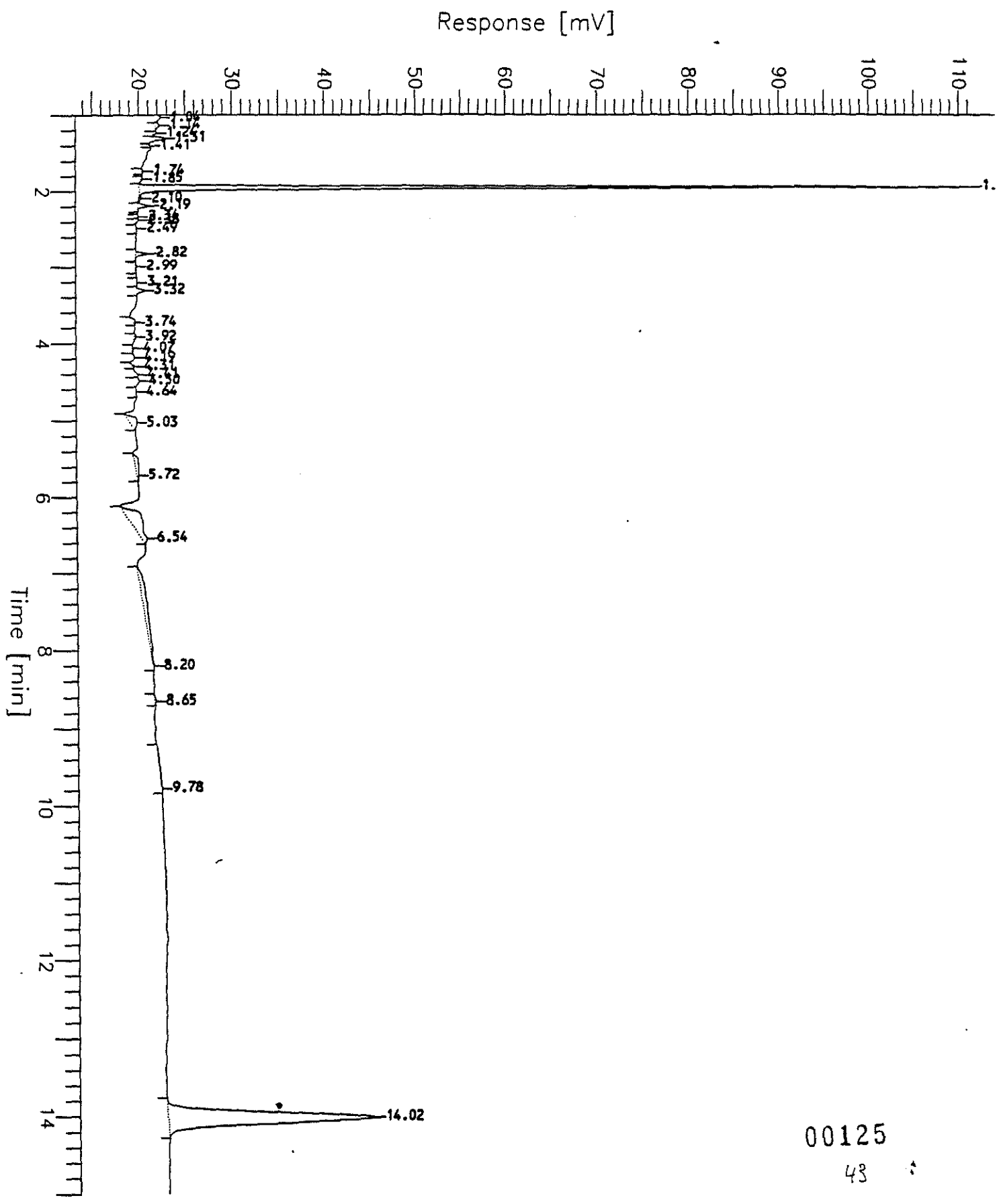
00124

42

PCB

Sample Name : BLK 98205
FileName : g:\users\acquire\gc1\AA20235.raw
Method : A8080.ins
Start Time : 1.00 min End Time : 15.00 min
Scale Factor: 1.0 Plot Offset: 13 mV

Sample #: 24 Page 1 of 1
Date : 04/25/96 15:10
Time of Injection: 04/25/96 14:54
Low Point : 13.20 mV High Point : 111.43 mV
Plot Scale: 98.2 mV



00125

43

INORGANIC SAMPLE DATA

Drum 4

609.05
10882

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

SOW No.: SW846

EPA Sample No.	Lab Sample ID
_#5_WA_DR_#4__	_P10882-005___
_PBT98878_____	_PBT98878_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES

If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

#5 WA DR #4

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10882

Matrix (soil/water): WATER Lab Sample ID: P10882-005

Level (low/med): LOW Date Received: 04/17/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	471			P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

PBT98878

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: SAS No.: SDG No.: 10882

Matrix (soil/water): WATER Lab Sample ID: PBT98878

Level (low/med): LOW Date Received: 04/17/96

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7439-92-1	Lead	39.8	U		P

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

FORM I - IN

TCLP

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Initial Calibration Source: SOL/L/SPX/IC

Continuing Calibration Source: SOL+/LL/SPX_

Concentration Units: ug/L

Analyte	Initial Calibration True	Found	%R(1)	Continuing Calibration True	Found	%R(1)	Found	%R(1)	M
Lead	4000.0	4044.48	101.1	4000.0	4032.17	100.8	4021.31	100.5	P

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Initial Calibration Source: SOL/L/SPX/IC

Continuing Calibration Source: SOL+/LL/SPX_

Concentration Units: ug/L

Analyte	Initial Calibration True	Found	%R(1)	Continuing Calibration True	Found	%R(1)	Found	%R(1)	M
Lead				4000.0	3995.93	99.9			P

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

U.S. EPA - CLP

2B
CRDL STANDARD FOR AA AND ICP

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

AA CRDL Standard Source: SPX/SOL+/LL_

ICP CRDL Standard Source: SOL+/SPX____

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
	True	Found	%R	True	Initial Found	%R	Final Found	%R
Lead				200.0	214.85	107.4		

FORM II (PART 2) - IN

TCLP

U.S. EPA - CLP

3
BLANKS

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Lead	39.8	U	39.8	U	39.8	U	39.8	U	39.800	U	P

FORM III - IN

TCLP

U.S. EPA - CLP

4

ICP INTERFERENCE CHECK SAMPLE

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO Case No.: _____ SAS No: _____ SDG No.: 10882

ICP ID Number: TJA1100 ICS Source: SOL+/SPX

Concentration Units: ug/L

Analyte	True Sol. A	True Sol. AB	Initial Found Sol. A	Initial Found Sol. AB	Initial Found %R	Final Found Sol. A	Final Found Sol. AB	Final Found %R
Lead	0	1000	49	968.7	96.9	46	950.1	95.0

U.S. EPA - CLP

7

LABORATORY CONTROL SAMPLE

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Solid LCS Source: _____

Aqueous LCS Source: SOL+/CHEMPUR

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Lead	1000.0	991.29	99.1						

FORM VII - IN

TCLP

U.S. EPA - CLP

10

Instrument Detection Limits (Quarterly)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

ICP ID Number: TJA1100_____ Date: 04/01/96

Flame AA ID Number : _____

Furnace AA ID Number : _____

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Lead	220.35		100	39.8	P

Comments:

_____

_____

_____

_____

FORM X - IN TCLP

00010

54

U.S. EPA - CLP

11A

ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

ICP ID Number: TJA1100_____ Date: 10/01/95

Analyte	Wave-length (nm)	Interelement Correction Factors for : Al	Ca	Fe	Mg	AS_
Lead	220.35	0.0013200	0.0000000	0.0000000	0.0000000	0.0000000

Comments:

FORM XI (Part 1) - IN TCLP

U.S. EPA - CLP

11B

ICP INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

ICP ID Number: TJA1100_____ Date: 10/01/95

Analyte	Wave-length (nm)	Interelement Correction Factors for : NA_	TH_	U__	___	___
Lead	220.35	0.0000000	-0.0017600	0.0009690		

Comments:

FORM XI (Part 2) - IN TCLP

U.S. EPA - CLP

12
ICP LINEAR RANGES (QUARTERLY)

Lab Name: QUANTERRA_MO Contract: 609.05

Lab Code: ITMO_ Case No.: _____ SAS No.: _____ SDG No.: 10882

ICP ID Number: TJA1100 Date: 04/01/96

Analyte	Integ. Time (sec.)	Concentration (ug/L)	M
Lead	5.00	50000.0	P

Comments:

FORM XII - IN TCLP

U.S. EPA - CLP

13
PREPARATION LOG

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Method: P_

EPA Sample No.	Preparation Date	Weight (gram)	Volume (mL)
#5 WA DR #4	04/30/96		100
LCSW99006	04/30/96		100
PBT98878	04/30/96		100
PBW99006	04/30/96		100

FORM XIII - IN TCLP

U.S. EPA - CLP

14
ANALYSIS RUN LOG

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Instrument ID Number: TJA1100_____ Method: P_

Start Date: 04/30/96 End Date: 04/30/96

EPA Sample No.	D/F	Time	% R	Analytes PB																						
S0	1.00	1301		X																						
S	1.00	1304		X																						
S	1.00	1307																								
S	1.00	1311																								
ICV	1.00	1314		X																						
ICB	1.00	1317		X																						
CRI	1.00	1320		X																						
S	1.00	1324		X																						
ICSA	1.00	1329		X																						
ICSAB	1.00	1332		X																						
PBW99006	1.00	1336		X																						
LCSW99006	1.00	1339		X																						
ZZZZZZ	1.00	1342																								
CCV	1.00	1345		X																						
CCB	1.00	1348		X																						
#5 WA DR #4	1.00	1352		X																						
ZZZZZZ	1.00	1355																								
ZZZZZZ	1.00	1358																								
ZZZZZZ	1.00	1401																								
ZZZZZZ	1.00	1404																								
ZZZZZZ	1.00	1408																								
ZZZZZZ	1.00	1411																								
ZZZZZZ	5.00	1414																								
PBT98878	1.00	1417		X																						
ZZZZZZ	1.00	1420																								
CCV	1.00	1424		X																						
CCB	1.00	1427		X																						
ZZZZZZ	3.00	1430																								
ZZZZZZ	3.00	1433																								
ZZZZZZ	3.00	1436																								
PBT98878	1.00	1440																								
ICSA	1.00	1443		X																						

FORM XIV - IN TCLP

U.S. EPA - CLP

14

ANALYSIS RUN LOG

Lab Name: QUANTERRA_MO_____ Contract: 609.05____

Lab Code: ITMO__ Case No.: _____ SAS No.: _____ SDG No.: 10882_____

Instrument ID Number: TJA1100_____ Method: P_

Start Date: 04/30/96 End Date: 04/30/96

EPA Sample No.	D/F	Time	% R	Analytes: PB																							
ICSAB	1.00	1446		X																							
CCV	1.00	1449		X																							
CCB	1.00	1452		X																							

FORM XIV - IN TCLP

CHAIN OF CUSTODY
SAMPLE LOG-IN/RECEIPT RECORDS

DRUM 4

Quanterra April 18, 1996 03:44 pm

Account: 11084 Project: 609.05 ABB QAS No. 609.05 Rev. 0

Master Sample Login: 10882

Project Manager: A. Field

Draft: (Final:) Entered and Reviewed by: D. L. Jones PM Review: Allen McDaniel

Sample Header Template:

Sample No. / Client ID	C-Matrix	Date: Collected	Received	Due	Shipper	Rad Category	Rad Sample No.
Comments							
# Container Type	Analysis	Class	Preservative	Anal. Due Date	Hold Date	Site	(Container Numbers:% Filled)
Data:							
10882-001 #1 HOLE #8	Soil	16-APR-96 08:30	17-APR-96 09:20	08-MAY-96	FED-EX	3*	R4896-001
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	01-MAY-96	15-OCT-96	S4J	(225557:100)
1	RAD/SCREEN/Q4	S	COLD	01-MAY-96	14-OCT-96	S4J	(225557:100)
10882-002 #2 HOLE #10	Soil	16-APR-96 08:40	17-APR-96 09:20	08-MAY-96	FED-EX	3*	R4896-002
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	01-MAY-96	15-OCT-96	S4J	(225558:100)
1	RAD/SCREEN/Q4	S	COLD	01-MAY-96	14-OCT-96	S4J	(225558:100)
10882-003 #3 DUPLICATE #10	Soil	16-APR-96 08:40	17-APR-96 09:20	08-MAY-96	FED-EX	3*	R4896-003
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	01-MAY-96	15-OCT-96	S4J	(225559:100)
1	RAD/SCREEN/Q4	S	COLD	01-MAY-96	14-OCT-96	S4J	(225559:100)
10882-004 #4 WASTE DRUM #4	Soil	16-APR-96 08:45	17-APR-96 09:20	08-MAY-96	FED-EX	3*	R4896-004
1 PN - Plastic-1L	RAD/GAMMA/Q4	S	COLD	01-MAY-96	15-OCT-96	S4J	(225560:100)
1	RAD/SCREEN/Q4	S	COLD	01-MAY-96	14-OCT-96	S4J	(225560:100)
10882-005 #5 WASTE DRUM #4	Soil	16-APR-96 08:56	17-APR-96 09:20	08-MAY-96	FED-EX	3*	R4896-005
ICAP/TCLP - PB ONLY.							
2 PN - Plastic-1L	EXTMETAL/TCLP/Q4	S	COLD	01-MAY-96	14-MAY-96	S4J	(225561:100 225577:99)
2	ICAP/TCLP/Q4	S	COLD	01-MAY-96	13-OCT-96	S4J	(225561:100 225577:99)
1	PCB/8080/Q4	S	COLD	01-MAY-96	30-APR-96	S4J	(225578:98)
1	RAD/SCREEN/Q4	S	COLD	01-MAY-96	14-OCT-96	S4J	(225561:100)

00076

3*-Sample has not been rad screened.

TLMT 7C CUR# 6722

Chain of Custody Record

Quanterra Environmental Services

QUA 4124

Client	Project Manager	Date	Chain Of Custody Number
ABB Environmental Services	Herb Colby	4/16/95	11746

Address	Telephone Number (Area Code)/Fax Number	Lab Number	
107 Audubon Rd STE 25	617 245-6606		Page 1 of 1

City	State	Zip Code	Site Contact
Wakefield	MA	01880	Jake Jacobson

Project Name	Carrier/Waybill Number
DRMO Yard - Ft. Devens	Fed-X 316 9734 057

Contract/Purchase Order/Quote No.

Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers Type	Containers No.	Preservative	Condition on Receipt	Analysis: 901.1	PCBs	8080/1311 PB only
#1 Hole #8	4/16/96	0830	Soil	1 l	1 l	1	None	100%	✓		
#2 Hole #10	4/16/96	0840	Soil	1 l	1 l	1	None	100%	✓		
#3 Duplicate #10	4/16/96	0840	Soil	1 l	1 l	1	None	100%	✓		
#4 Waste Drum #4	4/16/96	0845	Soil	1 l	1 l	1	None	100%	✓		
#5 Waste Drum #4	4/16/96	0856	Soil	250 ml	250 ml	3 (RDJ)	Cold	3 X 100			✓
~~#6 Waste Drum #4~~ RDJ	~~4/16/96~~	~~0850~~	~~Soil~~	~~250 ml~~	~~250 ml~~	~~1~~	~~Cold~~				✓
~~#7 Waste Drum #4~~ RDJ	~~4/16/96~~	~~0850~~	~~Soil~~	~~250 ml~~	~~250 ml~~	~~1~~	~~Cold~~				✓

Special Instructions

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Turn Around Time Required: ☐ Normal ☐ Rush

QC Level: ☐ I. ☐ II. ☐ III.

Project Specific (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
[signature]	4/16/95	0915	[signature]	4-17-96	09:20

2. Relinquished By	Date	Time	2. Received By	Date	Time
R.D. Jacobson ABB-ES to Fed-X	4/16/96	14:30			

3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with Sample; CANARY - ...

000177

63

Quanterra
Environmental
Services

...D C.O.C.
...D BWL DS
...TE 4-17-96
TIME 1145
BY: [illegible]

Login No.: 10882

Condition Upon Receipt Variance Report
St. Louis Laboratory

Client: ABB
Project No: SW ~~534.CT~~ 609.05
Shipper/No: FedEx 316 9734 057
Date: 4-17-96 Time: 0920
Initiated by: [signature]
RFA/COC Numbers: 11746

Condition/Variance (Check all that apply):

1. ☐ Sample received broken/leaking.
2. ☐ Sample received without proper preservative.
   - ☐ Cooler temperature not within 4°C ± 2°C
     Record temperature: ______
   - ☐ pH ______
   - ☐ other: ______
3. ☐ Sample received in improper container.
4. ☐ Sample received without proper paperwork. Explain: ______
5. ☐ Paperwork received without sample.
6. ☐ No sample ID on sample container.
7. ☐ Custody tape disturbed/broken/missing.
8. ☐ Sample ID on container does not match sample ID on paperwork. Explain: ______
9. ☐ All coolers on airbill not received with shipment.
10. ☐ Other (explain below): ______

☑ No variances were noted during sample receipt. **Cooler Temperature Upon Receipt:** 4°C

Notes: ______

Corrective Action:

☐ Client's Name: ______ Informed verbally on: ______ By: ______

☐ Client's Name: ______ Informed in writing on: ______ By: ______

☐ Sample(s) processed "as is". ______

☐ Sample(s) on hold until: ______ If released, notify: ______

Sample Control Supervisor Review: (or designate) [signature] Date: 4-17-96

Project Management Review: [signature] Date: 4-18-96

SIGNED ORIGINAL MUST BE RETAINED IN THE PROJECT FILE

SL-ADMIN-0004, Revised 11/24/95

QC Summary

Drum 5

: BATCH : G73308
LYSIS : EPA 8080/3540

TYPE : FDER/SW
LYST : VICTOR BAUDER
RACTOR : CURTIS GUINYARD
A ENTRY : VICTOR BAUDER

REPORT DATE/TIME : 07/31/96 09:47
ANALYSIS DATE/TIME : 07/14/96
EXTRACT DATE : 07/16/96

TUS : FINAL

HOD BLANK CORRECTION METHOD : NONE
THAMA LOT: QEES

LD GRP	QC TYPE	PROJECT NUMBER	PROJECT NAME	LAB COORDINATOR
S	ESE	1296066G 0201	ABB FT DEVENS TASK 7	JOSEPH VONDRICK

PLE	CLIENT	DATE	TIME
E	ID	ANALYZED	ANALYZED
S*99	DRUM 5	07/22/96	06:07PM

HOLDING TIMES CHECK

PLE	ANALYTE	ANL DATE	EXT DATE	SMP DATE	H.T. OVER

HOLDING TIMES MET

hod Blank Sample Summary

E	SAMPLE	STORET	PARAMETER	UNITS	FOUND	DET LMT
19/96	MB*THAMA*1	39514*8080/3540-G	PCB-1016	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39491*8080/3540-G	PCB-1221	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39495*8080/3540-G	PCB-1232	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39499*8080/3540-G	PCB-1242	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39503*8080/3540-G	PCB-1248	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39507*8080/3540-G	PCB-1254	UG/KG-	ND	13.3
19/96	MB*THAMA*1	39511*8080/3540-G	PCB-1260	UG/KG-	ND	13.3

rogate Spike Recovery Summary

E	SAMPLE	STORET	PARAMETER	UNITS	TARGET	FOUND	%RECV	RECV CRIT
19/96	CCS*1060*133	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	200	219	110	67-119
19/96	CCS*1060*133	96519*SUR	DECACHLOROBIPHENYL	UG/KG	200	221	111	51-169
19/96	MB*THAMA*1	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	66.7	58.3	87.4	67-119
19/96	MB*THAMA*1	96519*SUR	DECACHLOROBIPHENYL	UG/KG	66.7	73.4	110	51-169
19/96	SP1*THAMA*1	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	66.7	55.4	83.1	67-119
19/96	SP1*THAMA*1	96519*SUR	DECACHLOROBIPHENYL	UG/KG	66.7	71.4	107	51-169
22/96	DA*DV5S*99	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	66.7	60.9	91.3	67-119
22/96	DA*DV5S*99	96519*SUR	DECACHLOROBIPHENYL	UG/KG	66.7	82.3	123	51-169
19/96	SPM1*DV5S*99	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	66.7	48.2	72.3	67-119
19/96	SPM1*DV5S*99	96519*SUR	DECACHLOROBIPHENYL	UG/KG	66.7	63.9	95.8	51-169
19/96	SPM2*DV5S*99	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	66.7	49.1	73.6	67-119
19/96	SPM2*DV5S*99	96519*SUR	DECACHLOROBIPHENYL	UG/KG	66.7	67.0	100	51-169
19/96	CCS*1060*143	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG	200	223	112	67-119
19/96	CCS*1060*143	96519*SUR	DECACHLOROBIPHENYL	UG/KG	200	207	104	51-169
22/96	CCS*1254*14	96798*SUR	TETRACHLORO-M-XYLENE (8080,354	UG/KG		NA		67-119
22/96	CCS*1254*14	96519*SUR	DECACHLOROBIPHENYL	UG/KG		NA		51-169

Batch Narrative - G73308 Analysis: EPA 8080/3540

Updated by 1781

CCS*1060*143 HAS PCB-1016 AT 21.0% DIFFERENCE WHICH IS SLIGHTLY ABOVE THE 20.0% CRITERIA. THE SAMPLE DOES NOT HAVE ANY PCB-1016 IN IT. ALL OTHER CCS COMPOUNDS ARE WITHIN CRITERIA. VSB 7-23-96

Updated by 3377

PROBLEM:
Sample matrix spike not within acceptance criteria:
PB UN*DV5SL*99 Exceeds criteria. (Recovery Limit 100 +/- 15)
EXPLANATION:Sample concentration is greater than 4 times the spike concentration.
PROBLEM:
Sample matrix spike duplicate not within acceptance criteria:
PB UN*DV5SL*99 Exceeds criteria. (Recovery Limit 100 +/- 15)
EXPLANATION:Sample concentration is greater than 4 times the spike concentration.

Analyst _____ DATE _____

Reviewer _____ DATE _____

_____ _____

_____ _____

FT DEVENS SOIL QC SUMMARY

Standard Matrix Spike (SP) Recovery and Replicate Summary

NAME	UNITS	STOR*METH	BATCH	SAMPLE	DATE	TARGET	FOUND	%RECV	RECV CRIT	R.P.D.	R.P.D. CRIT.
PCB-1016	UG/KG-	39514*8080/3540-G	G73308	SP1*THAMA*1	07/19/96	267	294	110.1	N/A		N/A
PCB-1260	UG/KG-	39511*8080/3540-G		SP1*THAMA*1		267	312	116.9	N/A		N/A
LEAD,TOTAL	UG/L	1051*6020-G	G73649	SP*QC*1	07/30/96	20.0	19.6	98.0	75-137		31

07/31/96 Environmental Science & Engineering, Inc.

FT DEVENS SOIL QC SUMMARY

Sample Matrix Spike (SPM) Recovery Summary

NAME	UNITS	STOR*METH	BATCH	SAMPLE	DATE	TARGET	FOUND	%RECV	RECV CRIT	UNSPIKED	R.P.D.	R.P.D. CRIT.
PCB-1016	UG/KG-	39514*8080/3540-G	G73308	SPM1*DV5S*99	07/19/96	303	360	118.9	N/A	0.0		N/A
PCB-1016	UG/KG-			SPM2*DV5S*99		303	324	107.0	N/A	0.0	10.5	N/A
PCB-1260	UG/KG-	39511*8080/3540-G		SPM1*DV5S*99		303	482	159.2	N/A	0.0		N/A
PCB-1260	UG/KG-			SPM2*DV5S*99		303	506	167.2	N/A	0.0	5.0	N/A
LEAD,TOTAL	UG/L	1051*6020-G	G73649	SPM1*DV5SL*99	07/31/96	22.2	800	3600	75-137	29900		31
LEAD,TOTAL	UG/L			SPM2*DV5SL*99		22.2	800	3600	75-137	29900	0.1	31

07/31/96 Environmental Science & Engineering, Inc.

FT DEVENS SOIL QC SUMMARY

Spike into Matrix (SPX) Recovery Summary

NAME	UNITS	STOR*METH	BATCH	SAMPLE	DATE	TARGET	FOUND	%RECV	RECV CRIT	UNSPIKED
LEAD,TOTAL	UG/L	1051*6020-G	G73649	SPX*DV5SL*99	07/30/96	5.6	-318	-5679	N/A	29900

Environmental Science and Engineering, Inc.

FT DEVENS SOIL QC SUMMARY

Standard Matrix Spike Recovery and Replicate Statistics Summary

STORET*METHOD	NAME	N	MINIMUM	MAXIMUM	AVERAGE	STANDARD DEVIATION
39514*8080/3540	PCB-1016	1	110.1	110.1	110.1	0.0
39511*8080/3540	PCB-1260	1	116.9	116.9	116.9	0.0
1051*6020-G	LEAD,TOTAL	1	98.0	98.0	98.0	0.0

Environmental Science and Engineering, Inc.

FT DEVENS SOIL QC SUMMARY

Sample Matrix Spike Recovery Statistics Summary

STORET*METHOD	NAME	N	MINIMUM	MAXIMUM	AVERAGE	STANDARD DEVIATION
39514*8080/3540	PCB-1016	2	107.0	118.9	113.0	8.4
39511*8080/3540	PCB-1260	2	159.2	167.2	163.2	5.7
1051*6020-G	LEAD,TOTAL	2	3600	3600	3600	0.0

Environmental Science and Engineering, Inc.

FT DEVENS SOIL QC SUMMARY

Spike into Matrix Recovery Statistics Summary

STORET*METHOD	NAME	N	MINIMUM	MAXIMUM	AVERAGE	STANDARD DEVIATION
1051*6020-G	LEAD,TOTAL	1	-5679	-5679	-5679	0.0

Chains of Custody (copies)

Drum 5

CHAIN OF CUSTODY RECORD

PROJECT NO.: 9376.02

PROJECT NAME: Ft. Devens - DRMO Rad. Survey

SAMPLERS (SIGNATURE): Timothy Dame - ABB-ES

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	SAMPLE TYPE: TCLP-1311-(Pb)	SAMPLE TYPE: PCB-8080	REMARKS: INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE
	6/12/96	1115	X		DRUM 5	2	X	X	Soil DV55+99
									List - DV55A

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
Timothy Dame	6/12/96 1108	Fed Ex			
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR DISPOSAL BY: (SIGNATURE)	DATE/TIME	REMARKS	
				- TCLP-lead only and PCB in soil Potential for low level Ra-226 (3-10 pCi/g)	

ABB Environmental Services, Inc.

OH-62

9000

cc 10/14/96

Environmental Science & Engineering, Inc. 07-03-96 *** FIELD LOGSHEET *** FIELD GROUP: **DV5SL** 1/19
PROJECT NUMBER 1296066G 0201 FG NAME: FT DEVENS ABB LEACHATE LAB COORD. JOSEPH VONDRICK

DV55L

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST
*99	DRUM 5		NF	7/2/96	4p-	~~ALGAL~~ cc per JJV

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: **I**=IGNITABLE **C**=CORROSIVE **R**=REACTIVE **T**=TOXIC WASTE **H**=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Environmental Science & Engineering, Inc.

SAMPLED BY: (Name/Organization) _____

RELINQUISHED	(Name/Organization/Date/Time)	VIA:	REC'D BY (Name/Organization/Date/Ti
1	ABRAHAM JACOB/ESE/7/3/96 1p	mailing	[signature] 656 7/3/96 1300
2			
3			CC 7/3/96

SAMPLER: Shipped on Ice? Yes/No; I anticipate shipping ____ (#) more samples on ___/___
SAMPLE CUSTODIAN: Custody Seals Used? Yes/~~No~~ If Yes, Seals Intact? Yes/~~No~~ Interior Temp? N Deg C
Preservatives Audited? Yes/No Any Problems? Yes/~~No~~; If Yes, describe:
Had delivered cust Intact

0007

Appendix F

Radioactive Package Shipment Survey Record

Radioactive Package Shipment Record

DRUM # 1

Date Surveyed 2/23/96 Surveyed By Tom Bracken

Transported By _____ License Plate # _____

Type of Package 55 gallon drum Label (circle one) White I
Yellow II
Yellow III

Dose rate survey

Survey Instrument & serial # Bicron # B966N

Reading at Contact 50 Reading at 3 ft. 10

Smear Survey

Survey Instrument & serial # Ludlum Model #2223 scaler/Rateneter Serial # 102933

Results < 26 dpm/100 cm^2 α

Results < 496 dpm/100 cm^2 β / γ

Contamination greater than 2,2000 dpm/100 cm^2 removable must be decontaminated prior to shipment.

Describe Radioactive Material (activity, physical form, and quantity)

Radium 226 in soil and asphalt mix

Reviewed By: _____ Date: 2/27/96

Radioactive Package Shipment Record

DRUM #2

Date Surveyed 2/23/96 Surveyed By TOM BRACKE

Transported By _____ License Plate # _____

Type of Package 55 gallon drum Label (circle one) White I
Yellow II
Yellow III

Dose rate survey

Survey Instrument & serial # BICRON # B966N

Reading at Contact 50 Reading at 3 ft. 10

Smear Survey

Survey Instrument & serial # Ludium Model # 2223 scaler/Rateneter Serial # 162933

Results <26 dpm/100 cm^2 α

Results <496 dpm/100 cm^2 β / γ

Contamination greater than 2,2000 dpm/100 cm^2 removable must be decontaminated prior to shipment.

Describe Radioactive Material (activity, physical form, and quantity)

Radium 226 in soil and asphalt mix

Reviewed By: _____ Date: 2/27/96

Radioactive Package Shipment Record

Drum #3

Date Surveyed 2/23/96 Surveyed By Tom Brooke

Transported By _____ License Plate # _____

Type of Package 55 gallon drum Label (circle one) White I
Yellow II
Yellow III

Dose rate survey

Survey Instrument & serial # Bicron #B966N

Reading at Contact 55 Reading at 3 ft. 10

Smear Survey

Survey Instrument & serial # Ludlum Scaler/Rateneter Model # 2223 Serial # 102933

Results <26 dpm/100 cm^2 α

Results <49 dpm/100 cm^2 β / γ

Contamination greater than 2,2000 dpm/100 cm^2 removable must be decontaminated prior to shipment.

Describe Radioactive Material (activity, physical form, and quantity)

Radium 226 in soil and asphalt mix, Radium 226 in DAW - paper, plastic + metal

Reviewed By: Tom Brooke Date: 2/27/96

Radioactive Package Shipment Record

Drum # 4

Date Surveyed 4/16/96 Surveyed By Scott Dennerlein

Transported By _____ License Plate # _____

Type of Package 55 gallon drum Label (circle one) White I
Yellow II
Yellow III

Dose rate survey

Survey Instrument & serial # Bicron # B966N

Reading at Contact 15 μR/hr Reading at 3 ft. 10 μR/hr

Smear Survey

Survey Instrument & serial # Ludlum 2223 # 102933

Results < 30 dpm/100 cm^2 α

Results < 500 dpm/100 cm^2 β /~~γ~~

Contamination greater than 2,2000 dpm/100 cm^2 removable must be decontaminated prior to shipment.

Describe Radioactive Material (activity, physical form, and quantity)

Radium -226 in soil / asphalt

Reviewed By: Thomas P. Beadle Date: 8/8/96

Radiation Science, Inc. Form XX

Radioactive Package Shipment Record

Drum # 5

Date Surveyed 6/12/96 Surveyed By Scott Dennerlein

Transported By _____ License Plate # _____

Type of Package 55 gallon drum Label (circle one) White I
Yellow II
Yellow III

Dose rate survey

Survey Instrument & serial # Bicron * B966N

Reading at Contact 9 μR/hr Reading at 3 ft. 9 μR/h.

Smear Survey

Survey Instrument & serial # Ludlum 2223 # 102933

Results < 30 dpm/100 cm^2 α

Results < 500 dpm/100 cm^2 β / γ

Contamination greater than 2,2000 dpm/100 cm^2 removable must be decontaminated prior to shipment.

Describe Radioactive Material (activity, physical form, and quantity)

Radium-226 in soil / asphalt

Reviewed By: Thomas Rado Date: 8/8/96

Radiation Science, Inc. **Form XX**