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FEB 20 2009

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Federal Facilities Branch
61 Forsyth Street
Atlanta, Georgia 30303

PPPO-02-308-09

Mr. Ed Winner, FFA Manager
Kentucky Department for Environmental Protection
Division of Waste Management
200 Fair Oaks Lane, 2nd Floor
Frankfort, Kentucky 40601

Dear Mr. Ballard and Mr. Winner:

ADDENDUM TO THE WORK PLAN FOR THE BURIAL GROUNDS OPERABLE UNIT REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY- SOLID WASTE MANAGEMENT UNIT 13 FIELD SAMPLING PLAN (DOE/OR/07-2179/A1&D2/R1)

Please find enclosed the D2/R1 Addendum to the Work Plan for the Burial Grounds Operable Unit (BGOU) Remedial Investigation/Feasibility Study (RI/FS). Also enclosed is a comment response summary that addresses comments received from U.S. Environmental Protection Agency and the Kentucky Department for Environmental Protection on January 22 and January 21, 2009 respectively.

If you have any questions or require additional information, please contact Jennifer Woodard at (270) 441-6820.

Sincerely,

Reinhard Knerr
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosures:

1. D2/R1 Addendum to the WP for the BGOU RI/FS – SWMU 13 FSP
2. Comment Response Summary

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EIC/Paducah
J. Woodard, PPPO/PAD

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CERTIFICATION

Document Identification: ***Field Sampling Plan Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Solid Waste Management Unit (SWMU) 13*** **(DOE/OR/07-2179&D2/A1/R1)**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Paducah Remediation Services, LLC
Co-Operator

Mike Spry, President

2/19/09
Date Signed

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

U.S. Department of Energy (DOE)
Owner and Operator

Reinhard Knerr, Paducah Site Lead

2/20/09
Date Signed

DOE/OR/07-2179&D2/A1/R1
Primary Document

Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13 Field Sampling Plan

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Primary Document

Addendum to the
Work Plan for the Burial Grounds Operable Unit
Remedial Investigation/Feasibility Study
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky–Solid Waste Management Unit
(SWMU) 13
Field Sampling Plan

Date Issued—February 2009

Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
PADUCAH REMEDIATION SERVICES, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-06EW05001

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CONTENTS

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FIGURES

TABLES

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ACRONYMS

BGOU	Burial Grounds Operable Unit
BHC	hexachlorocyclohexane
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOE	U.S. Department of Energy
DPT	direct-push technology
EM	electromagnetometer
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
HU	hydrogeologic unit
KEEC	Kentucky Energy and Environment Cabinet
NA	not applicable
NAL	no action level
ND	not detected
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PGDP	Paducah Gaseous Diffusion Plant
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SWMU	solid waste management unit
TBD	to be determined
TCL	target compound list
UCRS	Upper Continental Recharge System
VOC	volatile organic compound

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1. INTRODUCTION

Solid Waste Management Unit (SWMU) 13 occupies an area of approximately 294,000 ft^2 (with maximum dimensions of 290 ft in a north-south direction and 1,076 ft in an east-west direction) in the northwest quadrant of the secured area of the U.S. Department of Energy (DOE) Paducah Gaseous Diffusion Plant (PGDP) (Figure 1). The SWMU consists of the C-746-P and C-746-P1 Yards, formerly used for the storage of clean scrap metal prior to sale to scrap metal reclaiming vendors,[1] beginning in the late 1970s. A PGDP Scrap Metal Removal Project, begun in 2002, addressed the aboveground metal in the C-746-P1 Yard in September 2005 and the C-746-P Yard in February 2006. This action removed larger pieces of metal, but left smaller pieces of metal on the surface and in the upper 1 to 2 ft of the subsurface.

Analyses of soil samples collected in 2001 (0-to-1 ft depth) and in 2004 (3.0-to-3.5 ft depth) characterized the contaminant levels of the shallow soils at SWMU 13. March and April 2007 interviews of a site employee identified three areas of interest where materials may have been buried previously as part of routine maintenance of the scrap yards (DOE 2008) (hereafter referred to as "the three areas of interest"). DOE followed up on the interview with geophysical surveys of expanded areas at the three locations in April and May 2007 [independent of the Burial Grounds Operable Unit (BGOU) Remedial Investigation (RI)] to verify the presence of buried materials.

The objectives of this Field Sampling Plan, which is an addendum to the BGOU RI/Feasibility Study (RI/FS) Work Plan (DOE 2006), are to (1) determine extent of buried materials (i.e., scrap metal) where present at SWMU 13 and (2) determine the nature of any releases from buried materials located. (Any surface soil contamination present at SWMU 13 will be addressed by the Soils Operable Unit.) These objectives are consistent with the scope of a site investigation. To accomplish these objectives, a geophysical survey will be completed to verify the location of buried materials. Subsequently, samples will be collected from soil and groundwater (if possible) associated with buried materials. The information developed will be used to evaluate appropriate remedial alternatives (if necessary). If further investigation of SWMU 13 is necessary, based on results of this site investigation, agreement among parties will be made as to further evaluation and/or action.

The conceptual model for buried materials at SWMU 13, which is based upon process knowledge and earlier sampling results, is that the buried materials are inert, clean metal that has not released contamination to surrounding soil and groundwater. Additionally, if contaminants were released, site knowledge suggests that chemical and physical diffusion should limit contaminant migration to soils adjacent to and below buried material.

Section 2 presents the existing data for SWMU 13. The conceptual site model (Section 3) serves as the basis for the proposed investigative activities. Data gaps are summarized in Section 4. Sections 5 and 6 present the sampling media and methods and documentation for sample analysis. (Federal Facility Agreement requirements for a site-specific sampling plan are addressed in Section 5.) Sampling procedures, documentation, and the sample location survey are the subjects of Sections 7, 8, and 9.

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[1]The C-746-P Clean Scrap Yard was divided into east (C-746-P) and west (C-746-P1) units to allow for the continuous disposal of clean scrap material. As sold scrap was removed from one yard, the other yard was filled.

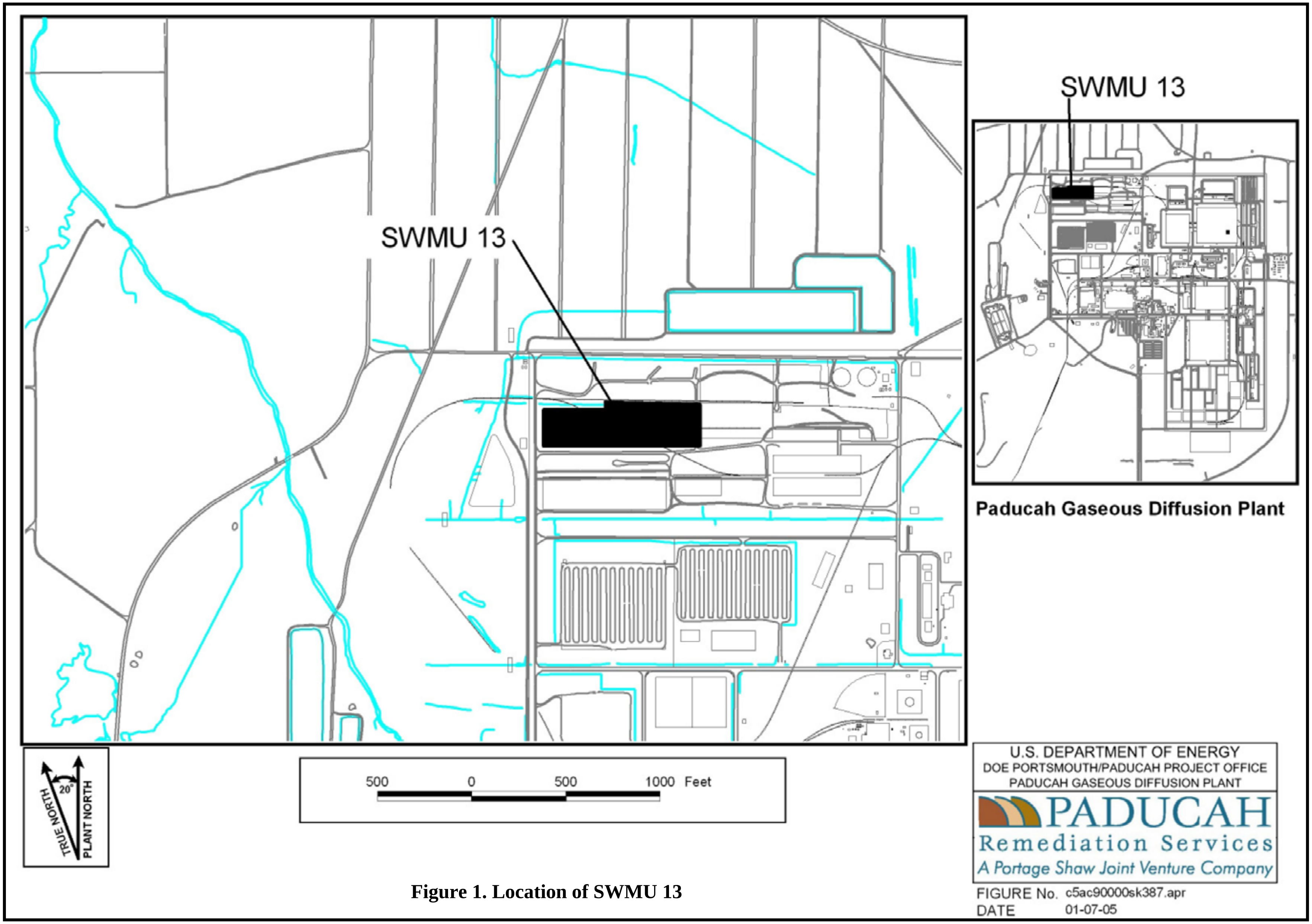

Figure 1. Location of SWMU 13

2. REVIEW OF EXISTING DATA

The surface at SWMU 13 is covered by soil and up to 2 ft of gravel. Loess (silt) of Hydrogeologic Unit (HU) 1 underlies the soil and gravel cover to a depth of approximately 20 ft, based on logs of soil borings in adjacent areas. A shallow water table commonly occurs in the northwest quadrant of the PGDP-secured area. The depth of the water table at SWMU 13 likely is between 5 and 10 ft.

The existing characterization data for SWMU 13 include 1 sediment sample[2] from the Waste Area Group 22 RI (collected October 2, 1996); 7 surface soil samples collected November 15 through 21, 2001; and 27 shallow soil samples (sampling the 3.0 to 3.5-ft depth interval) collected September 7 through 10, 2004. Figure 2 is a map of existing sample locations at SWMU 13. This figure also shows the location of the three areas of interest.

Table 1 summarizes the analysis types that are available for each medium (and number of samples within each medium). The sample locations specific to each medium are presented in Table 2. Tables in the appendix summarize the screening of the analyses for each medium against background and the no action level (excavation worker scenario).

Table 1. Analysis Types for Each Medium Previously Sampled for SWMU 13

Media	Depth (ft)	Number of Samples	Analysis Type				
			Metals	PCBs	Radionuclides	Semivolatile Organics	Volatile Organics
Sediment	0	1	√[a]	√	√	√	NA[b]
Surface Soil	0–1	7	√	√	√	√	√
Subsurface Soil	3–3.5	27	√	√	√	√	√

[a] √ = All samples were tested for the analysis.
[b] The sediment sample was not analyzed for volatile organic compounds.

Table 2. Sample Stations for Each Medium Previously Sampled for SWMU 13

Sediment 0 ft depth	Surface Soil 0–1 ft depth	Subsurface Soil 3–3.5 ft depth	
DD-07	SYP001	C746P1GR5	C746PGR1
	SYP002	C746P1GR13	C746PGR7
	SYP003	C746P1GR14	C746PGR27
	SYP004	C746P1GR15	C746PGR29
	SYP005	C746P1GR18	C746PGR31
	SYP006	C746P1GR20	C746PGR38
	SYP007	C746P1GR31	C746PGR41
		C746P1GR33	C746PGR58
		C746P1GR37	C746PGR65
		C746P1GR41	C746PGR78
		C746P1GR45	C746PGR83
		C746P1GR58	C746PGR91
		C746P1GR60	C746PGR104
			C746PGR106

[2]Any contamination in the ditches adjacent to SWMU 13 will be addressed under the decontamination and decommissioning of the gaseous diffusion plant.

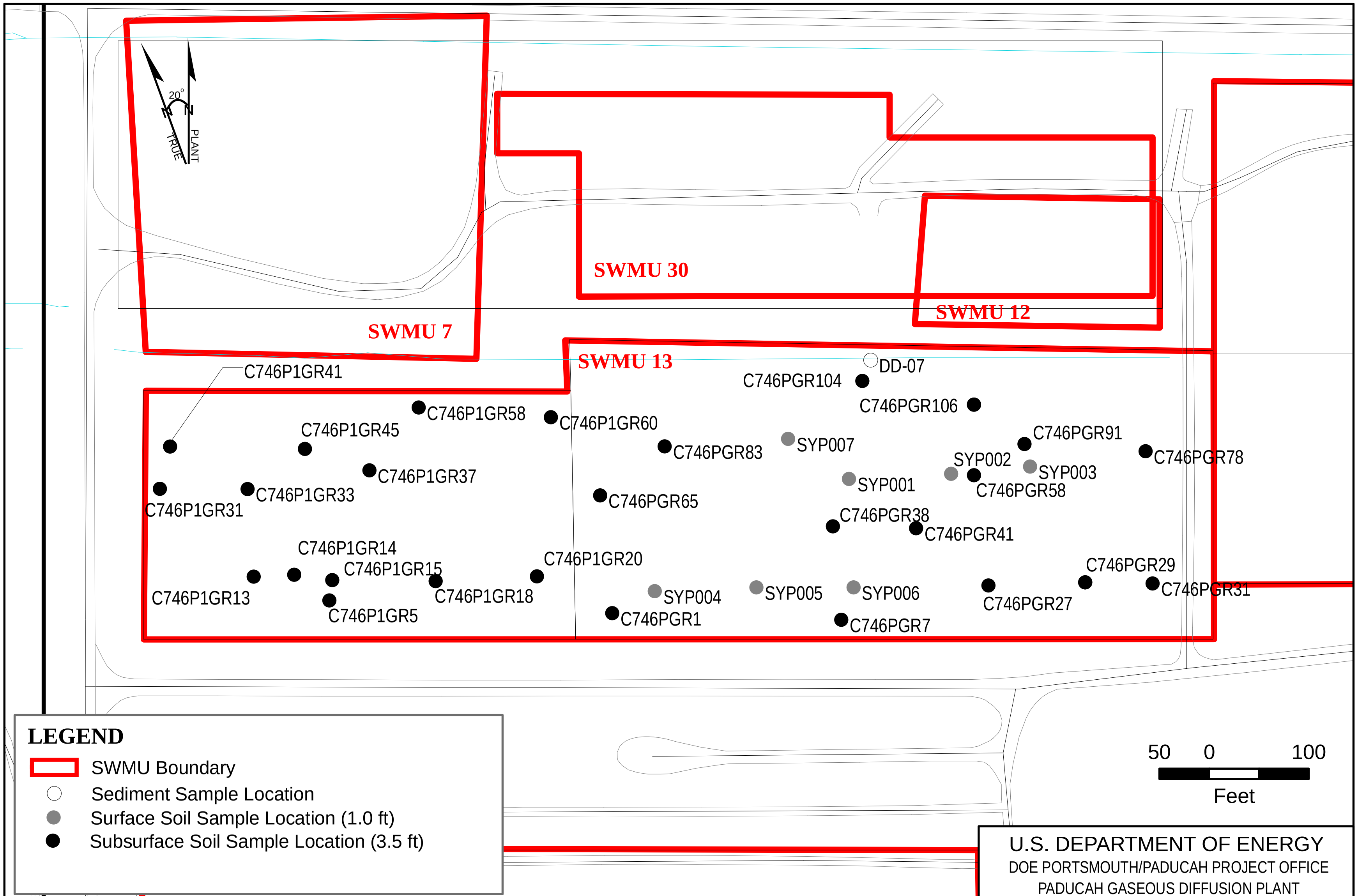

Figure 2. Existing Sample Locations at SWMU 13

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Metals and radionuclides were commonly detected. The only metal or radionuclide to exceed its background level in surface soil was uranium-238.

The metals and radionuclides occurring most frequently above their background levels in subsurface soil were cadmium, calcium, technetium-99, and uranium-238. Notably, cadmium and calcium levels frequently exceeded 5X and 10X the background levels. (Barium, beryllium, cesium-137, chromium, copper, vanadium, zinc and uranium-234 also were frequently detected and sometimes exceeded their background levels.) Two polyaromatic hydrocarbons (PAHs) frequently were detected in subsurface soil: fluoranthene (17% of the analyses) and pyrene (17% of the analyses). Di-n-butyl phthalate (detected in 31% of the analyses) was another frequently detected semivolatile compound. Polychlorinated biphenyls (PCBs) were detected in 28% of subsurface soil samples, with PCB-1254 (in 21% of the analyses) and PCB-1260 (in 14% of the analyses) being the most common. Detections of volatile organic compounds (VOCs) in subsurface soils were commonly limited to 2-Butanone (detected in 81% of the samples at 6 to 28 µg/kg), carbon disulfide (in 96% of the samples at 7 to 8 µg/kg and in a lab blank sample), and acetone (in 72% of the samples at 11 to 98 µg/kg). These VOCs are not expected to be indicative of contamination in the soils.[3]

Based on the historical analyses of subsurface soil samples collected from the 3.0 to 3.5 ft-depth interval, the primary contaminants in the subsurface soils are calcium, cadmium, several PAHs, PCB-1254, and PCB-1260.

Interviews (on March 28, 2007, and April 24, 2007) with a United States Enrichment Corporation operator who had knowledge of burial at PGDP (DOE 2008) indicate that formerly it was common practice to sell scrap to dealers in the C-746-P Clean Scrap Yards. Excess (not sold) scrap was collected in a pile and buried in 5- to 6-ft deep holes and then covered. Three areas were identified as potential burial sites (Figure 3) during the interviews. The operator recalled working in an area on the east side of the combined C-746-P/-P1 Scrap Yards and in an area near the center of the yards, but was unsure of the type of work (i.e., possibly grading work and not burial). The operator was more confident that a third area, at the western end of the scrap yards, was used as a burial location for scrap that was not collected by the local scrap dealers for resale. In the interview, the operator suggested that copper bars from fluorine cells might be buried in the third area.

Geophysical surveys were performed over expanded areas at the three locations (Figure 3) on April 24, May 2, 3, 7, and 10, 2007. These surveys used a Geonics Electromagnetometer™ (EM)-61, pulled as a trailer, to locate buried metal in the three areas of interest. Readings were taken along continuous lines spaced 5 ft apart. The EM-61 survey identified metal throughout the three areas of interest beginning at a depth of 2 ft. This metal likely is small scrap related to previous housekeeping activities (spreading and covering small amounts of metal). The EM-61 survey detected an anomaly (Figure 4) beginning at approximately 4 to 8 ft in depth in the area of interest at the western end of the scrap yards.

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[3]2-Butanone is a widespread air contaminant associated with paints, coatings, glues, and automobile exhaust. Carbon disulfide has not been used in PGDP processes. Carbon disulfide was detected in the laboratory blank sample and likely is a laboratory-related contaminant. Acetone is a common laboratory-related contaminant.

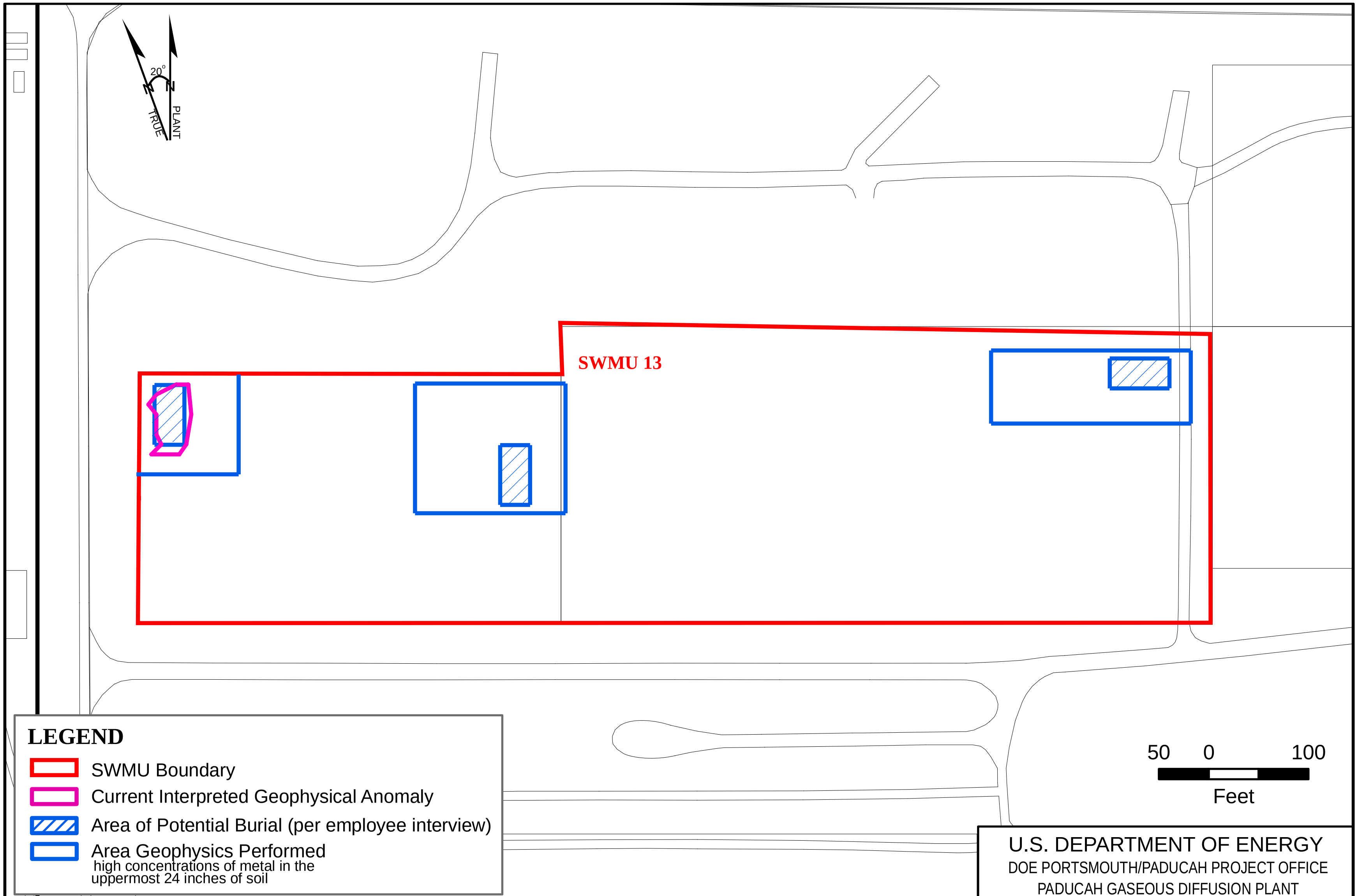

Figure 3. Area of Geophysical Surveys (April and May 2007) in SWMU 13

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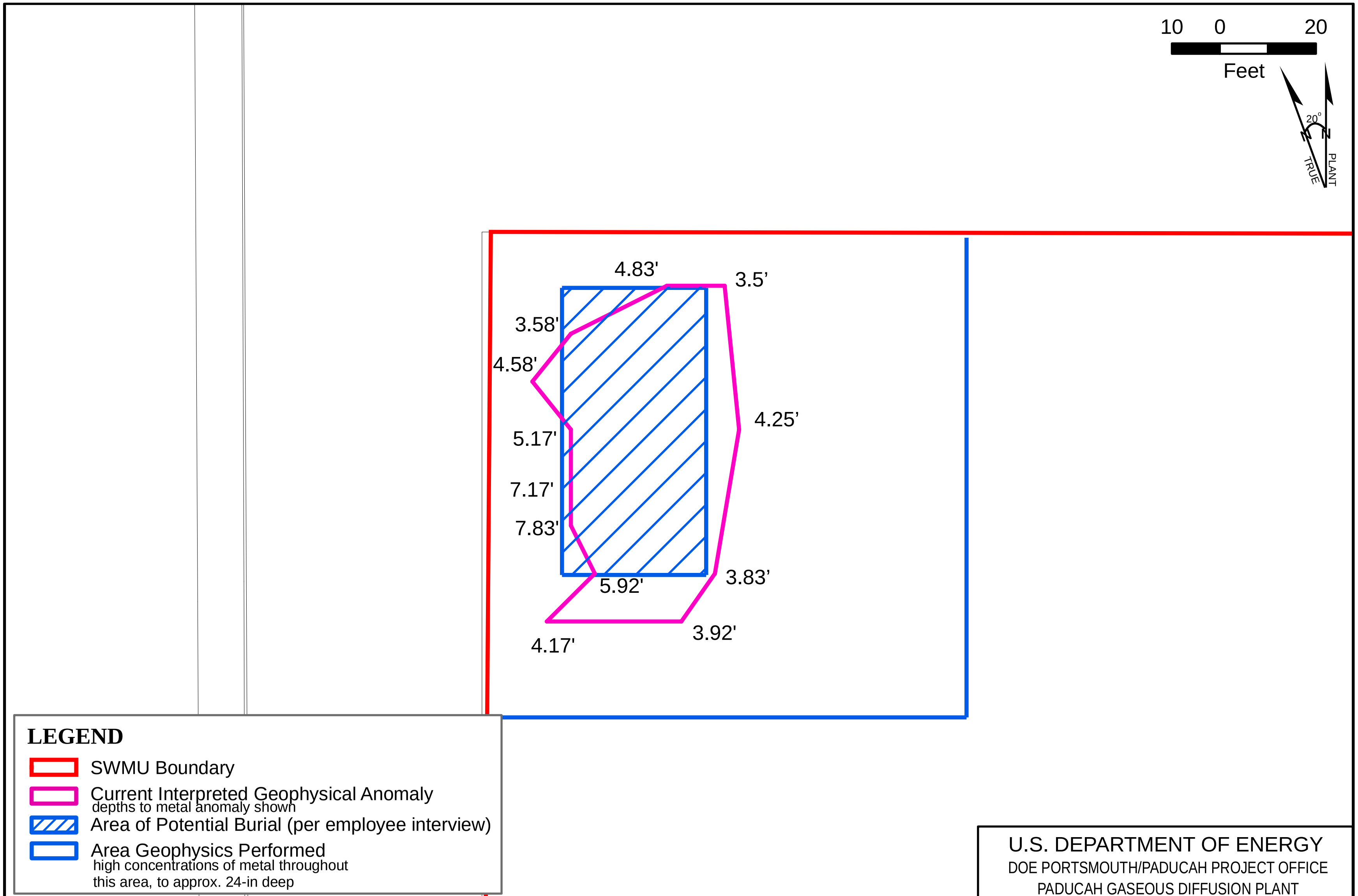

Figure 4. Geophysical Anomaly at West End of SWMU 13

U.S. DEPARTMENT OF ENERGY
DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

PADUCAH Remediation Services
A Portage Shaw Joint Venture Company

Figure No. bgou\ri swmu 13_anomaly.mxd
DATE 07-10-08

3. CONCEPTUAL SITE MODEL

SWMU 13 is a former scrap yard used for the storage of clean scrap metal prior to sale to scrap metal reclaiming vendors. The conceptual site model to support the investigation of SWMU 13 is that clean, inert material was buried at SWMU 13; no migration of contaminants derived from the buried material has occurred. Possible deviations of this model are that some migration of dissolved metals has occurred and that the buried material was not clean; other contaminants associated with the buried materials have migrated to the surrounding soil. Metals, PAHs, and PCBs are the primary contaminants associated with the historical samples of SWMU 13 subsurface soil and represent possible contaminants of the buried materials. Radionuclides and VOCs are likely deviations to the possible contaminants. Containers are not known to have been buried at SWMU 13; therefore, any contaminants that may have migrated should be derived from the buried materials.

4. DATA GAPS

Surface geophysics will be used to identify and locate burial areas within SWMU 13. Soil and groundwater (if possible) will be used to determine the nature of buried material and releases from it. The data gaps associated with characterization of SWMU 13 are as follows.

- The nature and location of buried materials have not been adequately characterized.[4]
- The nature of any release from buried materials remains undetermined.

5. SAMPLING MEDIA AND METHODS

Surface geophysics will be used to identify and locate burial areas within SWMU 13. Soil and groundwater (if possible) will be used to determine the nature of buried material and releases from it. If soil sampling identifies a water-productive zone (saturated sand horizon), then attempts will be made to collect groundwater samples.

5.1 SURFACE GEOPHYSICS

Geophysical Survey Design. The previous surface geophysical survey was limited to the three areas of interest identified in the March and April 2007 interviews of a site employee. As part of the investigation of SWMU 13, this Field Sampling Plan provides a surface geophysical survey of the whole SWMU 13 scrap yard.

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[4]A previous surface geophysical survey of SWMU 13 using an EM-61 identified the presence of shallow metal throughout the survey area, at a depth of 2 ft, and a discrete area of buried metal beginning at 4 to 8 ft below ground surface in the northwest area of interest. The shallow buried metal at 2 ft depth limited the ability of the EM-61 used in the previous geophysical survey to characterize deeper soils; uncertainty remains regarding the presence of deeper buried materials within the three areas of interest identified in the interview of the site employee (DOE 2008).

In order to image deeper soils, the surface geophysical survey will use an EM-61-MK2 Differential System, which reduces the response from shallow buried metal and allows for an approximation of the depth to discrete deeper metal targets.[5] The EM-61-MK2 survey will be implemented along continuous lines spaced 4 to 5 ft apart across the entire SWMU 13 scrap yard.

The EM-61-MK2 Differential System consists of a main receiver coil and a second receiver coil, mounted 1.3 ft above the main receiver coil. Electronics screen out the electromagnetic response of shallow buried metal, using the decay of the electromagnetic signal over the distance between the main receiver coil and the second receiver coil, and characterize the deeper soil. A central processing unit automatically records the electromagnetic response and location [via global positioning system (GPS) such as a Trimble AG114 GPS Unit™]. Results of the geophysical survey will be reduced by the EM-61-MK2 Differential System and plotted using Trackmaster 61™ software, or equivalent, to present the electromagnetic characteristics of the subsurface soil.

5.2 SOIL AND GROUNDWATER SAMPLING

Soil Boring Locations. The project manager and project geologist will review the geophysical survey results, plotted as contours of soil conductivity, to identify likely areas of buried materials. If no anomalies are found within an area of interest, the project geologist will use the results to map regions of distinctive soil conductivity (areas of relative uniform conductivity and areas of highly variable conductivity) within the area of interest to help locate the sample borings. DOE will consult with U.S. Environmental Protection Agency (EPA) and the Kentucky Energy and Environment Cabinet (KEEC) prior to placement of the soil borings.

Soil samples will be collected within the anomalies and adjacent to anomalies that are indicative of buried material, if possible. The preferred sample locations will be within the areas identified by the geophysical survey as containing buried materials of larger size.[6] If refusal is encountered, additional attempts will be made to collect soil samples. If the buried metal is in a dense configuration making it impractical to obtain a soil sample at the specified depth, then angular borings will be made to collect soil samples from beneath the buried material. In the case where the geophysical survey indicates that no buried material is present at a location previously identified as an area of interest in the subsurface soils below 2 ft depth, the soil borings will be distributed across that area and the locations will be selected based on professional judgment to characterize all regions of soil conductivity. Table 3 presents the anticipated number of soil borings that will be used for the characterization. These sampling numbers are based upon the assumption that the geophysical survey will verify that sampling is needed only in the previously identified areas of interest. If other areas of buried materials are identified, up to eight contingency borings will be sampled.

In the case where the geophysical survey results are nondescriptive and don't identify buried waste or regions of distinctive soil conductivity, sampling locations will be limited to the areas of interest and will be picked using a triangular grid that has density sufficient to identify a circular area of contamination with a radius of 20 ft at a 95% probability.[7]

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[5]The EM-61-MK2 has a maximum depth of detection of approximately 17 ft and is able to detect a single 55-gal drum at depths greater than 9 ft. The lateral resolution of the survey is expected to be several feet at the expected depth of any buried metal.

[6]There is no basis for assuming any sorting of buried waste. Characterization is targeted toward larger features as the most likely source of sufficient soil contaminant mass to exceed action criteria.

[7]*Visual Sample Plan*, version 5.1.1 (Battelle 2008).

Table 3. SWMU 13 Investigation and Sampling Summary

Area of Interest	Dimensions (ft)	Surface Geophysics	Soil Borings[a]	Soil Samples (2 per boring)	Groundwater Samples	Quality Assurance Samples
Northeast	70 X 200	Yes	6	12	1	2 field blank 2 field duplicate
Central	130 X 150	Yes	8	16	1	2 field blank 2 field duplicate
Northwest	100 X 100	Yes	5	10	1	2 field blank 2 field duplicate
Unidentified	TBD[b]	Yes	TBD	TBD	TBD	TBD
TOTAL	NA[c]	NA	19	38	3	6 field blanks 6 field duplicates

[a]Additional soil borings may be necessary, if required, to adequately characterize burial cells within the three areas of interest and if other areas of interest are identified during the geophysics survey.
[b]TBD = to be determined. A maximum of 8 contingency soil borings/16 sample intervals and 1 field blank and 1 field duplicate will be sampled prior to consultation with EPA and KEEC.
[c]NA = not applicable

If suspected burial areas are identified outside the three areas of interest, soil borings will be located in a manner similar to the placement of soil borings within the three areas of interest.

Sampling Method. The soil borings will be sampled using direct-push technology (DPT) in accordance with DOE Prime Contractor-approved procedures. The drill rig will use a dual-tube sampling system to advance a set of sampling rods. Once the sampling depths are achieved, a soil sampler containing an acetate sample tube will be lowered to the top of the sample interval (10 ft depth for the top soil sample, 15 ft depth for the bottom soil sample), and the soil sampler will be pushed across the sample interval (10 to 13-ft depth interval for the top soil sample, 15 to 18-ft depth interval for the bottom soil sample[8]) to collect the undisturbed soil sample. Immediately upon retrieval of the soil sample and opening of the acetate sample tube, the soil core will be surveyed for VOCs using hand-held instrumentation such as a photoionization detector (with a detection limit of 0.1-1 ppm). The VOC sample will be collected first, from a targeted area of the soil core if identified by the survey. The field crew next will record the lithology of the sample, and the soil will be placed in a clean bowl and mixed thoroughly to homogenize the soil before subsampling for other laboratory analysis (i.e., two sets of samples from each boring). This resulting soil mixture will be placed in the appropriate sample jars for analysis. Table 4 identifies the analyses for the SWMU 13 soil samples. These analyses include metals, PAHs, and PCBs, the primary contaminants associated with SWMU 13; and radionuclides and VOCs, which represent reasonable deviations from the conceptual site model.

Although the water table is expected to be shallow at SWMU 13, the Upper Continental Recharge System (UCRS) (water table system) typically does not yield good quality (low suspended solids) water samples. An attempt will be made to collect an unfiltered and filtered UCRS groundwater sample from each of the areas containing buried metal based on the geophysics survey results.

If soil sampling identifies a water-productive zone (saturated sand horizon) near the base of the borings, the field crew will collect the groundwater samples from within the DPT sample rods after the collection of the soil sample by retracting the DPT sample rods enough to expose the water-productive zone in the open borehole. Otherwise, the DPT sample rods will remain at the total depth. Where groundwater

[8]3-ft length cores are required to ensure adequate soil volume to meet sample requirements.

collects in the soil boring and sample rods, a limited amount of groundwater, typically less than a gallon, will be pumped to the surface with a small bladder or inertial pump to reduce the turbidity of the water sample. Since sampling will take place soon after drilling ceases, there will be no stagnant water to remove from the boring; therefore, there will be no minimum purge volume. The water sample will be collected using a flow rate of 200 mL/minute or less after sufficient water has been purged to allow geochemical parameters (i.e., pH, dissolved oxygen, conductivity, and temperature) to stabilize within the boring. After sampling is completed, the sample tubing and pump will be removed from the boring and decontaminated in accordance with DOE Prime Contractor-approved procedures.

Aliquots will be collected for the parameters listed in Table 9.9 of the BGOU RI/FS Work Plan. If the sample volume is not sufficient to collect aliquots for all analyses, then aliquots for analysis of unfiltered water will take precedence. For both unfiltered and filtered water analyses, the preferred order of analyses will be metals, radionuclides, PCBs, PAHs, and volatiles.

Table 4. SWMU 13 Soil Analytes and Reporting Limits

Reporting Limit[a] (mg/kg)	Metals SW-846, 6010		
20	Aluminum		
0.5	Beryllium		
2	Cadmium		
100	Calcium		
2.5	Chromium		
2.5	Copper		
20	Iron		
2.5	Manganese		
5	Molybdenum		
5	Nickel		
2.5	Silver		
2.5	Vanadium		
20	Zinc		
(mg/kg)	**Metals SW-846, 6020**		
1	Arsenic		
20	Selenium		
2	Thallium		
1	Uranium		
(μg/kg)	**TCL PAHs SW-846, 8270**		
660	Acenapthene	Benzo(g,h,i)perylene	Fluoranthene
	Acenaphthylene	Benzo(k)fluoranthene	Fluorene
	Anthracene	Chrysene	Indeno(1,2,3-cd)pyrene
	Benz(a)anthracene	Dibenz(a,h)anthracene	Naphthalene
	Benzo(a)pyrene		Phenanthrene
	Benzo(b)fluoranthene		Pyrene
(μg/kg)	**TCL Other Semivolatiles SW-846, 8270**		
660	di-N-butylphthalate		
(mg/kg)	**TCL PCBs SW-846, 8082**		
0.1	Aroclor-1016	Aroclor-1242	Aroclor-1254
	Aroclor-1221	Aroclor-1248	Aroclor-1260
	Aroclor-1232		Total PCBs

Table 4. SWMU 13 Soil Analytes and Reporting Limits (Continued)

Reporting Limit[a] (µg/kg)	TCL Volatiles SW-846, 8260		
10	Acetone	*trans*-1,2 Dichloroethene	Methylene chloride
	Acrolein	*cis*-1,3-Dichloropropene	Styrene
	Acrylonitrile	*trans*-1,3-Dichloropropene	1,1,2,2-Tetrachloroethane
	Benzene	Dibromochloromethane	1,1,1,2-Tetrachloroethane
	Bromodichloromethane	Dibromomethane	Tetrachloroethene
	Bromoform	Dichlorodifluoromethane	Toluene
	Bromomethane	1,1-Dichloroethane	1,1,1-Trichloroethane
	2-Butanone	1,2-Dichloroethane	1,1,2-Trichloroethane
	Carbon disulfide	1,1-Dichlorethene	Trichloroethene
	Carbon tetrachloride	*cis*-1,2-Dichloroethene	Trichlorofluoromethane
	Chlorobenzene	1,2-Dichloropropane	1,2,3-Trichloropropane
	Chloroethane	Ethyl benzene	*m,p-* xylene (20 µg/kg)
	2-Chloroethyl vinyl ether	Ethyl methacrylate	*o-* xylene
	Chloroform	2-Hexanone	Vinyl acetate
	Chloromethane	Iodomethane	Vinyl chloride
	trans-1,4-Dichloro-2-butene (100 µg/kg)	4-Methyl-2-pentanone	
(pCi/g)	**Radionuclides EPA-900**		
5	Gross alpha		
	Gross beta		
(pCi/g)	**Radionuclides Alpha Spec[b]**		
3	Americium-241		
3	Neptunium-237		
6	Plutonium-238		
4	Plutonium-239/240		
3	Thorium-228		
4	Throium-230		
3	Thorium-232		
3	Uranium-234		
2	Uranium-235		
2	Uranium-238		
(pCi/g)	**Radionuclides Gamma Spec[b]**		
0.5	Cesium-137		
(pCi/g)	**Radionuclides Liquid Scintillation[b]**		
8	Technetium-99		

[a] With the exception of aluminum, the reporting limits match those of the BGOU RI/FS Work Plan (DOE 2006). The reporting limit for the aluminum analysis in the Field Sampling Plan of the BGOU RI/FS Work Plan is 10 mg/kg. Compared to the provisional background concentration for aluminum in subsurface soil at the PGDP (12,000 mg/kg), the increase in the reporting limit for aluminum to 20 mg/kg will not impact the conclusions reached using the results of this Field Sampling Plan Addendum.
[b] This procedure is derived from a variety of sources including, but not limited to, *Environmental Measurements Laboratory Procedures Manual* (HASL-300). Equivalent laboratory methods may be used for radiological analyses if the laboratory standard operating procedures have been approved by DOE.
TCL = target compound list

The acetate sleeve and any remaining soil will be handled as investigation-derived waste. Upon the completion of sampling in each borehole, the field crew will abandon the boreholes by filling them with (dry) bentonite pellets. Available soil moisture will hydrate the pellets.

If obvious contamination (e.g., soil staining or the presence of oil) is observed in the 15 to 18-ft depth sample interval, contingency is available to collect deeper soil samples using the same methodology to further characterize the vertical extent of contamination, down to the top of the Regional Gravel Aquifer at an approximate depth of 55 ft at SWMU 13. The deeper soil sample intervals would be approximately 27 to 30 ft, 37 to 40 ft, and 52 to 55 ft.

If the data evaluation for this SWMU 13 investigation (to be reported in an appendix to the BGOU FS) determines the presence of unacceptable contamination in the 15 to 18-ft depth samples, the response action for SWMU 13 will include additional soil sampling (e.g., in support of design of the response action or to confirm achievement of the response action goal).

6. SAMPLE ANALYSIS

The sample analyses for this investigation will characterize soil and groundwater, if possible, and project-generated waste materials. Specific analytical requirements, methods, and procedures applicable to this Field Sampling Plan are identified in Table 4 and described in the Quality Assurance Project Plan, Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006).

7. SAMPLING PROCEDURES

Fieldwork and sampling at PGDP will be conducted in accordance with DOE Prime Contractor-approved medium-specific work instructions or procedures. DOE or its Prime Contractor will approve any deviations from these work instructions and procedures. The DOE Prime Contractor will document changes on Field Change Request forms as detailed in the Quality Assurance Project Plan, Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006). Table 5 provides an example list of investigation activities that may require work instructions or procedures.

Table 5. Example Fieldwork and Sampling Activities Requiring Work Instructions or Procedures

Investigation Activity
Use of Field Logbooks
Lithologic Logging
Labeling, Packaging, and Shipping of Environmental Field Samples
Sampling of Containerized Wastes
Opening Containerized Waste
On-Site Handling and Disposal of Waste Materials
Identification and Management of Waste Not from a Radioactive Material Management Area
Paducah Contractor Records Management Program
Quality Assured Data
Chain-of-Custody
Field Quality Control
Data Management Coordination Equipment Decontamination
Off-Site Decontamination Pad Operating Procedures
Cleaning and Decontaminating Sample Containers and Sampling Equipment
Environmental Radiological Screening
Archival of Environmental Data within the ER Program
Data Entry
Data Validation
Well and Temporary Boring Abandonment

8. DOCUMENTATION

Field documentation will be maintained throughout the SWMU 13 investigation in various types of documents and formats including field logbooks, sample labels, sample tags, chain-of-custody forms, and field data sheets. The "Data Management Implementation Plan," Chapter 12 of the BGOU RI/FS Work Plan (DOE 2006), provides the applicable guidelines for maintaining field documentation.

The documentation for the investigation of subsurface buried materials at SWMU 13 will be consistent with that done for other units included in the BGOU RI and will be reported in an appendix to the BGOU FS. This will include a baseline risk assessment of contamination found to be associated with the buried materials. As noted earlier, surface soil sampling at SWMU 13 will be completed as part of the Soils Operable Unit RI; therefore, the baseline risk assessment for exposure to contaminants in surface soil at SWMU 13 will be included in the baseline risk assessment that will be completed as part of the Soils Operable Unit RI.

9. SAMPLE LOCATION SURVEY

A civil survey of sampling locations will be performed upon completion of the SWMU 13 investigation field activities. Section 9.6, "Sample Location Survey," of the BGOU RI/FS Work Plan (DOE 2006) documents the requirements for the civil survey.

10. REFERENCES

Battelle 2008. *Visual Sample Plan*, Version 5.1.1, Battelle Memorial Institute.

DOE (U.S. Department of Energy) 2001. *Methods for Conducting Risk Assessment and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health*. DOE/OR/07-1506&D2, U.S. Department of Energy, Paducah, KY, December.

DOE 2006. *Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. DOE/OR/07-2179&D2/R1, U.S. Department of Energy, Paducah, KY, August.

DOE 2008. *C-746-P and C-746-P1 Scrap Yards, Solid Waste Management Unit (SWMU) Assessment Report*, DOE/LX/07-0059&D1, U.S. Department of Energy, Paducah, KY, January.

EPA (U.S. Environmental Protection Agency) 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant, U.S. Environmental Protection Agency*, Atlanta, GA, February 13.

APPENDIX

SCREENING OF ANALYSES FOR EACH MEDIUM PREVIOUSLY SAMPLED FOR SWMU 13

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Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Anion (mg/kg)							
Cyanide	0/1	ND	1.40E-01	NA	9.18E+01	NA	0/1
Metals (mg/kg)							
Aluminum	1/1	1.40E+04	1.40E+04	1.30E+04	5.25E+03	1/1	1/1
Antimony	1/1	8.20E-01	8.20E-01	2.10E-01	4.92E-01	1/1	1/1
Arsenic	1/1	4.20E+00	4.20E+00	1.20E+01	3.24E-01	0/1	1/1
Barium	1/1	1.20E+02	1.20E+02	2.00E+02	2.72E+02	0/1	0/1
Beryllium	1/1	5.50E-01	5.50E-01	6.70E-01	1.26E+00	0/1	0/1
Cadmium	1/1	1.20E+00	1.20E+00	2.10E-01	1.52E+01	1/1	0/1
Calcium	1/1	3.00E+03	3.00E+03	2.00E+05	NA	0/1	NA
Chromium	1/1	1.90E+01	1.90E+01	1.60E+01	4.76E+02	1/1	0/1
Cobalt	1/1	3.10E+00	3.10E+00	1.40E+01	1.11E+03	0/1	0/1
Copper	1/1	4.60E+01	4.60E+01	1.90E+01	4.27E+02	1/1	0/1
Iron	1/1	1.40E+04	1.40E+04	2.80E+04	2.17E+03	0/1	1/1
Lead	1/1	3.10E+01	3.10E+01	3.60E+01	5.00E+01	0/1	0/1
Magnesium	1/1	1.60E+03	1.60E+03	7.70E+03	NA	0/1	NA
Manganese	1/1	2.20E+02	2.20E+02	1.50E+03	5.66E+01	0/1	1/1
Mercury	0/1	ND	3.40E-02	2.00E-01	1.17E+00	0/1	0/1
Molybdenum	0/1	ND	4.10E-01	NA	6.60E+01	NA	0/1
Nickel	1/1	1.40E+02	1.40E+02	2.10E+01	2.16E+02	1/1	0/1
Potassium	0/1	ND	8.70E+02	1.30E+03	NA	0/1	NA
Selenium	0/1	ND	3.90E-01	8.00E-01	7.13E+01	0/1	0/1
Silver	0/1	ND	1.60E-01	2.30E+00	4.12E+01	0/1	0/1
Sodium	0/1	ND	7.50E+01	3.20E+02	NA	0/1	NA
Thallium	0/1	ND	1.00E+00	2.10E-01	NA	0/1	NA
Tin	0/1	ND	1.50E+01	NA	3.15E+03	NA	0/1
Uranium	1/1	1.30E+02	1.30E+02	4.90E+00	1.13E+01	1/1	1/1
Vanadium	1/1	2.70E+01	2.70E+01	3.80E+01	4.40E+00	0/1	1/1
Zinc	1/1	2.40E+02	2.40E+02	6.50E+01	2.66E+03	1/1	0/1
Pesticides/PCBs (mg/kg)							
4,4'-DDD	0/1	ND	1.40E-02	NA	2.43E+00	NA	0/1
4,4'-DDE	0/1	ND	1.20E-02	NA	1.71E+00	NA	0/1
4,4'-DDT	0/1	ND	8.00E-03	NA	1.71E+00	NA	0/1
Aldrin	0/1	ND	1.00E-02	NA	1.70E-02	NA	0/1
alpha-BHC	0/1	ND	8.00E-03	NA	9.34E-02	NA	0/1
beta-BHC	0/1	ND	1.60E-02	NA	3.21E-01	NA	0/1
delta-BHC	0/1	ND	1.80E-02	NA	NA	NA	NA
Dieldrin	0/1	ND	1.70E-02	NA	1.80E-02	NA	0/1
Heptachlor	0/1	ND	7.00E-03	NA	7.98E-02	NA	0/1
Lindane	0/1	ND	8.00E-03	NA	4.53E-01	NA	0/1
Methoxychlor	0/1	ND	4.00E-03	NA	5.15E+01	NA	0/1
PCB-1016	1/1	5.10E-02	5.10E-02	NA	1.68E-01	NA	0/1
PCB-1221	0/1	ND	9.00E-03	NA	1.68E-01	NA	0/1
PCB-1232	0/1	ND	3.70E-03	NA	1.68E-01	NA	0/1
PCB-1242	0/1	ND	2.40E-03	NA	1.68E-01	NA	0/1
PCB-1248	0/1	ND	7.40E-04	NA	1.68E-01	NA	0/1
PCB-1254	0/1	ND	7.10E-04	NA	1.68E-01	NA	0/1
PCB-1260	1/1	1.20E+00	1.20E+00	NA	1.68E-01	NA	1/1

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Radionuclides (pCi/g)							
Alpha activity	1/2	1.02E+02	1.02E+02	NA	NA	NA	NA
Beta activity	1/2	2.34E+02	2.34E+02	NA	NA	NA	NA
Neptunium-237	1/1	5.30E-01	5.30E-01	1.00E-01	3.28E-01	1/1	1/1
Plutonium-239	1/1	3.00E-02	3.00E-02	2.50E-02	1.63E+00	1/1	0/1
Technetium-99	1/1	1.50E+02	1.50E+02	2.50E+00	5.79E+01	1/1	1/1
Thorium-230	1/1	1.16E+00	1.16E+00	1.50E+00	2.22E+00	0/1	0/1
Uranium-234	1/1	3.57E+01	3.57E+01	2.50E+00	2.84E+00	1/1	1/1
Uranium-235/236	1/1	4.12E+00	4.12E+00	1.40E-01	4.55E-01	1/1	1/1
Uranium-238	1/1	6.41E+01	6.41E+01	1.20E+00	1.17E+00	1/1	1/1
Semivolatile Organics (mg/kg)							
1,2,4,5-Tetrachlorobenzene	0/1	ND	8.00E-03	NA	4.07E+00	NA	0/1
1,2,4-Trichlorobenzene	0/1	ND	1.00E-02	NA	8.30E+01	NA	0/1
1,2-Dichlorobenzene	0/1	ND	9.00E-03	NA	3.22E+02	NA	0/1
1,2-Diphenylhydrazine	0/1	ND	7.00E-03	NA	3.61E-01	NA	0/1
1,3-Dichlorobenzene	0/1	ND	1.00E-02	NA	6.82E+00	NA	0/1
1,4-Dichlorobenzene	0/1	ND	9.00E-03	NA	5.35E+00	NA	0/1
1-Chloronaphtalene	0/1	ND	1.00E-02	NA	NA	NA	NA
1-Naphthalenamine	0/1	ND	3.80E-02	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	0/1	ND	1.20E-02	NA	3.09E+02	NA	0/1
2,4,5-Trichlorophenol	0/1	ND	9.00E-03	NA	1.03E+03	NA	0/1
2,4,6-Trichlorophenol	0/1	ND	1.00E-02	NA	2.62E+01	NA	0/1
2,4-Dichlorophenol	0/1	ND	9.00E-03	NA	4.13E+01	NA	0/1
2,4-Dimethylphenol	0/1	ND	2.30E-02	NA	2.06E+02	NA	0/1
2,4-Dinitrophenol	0/1	ND	4.90E-02	NA	3.04E+01	NA	0/1
2,4-Dinitrotoluene	0/1	ND	1.50E-02	NA	5.77E-01	NA	0/1
2,6-Dichlorophenol	0/1	ND	1.00E-02	NA	NA	NA	NA
2,6-Dinitrotoluene	0/1	ND	8.00E-03	NA	5.77E-01	NA	0/1
2-Chloronaphthalene	0/1	ND	4.00E-03	NA	2.67E+02	NA	0/1
2-Chlorophenol	0/1	ND	1.10E-02	NA	2.12E+01	NA	0/1
2-Methyl-4,6-dinitrophenol	0/1	ND	5.20E-02	NA	NA	NA	NA
2-Methylnaphthalene	0/1	ND	9.00E-03	NA	NA	NA	NA
2-Methylphenol	0/1	ND	8.00E-03	NA	5.15E+02	NA	0/1
2-Methylpyridine	0/1	ND	6.70E-02	NA	NA	NA	NA
2-Naphthalenamine	0/1	ND	6.60E-02	NA	NA	NA	NA
2-Nitrobenzenamine	0/1	ND	1.00E-02	NA	5.89E-01	NA	0/1
2-Nitrophenol	0/1	ND	9.00E-03	NA	NA	NA	NA
3,3'-Dichlorobenzidine	0/1	ND	3.60E-02	NA	6.41E-01	NA	0/1
3-Methylcholanthrene	0/1	ND	2.00E-02	NA	NA	NA	NA
3-Nitrobenzenamine	0/1	ND	2.50E-02	NA	NA	NA	NA
4-Aminobiphenyl	0/1	ND	5.70E-02	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/1	ND	8.00E-03	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/1	ND	1.00E-02	NA	NA	NA	NA

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
4-Chlorobenzenamine	0/1	ND	4.70E-02	NA	4.12E+01	NA	0/1
4-Chlorophenyl phenyl ether	0/1	ND	7.00E-03	NA	NA	NA	NA
4-Methylphenol	0/1	ND	8.00E-03	NA	6.05E+01	NA	0/1
4-Nitrobenzenamine	0/1	ND	6.60E-02	NA	NA	NA	NA
4-Nitrophenol	0/1	ND	2.20E-02	NA	1.21E+02	NA	0/1
7,12-Dimethy-lbenz(a)anthracene	0/1	ND	8.50E-02	NA	NA	NA	NA
a,a-Dimethy-lphenethylamine	0/1	ND	1.30E-02	NA	NA	NA	NA
Acenaphthene	0/1	ND	8.00E-03	NA	3.50E+02	NA	0/1
Acenaphthylene	0/1	ND	8.00E-03	NA	NA	NA	NA
Acetophenone	0/1	ND	8.00E-03	NA	2.25E-01	NA	0/1
Aniline	0/1	ND	5.10E-02	NA	5.06E+01	NA	0/1
Anthracene	1/1	1.50E-02	1.50E-02	NA	3.34E+03	NA	0/1
Benz(a)anthracene	1/1	5.60E-02	5.60E-02	NA	2.32E-01	NA	0/1
Benzenemethanol	0/1	ND	1.00E-02	NA	3.66E+03	NA	0/1
Benzidine	0/1	ND	3.27E-01	NA	1.65E-03	NA	0/1
Benzo(a)pyrene	1/1	5.10E-02	5.10E-02	NA	2.32E-02	NA	1/1
Benzo(b)fluoranthene	1/1	9.60E-02	9.60E-02	NA	2.32E-01	NA	0/1
Benzo(ghi)perylene	0/1	ND	1.90E-02	NA	NA	NA	NA
Benzo(k)fluoranthene	1/1	2.10E-02	2.10E-02	NA	2.32E+00	NA	0/1
Benzoic acid	0/1	ND	1.20E-01	NA	6.07E+04	NA	0/1
Bis(2-chloroethoxy) methane	0/1	ND	9.00E-03	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/1	ND	1.10E-02	NA	1.09E-01	NA	0/1
Bis(2-chloroisopropyl) ether	0/1	ND	5.60E-02	NA	4.12E+00	NA	0/1
Bis(2-ethylhexyl) phthalate	1/1	2.30E-01	2.30E-01	NA	1.01E+01	NA	0/1
Butyl benzyl phthalate	0/1	ND	1.28E-01	NA	2.33E+03	NA	0/1
Chrysene	1/1	6.00E-02	6.00E-02	NA	2.32E+01	NA	0/1
Dibenz(a,h)anthracene	0/1	ND	1.20E-02	NA	2.32E-02	NA	0/1
Dibenzofuran	0/1	ND	4.00E-03	NA	2.10E+01	NA	0/1
Diethyl phthalate	0/1	ND	1.10E-02	NA	1.15E+04	NA	0/1
Dimethyl phthalate	0/1	ND	9.00E-03	NA	1.00E+05	NA	0/1
Di-n-butyl phthalate	0/1	ND	5.90E-02	NA	1.52E+03	NA	0/1
Di-n-octylphthalate	0/1	ND	1.10E-02	NA	2.88E+02	NA	0/1
Ethyl methane-sulfonate	0/1	ND	8.00E-03	NA	NA	NA	NA
Fluoranthene	1/1	1.40E-01	1.40E-01	NA	2.42E+02	NA	0/1
Fluorene	0/1	ND	9.00E-03	NA	3.38E+02	NA	0/1
Hexachlorobenzene	0/1	ND	7.00E-03	NA	1.80E-01	NA	0/1
Hexachlorobutadiene	0/1	ND	8.00E-03	NA	2.06E+00	NA	0/1
Hexachlorocyclo-pentadiene	0/1	ND	6.00E-03	NA	6.18E+01	NA	0/1

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Hexachloroethane	0/1	ND	9.00E-03	NA	1.03E+01	NA	0/1
Indeno(1,2,3-cd)pyrene	0/1	ND	1.30E-02	NA	2.32E-01	NA	0/1
Isophorone	0/1	ND	9.00E-03	NA	3.04E+02	NA	0/1
Methyl methane-sulfonate	0/1	ND	6.80E-02	NA	NA	NA	NA
Naphthalene	0/1	ND	1.00E-02	NA	3.04E+01	NA	0/1
Nitrobenzene	0/1	ND	3.40E-02	NA	3.52E+00	NA	0/1
N-Nitroso-dimethylamine	0/1	ND	1.70E-02	NA	5.66E-03	NA	0/1
N-Nitroso-di-n-propylamine	0/1	ND	1.20E-02	NA	2.51E-02	NA	0/1
N-Nitroso-diphenylamine	0/1	ND	4.00E-03	NA	3.59E+01	NA	0/1
N-Nitrosopiperidine	0/1	ND	8.00E-03	NA	NA	NA	NA
p-Dimethyl-aminoazobenzene	0/1	ND	2.00E-02	NA	NA	NA	NA
Pentachlorobenzene	0/1	ND	9.00E-03	NA	1.09E+01	NA	0/1
Pentachloronitrobenzene	0/1	ND	1.30E-02	NA	1.46E+00	NA	0/1
Pentachlorophenol	0/1	ND	9.00E-03	NA	2.07E+00	NA	0/1
Phenacetin	0/1	ND	1.40E-02	NA	NA	NA	NA
Phenanthrene	1/1	8.40E-02	8.40E-02	NA	NA	NA	NA
Phenol	0/1	ND	9.00E-03	NA	8.65E+03	NA	0/1
Pronamide	0/1	ND	1.20E-02	NA	7.73E+02	NA	0/1
Pyrene	1/1	1.10E-01	1.10E-01	NA	1.81E+02	NA	0/1
Pyridine	0/1	ND	5.30E-02	NA	1.03E+01	NA	0/1

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Metals (mg/kg)							
Aluminum	8/8	1.15E+04	2.00E+01	1.30E+04	5.25E+03	0/8	7/8
Antimony	0/8	ND	2.00E+01	2.10E-01	4.92E-01	0/8	0/8
Arsenic	0/8	ND	5.00E+00	1.20E+01	3.24E-01	0/8	0/8
Barium	8/8	1.04E+02	2.50E+00	2.00E+02	2.72E+02	0/8	0/8
Beryllium	0/8	ND	5.00E-01	6.70E-01	1.26E+00	0/8	0/8
Cadmium	0/8	ND	2.00E+00	2.10E-01	1.52E+01	0/8	0/8
Calcium	8/8	2.50E+03	2.00E+02	2.00E+05	NA	0/8	NA
Chromium	8/8	1.37E+01	2.50E+00	1.60E+01	4.76E+02	0/8	0/8
Cobalt	8/8	8.75E+00	2.50E+00	1.40E+01	1.11E+03	0/8	0/8
Copper	8/8	1.88E+01	2.50E+00	1.90E+01	4.27E+02	0/8	0/8
Iron	8/8	1.21E+04	2.00E+01	2.80E+04	2.17E+03	0/8	8/8
Lead	0/8	ND	2.00E+01	3.60E+01	5.00E+01	0/8	0/8
Lithium	6/8	8.59E+00	5.00E+00	NA	3.69E+02	NA	0/8
Magnesium	8/8	1.24E+03	2.50E+00	7.70E+03	NA	0/8	NA
Manganese	8/8	1.12E+03	2.50E+00	1.50E+03	5.66E+01	0/8	8/8
Mercury	0/8	ND	2.00E-01	2.00E-01	1.17E+00	0/8	0/8
Nickel	7/8	1.18E+01	5.00E+00	2.10E+01	2.16E+02	0/8	0/8
Selenium	0/8	ND	1.00E+00	8.00E-01	7.13E+01	0/8	0/8
Silver	0/8	ND	2.50E+00	2.30E+00	4.12E+01	0/8	0/8
Thallium	0/8	ND	2.00E+01	2.10E-01	NA	0/8	NA
Tin	0/8	ND	1.00E+02	NA	3.15E+03	NA	0/8
Uranium	0/8	ND	1.00E+02	4.90E+00	1.13E+01	0/8	0/8
Vanadium	8/8	2.59E+01	2.50E+00	3.80E+01	4.40E+00	0/8	8/8
Zinc	8/8	5.22E+01	1.00E+01	6.50E+01	2.66E+03	0/8	0/8
Pesticides/PCBs (mg/kg)							
PCB-1016	0/8	ND	6.00E-01	NA	1.68E-01	NA	0/8
PCB-1221	0/8	ND	1.00E-01	NA	1.68E-01	NA	0/8
PCB-1232	0/8	ND	9.00E-02	NA	1.68E-01	NA	0/8
PCB-1242	0/8	ND	7.00E-02	NA	1.68E-01	NA	0/8
PCB-1248	0/8	ND	8.00E-02	NA	1.68E-01	NA	0/8
PCB-1254	1/8	3.00E-01	6.00E-02	NA	1.68E-01	NA	1/8
PCB-1260	1/8	4.00E-01	9.00E-02	NA	1.68E-01	NA	1/8
PCB-1268	0/8	ND	1.00E-01	NA	NA	NA	NA
Polychlorinated biphenyl	1/8	7.00E-01	1.00E-01	NA	1.68E-01	NA	1/8
Radionuclides (pCi/g)							
Americium-241	0/8	ND	0.034-0.142	NA	1.74E+00	NA	0/8
Cesium-134	0/8	ND	0.009-0.02	NA	NA	NA	NA
Cesium-137	0/8	ND	0.011-0.024	4.90E-01	1.15E-01	0/8	0/8
Cobalt-60	0/8	ND	0.011-0.029	NA	2.38E-02	NA	0/8
Neptunium-237	0/8	ND	0.017-0.038	1.00E-01	3.28E-01	0/8	0/8
Plutonium-238	0/8	ND	0.2-0.212	7.30E-02	1.66E+00	0/8	0/8
Plutonium-239/240	0/8	ND	0.038-0.041	2.50E-02	1.63E+00	0/8	0/8
Technetium-99	0/8	ND	3.1-3.38	2.50E+00	5.79E+01	0/8	0/8
Thorium-228	8/8	5.48E-01	0.063-0.065	1.60E+00	3.57E-02	0/8	8/8
Thorium-230	8/8	4.99E-01	0.188-0.198	1.50E+00	2.22E+00	0/8	0/8
Thorium-232	8/8	5.11E-01	0.044-0.064	1.50E+00	1.95E+00	0/8	0/8

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Radionuclides (pCi/g) (Continued)							
Uranium	0/8	ND	0.426-1.04	4.90E+00	1.13E+01	0/8	0/8
Uranium-234	0/8	ND	0.155-0.505	2.50E+00	2.84E+00	0/8	0/8
Uranium-235	7/8	5.72E-02	0.013-0.027	1.40E-01	4.55E-01	0/8	0/8
Uranium-238	7/8	1.32E+00	0.258-0.531	1.20E+00	1.17E+00	4/8	4/8
Semivolatile Organics (mg/kg)							
1,2,4-Trichlorobenzene	0/8	ND	0.46-0.5	NA	8.30E+01	NA	0/8
1,2-Dichlorobenzene	0/8	ND	0.46-0.5	NA	3.22E+02	NA	0/8
1,3-Dichlorobenzene	0/8	ND	0.46-0.5	NA	6.82E+00	NA	0/8
1,4-Dichlorobenzene	0/8	ND	0.46-0.5	NA	5.35E+00	NA	0/8
2,4,5-Trichlorophenol	0/8	ND	0.46-0.5	NA	1.03E+03	NA	0/8
2,4,6-Trichlorophenol	0/8	ND	0.46-0.5	NA	2.62E+01	NA	0/8
2,4-Dichlorophenol	0/8	ND	0.46-0.5	NA	4.13E+01	NA	0/8
2,4-Dimethylphenol	0/8	ND	0.46-0.5	NA	2.06E+02	NA	0/8
2,4-Dinitrophenol	0/8	ND	0.46-0.5	NA	3.04E+01	NA	0/8
2,4-Dinitrotoluene	0/8	ND	0.46-0.5	NA	5.77E-01	NA	0/8
2,6-Dinitrotoluene	0/8	ND	0.46-0.5	NA	5.77E-01	NA	0/8
2-Chloronaphthalene	0/8	ND	0.46-0.5	NA	2.67E+02	NA	0/8
2-Chlorophenol	0/8	ND	0.46-0.5	NA	2.12E+01	NA	0/8
2-Methyl-4,6-dinitrophenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
2-Methylnaphthalene	0/8	ND	0.46-0.5	NA	NA	NA	NA
2-Methylphenol	0/8	ND	0.46-0.5	NA	5.15E+02	NA	0/8
2-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	5.89E-01	NA	0/8
2-Nitrophenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
3,3'-Dichlorobenzidine	0/8	ND	0.46-0.5	NA	6.41E-01	NA	0/8
3-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Chlorobenzenamine	0/8	ND	0.46-0.5	NA	4.12E+01	NA	0/8
4-Chlorophenyl phenyl ether	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Methylphenol	0/8	ND	0.46-0.5	NA	6.05E+01	NA	0/8
4-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Nitrophenol	0/8	ND	0.46-0.5	NA	1.21E+02	NA	0/8
Acenaphthene	0/8	ND	0.46-0.5	NA	3.50E+02	NA	0/8
Acenaphthylene	0/8	ND	0.46-0.5	NA	NA	NA	NA
Anthracene	0/8	ND	0.46-0.5	NA	3.34E+03	NA	0/8
Benz(a)anthracene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Benzo(a)pyrene	0/8	ND	0.46-0.5	NA	2.32E-02	NA	0/8
Benzo(b)fluoranthene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Benzo(ghi)perylene	0/8	ND	0.46-0.5	NA	NA	NA	NA

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Bis(2-chloroethoxy) methane	0/8	ND	0.46-0.5	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/8	ND	0.46-0.5	NA	1.09E-01	NA	0/8
Bis(2-chloroisopropyl) ether	0/8	ND	0.46-0.5	NA	4.12E+00	NA	0/8
Bis(2-ethylhexyl)phthalate	0/8	ND	0.46-0.5	NA	1.01E+01	NA	0/8
Butyl benzyl phthalate	0/8	ND	0.46-0.5	NA	2.33E+03	NA	0/8
Carbazole	0/8	ND	0.46-0.5	NA	1.77E+01	NA	0/8
Chrysene	0/8	ND	0.46-0.5	NA	2.32E+01	NA	0/8
Di-n-octylphthalate	0/8	ND	0.46-0.5	NA	2.88E+02	NA	0/8
Fluorene	0/8	ND	0.46-0.5	NA	3.38E+02	NA	0/8
Hexachlorocyclopentadiene	0/8	ND	0.46-0.5	NA	6.18E+01	NA	0/8
Hexachloroethane	0/8	ND	0.46-0.5	NA	1.03E+01	NA	0/8
Indeno(1,2,3-cd)pyrene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Isophorone	0/8	ND	0.46-0.5	NA	3.04E+02	NA	0/8
Naphthalene	0/8	ND	0.46-0.5	NA	3.04E+01	NA	0/8
Nitrobenzene	0/8	ND	0.46-0.5	NA	3.52E+00	NA	0/8
N-Nitroso-di-n-propylamine	0/8	ND	0.46-0.5	NA	2.51E-02	NA	0/8
N-Nitrosodiphenylamine	0/8	ND	0.46-0.5	NA	3.59E+01	NA	0/8
Pentachlorophenol	0/8	ND	0.46-0.5	NA	2.07E+00	NA	0/8
Phenanthrene	0/8	ND	0.46-0.5	NA	NA	NA	NA
Phenol	0/8	ND	0.46-0.5	NA	8.65E+03	NA	0/8
Pyrene	0/8	ND	0.46-0.5	NA	1.81E+02	NA	0/8
Pyridine	0/8	ND	0.46-0.5	NA	1.03E+01	NA	0/8
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0/8	ND	1.00E-02	NA	1.78E+02	NA	0/8
1,1,2,2-Tetrachloroethane	0/8	ND	1.00E-02	NA	5.73E-01	NA	0/8
1,1,2-Trichloroethane	0/8	ND	1.00E-02	NA	1.45E+00	NA	0/8
1,1-Dichloroethane	0/8	ND	1.00E-02	NA	1.97E+02	NA	0/8
1,1-Dichloroethene	0/8	ND	1.00E-02	NA	1.19E-01	NA	0/8
1,2-Dichloroethane	0/8	ND	1.00E-02	NA	6.65E-01	NA	0/8
1,2-Dichloropropane	0/8	ND	1.00E-02	NA	7.89E-01	NA	0/8
1,2-Dimethylbenzene	0/8	ND	1.00E-02	NA	5.59E+03	NA	0/8
2-Butanone	0/8	ND	2.50E-01	NA	1.30E+03	NA	0/8
2-Hexanone	0/8	ND	5.00E-02	NA	NA	NA	NA
4-Methyl-2-pentanone	0/8	ND	2.50E-01	NA	8.51E+01	NA	0/8

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Volatile Organics (mg/kg) (Continued)							
Acetone	0/8	ND	2.50E-01	NA	4.21E+02	NA	0/8
Benzene	0/8	ND	1.00E-02	NA	1.40E+00	NA	0/8
Bromodichloromethane	0/8	ND	1.00E-02	NA	1.61E+00	NA	0/8
Bromoform	0/8	ND	1.00E-02	NA	4.09E+01	NA	0/8
Bromomethane	0/8	ND	2.00E-02	NA	1.63E+00	NA	0/8
Carbon disulfide	0/8	ND	1.00E-02	NA	1.37E+02	NA	0/8
Carbon tetrachloride	0/8	ND	1.00E-02	NA	5.10E-01	NA	0/8
Chlorobenzene	0/8	ND	1.00E-02	NA	3.68E+01	NA	0/8
Ethylbenzene	0/8	ND	1.00E-02	NA	2.87E+01	NA	0/8
m,p-Xylene	0/8	ND	1.00E-02	NA	9.63E+02	NA	0/8
Methylene chloride	0/8	ND	1.00E-02	NA	1.57E+01	NA	0/8
Styrene	0/8	ND	1.00E-02	NA	9.82E+02	NA	0/8
Tetrachloroethene	0/8	ND	1.00E-02	NA	4.04E+00	NA	0/8
Toluene	0/8	ND	1.00E-02	NA	2.72E+02	NA	0/8
trans-1,2-Dichloroethene	0/8	ND	1.00E-02	NA	2.84E+01	NA	0/8
trans-1,3-Dichloropropene	0/8	ND	1.00E-02	NA	NA	NA	NA
Trichloroethene	0/8	ND	1.00E-02	NA	3.25E+00	NA	0/8

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Metals (mg/kg)							
Aluminum	29/29	1.02E+04	17.2-19.8	1.20E+04	5.25E+03	0/29	20/29
Antimony	0/29	ND	8.6-9.9	2.10E-01	4.92E-01	0/29	0/29
Arsenic	0/29	ND	17.2-19.8	7.90E+00	3.24E-01	0/29	0/29
Barium	29/29	1.78E+02	2.15-2.47	1.70E+02	2.72E+02	1/29	0/29
Beryllium	14/29	9.40E-01	0.43-0.495	6.90E-01	1.26E+00	4/29	0/29
Cadmium	8/29	6.78E+00	1.72-1.98	2.10E-01	1.52E+01	8/29	0/29
Calcium	28/29	9.14E+04	86-1000	6.10E+03	NA	16/29	NA
Chromium	29/29	1.64E+02	2.15-2.47	4.30E+01	4.76E+02	1/29	0/29
Copper	29/29	4.31E+01	2.15-2.47	2.50E+01	4.27E+02	3/29	0/29
Lead	3/29	4.99E+01	18.4-19.8	2.30E+01	5.00E+01	2/29	0/29
Mercury	0/29	ND	2.00E-01	1.30E-01	1.17E+00	0/29	0/29
Nickel	25/29	2.04E+01	4.3-4.95	2.20E+01	2.16E+02	0/29	0/29
Selenium	0/29	ND	17.2-19.8	7.00E-01	7.13E+01	0/29	0/29
Silver	1/29	2.81E+00	2.47-2.47	2.70E+00	4.12E+01	1/29	0/29
Thallium	0/29	ND	17.2-19.8	3.40E-01	NA	0/29	NA
Vanadium	29/29	3.93E+01	2.15-2.47	3.70E+01	4.40E+00	2/29	29/29
Zinc	24/29	1.37E+02	17.2-19.8	6.00E+01	2.66E+03	5/29	0/29
Pesticides/PCBs (mg/kg)							
PCB-1016	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1221	0/29	ND	1.30E-01	NA	1.68E-01	NA	0/29
PCB-1232	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1242	0/29	ND	6.00E-02	NA	1.68E-01	NA	0/29
PCB-1248	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1254	6/29	9.90E-01	9.00E-02	NA	1.68E-01	NA	4/29
PCB-1260	4/29	4.80E-01	1.00E-01	NA	1.68E-01	NA	2/29
PCB-1268	0/29	ND	8.00E-02	NA	NA	NA	NA
Polychlorinated biphenyl	8/29	9.90E-01	0.09-0.1	NA	1.68E-01	NA	6/29
Radionuclides (pCi/g)							
Mass of U-235 (mg/kg)	4/29	9.38E-02	0.038-0.040	NA	NA	NA	NA
Americium-241	0/29	ND	0.090-0.095	NA	1.74E+00	NA	0/29
Cesium-137	9/29	5.62E-01	0.031-0.035	2.80E-01	1.15E-01	2/29	4/29
Cobalt-60	1/29	9.70E-02	0.029-0.029	NA	2.38E-02	NA	1/29
Neptunium-237	3/29	1.51E-01	0.054-0.059	NA	3.28E-01	NA	0/29
Plutonium-238	0/29	ND	0.050-0.056	NA	1.66E+00	NA	0/29
Plutonium-239/240	3/29	1.31E-01	0.041-0.049	NA	1.63E+00	NA	0/29
Potassium-40	29/29	1.16E+01	0.23-0.362	1.60E+01	NA	0/29	NA
Radium-226	2/29	4.89E-01	0.094-0.099	1.50E+00	3.30E-02	0/29	2/29
Strontium-90	0/29	ND	1.17-1.54	NA	2.59E+00	NA	0/29
Technetium-99	10/29	1.81E+01	1.72-1.78	2.80E+00	5.79E+01	7/29	0/29
Thorium-228	0/29	ND	0.98-0.989	1.60E+00	3.57E-02	0/29	0/29
Thorium-230	11/29	8.26E-01	0.485-0.509	1.40E+00	2.22E+00	0/29	0/29
Thorium-232	29/29	8.31E-01	0.098-0.23	1.50E+00	1.95E+00	0/29	0/29
Uranium	7/29	9.23E+00	0.634-0.645	4.60E+00	1.13E+01	6/29	0/29
Uranium-234	15/29	3.48E+00	0.035-0.192	2.40E+00	2.84E+00	2/29	1/29
Uranium-235	4/29	2.03E-01	0.082-0.086	1.40E-01	4.55E-01	1/29	0/29
Uranium-238	15/29	6.42E+00	0.377-0.529	1.20E+00	1.17E+00	8/29	8/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg)							
1,2,4-Trichlorobenzene	0/29	ND	0.47-0.5	NA	8.30E+01	NA	0/29
1,2-Dichlorobenzene	0/29	ND	0.47-0.5	NA	3.22E+02	NA	0/29
1,3-Dichlorobenzene	0/29	ND	0.47-0.5	NA	6.82E+00	NA	0/29
1,4-Dichlorobenzene	0/29	ND	0.47-0.5	NA	5.35E+00	NA	0/29
2,4,5-Trichlorophenol	0/29	ND	0.47-0.5	NA	1.03E+03	NA	0/29
2,4,6-Trichlorophenol	0/29	ND	0.47-0.5	NA	2.62E+01	NA	0/29
2,4-Dichlorophenol	0/29	ND	0.47-0.5	NA	4.13E+01	NA	0/29
2,4-Dimethylphenol	0/29	ND	0.47-0.5	NA	2.06E+02	NA	0/29
2,4-Dinitrophenol	0/29	ND	0.47-0.5	NA	3.04E+01	NA	0/29
2,4-Dinitrotoluene	0/29	ND	0.47-0.5	NA	5.77E-01	NA	0/29
2,6-Dinitrotoluene	0/29	ND	0.47-0.5	NA	5.77E-01	NA	0/29
2-Chloronaphthalene	0/29	ND	0.47-0.5	NA	2.67E+02	NA	0/29
2-Chlorophenol	0/29	ND	0.47-0.5	NA	2.12E+01	NA	0/29
2-Methyl-4,6-dinitrophenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
2-Methylnaphthalene	0/29	ND	0.47-0.5	NA	NA	NA	NA
2-Methylphenol	0/29	ND	0.47-0.5	NA	5.15E+02	NA	0/29
2-Nitrophenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Nitrophenol	0/29	ND	0.47-0.5	NA	1.21E+02	NA	0/29
Acenaphthene	0/29	ND	0.47-0.5	NA	3.50E+02	NA	0/29
Acenaphthylene	0/29	ND	0.47-0.5	NA	NA	NA	NA
Anthracene	0/29	ND	0.47-0.5	NA	3.34E+03	NA	0/29
Benz(a)anthracene	1/29	1.10E+00	0.49-0.49	NA	2.32E-01	NA	1/29
Benzo(a)pyrene	1/29	9.10E-01	0.49-0.49	NA	2.32E-02	NA	1/29
Benzo(b)fluoranthene	2/29	1.50E+00	0.48-0.49	NA	2.32E-01	NA	2/29
Benzo(ghi)perylene	0/29	ND	0.47-0.5	NA	NA	NA	NA
Benzo(k)fluoranthene	2/29	1.70E+00	0.48-0.49	NA	2.32E+00	NA	0/29
Bis(2-chloroethoxy)-methane	0/29	ND	0.47-0.5	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/29	ND	0.47-0.5	NA	1.09E-01	NA	0/29
Bis(2-chloroisopropyl) ether	0/29	ND	0.47-0.5	NA	4.12E+00	NA	0/29
Bis(2-ethylhexyl)-phthalate	0/29	ND	0.47-0.5	NA	1.01E+01	NA	0/29
Butyl benzyl phthalate	0/29	ND	0.47-0.5	NA	2.33E+03	NA	0/29
Chrysene	2/29	1.60E+00	0.48-0.49	NA	2.32E+01	NA	0/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Dibenz(a,h)anthracene	0/29	ND	0.47-0.5	NA	2.32E-02	NA	0/29
Diethyl phthalate	0/29	ND	0.47-0.5	NA	1.15E+04	NA	0/29
Dimethyl phthalate	0/29	ND	0.47-0.5	NA	1.00E+05	NA	0/29
Di-n-butyl phthalate	9/29	6.80E+00	0.48-0.5	NA	1.52E+03	NA	0/29
Di-n-octylphthalate	0/29	ND	0.47-0.5	NA	2.88E+02	NA	0/29
Fluoranthene	5/29	1.40E+00	0.48-0.5	NA	2.42E+02	NA	0/29
Fluorene	0/29	ND	0.47-0.5	NA	3.38E+02	NA	0/29
Hexachlorobenzene	0/29	ND	0.47-0.5	NA	1.80E-01	NA	0/29
Hexachlorobutadiene	0/29	ND	0.47-0.5	NA	2.06E+00	NA	0/29
Hexachlorocyclopentadiene	0/29	ND	0.47-0.5	NA	6.18E+01	NA	0/29
Hexachloroethane	0/29	ND	0.47-0.5	NA	1.03E+01	NA	0/29
Indeno(1,2,3-cd)pyrene	1/29	5.80E-01	0.49-0.49	NA	2.32E-01	NA	1/29
Isophorone	0/29	ND	0.47-0.5	NA	3.04E+02	NA	0/29
m,p-Cresol	0/29	ND	0.47-0.5	NA	NA	NA	NA
Naphthalene	0/29	ND	0.47-0.5	NA	3.04E+01	NA	0/29
Nitrobenzene	0/29	ND	0.47-0.5	NA	3.52E+00	NA	0/29
N-Nitroso-di-n-propylamine	0/29	ND	0.47-0.5	NA	2.51E-02	NA	0/29
N-Nitrosodiphenylamine	0/29	ND	0.47-0.5	NA	3.59E+01	NA	0/29
Pentachlorophenol	0/29	ND	0.47-0.5	NA	2.07E+00	NA	0/29
Phenanthrene	2/29	5.50E-01	0.48-0.5	NA	NA	NA	NA
Phenol	0/29	ND	0.47-0.5	NA	8.65E+03	NA	0/29
Pyrene	5/29	1.70E+00	0.48-0.5	NA	1.81E+02	NA	0/29
Pyridine	0/29	ND	0.47-0.5	NA	1.03E+01	NA	0/29
Total Cresols	0/29	ND	0.94-1	NA	NA	NA	NA
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0/29	ND	5.00E-03	NA	1.78E+02	NA	0/29
1,1,2,2-Tetrachloroethane	0/29	ND	0.005-0.01	NA	5.73E-01	NA	0/29
1,1,2-Trichloroethane	0/29	ND	5.00E-03	NA	1.45E+00	NA	0/29
1,1-Dichloroethane	0/29	ND	5.00E-03	NA	1.97E+02	NA	0/29
1,1-Dichloroethene	0/29	ND	5.00E-03	NA	1.19E-01	NA	0/29
1,2-Dichloroethane	0/29	ND	5.00E-03	NA	6.65E-01	NA	0/29
1,2-Dichloropropane	0/29	ND	5.00E-03	NA	7.89E-01	NA	0/29
1,2-Dimethylbenzene	0/29	ND	5.00E-03	NA	5.59E+03	NA	0/29
2-Butanone	21/29	4.20E-02	5.00E-03	NA	1.30E+03	NA	0/29
2-Hexanone	0/29	ND	5.00E-03	NA	NA	NA	NA
4-Methyl-2-pentanone	0/29	ND	5.00E-03	NA	8.51E+01	NA	0/29
Acetone	21/29	9.80E-02	5.00E-03	NA	4.21E+02	NA	0/29
Benzene	0/29	ND	5.00E-03	NA	1.40E+00	NA	0/29
Bromodichloromethane	0/29	ND	5.00E-03	NA	1.61E+00	NA	0/29
Bromoform	0/29	ND	5.00E-03	NA	4.09E+01	NA	0/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Volatile Organics (mg/kg) (Continued)							
Bromomethane	0/29	ND	5.00E-03	NA	1.63E+00	NA	0/29
Carbon disulfide	28/29	7.60E-03	5.00E-03	NA	1.37E+02	NA	0/29
Carbon tetrachloride	0/29	ND	5.00E-03	NA	5.10E-01	NA	0/29
Chlorobenzene	0/29	ND	5.00E-03	NA	3.68E+01	NA	0/29
Chloroethane	0/29	ND	5.00E-03	NA	4.57E+00	NA	0/29
Chloroform	0/29	ND	5.00E-03	NA	1.66E-01	NA	0/29
Chloromethane	0/29	ND	5.00E-03	NA	3.91E+00	NA	0/29
cis-1,2-Dichloroethene	0/29	ND	5.00E-03	NA	1.71E+01	NA	0/29
cis-1,3-Dichloropropene	0/29	ND	5.00E-03	NA	NA	NA	NA
Dibromochloromethane	0/29	ND	5.00E-03	NA	1.31E+00	NA	0/29
Ethylbenzene	0/29	ND	5.00E-03	NA	2.87E+01	NA	0/29
m,p-Xylene	0/29	ND	0.005-0.01	NA	9.63E+02	NA	0/29
Methylene chloride	0/29	ND	5.00E-03	NA	1.57E+01	NA	0/29
Styrene	0/29	ND	5.00E-03	NA	9.82E+02	NA	0/29
Tetrachloroethene	0/29	ND	5.00E-03	NA	4.04E+00	NA	0/29
Toluene	0/29	ND	5.00E-03	NA	2.72E+02	NA	0/29
trans-1,2-Dichloroethene	0/29	ND	5.00E-03	NA	2.84E+01	NA	0/29
trans-1,3-Dichloropropene	0/29	ND	5.00E-03	NA	NA	NA	NA
Trichloroethene	0/29	ND	5.00E-03	NA	3.25E+00	NA	0/29
Vinyl chloride	0/29	ND	5.00E-03	NA	1.41E-01	NA	0/29

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

Comment Response Summary

for the

Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13 Field Sampling Plan

DOE/OR/07-2179/A1&D2

Prepared for
U.S. Department of Energy
Office of Environmental Management

COMMENT RESPONSE SUMMARY
for the
Addendum to the
Work Plan for the Burial Grounds Operable Unit
Remedial Investigation/Feasibility Study
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13
Field Sampling Plan
DOE/OR/07-2179/A1&D2

Comment Number	§/Page/¶	Comment	Response
KY Division of Waste Management – Conditional Concurrence Letter dated 1/21/09			
1	General Condition	Account for one of the following in the SWMU 13 FSP: 1) Follow the procedures utilized during the BGOU RI/FS WP to collect UCRS groundwater samples; or 2) submit alternative procedures, designed to collect UCRS groundwater samples, to the Division for approval.	The Field Sampling Plan has been revised to include collection of UCRS groundwater samples.
2	General Condition	Account for both of the following conditions in the SWMU 13 FSP: 1) Add language assuring that vertical borings will be first attempted within anomalous areas, accounting for additional attempts (within the anomalous area) if premature refusal is encountered; and 2) use angular borings, consistent with the BGOU RI/FS WP, to collect samples from areas directly beneath anomalous burial areas whenever vertical borings are impracticable due to safety concerns or soil samples are unobtainable beneath the anomalous areas using vertical borings. Some vertical samples on the edge of the anomalies are acceptable; however, the vast majority of the samples shall come from areas beneath the anomalies.	The Field Sampling Plan has been revised to account for the condition of refusal within the larger anomalies. If several attempts are made and meet with refusal, angled borings will be utilized to collect soil samples. The location of samples will be targeted within and adjacent to the larger anomalies once the results of the geophysics survey have been evaluated.

COMMENT RESPONSE SUMMARY
for the
Addendum to the
Work Plan for the Burial Grounds Operable Unit
Remedial Investigation/Feasibility Study
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DOE/OR/07-2179/A1&D2

Comment Number	§/Page/¶	Comment	Response
3	Page A-8	For uranium-234 (234U) and uranium-235 (235U), the results are less than background? The response provided stated that 234U was not detected. As a simple rule of thumb, both 234 and 238U should have individual activities about 1.0 pCi/g while 235U should have an activity about 0.05 pCi/g. The relative activities of 234, 235, and 238U are of particular interest because they indicate enrichment or depletion from natural uranium. The failure to detect 234U should have been noted when the data was checked.	The anomalous result was noted during data screening. This anomalous result was one factor that lead to radionuclides being included in the analytical suite for soil and water samples collected under the FSP.
4	Page A-8	The statement that background numbers are values representative of the site is correct but misapplied. The values being cited as background are 95%, 95% Upper Tolerance Bounds (UTB). Reference Background Levels of Selected Radionuclides and Metals in Soils and Geologic Media at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (June, 1997). When a particular sample exceeds the UTB, one may surmise that the sample is probably above background. One cannot automatically draw the opposite conclusion. A sample below the UTB could still represent a contaminated sample and not represent background. Please reframe from concluding that a sample having a concentration below the UTB “representative level” is below or consistent with background.	The calculation and use of background values is being reassessed for this site. The revised Risk Methods Document will incorporate new background values as they are agreed to by the stakeholders. The use of background values in this document is consistent with the current approved Risk Methods Document.
5	Page A-8	Please note that the UTB values calculated for soil horizon / hydrologic units A & B are reported in the above reference background document are likely incorrect. Please provide the calculations before using these values in future documents.	Noted.

COMMENT RESPONSE SUMMARY
for the
Addendum to the
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Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13
Field Sampling Plan
DOE/OR/07-2179/A1&D2

Comment Number	§/Page/¶	Comment	Response
EPA – Conditional Approval Letter dated 1/22/09			
1	General Condition	The introduction must clarify that the scope of the SWMU-13 investigation is consistent with a site investigation, not a remedial investigation, and that additional scope will be agreed upon should SI results indicate a subsurface release that requires further evaluation.	The introduction states that the objectives of the Field Sampling Plan are consistent with a Site Investigation. If further investigation of SWMU 13 is necessary, based on results of this site investigation, agreement among parties will be made as to further evaluation and/or action.
2	General Condition	Include Project Objectives as follows: a. Identify the horizontal extent of buried waste through remote sensing b. Characterize the nature and vertical extent of waste within and below areas identified through remote sensing. The scope of investigation for DQO 2 i. Soil ii. Ground water in the UCRS (to the extent it is collectible) 1. Water samples for metals will be filtered and unfiltered	The objectives of this Field Sampling Plan are to (1) determine extent of buried materials (i.e., scrap metal) where present at SWMU 13 and (2) determine the nature of any releases from buried materials located. The Field Sampling Plan has been revised to include collection of UCRS groundwater samples both filtered and unfiltered.

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Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13 Field Sampling Plan

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Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky–Solid Waste Management Unit (SWMU) 13 Field Sampling Plan

Date Issued—February 2009

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Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
PADUCAH REMEDIATION SERVICES, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-06EW05001

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CONTENTS

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FIGURES

TABLES

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ACRONYMS

BGOU	Burial Grounds Operable Unit
BHC	hexachlorocyclohexane
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOE	U.S. Department of Energy
DPT	direct-push technology
EM	electromagnetometer
EPA	U.S. Environmental Protection Agency
GPS	global positioning system
HU	hydrogeologic unit
KEEC	Kentucky Energy and Environment Cabinet
NA	not applicable
NAL	no action level
ND	not detected
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PGDP	Paducah Gaseous Diffusion Plant
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SWMU	solid waste management unit
TBD	to be determined
TCL	target compound list
UCRS	Upper Continental Recharge System
VOC	volatile organic compound

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1. INTRODUCTION

Solid Waste Management Unit (SWMU) 13 occupies an area of approximately 294,000 ft^2 (with maximum dimensions of 290 ft in a north-south direction and 1,076 ft in an east-west direction) in the northwest quadrant of the secured area of the U.S. Department of Energy (DOE) Paducah Gaseous Diffusion Plant (PGDP) (Figure 1). The SWMU consists of the C-746-P and C-746-P1 Yards, formerly used for the storage of clean scrap metal prior to sale to scrap metal reclaiming vendors,[1] beginning in the late 1970s. A PGDP Scrap Metal Removal Project, begun in 2002, addressed the aboveground metal in the C-746-P1 Yard in September 2005 and the C-746-P Yard in February 2006. This action removed larger pieces of metal, but left smaller pieces of metal on the surface and in the upper 1 to 2 ft of the subsurface.

Analyses of soil samples collected in 2001 (0-to-1 ft depth) and in 2004 (3.0-to-3.5 ft depth) characterized the contaminant levels of the shallow soils at SWMU 13. March and April 2007 interviews of a site employee identified three areas of interest where materials may have been buried previously as part of routine maintenance of the scrap yards (DOE 2008) (hereafter referred to as “the three areas of interest”). DOE followed up on the interview with geophysical surveys of expanded areas at the three locations in April and May 2007 [independent of the Burial Grounds Operable Unit (BGOU) Remedial Investigation (RI)] to verify the presence of buried materials.

The objectives of this Field Sampling Plan, which is an addendum to the BGOU RI/Feasibility Study (RI/FS) Work Plan (DOE 2006), are to (1) determine extent of buried materials (i.e., scrap metal) where present at SWMU 13 and (2) determine the nature of any releases from buried materials located. (Any surface soil contamination present at SWMU 13 will be addressed by the Soils Operable Unit.) These objectives are consistent with the scope of a site investigation. To accomplish these objectives, a geophysical survey will be completed to verify the location of buried materials. Subsequently, samples will be collected from soil and groundwater (if possible) associated with buried materials. The information developed will be used to evaluate appropriate remedial alternatives (if necessary). If further investigation of SWMU 13 is necessary, based on results of this site investigation, agreement among parties will be made as to further evaluation and/or action.

The conceptual model for buried materials at SWMU 13, which is based upon process knowledge and earlier sampling results, is that the buried materials are inert, clean metal that has not released contamination to surrounding soil and groundwater. Additionally, if contaminants were released, site knowledge suggests that chemical and physical diffusion should limit contaminant migration to soils adjacent to and below buried material.

Section 2 presents the existing data for SWMU 13. The conceptual site model (Section 3) serves as the basis for the proposed investigative activities. Data gaps are summarized in Section 4. Sections 5 and 6 present the sampling media and methods and documentation for sample analysis. (Federal Facility Agreement requirements for a site-specific sampling plan are addressed in Section 5.) Sampling procedures, documentation, and the sample location survey are the subjects of Sections 7, 8, and 9.

[1]The C-746-P Clean Scrap Yard was divided into east (C-746-P) and west (C-746-P1) units to allow for the continuous disposal of clean scrap material. As sold scrap was removed from one yard, the other yard was filled.

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Deleted: The focus of this Field Sampling Plan Addendum to the BGOU RI/Feasibility Study (RI/FS) Work Plan (DOE 2006) is to perform an additional geophysical survey across the SWMU 13 scrap yard to verify the location of potential buried materials (primarily scrap metal) and then collect soil samples associated with these buried materials. The analysis of these soil samples will be used to determine any soil contamination originating from potential buried materials that may be present in the scrap yards of SWMU 13 that may be migrating from the waste to the aquifer and, if migration has occurred, the extent of the subsurface soil contamination. This information will be used in the BGOU FS to evaluate appropriate remedial alternatives (if necessary). Surface soils in SWMU 13 will be addressed by the Soils Operable Unit.¶

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Figure 1. Location of SWMU 13

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Figure 1.¶

1. Location of SWMU 13¶

2. REVIEW OF EXISTING DATA

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The surface at SWMU 13 is covered by soil and up to 2 ft of gravel. Loess (silt) of Hydrogeologic Unit (HU) 1 underlies the soil and gravel cover to a depth of approximately 20 ft, based on logs of soil borings in adjacent areas. A shallow water table commonly occurs in the northwest quadrant of the PGDP-secured area. The depth of the water table at SWMU 13 likely is between 5 and 10 ft.

The existing characterization data for SWMU 13 include 1 sediment sample[2] from the Waste Area Group 22 RI (collected October 2, 1996); 7 surface soil samples collected November 15 through 21, 2001; and 27 shallow soil samples (sampling the 3.0 to 3.5-ft depth interval) collected September 7 through 10, 2004. Figure 2 is a map of existing sample locations at SWMU 13. This figure also shows the location of the three areas of interest.

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Table 1 summarizes the analysis types that are available for each medium (and number of samples within each medium). The sample locations specific to each medium are presented in Table 2. Tables in the appendix summarize the screening of the analyses for each medium against background and the no action level (excavation worker scenario).

Table 1. Analysis Types for Each Medium Previously Sampled for SWMU 13

Media	Depth (ft)	Number of Samples	Analysis Type				
			Metals	PCBs	Radionuclides	Semivolatile Organics	Volatile Organics
Sediment	0	1	√[a]	√	√	√	NA[b]
Surface Soil	0–1	7	√	√	√	√	√
Subsurface Soil	3–3.5	27	√	√	√	√	√

[a] √ = All samples were tested for the analysis.
[b] The sediment sample was not analyzed for volatile organic compounds.

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Table 2. Sample Stations for Each Medium Previously Sampled for SWMU 13

Sediment 0 ft depth	**Surface Soil** 0–1 ft depth	**Subsurface Soil** 3–3.5 ft depth	
DD-07	SYP001	C746P1GR5	C746PGR1
	SYP002	C746P1GR13	C746PGR7
	SYP003	C746P1GR14	C746PGR27
	SYP004	C746P1GR15	C746PGR29
	SYP005	C746P1GR18	C746PGR31
	SYP006	C746P1GR20	C746PGR38
	SYP007	C746P1GR31	C746PGR41
		C746P1GR33	C746PGR58
		C746P1GR37	C746PGR65
		C746P1GR41	C746PGR78
		C746P1GR45	C746PGR83
		C746P1GR58	C746PGR91
		C746P1GR60	C746PGR104
			C746PGR106

[2]Any contamination in the ditches adjacent to SWMU 13 will be addressed under the decontamination and decommissioning of the gaseous diffusion plant.

Figure 2. Existing Sample Locations at SWMU 13

Metals and radionuclides were commonly detected. The only metal or radionuclide to exceed its background level in surface soil was uranium-238.

The metals and radionuclides occurring most frequently above their background levels in subsurface soil were cadmium, calcium, technetium-99, and uranium-238. Notably, cadmium and calcium levels frequently exceeded 5X and 10X the background levels. (Barium, beryllium, cesium-137, chromium, copper, vanadium, zinc and uranium-234 also were frequently detected and sometimes exceeded their background levels.) Two polyaromatic hydrocarbons (PAHs) frequently were detected in subsurface soil: fluoranthene (17% of the analyses) and pyrene (17% of the analyses). Di-n-butyl phthalate (detected in 31% of the analyses) was another frequently detected semivolatile compound. Polychlorinated biphenyls (PCBs) were detected in 28% of subsurface soil samples, with PCB-1254 (in 21% of the analyses) and PCB-1260 (in 14% of the analyses) being the most common. Detections of volatile organic compounds (VOCs) in subsurface soils were commonly limited to 2-Butanone (detected in 81% of the samples at 6 to 28 µg/kg), carbon disulfide (in 96% of the samples at 7 to 8 µg/kg and in a lab blank sample), and acetone (in 72% of the samples at 11 to 98 µg/kg). These VOCs are not expected to be indicative of contamination in the soils.[3]

Based on the historical analyses of subsurface soil samples collected from the 3.0 to 3.5 ft-depth interval, the primary contaminants in the subsurface soils are calcium, cadmium, several PAHs, PCB-1254, and PCB-1260.

Interviews (on March 28, 2007, and April 24, 2007) with a United States Enrichment Corporation operator who had knowledge of burial at PGDP (DOE 2008) indicate that formerly it was common practice to sell scrap to dealers in the C-746-P Clean Scrap Yards. Excess (not sold) scrap was collected in a pile and buried in 5- to 6-ft deep holes and then covered. Three areas were identified as potential burial sites (Figure 3) during the interviews. The operator recalled working in an area on the east side of the combined C-746-P/-P1 Scrap Yards and in an area near the center of the yards, but was unsure of the type of work (i.e., possibly grading work and not burial). The operator was more confident that a third area, at the western end of the scrap yards, was used as a burial location for scrap that was not collected by the local scrap dealers for resale. In the interview, the operator suggested that copper bars from fluorine cells might be buried in the third area.

Geophysical surveys were performed over expanded areas at the three locations (Figure 3) on April 24, May 2, 3, 7, and 10, 2007. These surveys used a Geonics Electromagnetometer™ (EM)-61, pulled as a trailer, to locate buried metal in the three areas of interest. Readings were taken along continuous lines spaced 5 ft apart. The EM-61 survey identified metal throughout the three areas of interest beginning at a depth of 2 ft. This metal likely is small scrap related to previous housekeeping activities (spreading and covering small amounts of metal). The EM-61 survey detected an anomaly (Figure 4) beginning at approximately 4 to 8 ft in depth in the area of interest at the western end of the scrap yards.

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[3] 2-Butanone is a widespread air contaminant associated with paints, coatings, glues, and automobile exhaust. Carbon disulfide has not been used in PGDP processes. Carbon disulfide was detected in the laboratory blank sample and likely is a laboratory-related contaminant. Acetone is a common laboratory-related contaminant.

Figure 3. Area of Geophysical Surveys (April and May 2007) in SWMU 13

Figure 4. Geophysical Anomaly at West End of SWMU 13

3. CONCEPTUAL SITE MODEL

SWMU 13 is a former scrap yard used for the storage of clean scrap metal prior to sale to scrap metal reclaiming vendors. The conceptual site model to support the investigation of SWMU 13 is that clean, inert material was buried at SWMU 13; no migration of contaminants derived from the buried material has occurred. Possible deviations of this model are that some migration of dissolved metals has occurred and that the buried material was not clean; other contaminants associated with the buried materials have migrated to the surrounding soil. Metals, PAHs, and PCBs are the primary contaminants associated with the historical samples of SWMU 13 subsurface soil and represent possible contaminants of the buried materials. Radionuclides and VOCs are likely deviations to the possible contaminants. Containers are not known to have been buried at SWMU 13; therefore, any contaminants that may have migrated should be derived from the buried materials.

4. DATA GAPS

Surface geophysics will be used to identify and locate burial areas within SWMU 13. Soil and groundwater (if possible) will be used to determine the nature of buried material and releases from it. The data gaps associated with characterization of SWMU 13 are as follows.

- The nature and location of buried materials have not been adequately characterized.[4]
- The nature of any release from buried materials remains undetermined.

5. SAMPLING MEDIA AND METHODS

Surface geophysics will be used to identify and locate burial areas within SWMU 13. Soil and groundwater (if possible) will be used to determine the nature of buried material and releases from it. If soil sampling identifies a water-productive zone (saturated sand horizon), then attempts will be made to collect groundwater samples.

5.1 SURFACE GEOPHYSICS

Geophysical Survey Design. The previous surface geophysical survey was limited to the three areas of interest identified in the March and April 2007 interviews of a site employee. As part of the investigation of SWMU 13, this Field Sampling Plan provides a surface geophysical survey of the whole SWMU 13 scrap yard.

[4]A previous surface geophysical survey of SWMU 13 using an EM-61 identified the presence of shallow metal throughout the survey area, at a depth of 2 ft, and a discrete area of buried metal beginning at 4 to 8 ft below ground surface in the northwest area of interest. The shallow buried metal at 2 ft depth limited the ability of the EM-61 used in the previous geophysical survey to characterize deeper soils; uncertainty remains regarding the presence of deeper buried materials within the three areas of interest identified in the interview of the site employee (DOE 2008).

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In order to image deeper soils, the surface geophysical survey will use an EM-61-MK2 Differential System, which reduces the response from shallow buried metal and allows for an approximation of the depth to discrete deeper metal targets.[5] The EM-61-MK2 survey will be implemented along continuous lines spaced 4 to 5 ft apart across the entire SWMU 13 scrap yard.

The EM-61-MK2 Differential System consists of a main receiver coil and a second receiver coil, mounted 1.3 ft above the main receiver coil. Electronics screen out the electromagnetic response of shallow buried metal, using the decay of the electromagnetic signal over the distance between the main receiver coil and the second receiver coil, and characterize the deeper soil. A central processing unit automatically records the electromagnetic response and location [via global positioning system (GPS) such as a Trimble AG114 GPS Unit™]. Results of the geophysical survey will be reduced by the EM-61-MK2 Differential System and plotted using Trackmaster 61™ software, or equivalent, to present the electromagnetic characteristics of the subsurface soil.

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Geophysical Survey Design. The previous surface geophysical survey was limited to the three areas of interest identified in the March and April 2007 interviews of a site employee. As part of the investigation of SWMU 13, this Field Sampling Plan provides a surface geophysical survey of the whole SWMU 13 scrap yard.¶

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5.2 SOIL AND GROUNDWATER SAMPLING

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Soil Boring Locations. The project manager and project geologist will review the geophysical survey results, plotted as contours of soil conductivity, to identify likely areas of buried materials. If no anomalies are found within an area of interest, the project geologist will use the results to map regions of distinctive soil conductivity (areas of relative uniform conductivity and areas of highly variable conductivity) within the area of interest to help locate the sample borings. DOE will consult with U.S. Environmental Protection Agency (EPA) and the Kentucky Energy and Environment Cabinet (KEEC) prior to placement of the soil borings.

Soil samples will be collected within the anomalies and adjacent to anomalies that are indicative of buried material, if possible. The preferred sample locations will be within the areas identified by the geophysical survey as containing buried materials of larger size.[6] If refusal is encountered, additional attempts will be made to collect soil samples. If the buried metal is in a dense configuration making it impractical to obtain a soil sample at the specified depth, then angular borings will be made to collect soil samples from beneath the buried material. In the case where the geophysical survey indicates that no buried material is present at a location previously identified as an area of interest in the subsurface soils below 2 ft depth, the soil borings will be distributed across that area and the locations will be selected based on professional judgment to characterize all regions of soil conductivity. Table 3 presents the anticipated number of soil borings that will be used for the characterization. These sampling numbers are based upon the assumption that the geophysical survey will verify that sampling is needed only in the previously identified areas of interest. If other areas of buried materials are identified, up to eight contingency borings will be sampled.

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In the case where the geophysical survey results are nondescriptive and don't identify buried waste or regions of distinctive soil conductivity, sampling locations will be limited to the areas of interest and will be picked using a triangular grid that has density sufficient to identify a circular area of contamination with a radius of 20 ft at a 95% probability.[7]

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[5]The EM-61-MK2 has a maximum depth of detection of approximately 17 ft and is able to detect a single 55-gal drum at depths greater than 9 ft. The lateral resolution of the survey is expected to be several feet at the expected depth of any buried metal.

[6]There is no basis for assuming any sorting of buried waste. Characterization is targeted toward larger features as the most likely source of sufficient soil contaminant mass to exceed action criteria.

[7]*Visual Sample Plan*, version 5.1.1 (Battelle 2008).

Table 3. SWMU 13 Investigation and Sampling Summary

Area of Interest	Dimensions (ft)	Surface Geophysics	Soil Borings[a]	Soil Samples (2 per boring)	Groundwater Samples	Quality Assurance Samples
Northeast	70 X 200	Yes	6	12	1	2 field blank 2 field duplicate
Central	130 X 150	Yes	8	16	1	2 field blank 2 field duplicate
Northwest	100 X 100	Yes	5	10	1	2 field blank 2 field duplicate
Unidentified	TBD[b]	Yes	TBD	TBD	TBD	TBD
TOTAL	NA[c]	NA	19	38	3	6 field blanks 6 field duplicates

[a]Additional soil borings may be necessary, if required, to adequately characterize burial cells within the three areas of interest and if other areas of interest are identified during the geophysics survey.
[b]TBD = to be determined. A maximum of 8 contingency soil borings/16 sample intervals and 1 field blank and 1 field duplicate will be sampled prior to consultation with EPA and KEEC.
[c]NA = not applicable

If suspected burial areas are identified outside the three areas of interest, soil borings will be located in a manner similar to the placement of soil borings within the three areas of interest.

Sampling Method. The soil borings will be sampled using direct-push technology (DPT) in accordance with DOE Prime Contractor-approved procedures. The drill rig will use a dual-tube sampling system to advance a set of sampling rods. Once the sampling depths are achieved, a soil sampler containing an acetate sample tube will be lowered to the top of the sample interval (10 ft depth for the top soil sample, 15 ft depth for the bottom soil sample), and the soil sampler will be pushed across the sample interval (10 to 13-ft depth interval for the top soil sample, 15 to 18-ft depth interval for the bottom soil sample[8]) to collect the undisturbed soil sample. Immediately upon retrieval of the soil sample and opening of the acetate sample tube, the soil core will be surveyed for VOCs using hand-held instrumentation such as a photoionization detector (with a detection limit of 0.1-1 ppm). The VOC sample will be collected first, from a targeted area of the soil core if identified by the survey. The field crew next will record the lithology of the sample, and the soil will be placed in a clean bowl and mixed thoroughly to homogenize the soil before subsampling for other laboratory analysis (i.e., two sets of samples from each boring). This resulting soil mixture will be placed in the appropriate sample jars for analysis. Table 4 identifies the analyses for the SWMU 13 soil samples. These analyses include metals, PAHs, and PCBs, the primary contaminants associated with SWMU 13; and radionuclides and VOCs, which represent reasonable deviations from the conceptual site model.

Although the water table is expected to be shallow at SWMU 13, the Upper Continental Recharge System (UCRS) (water table system) typically does not yield good quality (low suspended solids) water samples. An attempt will be made to collect an unfiltered and filtered UCRS groundwater sample from each of the areas containing buried metal based on the geophysics survey results.

If soil sampling identifies a water-productive zone (saturated sand horizon) near the base of the borings, the field crew will collect the groundwater samples from within the DPT sample rods after the collection of the soil sample by retracting the DPT sample rods enough to expose the water-productive zone in the open borehole. Otherwise, the DPT sample rods will remain at the total depth. Where groundwater

[8]3-ft length cores are required to ensure adequate soil volume to meet sample requirements.

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collects in the soil boring and sample rods, a limited amount of groundwater, typically less than a gallon, will be pumped to the surface with a small bladder or inertial pump to reduce the turbidity of the water sample. Since sampling will take place soon after drilling ceases, there will be no stagnant water to remove from the boring; therefore, there will be no minimum purge volume. The water sample will be collected using a flow rate of 200 mL/minute or less after sufficient water has been purged to allow geochemical parameters (i.e., pH, dissolved oxygen, conductivity, and temperature) to stabilize within the boring. After sampling is completed, the sample tubing and pump will be removed from the boring and decontaminated in accordance with DOE Prime Contractor-approved procedures.

Aliquots will be collected for the parameters listed in Table 9.9 of the BGOU RI/FS Work Plan. If the sample volume is not sufficient to collect aliquots for all analyses, then aliquots for analysis of unfiltered water will take precedence. For both unfiltered and filtered water analyses, the preferred order of analyses will be metals, radionuclides, PCBs, PAHs, and volatiles.

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Table 4. SWMU 13 Soil Analytes and Reporting Limits

Reporting Limit[a] (mg/kg)	Metals SW-846, 6010		
20	Aluminum		
0.5	Beryllium		
2	Cadmium		
100	Calcium		
2.5	Chromium		
2.5	Copper		
20	Iron		
2.5	Manganese		
5	Molybdenum		
5	Nickel		
2.5	Silver		
2.5	Vanadium		
20	Zinc		
(mg/kg)	**Metals SW-846, 6020**		
1	Arsenic		
20	Selenium		
2	Thallium		
1	Uranium		
(µg/kg)	**TCL PAHs SW-846, 8270**		
660	Acenapthene	Benzo(g,h,i)perylene	Fluoranthene
	Acenaphthylene	Benzo(k)fluoranthene	Fluorene
	Anthracene	Chrysene	Indeno(1,2,3-cd)pyrene
	Benz(a)anthracene	Dibenz(a,h)anthracene	Naphthalene
	Benzo(a)pyrene		Phenanthrene
	Benzo(b)fluoranthene		Pyrene
(µg/kg)	**TCL Other Semivolatiles SW-846, 8270**		
660	di-N-butylphthalate		
(mg/kg)	**TCL PCBs SW-846, 8082**		
0.1	Aroclor-1016	Aroclor-1242	Aroclor-1254
	Aroclor-1221	Aroclor-1248	Aroclor-1260
	Aroclor-1232		Total PCBs

Table 4. SWMU 13 Soil Analytes and Reporting Limits (Continued)

Reporting Limit[a] (µg/kg)	TCL Volatiles SW-846, 8260		
10	Acetone	*trans*-1,2 Dichloroethene	Methylene chloride
	Acrolein	*cis*-1,3-Dichloropropene	Styrene
	Acrylonitrile	*trans*-1,3-Dichloropropene	1,1,2,2-Tetrachloroethane
	Benzene	Dibromochloromethane	1,1,1,2-Tetrachloroethane
	Bromodichloromethane	Dibromomethane	Tetrachloroethene
	Bromoform	Dichlorodifluoromethane	Toluene
	Bromomethane	1,1-Dichloroethane	1,1,1-Trichloroethane
	2-Butanone	1,2-Dichloroethane	1,1,2-Trichloroethane
	Carbon disulfide	1,1-Dichlorethene	Trichloroethene
	Carbon tetrachloride	*cis*-1,2-Dichloroethene	Trichlorofluoromethane
	Chlorobenzene	1,2-Dichloropropane	1,2,3-Trichloropropane
	Chloroethane	Ethyl benzene	*m,p*- xylene (20 µg/kg)
	2-Chloroethyl vinyl ether	Ethyl methacrylate	*o*- xylene
	Chloroform	2-Hexanone	Vinyl acetate
	Chloromethane	Iodomethane	Vinyl chloride
	trans-1,4-Dichloro-2-butene (100 µg/kg)	4-Methyl-2-pentanone	
(pCi/g)	**Radionuclides EPA-900**		
5	Gross alpha		
	Gross beta		
(pCi/g)	**Radionuclides Alpha Spec[b]**		
3	Americium-241		
3	Neptunium-237		
6	Plutonium-238		
4	Plutonium-239/240		
3	Thorium-228		
4	Throium-230		
3	Thorium-232		
3	Uranium-234		
2	Uranium-235		
2	Uranium-238		
(pCi/g)	**Radionuclides Gamma Spec[b]**		
0.5	Cesium-137		
(pCi/g)	**Radionuclides Liquid Scintillation[b]**		
8	Technetium-99		

[a] With the exception of aluminum, the reporting limits match those of the BGOU RI/FS Work Plan (DOE 2006). The reporting limit for the aluminum analysis in the Field Sampling Plan of the BGOU RI/FS Work Plan is 10 mg/kg. Compared to the provisional background concentration for aluminum in subsurface soil at the PGDP (12,000 mg/kg), the increase in the reporting limit for aluminum to 20 mg/kg will not impact the conclusions reached using the results of this Field Sampling Plan Addendum.
[b] This procedure is derived from a variety of sources including, but not limited to, *Environmental Measurements Laboratory Procedures Manual* (HASL-300). Equivalent laboratory methods may be used for radiological analyses if the laboratory standard operating procedures have been approved by DOE.
TCL = target compound list

The acetate sleeve and any remaining soil will be handled as investigation-derived waste. Upon the completion of sampling in each borehole, the field crew will abandon the boreholes by filling them with (dry) bentonite pellets. Available soil moisture will hydrate the pellets.

If obvious contamination (e.g., soil staining or the presence of oil) is observed in the 15 to 18-ft depth sample interval, contingency is available to collect deeper soil samples using the same methodology to further characterize the vertical extent of contamination, down to the top of the Regional Gravel Aquifer at an approximate depth of 55 ft at SWMU 13. The deeper soil sample intervals would be approximately 27 to 30 ft, 37 to 40 ft, and 52 to 55 ft.

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If the data evaluation for this SWMU 13 investigation (to be reported in an appendix to the BGOU FS) determines the presence of unacceptable contamination in the 15 to 18-ft depth samples, the response action for SWMU 13 will include additional soil sampling (e.g., in support of design of the response action or to confirm achievement of the response action goal).

6. SAMPLE ANALYSIS

The sample analyses for this investigation will characterize soil and groundwater, if possible, and project-generated waste materials. Specific analytical requirements, methods, and procedures applicable to this Field Sampling Plan are identified in Table 4 and described in the Quality Assurance Project Plan, Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006).

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7. SAMPLING PROCEDURES

Fieldwork and sampling at PGDP will be conducted in accordance with DOE Prime Contractor-approved medium-specific work instructions or procedures. DOE or its Prime Contractor will approve any deviations from these work instructions and procedures. The DOE Prime Contractor will document changes on Field Change Request forms as detailed in the Quality Assurance Project Plan, Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006). Table 5 provides an example list of investigation activities that may require work instructions or procedures.

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Table 5. Example Fieldwork and Sampling Activities Requiring Work Instructions or Procedures

Investigation Activity
Use of Field Logbooks
Lithologic Logging
Labeling, Packaging, and Shipping of Environmental Field Samples
Sampling of Containerized Wastes
Opening Containerized Waste
On-Site Handling and Disposal of Waste Materials
Identification and Management of Waste Not from a Radioactive Material Management Area
Paducah Contractor Records Management Program
Quality Assured Data
Chain-of-Custody
Field Quality Control
Data Management Coordination Equipment Decontamination
Off-Site Decontamination Pad Operating Procedures
Cleaning and Decontaminating Sample Containers and Sampling Equipment
Environmental Radiological Screening
Archival of Environmental Data within the ER Program
Data Entry
Data Validation
Well and Temporary Boring Abandonment

8. DOCUMENTATION

Field documentation will be maintained throughout the SWMU 13 investigation in various types of documents and formats including field logbooks, sample labels, sample tags, chain-of-custody forms, and field data sheets. The "Data Management Implementation Plan," Chapter 12 of the BGOU RI/FS Work Plan (DOE 2006), provides the applicable guidelines for maintaining field documentation.

The documentation for the investigation of subsurface buried materials at SWMU 13 will be consistent with that done for other units included in the BGOU RI and will be reported in an appendix to the BGOU FS. This will include a baseline risk assessment of contamination found to be associated with the buried materials. As noted earlier, surface soil sampling at SWMU 13 will be completed as part of the Soils Operable Unit RI; therefore, the baseline risk assessment for exposure to contaminants in surface soil at SWMU 13 will be included in the baseline risk assessment that will be completed as part of the Soils Operable Unit RI.

9. SAMPLE LOCATION SURVEY

A civil survey of sampling locations will be performed upon completion of the SWMU 13 investigation field activities. Section 9.6, "Sample Location Survey," of the BGOU RI/FS Work Plan (DOE 2006) documents the requirements for the civil survey.

10. REFERENCES

Battelle 2008. *Visual Sample Plan*, Version 5.1.1, Battelle Memorial Institute.

DOE (U.S. Department of Energy) 2001. *Methods for Conducting Risk Assessment and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health*. DOE/OR/07-1506&D2, U.S. Department of Energy, Paducah, KY, December.

DOE 2006. *Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. DOE/OR/07-2179&D2/R1, U.S. Department of Energy, Paducah, KY, August.

DOE 2008. *C-746-P and C-746-P1 Scrap Yards, Solid Waste Management Unit (SWMU) Assessment Report*, DOE/LX/07-0059&D1, U.S. Department of Energy, Paducah, KY, January.

EPA (U.S. Environmental Protection Agency) 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant, U.S. Environmental Protection Agency*, Atlanta, GA, February 13.

APPENDIX

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SCREENING OF ANALYSES FOR EACH MEDIUM PREVIOUSLY SAMPLED FOR SWMU 13

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Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Anion (mg/kg)							
Cyanide	0/1	ND	1.40E-01	NA	9.18E+01	NA	0/1
Metals (mg/kg)							
Aluminum	1/1	1.40E+04	1.40E+04	1.30E+04	5.25E+03	1/1	1/1
Antimony	1/1	8.20E-01	8.20E-01	2.10E-01	4.92E-01	1/1	1/1
Arsenic	1/1	4.20E+00	4.20E+00	1.20E+01	3.24E-01	0/1	1/1
Barium	1/1	1.20E+02	1.20E+02	2.00E+02	2.72E+02	0/1	0/1
Beryllium	1/1	5.50E-01	5.50E-01	6.70E-01	1.26E+00	0/1	0/1
Cadmium	1/1	1.20E+00	1.20E+00	2.10E-01	1.52E+01	1/1	0/1
Calcium	1/1	3.00E+03	3.00E+03	2.00E+05	NA	0/1	NA
Chromium	1/1	1.90E+01	1.90E+01	1.60E+01	4.76E+02	1/1	0/1
Cobalt	1/1	3.10E+00	3.10E+00	1.40E+01	1.11E+03	0/1	0/1
Copper	1/1	4.60E+01	4.60E+01	1.90E+01	4.27E+02	1/1	0/1
Iron	1/1	1.40E+04	1.40E+04	2.80E+04	2.17E+03	0/1	1/1
Lead	1/1	3.10E+01	3.10E+01	3.60E+01	5.00E+01	0/1	0/1
Magnesium	1/1	1.60E+03	1.60E+03	7.70E+03	NA	0/1	NA
Manganese	1/1	2.20E+02	2.20E+02	1.50E+03	5.66E+01	0/1	1/1
Mercury	0/1	ND	3.40E-02	2.00E-01	1.17E+00	0/1	0/1
Molybdenum	0/1	ND	4.10E-01	NA	6.60E+01	NA	0/1
Nickel	1/1	1.40E+02	1.40E+02	2.10E+01	2.16E+02	1/1	0/1
Potassium	0/1	ND	8.70E+02	1.30E+03	NA	0/1	NA
Selenium	0/1	ND	3.90E-01	8.00E-01	7.13E+01	0/1	0/1
Silver	0/1	ND	1.60E-01	2.30E+00	4.12E+01	0/1	0/1
Sodium	0/1	ND	7.50E+01	3.20E+02	NA	0/1	NA
Thallium	0/1	ND	1.00E+00	2.10E-01	NA	0/1	NA
Tin	0/1	ND	1.50E+01	NA	3.15E+03	NA	0/1
Uranium	1/1	1.30E+02	1.30E+02	4.90E+00	1.13E+01	1/1	1/1
Vanadium	1/1	2.70E+01	2.70E+01	3.80E+01	4.40E+00	0/1	1/1
Zinc	1/1	2.40E+02	2.40E+02	6.50E+01	2.66E+03	1/1	0/1
Pesticides/PCBs (mg/kg)							
4,4'-DDD	0/1	ND	1.40E-02	NA	2.43E+00	NA	0/1
4,4'-DDE	0/1	ND	1.20E-02	NA	1.71E+00	NA	0/1
4,4'-DDT	0/1	ND	8.00E-03	NA	1.71E+00	NA	0/1
Aldrin	0/1	ND	1.00E-02	NA	1.70E-02	NA	0/1
alpha-BHC	0/1	ND	8.00E-03	NA	9.34E-02	NA	0/1
beta-BHC	0/1	ND	1.60E-02	NA	3.21E-01	NA	0/1
delta-BHC	0/1	ND	1.80E-02	NA	NA	NA	NA
Dieldrin	0/1	ND	1.70E-02	NA	1.80E-02	NA	0/1
Heptachlor	0/1	ND	7.00E-03	NA	7.98E-02	NA	0/1
Lindane	0/1	ND	8.00E-03	NA	4.53E-01	NA	0/1
Methoxychlor	0/1	ND	4.00E-03	NA	5.15E+01	NA	0/1
PCB-1016	1/1	5.10E-02	5.10E-02	NA	1.68E-01	NA	0/1
PCB-1221	0/1	ND	9.00E-03	NA	1.68E-01	NA	0/1
PCB-1232	0/1	ND	3.70E-03	NA	1.68E-01	NA	0/1
PCB-1242	0/1	ND	2.40E-03	NA	1.68E-01	NA	0/1
PCB-1248	0/1	ND	7.40E-04	NA	1.68E-01	NA	0/1
PCB-1254	0/1	ND	7.10E-04	NA	1.68E-01	NA	0/1
PCB-1260	1/1	1.20E+00	1.20E+00	NA	1.68E-01	NA	1/1

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Radionuclides (pCi/g)							
Alpha activity	1/2	1.02E+02	1.02E+02	NA	NA	NA	NA
Beta activity	1/2	2.34E+02	2.34E+02	NA	NA	NA	NA
Neptunium-237	1/1	5.30E-01	5.30E-01	1.00E-01	3.28E-01	1/1	1/1
Plutonium-239	1/1	3.00E-02	3.00E-02	2.50E-02	1.63E+00	1/1	0/1
Technetium-99	1/1	1.50E+02	1.50E+02	2.50E+00	5.79E+01	1/1	1/1
Thorium-230	1/1	1.16E+00	1.16E+00	1.50E+00	2.22E+00	0/1	0/1
Uranium-234	1/1	3.57E+01	3.57E+01	2.50E+00	2.84E+00	1/1	1/1
Uranium-235/236	1/1	4.12E+00	4.12E+00	1.40E-01	4.55E-01	1/1	1/1
Uranium-238	1/1	6.41E+01	6.41E+01	1.20E+00	1.17E+00	1/1	1/1
Semivolatile Organics (mg/kg)							
1,2,4,5-Tetrachlorobenzene	0/1	ND	8.00E-03	NA	4.07E+00	NA	0/1
1,2,4-Trichlorobenzene	0/1	ND	1.00E-02	NA	8.30E+01	NA	0/1
1,2-Dichlorobenzene	0/1	ND	9.00E-03	NA	3.22E+02	NA	0/1
1,2-Diphenylhydrazine	0/1	ND	7.00E-03	NA	3.61E-01	NA	0/1
1,3-Dichlorobenzene	0/1	ND	1.00E-02	NA	6.82E+00	NA	0/1
1,4-Dichlorobenzene	0/1	ND	9.00E-03	NA	5.35E+00	NA	0/1
1-Chloronaphtalene	0/1	ND	1.00E-02	NA	NA	NA	NA
1-Naphthalenamine	0/1	ND	3.80E-02	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol	0/1	ND	1.20E-02	NA	3.09E+02	NA	0/1
2,4,5-Trichlorophenol	0/1	ND	9.00E-03	NA	1.03E+03	NA	0/1
2,4,6-Trichlorophenol	0/1	ND	1.00E-02	NA	2.62E+01	NA	0/1
2,4-Dichlorophenol	0/1	ND	9.00E-03	NA	4.13E+01	NA	0/1
2,4-Dimethylphenol	0/1	ND	2.30E-02	NA	2.06E+02	NA	0/1
2,4-Dinitrophenol	0/1	ND	4.90E-02	NA	3.04E+01	NA	0/1
2,4-Dinitrotoluene	0/1	ND	1.50E-02	NA	5.77E-01	NA	0/1
2,6-Dichlorophenol	0/1	ND	1.00E-02	NA	NA	NA	NA
2,6-Dinitrotoluene	0/1	ND	8.00E-03	NA	5.77E-01	NA	0/1
2-Chloronaphthalene	0/1	ND	4.00E-03	NA	2.67E+02	NA	0/1
2-Chlorophenol	0/1	ND	1.10E-02	NA	2.12E+01	NA	0/1
2-Methyl-4,6-dinitrophenol	0/1	ND	5.20E-02	NA	NA	NA	NA
2-Methylnaphthalene	0/1	ND	9.00E-03	NA	NA	NA	NA
2-Methylphenol	0/1	ND	8.00E-03	NA	5.15E+02	NA	0/1
2-Methylpyridine	0/1	ND	6.70E-02	NA	NA	NA	NA
2-Naphthalenamine	0/1	ND	6.60E-02	NA	NA	NA	NA
2-Nitrobenzenamine	0/1	ND	1.00E-02	NA	5.89E-01	NA	0/1
2-Nitrophenol	0/1	ND	9.00E-03	NA	NA	NA	NA
3,3'-Dichlorobenzidine	0/1	ND	3.60E-02	NA	6.41E-01	NA	0/1
3-Methylcholanthrene	0/1	ND	2.00E-02	NA	NA	NA	NA
3-Nitrobenzenamine	0/1	ND	2.50E-02	NA	NA	NA	NA
4-Aminobiphenyl	0/1	ND	5.70E-02	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/1	ND	8.00E-03	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/1	ND	1.00E-02	NA	NA	NA	NA

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
4-Chlorobenzenamine	0/1	ND	4.70E-02	NA	4.12E+01	NA	0/1
4-Chlorophenyl phenyl ether	0/1	ND	7.00E-03	NA	NA	NA	NA
4-Methylphenol	0/1	ND	8.00E-03	NA	6.05E+01	NA	0/1
4-Nitrobenzenamine	0/1	ND	6.60E-02	NA	NA	NA	NA
4-Nitrophenol	0/1	ND	2.20E-02	NA	1.21E+02	NA	0/1
7,12-Dimethy-lbenz(a)anthracene	0/1	ND	8.50E-02	NA	NA	NA	NA
a,a-Dimethy-lphenethylamine	0/1	ND	1.30E-02	NA	NA	NA	NA
Acenaphthene	0/1	ND	8.00E-03	NA	3.50E+02	NA	0/1
Acenaphthylene	0/1	ND	8.00E-03	NA	NA	NA	NA
Acetophenone	0/1	ND	8.00E-03	NA	2.25E-01	NA	0/1
Aniline	0/1	ND	5.10E-02	NA	5.06E+01	NA	0/1
Anthracene	1/1	1.50E-02	1.50E-02	NA	3.34E+03	NA	0/1
Benz(a)anthracene	1/1	5.60E-02	5.60E-02	NA	2.32E-01	NA	0/1
Benzenemethanol	0/1	ND	1.00E-02	NA	3.66E+03	NA	0/1
Benzidine	0/1	ND	3.27E-01	NA	1.65E-03	NA	0/1
Benzo(a)pyrene	1/1	5.10E-02	5.10E-02	NA	2.32E-02	NA	1/1
Benzo(b)fluoranthene	1/1	9.60E-02	9.60E-02	NA	2.32E-01	NA	0/1
Benzo(ghi)perylene	0/1	ND	1.90E-02	NA	NA	NA	NA
Benzo(k)fluoranthene	1/1	2.10E-02	2.10E-02	NA	2.32E+00	NA	0/1
Benzoic acid	0/1	ND	1.20E-01	NA	6.07E+04	NA	0/1
Bis(2-chloroethoxy) methane	0/1	ND	9.00E-03	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/1	ND	1.10E-02	NA	1.09E-01	NA	0/1
Bis(2-chloroisopropyl) ether	0/1	ND	5.60E-02	NA	4.12E+00	NA	0/1
Bis(2-ethylhexyl) phthalate	1/1	2.30E-01	2.30E-01	NA	1.01E+01	NA	0/1
Butyl benzyl phthalate	0/1	ND	1.28E-01	NA	2.33E+03	NA	0/1
Chrysene	1/1	6.00E-02	6.00E-02	NA	2.32E+01	NA	0/1
Dibenz(a,h)anthracene	0/1	ND	1.20E-02	NA	2.32E-02	NA	0/1
Dibenzofuran	0/1	ND	4.00E-03	NA	2.10E+01	NA	0/1
Diethyl phthalate	0/1	ND	1.10E-02	NA	1.15E+04	NA	0/1
Dimethyl phthalate	0/1	ND	9.00E-03	NA	1.00E+05	NA	0/1
Di-n-butyl phthalate	0/1	ND	5.90E-02	NA	1.52E+03	NA	0/1
Di-n-octylphthalate	0/1	ND	1.10E-02	NA	2.88E+02	NA	0/1
Ethyl methane-sulfonate	0/1	ND	8.00E-03	NA	NA	NA	NA
Fluoranthene	1/1	1.40E-01	1.40E-01	NA	2.42E+02	NA	0/1
Fluorene	0/1	ND	9.00E-03	NA	3.38E+02	NA	0/1
Hexachlorobenzene	0/1	ND	7.00E-03	NA	1.80E-01	NA	0/1
Hexachlorobutadiene	0/1	ND	8.00E-03	NA	2.06E+00	NA	0/1
Hexachlorocyclo-pentadiene	0/1	ND	6.00E-03	NA	6.18E+01	NA	0/1

Table A.1. Screening of Sediment Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Hexachloroethane	0/1	ND	9.00E-03	NA	1.03E+01	NA	0/1
Indeno(1,2,3-cd)pyrene	0/1	ND	1.30E-02	NA	2.32E-01	NA	0/1
Isophorone	0/1	ND	9.00E-03	NA	3.04E+02	NA	0/1
Methyl methane-sulfonate	0/1	ND	6.80E-02	NA	NA	NA	NA
Naphthalene	0/1	ND	1.00E-02	NA	3.04E+01	NA	0/1
Nitrobenzene	0/1	ND	3.40E-02	NA	3.52E+00	NA	0/1
N-Nitroso-dimethylamine	0/1	ND	1.70E-02	NA	5.66E-03	NA	0/1
N-Nitroso-di-n-propylamine	0/1	ND	1.20E-02	NA	2.51E-02	NA	0/1
N-Nitroso-diphenylamine	0/1	ND	4.00E-03	NA	3.59E+01	NA	0/1
N-Nitrosopiperidine	0/1	ND	8.00E-03	NA	NA	NA	NA
p-Dimethyl-aminoazobenzene	0/1	ND	2.00E-02	NA	NA	NA	NA
Pentachlorobenzene	0/1	ND	9.00E-03	NA	1.09E+01	NA	0/1
Pentachloronitrobenzene	0/1	ND	1.30E-02	NA	1.46E+00	NA	0/1
Pentachlorophenol	0/1	ND	9.00E-03	NA	2.07E+00	NA	0/1
Phenacetin	0/1	ND	1.40E-02	NA	NA	NA	NA
Phenanthrene	1/1	8.40E-02	8.40E-02	NA	NA	NA	NA
Phenol	0/1	ND	9.00E-03	NA	8.65E+03	NA	0/1
Pronamide	0/1	ND	1.20E-02	NA	7.73E+02	NA	0/1
Pyrene	1/1	1.10E-01	1.10E-01	NA	1.81E+02	NA	0/1
Pyridine	0/1	ND	5.30E-02	NA	1.03E+01	NA	0/1

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Metals (mg/kg)							
Aluminum	8/8	1.15E+04	2.00E+01	1.30E+04	5.25E+03	0/8	7/8
Antimony	0/8	ND	2.00E+01	2.10E-01	4.92E-01	0/8	0/8
Arsenic	0/8	ND	5.00E+00	1.20E+01	3.24E-01	0/8	0/8
Barium	8/8	1.04E+02	2.50E+00	2.00E+02	2.72E+02	0/8	0/8
Beryllium	0/8	ND	5.00E-01	6.70E-01	1.26E+00	0/8	0/8
Cadmium	0/8	ND	2.00E+00	2.10E-01	1.52E+01	0/8	0/8
Calcium	8/8	2.50E+03	2.00E+02	2.00E+05	NA	0/8	NA
Chromium	8/8	1.37E+01	2.50E+00	1.60E+01	4.76E+02	0/8	0/8
Cobalt	8/8	8.75E+00	2.50E+00	1.40E+01	1.11E+03	0/8	0/8
Copper	8/8	1.88E+01	2.50E+00	1.90E+01	4.27E+02	0/8	0/8
Iron	8/8	1.21E+04	2.00E+01	2.80E+04	2.17E+03	0/8	8/8
Lead	0/8	ND	2.00E+01	3.60E+01	5.00E+01	0/8	0/8
Lithium	6/8	8.59E+00	5.00E+00	NA	3.69E+02	NA	0/8
Magnesium	8/8	1.24E+03	2.50E+00	7.70E+03	NA	0/8	NA
Manganese	8/8	1.12E+03	2.50E+00	1.50E+03	5.66E+01	0/8	8/8
Mercury	0/8	ND	2.00E-01	2.00E-01	1.17E+00	0/8	0/8
Nickel	7/8	1.18E+01	5.00E+00	2.10E+01	2.16E+02	0/8	0/8
Selenium	0/8	ND	1.00E+00	8.00E-01	7.13E+01	0/8	0/8
Silver	0/8	ND	2.50E+00	2.30E+00	4.12E+01	0/8	0/8
Thallium	0/8	ND	2.00E+01	2.10E-01	NA	0/8	NA
Tin	0/8	ND	1.00E+02	NA	3.15E+03	NA	0/8
Uranium	0/8	ND	1.00E+02	4.90E+00	1.13E+01	0/8	0/8
Vanadium	8/8	2.59E+01	2.50E+00	3.80E+01	4.40E+00	0/8	8/8
Zinc	8/8	5.22E+01	1.00E+01	6.50E+01	2.66E+03	0/8	0/8
Pesticides/PCBs (mg/kg)							
PCB-1016	0/8	ND	6.00E-01	NA	1.68E-01	NA	0/8
PCB-1221	0/8	ND	1.00E-01	NA	1.68E-01	NA	0/8
PCB-1232	0/8	ND	9.00E-02	NA	1.68E-01	NA	0/8
PCB-1242	0/8	ND	7.00E-02	NA	1.68E-01	NA	0/8
PCB-1248	0/8	ND	8.00E-02	NA	1.68E-01	NA	0/8
PCB-1254	1/8	3.00E-01	6.00E-02	NA	1.68E-01	NA	1/8
PCB-1260	1/8	4.00E-01	9.00E-02	NA	1.68E-01	NA	1/8
PCB-1268	0/8	ND	1.00E-01	NA	NA	NA	NA
Polychlorinated biphenyl	1/8	7.00E-01	1.00E-01	NA	1.68E-01	NA	1/8
Radionuclides (pCi/g)							
Americium-241	0/8	ND	0.034-0.142	NA	1.74E+00	NA	0/8
Cesium-134	0/8	ND	0.009-0.02	NA	NA	NA	NA
Cesium-137	0/8	ND	0.011-0.024	4.90E-01	1.15E-01	0/8	0/8
Cobalt-60	0/8	ND	0.011-0.029	NA	2.38E-02	NA	0/8
Neptunium-237	0/8	ND	0.017-0.038	1.00E-01	3.28E-01	0/8	0/8
Plutonium-238	0/8	ND	0.2-0.212	7.30E-02	1.66E+00	0/8	0/8
Plutonium-239/240	0/8	ND	0.038-0.041	2.50E-02	1.63E+00	0/8	0/8
Technetium-99	0/8	ND	3.1-3.38	2.50E+00	5.79E+01	0/8	0/8
Thorium-228	8/8	5.48E-01	0.063-0.065	1.60E+00	3.57E-02	0/8	8/8
Thorium-230	8/8	4.99E-01	0.188-0.198	1.50E+00	2.22E+00	0/8	0/8
Thorium-232	8/8	5.11E-01	0.044-0.064	1.50E+00	1.95E+00	0/8	0/8

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Radionuclides (pCi/g) (Continued)							
Uranium	0/8	ND	0.426-1.04	4.90E+00	1.13E+01	0/8	0/8
Uranium-234	0/8	ND	0.155-0.505	2.50E+00	2.84E+00	0/8	0/8
Uranium-235	7/8	5.72E-02	0.013-0.027	1.40E-01	4.55E-01	0/8	0/8
Uranium-238	7/8	1.32E+00	0.258-0.531	1.20E+00	1.17E+00	4/8	4/8
Semivolatile Organics (mg/kg)							
1,2,4-Trichlorobenzene	0/8	ND	0.46-0.5	NA	8.30E+01	NA	0/8
1,2-Dichlorobenzene	0/8	ND	0.46-0.5	NA	3.22E+02	NA	0/8
1,3-Dichlorobenzene	0/8	ND	0.46-0.5	NA	6.82E+00	NA	0/8
1,4-Dichlorobenzene	0/8	ND	0.46-0.5	NA	5.35E+00	NA	0/8
2,4,5-Trichlorophenol	0/8	ND	0.46-0.5	NA	1.03E+03	NA	0/8
2,4,6-Trichlorophenol	0/8	ND	0.46-0.5	NA	2.62E+01	NA	0/8
2,4-Dichlorophenol	0/8	ND	0.46-0.5	NA	4.13E+01	NA	0/8
2,4-Dimethylphenol	0/8	ND	0.46-0.5	NA	2.06E+02	NA	0/8
2,4-Dinitrophenol	0/8	ND	0.46-0.5	NA	3.04E+01	NA	0/8
2,4-Dinitrotoluene	0/8	ND	0.46-0.5	NA	5.77E-01	NA	0/8
2,6-Dinitrotoluene	0/8	ND	0.46-0.5	NA	5.77E-01	NA	0/8
2-Chloronaphthalene	0/8	ND	0.46-0.5	NA	2.67E+02	NA	0/8
2-Chlorophenol	0/8	ND	0.46-0.5	NA	2.12E+01	NA	0/8
2-Methyl-4,6-dinitrophenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
2-Methylnaphthalene	0/8	ND	0.46-0.5	NA	NA	NA	NA
2-Methylphenol	0/8	ND	0.46-0.5	NA	5.15E+02	NA	0/8
2-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	5.89E-01	NA	0/8
2-Nitrophenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
3,3'-Dichlorobenzidine	0/8	ND	0.46-0.5	NA	6.41E-01	NA	0/8
3-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Chlorobenzenamine	0/8	ND	0.46-0.5	NA	4.12E+01	NA	0/8
4-Chlorophenyl phenyl ether	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Methylphenol	0/8	ND	0.46-0.5	NA	6.05E+01	NA	0/8
4-Nitrobenzenamine	0/8	ND	0.46-0.5	NA	NA	NA	NA
4-Nitrophenol	0/8	ND	0.46-0.5	NA	1.21E+02	NA	0/8
Acenaphthene	0/8	ND	0.46-0.5	NA	3.50E+02	NA	0/8
Acenaphthylene	0/8	ND	0.46-0.5	NA	NA	NA	NA
Anthracene	0/8	ND	0.46-0.5	NA	3.34E+03	NA	0/8
Benz(a)anthracene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Benzo(a)pyrene	0/8	ND	0.46-0.5	NA	2.32E-02	NA	0/8
Benzo(b)fluoranthene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Benzo(ghi)perylene	0/8	ND	0.46-0.5	NA	NA	NA	NA

Deleted: [a] The relative absence of uranium-234 compared to uranium-238 (the activities of the two radionuclides should be approximately equal in background soil) indicates the presence of enriched uranium in surface soil.¶

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Bis(2-chloroethoxy) methane	0/8	ND	0.46-0.5	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/8	ND	0.46-0.5	NA	1.09E-01	NA	0/8
Bis(2-chloroisopropyl) ether	0/8	ND	0.46-0.5	NA	4.12E+00	NA	0/8
Bis(2-ethylhexyl)phthalate	0/8	ND	0.46-0.5	NA	1.01E+01	NA	0/8
Butyl benzyl phthalate	0/8	ND	0.46-0.5	NA	2.33E+03	NA	0/8
Carbazole	0/8	ND	0.46-0.5	NA	1.77E+01	NA	0/8
Chrysene	0/8	ND	0.46-0.5	NA	2.32E+01	NA	0/8
Di-n-octylphthalate	0/8	ND	0.46-0.5	NA	2.88E+02	NA	0/8
Fluorene	0/8	ND	0.46-0.5	NA	3.38E+02	NA	0/8
Hexachlorocyclopentadiene	0/8	ND	0.46-0.5	NA	6.18E+01	NA	0/8
Hexachloroethane	0/8	ND	0.46-0.5	NA	1.03E+01	NA	0/8
Indeno(1,2,3-cd)pyrene	0/8	ND	0.46-0.5	NA	2.32E-01	NA	0/8
Isophorone	0/8	ND	0.46-0.5	NA	3.04E+02	NA	0/8
Naphthalene	0/8	ND	0.46-0.5	NA	3.04E+01	NA	0/8
Nitrobenzene	0/8	ND	0.46-0.5	NA	3.52E+00	NA	0/8
N-Nitroso-di-n-propylamine	0/8	ND	0.46-0.5	NA	2.51E-02	NA	0/8
N-Nitrosodiphenylamine	0/8	ND	0.46-0.5	NA	3.59E+01	NA	0/8
Pentachlorophenol	0/8	ND	0.46-0.5	NA	2.07E+00	NA	0/8
Phenanthrene	0/8	ND	0.46-0.5	NA	NA	NA	NA
Phenol	0/8	ND	0.46-0.5	NA	8.65E+03	NA	0/8
Pyrene	0/8	ND	0.46-0.5	NA	1.81E+02	NA	0/8
Pyridine	0/8	ND	0.46-0.5	NA	1.03E+01	NA	0/8
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0/8	ND	1.00E-02	NA	1.78E+02	NA	0/8
1,1,2,2-Tetrachloroethane	0/8	ND	1.00E-02	NA	5.73E-01	NA	0/8
1,1,2-Trichloroethane	0/8	ND	1.00E-02	NA	1.45E+00	NA	0/8
1,1-Dichloroethane	0/8	ND	1.00E-02	NA	1.97E+02	NA	0/8
1,1-Dichloroethene	0/8	ND	1.00E-02	NA	1.19E-01	NA	0/8
1,2-Dichloroethane	0/8	ND	1.00E-02	NA	6.65E-01	NA	0/8
1,2-Dichloropropane	0/8	ND	1.00E-02	NA	7.89E-01	NA	0/8
1,2-Dimethylbenzene	0/8	ND	1.00E-02	NA	5.59E+03	NA	0/8
2-Butanone	0/8	ND	2.50E-01	NA	1.30E+03	NA	0/8
2-Hexanone	0/8	ND	5.00E-02	NA	NA	NA	NA
4-Methyl-2-pentanone	0/8	ND	2.50E-01	NA	8.51E+01	NA	0/8

Table A.2. Screening of Surface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Volatile Organics (mg/kg) (Continued)							
Acetone	0/8	ND	2.50E-01	NA	4.21E+02	NA	0/8
Benzene	0/8	ND	1.00E-02	NA	1.40E+00	NA	0/8
Bromodichloromethane	0/8	ND	1.00E-02	NA	1.61E+00	NA	0/8
Bromoform	0/8	ND	1.00E-02	NA	4.09E+01	NA	0/8
Bromomethane	0/8	ND	2.00E-02	NA	1.63E+00	NA	0/8
Carbon disulfide	0/8	ND	1.00E-02	NA	1.37E+02	NA	0/8
Carbon tetrachloride	0/8	ND	1.00E-02	NA	5.10E-01	NA	0/8
Chlorobenzene	0/8	ND	1.00E-02	NA	3.68E+01	NA	0/8
Ethylbenzene	0/8	ND	1.00E-02	NA	2.87E+01	NA	0/8
m,p-Xylene	0/8	ND	1.00E-02	NA	9.63E+02	NA	0/8
Methylene chloride	0/8	ND	1.00E-02	NA	1.57E+01	NA	0/8
Styrene	0/8	ND	1.00E-02	NA	9.82E+02	NA	0/8
Tetrachloroethene	0/8	ND	1.00E-02	NA	4.04E+00	NA	0/8
Toluene	0/8	ND	1.00E-02	NA	2.72E+02	NA	0/8
trans-1,2-Dichloroethene	0/8	ND	1.00E-02	NA	2.84E+01	NA	0/8
trans-1,3-Dichloropropene	0/8	ND	1.00E-02	NA	NA	NA	NA
Trichloroethene	0/8	ND	1.00E-02	NA	3.25E+00	NA	0/8

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1]

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Metals (mg/kg)							
Aluminum	29/29	1.02E+04	17.2-19.8	1.20E+04	5.25E+03	0/29	20/29
Antimony	0/29	ND	8.6-9.9	2.10E-01	4.92E-01	0/29	0/29
Arsenic	0/29	ND	17.2-19.8	7.90E+00	3.24E-01	0/29	0/29
Barium	29/29	1.78E+02	2.15-2.47	1.70E+02	2.72E+02	1/29	0/29
Beryllium	14/29	9.40E-01	0.43-0.495	6.90E-01	1.26E+00	4/29	0/29
Cadmium	8/29	6.78E+00	1.72-1.98	2.10E-01	1.52E+01	8/29	0/29
Calcium	28/29	9.14E+04	86-1000	6.10E+03	NA	16/29	NA
Chromium	29/29	1.64E+02	2.15-2.47	4.30E+01	4.76E+02	1/29	0/29
Copper	29/29	4.31E+01	2.15-2.47	2.50E+01	4.27E+02	3/29	0/29
Lead	3/29	4.99E+01	18.4-19.8	2.30E+01	5.00E+01	2/29	0/29
Mercury	0/29	ND	2.00E-01	1.30E-01	1.17E+00	0/29	0/29
Nickel	25/29	2.04E+01	4.3-4.95	2.20E+01	2.16E+02	0/29	0/29
Selenium	0/29	ND	17.2-19.8	7.00E-01	7.13E+01	0/29	0/29
Silver	1/29	2.81E+00	2.47-2.47	2.70E+00	4.12E+01	1/29	0/29
Thallium	0/29	ND	17.2-19.8	3.40E-01	NA	0/29	NA
Vanadium	29/29	3.93E+01	2.15-2.47	3.70E+01	4.40E+00	2/29	29/29
Zinc	24/29	1.37E+02	17.2-19.8	6.00E+01	2.66E+03	5/29	0/29
Pesticides/PCBs (mg/kg)							
PCB-1016	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1221	0/29	ND	1.30E-01	NA	1.68E-01	NA	0/29
PCB-1232	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1242	0/29	ND	6.00E-02	NA	1.68E-01	NA	0/29
PCB-1248	0/29	ND	1.00E-01	NA	1.68E-01	NA	0/29
PCB-1254	6/29	9.90E-01	9.00E-02	NA	1.68E-01	NA	4/29
PCB-1260	4/29	4.80E-01	1.00E-01	NA	1.68E-01	NA	2/29
PCB-1268	0/29	ND	8.00E-02	NA	NA	NA	NA
Polychlorinated biphenyl	8/29	9.90E-01	0.09-0.1	NA	1.68E-01	NA	6/29
Radionuclides (pCi/g)							
Mass of U-235 (mg/kg)	4/29	9.38E-02	0.038-0.040	NA	NA	NA	NA
Americium-241	0/29	ND	0.090-0.095	NA	1.74E+00	NA	0/29
Cesium-137	9/29	5.62E-01	0.031-0.035	2.80E-01	1.15E-01	2/29	4/29
Cobalt-60	1/29	9.70E-02	0.029-0.029	NA	2.38E-02	NA	1/29
Neptunium-237	3/29	1.51E-01	0.054-0.059	NA	3.28E-01	NA	0/29
Plutonium-238	0/29	ND	0.050-0.056	NA	1.66E+00	NA	0/29
Plutonium-239/240	3/29	1.31E-01	0.041-0.049	NA	1.63E+00	NA	0/29
Potassium-40	29/29	1.16E+01	0.23-0.362	1.60E+01	NA	0/29	NA
Radium-226	2/29	4.89E-01	0.094-0.099	1.50E+00	3.30E-02	0/29	2/29
Strontium-90	0/29	ND	1.17-1.54	NA	2.59E+00	NA	0/29
Technetium-99	10/29	1.81E+01	1.72-1.78	2.80E+00	5.79E+01	7/29	0/29
Thorium-228	0/29	ND	0.98-0.989	1.60E+00	3.57E-02	0/29	0/29
Thorium-230	11/29	8.26E-01	0.485-0.509	1.40E+00	2.22E+00	0/29	0/29
Thorium-232	29/29	8.31E-01	0.098-0.23	1.50E+00	1.95E+00	0/29	0/29
Uranium	7/29	9.23E+00	0.634-0.645	4.60E+00	1.13E+01	6/29	0/29
Uranium-234	15/29	3.48E+00	0.035-0.192	2.40E+00	2.84E+00	2/29	1/29
Uranium-235	4/29	2.03E-01	0.082-0.086	1.40E-01	4.55E-01	1/29	0/29
Uranium-238	15/29	6.42E+00	0.377-0.529	1.20E+00	1.17E+00	8/29	8/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg)							
1,2,4-Trichlorobenzene	0/29	ND	0.47-0.5	NA	8.30E+01	NA	0/29
1,2-Dichlorobenzene	0/29	ND	0.47-0.5	NA	3.22E+02	NA	0/29
1,3-Dichlorobenzene	0/29	ND	0.47-0.5	NA	6.82E+00	NA	0/29
1,4-Dichlorobenzene	0/29	ND	0.47-0.5	NA	5.35E+00	NA	0/29
2,4,5-Trichlorophenol	0/29	ND	0.47-0.5	NA	1.03E+03	NA	0/29
2,4,6-Trichlorophenol	0/29	ND	0.47-0.5	NA	2.62E+01	NA	0/29
2,4-Dichlorophenol	0/29	ND	0.47-0.5	NA	4.13E+01	NA	0/29
2,4-Dimethylphenol	0/29	ND	0.47-0.5	NA	2.06E+02	NA	0/29
2,4-Dinitrophenol	0/29	ND	0.47-0.5	NA	3.04E+01	NA	0/29
2,4-Dinitrotoluene	0/29	ND	0.47-0.5	NA	5.77E-01	NA	0/29
2,6-Dinitrotoluene	0/29	ND	0.47-0.5	NA	5.77E-01	NA	0/29
2-Chloronaphthalene	0/29	ND	0.47-0.5	NA	2.67E+02	NA	0/29
2-Chlorophenol	0/29	ND	0.47-0.5	NA	2.12E+01	NA	0/29
2-Methyl-4,6-dinitrophenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
2-Methylnaphthalene	0/29	ND	0.47-0.5	NA	NA	NA	NA
2-Methylphenol	0/29	ND	0.47-0.5	NA	5.15E+02	NA	0/29
2-Nitrophenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Bromophenyl phenyl ether	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Chloro-3-methylphenol	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Chlorophenyl phenyl ether	0/29	ND	0.47-0.5	NA	NA	NA	NA
4-Nitrophenol	0/29	ND	0.47-0.5	NA	1.21E+02	NA	0/29
Acenaphthene	0/29	ND	0.47-0.5	NA	3.50E+02	NA	0/29
Acenaphthylene	0/29	ND	0.47-0.5	NA	NA	NA	NA
Anthracene	0/29	ND	0.47-0.5	NA	3.34E+03	NA	0/29
Benz(a)anthracene	1/29	1.10E+00	0.49-0.49	NA	2.32E-01	NA	1/29
Benzo(a)pyrene	1/29	9.10E-01	0.49-0.49	NA	2.32E-02	NA	1/29
Benzo(b)fluoranthene	2/29	1.50E+00	0.48-0.49	NA	2.32E-01	NA	2/29
Benzo(ghi)perylene	0/29	ND	0.47-0.5	NA	NA	NA	NA
Benzo(k)fluoranthene	2/29	1.70E+00	0.48-0.49	NA	2.32E+00	NA	0/29
Bis(2-chloroethoxy)-methane	0/29	ND	0.47-0.5	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/29	ND	0.47-0.5	NA	1.09E-01	NA	0/29
Bis(2-chloroisopropyl) ether	0/29	ND	0.47-0.5	NA	4.12E+00	NA	0/29
Bis(2-ethylhexyl)-phthalate	0/29	ND	0.47-0.5	NA	1.01E+01	NA	0/29
Butyl benzyl phthalate	0/29	ND	0.47-0.5	NA	2.33E+03	NA	0/29
Chrysene	2/29	1.60E+00	0.48-0.49	NA	2.32E+01	NA	0/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Semivolatile Organics (mg/kg) (Continued)							
Dibenz(a,h)anthracene	0/29	ND	0.47-0.5	NA	2.32E-02	NA	0/29
Diethyl phthalate	0/29	ND	0.47-0.5	NA	1.15E+04	NA	0/29
Dimethyl phthalate	0/29	ND	0.47-0.5	NA	1.00E+05	NA	0/29
Di-n-butyl phthalate	9/29	6.80E+00	0.48-0.5	NA	1.52E+03	NA	0/29
Di-n-octylphthalate	0/29	ND	0.47-0.5	NA	2.88E+02	NA	0/29
Fluoranthene	5/29	1.40E+00	0.48-0.5	NA	2.42E+02	NA	0/29
Fluorene	0/29	ND	0.47-0.5	NA	3.38E+02	NA	0/29
Hexachlorobenzene	0/29	ND	0.47-0.5	NA	1.80E-01	NA	0/29
Hexachlorobutadiene	0/29	ND	0.47-0.5	NA	2.06E+00	NA	0/29
Hexachlorocyclopentadiene	0/29	ND	0.47-0.5	NA	6.18E+01	NA	0/29
Hexachloroethane	0/29	ND	0.47-0.5	NA	1.03E+01	NA	0/29
Indeno(1,2,3-cd)pyrene	1/29	5.80E-01	0.49-0.49	NA	2.32E-01	NA	1/29
Isophorone	0/29	ND	0.47-0.5	NA	3.04E+02	NA	0/29
m,p-Cresol	0/29	ND	0.47-0.5	NA	NA	NA	NA
Naphthalene	0/29	ND	0.47-0.5	NA	3.04E+01	NA	0/29
Nitrobenzene	0/29	ND	0.47-0.5	NA	3.52E+00	NA	0/29
N-Nitroso-di-n-propylamine	0/29	ND	0.47-0.5	NA	2.51E-02	NA	0/29
N-Nitrosodiphenylamine	0/29	ND	0.47-0.5	NA	3.59E+01	NA	0/29
Pentachlorophenol	0/29	ND	0.47-0.5	NA	2.07E+00	NA	0/29
Phenanthrene	2/29	5.50E-01	0.48-0.5	NA	NA	NA	NA
Phenol	0/29	ND	0.47-0.5	NA	8.65E+03	NA	0/29
Pyrene	5/29	1.70E+00	0.48-0.5	NA	1.81E+02	NA	0/29
Pyridine	0/29	ND	0.47-0.5	NA	1.03E+01	NA	0/29
Total Cresols	0/29	ND	0.94-1	NA	NA	NA	NA
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0/29	ND	5.00E-03	NA	1.78E+02	NA	0/29
1,1,2,2-Tetrachloroethane	0/29	ND	0.005-0.01	NA	5.73E-01	NA	0/29
1,1,2-Trichloroethane	0/29	ND	5.00E-03	NA	1.45E+00	NA	0/29
1,1-Dichloroethane	0/29	ND	5.00E-03	NA	1.97E+02	NA	0/29
1,1-Dichloroethene	0/29	ND	5.00E-03	NA	1.19E-01	NA	0/29
1,2-Dichloroethane	0/29	ND	5.00E-03	NA	6.65E-01	NA	0/29
1,2-Dichloropropane	0/29	ND	5.00E-03	NA	7.89E-01	NA	0/29
1,2-Dimethylbenzene	0/29	ND	5.00E-03	NA	5.59E+03	NA	0/29
2-Butanone	21/29	4.20E-02	5.00E-03	NA	1.30E+03	NA	0/29
2-Hexanone	0/29	ND	5.00E-03	NA	NA	NA	NA
4-Methyl-2-pentanone	0/29	ND	5.00E-03	NA	8.51E+01	NA	0/29
Acetone	21/29	9.80E-02	5.00E-03	NA	4.21E+02	NA	0/29
Benzene	0/29	ND	5.00E-03	NA	1.40E+00	NA	0/29
Bromodichloromethane	0/29	ND	5.00E-03	NA	1.61E+00	NA	0/29
Bromoform	0/29	ND	5.00E-03	NA	4.09E+01	NA	0/29

Table A.3. Screening of Subsurface Soil Analytical Results Against Background and No Action Level[1] (Continued)

Analysis	Frequency of Detection	Maximum Detected Result	Reporting Limit	Background Value	No Action Level	Exceeds Background?	Exceeds NAL?
Volatile Organics (mg/kg) (Continued)							
Bromomethane	0/29	ND	5.00E-03	NA	1.63E+00	NA	0/29
Carbon disulfide	28/29	7.60E-03	5.00E-03	NA	1.37E+02	NA	0/29
Carbon tetrachloride	0/29	ND	5.00E-03	NA	5.10E-01	NA	0/29
Chlorobenzene	0/29	ND	5.00E-03	NA	3.68E+01	NA	0/29
Chloroethane	0/29	ND	5.00E-03	NA	4.57E+00	NA	0/29
Chloroform	0/29	ND	5.00E-03	NA	1.66E-01	NA	0/29
Chloromethane	0/29	ND	5.00E-03	NA	3.91E+00	NA	0/29
cis-1,2-Dichloroethene	0/29	ND	5.00E-03	NA	1.71E+01	NA	0/29
cis-1,3-Dichloropropene	0/29	ND	5.00E-03	NA	NA	NA	NA
Dibromochloromethane	0/29	ND	5.00E-03	NA	1.31E+00	NA	0/29
Ethylbenzene	0/29	ND	5.00E-03	NA	2.87E+01	NA	0/29
m,p-Xylene	0/29	ND	0.005-0.01	NA	9.63E+02	NA	0/29
Methylene chloride	0/29	ND	5.00E-03	NA	1.57E+01	NA	0/29
Styrene	0/29	ND	5.00E-03	NA	9.82E+02	NA	0/29
Tetrachloroethene	0/29	ND	5.00E-03	NA	4.04E+00	NA	0/29
Toluene	0/29	ND	5.00E-03	NA	2.72E+02	NA	0/29
trans-1,2-Dichloroethene	0/29	ND	5.00E-03	NA	2.84E+01	NA	0/29
trans-1,3-Dichloropropene	0/29	ND	5.00E-03	NA	NA	NA	NA
Trichloroethene	0/29	ND	5.00E-03	NA	3.25E+00	NA	0/29
Vinyl chloride	0/29	ND	5.00E-03	NA	1.41E-01	NA	0/29

[1] Background and No Action (excavation worker scenario) values are derived from the PGDP Risk Methods Document (DOE 2001).
ND = not detected
NA = not applicable
NAL = no action level

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