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Mr. Edward Winner, FFA Manager
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Dear Mr. Ballard and Mr. Winner:

**TRANSMITTAL OF SITE EVALUATION REPORT FOR SOLID WASTE
MANAGEMENT UNIT 13 BURIAL GROUNDS OPERABLE UNIT AT THE PADUCAH
GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/LX/07-1259&D1)**

As required by the Site Management Plan (SMP), the enclosed Site Evaluation Report (SER) includes the results of the sampling conducted in 2010 pursuant to the Solid Waste Management Unit (SWMU) 13 Field Sampling Plan, DOE/OR/07-2179&D2/A1/R2, and supports a regulatory path forward for SWMU 13.

Although the SMP currently characterizes SWMU 13 as both a Burial Ground Operable Unit (BGOU) SWMU and a Soils Operable Unit (OU) SWMU, this SER concludes that no BGOU response action is required at SWMU 13. It should be removed from the BGOU SWMU list, but retained on the list of Soils OU SWMUs. Decisions related to SWMU 13 from this point forward should be within the purview of the Soils OU. Accordingly, Appendix C of the SER contains an updated SWMU Assessment Report for SWMU 13, DOE/LX/07-0059&D1/R1.

If you have any questions or require additional information, please contact Lisa Santoro at (270) 441-6804.

Sincerely,

A handwritten signature in black ink, appearing to read "Reinhard Knerr", written over a horizontal line.

Reinhard Knerr
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosures:

1. Certification Page
2. Site Evaluation Report for SWMU 13 Burial Grounds Operable Unit

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CERTIFICATION

Document Identification: **Site Evaluation Report for Solid Waste Management Unit 13
Burial Grounds Operable Unit at the Paducah Gaseous
Diffusion Plant, Paducah, Kentucky, DOE/LX/07-1259&D1**

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 ensure 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.

LATA Environmental Services of Kentucky, LLC




Mark J. Duff, Paducah Project Manager

7-18-11

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 ensure 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



Reinhard Knerr, Paducah Site Lead
Portsmouth/Paducah Project Office

7/18/11

Date Signed

**DOE/LX/07-1259&D1
Primary Document**

**Site Evaluation Report for
Solid Waste Management Unit 13
Burial Grounds Operable Unit
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**



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**DOE/LX/07-1259&D1
Primary Document**

**Site Evaluation Report for
Solid Waste Management Unit 13
Burial Grounds Operable Unit
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**

Date Issued—July 2011

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

Prepared by
LATA Environmental Services of Kentucky, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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PREFACE

As required by the Site Management Plan, this *Site Evaluation Report for Solid Waste Management Unit 13 Burial Grounds Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1259&D1, includes the results of the sampling conducted in 2010 pursuant to the Solid Waste Management Unit (SWMU) 13 Field Sampling Plan, DOE/OR/07-2179&D2/A1/R2, (DOE 2010), and supports a regulatory path forward for SWMU 13.

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ACRONYMS

BGOU	Burial Grounds Operable Unit
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	chemical of potential concern
CSM	conceptual site model
DAF	dilution attenuation factor
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FFA	Federal Facility Agreement
FSP	Field Sampling Plan
HI	hazard index
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MCL	maximum contaminant level
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
MW	molecular weight
NAL	no action level
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PID	photoionization detector
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RGA	Regional Gravel Aquifer
RI	Remedial Investigation
RPD	relative percent difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SER	Site Evaluation Report
SMP	Site Management Plan
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
UCRS	Upper Continental Recharge System
VOC	volatile organic compound
WKWMA	West Kentucky Wildlife Management Area

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EXECUTIVE SUMMARY

This Site Evaluation Report (SER) presents the results of the 2010 sampling and analysis effort completed for Solid Waste Management Unit (SWMU) 13, which is located in the northwest quadrant of the secured area of the U.S. Department of Energy (DOE) Paducah Gaseous Diffusion Plant (PGDP). The sampling and analysis effort was completed in accordance with the following agency-approved 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*, DOE/OR/07-2179&D2/A1/R2 (FSP) (DOE 2010). Sampling and analysis was undertaken to determine whether SWMU 13 had been used as a burial area and, if so, the nature of any contaminant releases from buried material. The presence or absence of systematically buried material will help guide the assignment of SWMU 13 to the correct operable unit (OU) of PGDP. Appropriate OU designation will facilitate the regulatory process. Currently, SWMU 13 is within the purview of both the Burial Grounds Operable Unit (BGOU), based on the possibility that material may have been systematically buried there, and the Soils OU, based on site history and the results of past surface sampling.

SWMU 13 is a 294,000-ft² area formerly used for storage of clean scrap metal prior to sale to scrap metal reclaiming vendors. Analysis of soil samples collected in 2001 and 2004 suggested contaminants were present in the shallow soil at SWMU 13. Subsequent interviews with a site employee in 2007 suggested three areas of interest where materials may have been buried as part of routine maintenance of the scrap yards. Geophysical surveys were completed to identify locations of potential buried materials. Information from the geophysical surveys was used to determine soil and water sampling locations. In late June and early July 2010, soil and water sampling was completed.

The objectives of the 2010 sampling and analysis effort, as established in the FSP, were to obtain sufficient data of known quality to do the following:

- Determine the extent of buried materials (i.e., scrap metal) if present at SWMU 13; and
- Determine the nature of any contaminant releases from the buried materials, if located.

Soil, groundwater, and quality assurance samples were collected. All samples collected underwent fixed-base laboratory analysis. In addition, all soil cores were visually examined by a field geologist to assess whether they contained material consistent with buried debris or whether the soil showed signs of having been previously disturbed.

The sampling and analysis effort indicated that no burial areas are located in the subsurface soils below 2 ft bgs and that little evidence exists of subsurface disturbance below that level. In addition, concentrations of analytes detected in soil samples were below the screening levels selected for this project.

The approach for evaluating the potential risks posed by constituents detected in soils or Upper Continental Recharge System (UCRS) groundwater samples collected during the site evaluation focused on the potential for these constituents to migrate to the Regional Gravel Aquifer (RGA). Because of downward vertical gradients in the UCRS, no discharge to nearby drainage areas would occur. Consistent with the Risk Methods Document (DOE 2011a), no consistent direct contact exposures to contaminants would be expected at depths greater than 10 ft bgs.

For this evaluation, metals and radionuclides detected in soils encountered between 10 and 20 ft bgs are at background or below risk-based values for leaching. The results for all chemicals suggest these soils are

not a potential source of groundwater contamination. Because depths are greater than 10 ft bgs, the soils do not pose future direct contact risks to human health or ecological receptors. Even considering hypothetical potential direct contact to workers, potential risks are considered negligible.

Groundwater sample results for organic chemicals, radionuclides, and dissolved samples of naturally occurring metals showed no significant impacts that would limit potential future uses of RGA groundwater. The indications of particulates in unfiltered groundwater samples that contain naturally occurring metals are not considered representative of UCRS groundwater and were not used to estimate these impacts.

Although the Site Management Plan (DOE 2011b) currently characterizes SWMU 13 as a BGOU SWMU and a Soils OU SWMU, this SER concludes that no BGOU response action is required at SWMU 13, and it should be removed from the list of BGOU SWMUs, but retained on the list of Soils OU SWMUs. Decisions related to SWMU 13 will be within the purview of the Soils OU.

The data collected during the 2010 Site Evaluation will be included in the Oak Ridge Environmental Information System database and available to those addressing the Soils, Surface Water, and Groundwater OUs at PGDP.

1. INTRODUCTION

This Site Evaluation Report (SER) has been developed as required by the Site Management Plan (SMP). The report is organized as follows:

- Regulatory Overview, Project Background, Project Scope
- Area Description
- Field and Analytical Methods
- Quality Assurance (QA)/Quality Control (QC)
- Discussion and Results
- Conclusions and Recommendations

The subject of this SER is SWMU 13, which is located in the northwest quadrant of the secured area of Paducah Gaseous Diffusion Plant (PGDP). SWMU 13 is a 294,000-ft² area formerly used for storage of clean scrap metal prior to sale to scrap metal reclaiming vendors. The sampling and analyses effort described in this SER was completed in accordance with the following agency-approved 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*, DOE/OR/07-2179&D2/A1/R2 (FSP) (DOE 2010). Sampling and analysis was undertaken to determine whether systematically buried material is present at SWMU 13 and, if present, the nature of any contaminant releases from the buried material. The presence or absence of systematically buried material and associated contaminants will help determine if a BGOU response action is required and guide the assignment of SWMU 13 to the correct operable unit (OU). Appropriate OU designation will facilitate a regulatory path forward. Currently, SWMU 13 is within the purview of both the Burial Grounds Operable Unit (BGOU), based on the possibility that buried material may exist there, and the Soils OU, based on site history and the results of past surface sampling.

1.1 REGULATORY OVERVIEW

The PGDP was placed on the National Priorities List on May 31, 1994. In accordance with Section 120 of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the U.S. Department of Energy (DOE) entered into a Federal Facility Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) Region 4 and the Commonwealth of Kentucky (EPA 1998). The FFA includes an SMP, which, as stated above, assigns PGDP SWMUs to specific OUs. The SMP currently assigns SWMU 13 to two OUs—the Soils OU and the Burial Grounds OU. The current SMP description of the BGOU states that additional sampling would be conducted at SWMU 13 pursuant to the FSP, and that the results would be included in an SER. Accordingly, sampling was conducted after the FSP was approved by EPA (letter dated March 23, 2010) and by the Kentucky Department for Environmental Protection (letter dated April 22, 2010). The sampling activities and the results of the evaluation are included in this SER.

1.2 PROJECT BACKGROUND

Analyses of seven soil samples collected in 2001 (0 to 1-ft depth) and 27 soil samples collected in 2004 (3.0 to 3.5-ft depth) characterized the contaminant levels of the shallow soils at SWMU 13. This previous characterization information is presented in detail in the FSP. In the surface soils (0 to 1-ft depth), only uranium-238 (maximum detected result 1.32 pCi/g) was found to exceed background levels (1.2 pCi/g) in

four samples. When detected, all other chemicals were below background levels. In the shallow subsurface soils (3.0 to 3.5 ft depth), a more extensive list of chemicals of potential concern (COPCs) was identified. Those PGDP related COPCs (chemicals that exceeded background and no action levels (NALs) as evaluated in that study) are highlighted below.

The metals and radionuclides that occurred most frequently above their background levels in shallow subsurface soil were cadmium, technetium-99, and uranium-238. Cadmium levels frequently exceeded 5 to 10 times 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 polycyclic aromatic hydrocarbons (PAHs) were detected frequently 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 a frequently detected semivolatile organic compound (SVOC). Polychlorinated biphenyls (PCBs) were detected in 28% of shallow 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 shallow subsurface soils were 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).

March and April 2007 interviews of a site employee identified three areas of interest where materials may have been buried as part of routine maintenance of the scrap yards (DOE 2008). Later in 2007, DOE followed up on the interviews with geophysical surveys in SWMU 13 that indicated the presence of buried metal. The shallow subsurface soil results, combined with the information concerning the possible presence of systematically buried metal at the scrap yards (i.e., the employee interview and the geophysical results), created the need for characterization of the deeper strata at SWMU 13 [> 3.5 ft below ground surface (bgs)].

1.3 PROJECT SCOPE

The BGOU has been actively engaged for several years in investigation and characterization of several burial areas at PGDP. Other OUs at PGDP are responsible for the surface/shallow subsurface soils, surface water, and groundwater. The Soils OU focuses on accessible plant surface soils from the ground surface to 10 ft bgs, and to 16 ft bgs in the vicinity of pipelines. SWMU 13 is listed as a Soils OU SWMU in the SMP, and because it was considered possible that SWMU 13 might have been used to systematically bury materials, it also is listed as a BGOU SWMU. To help support a regulatory path forward for SWMU 13, the strata below the Soils OU (depths from 10 to 20 ft bgs) have been sampled and the results documented in this SER.

Subsequent to development of the BGOU Remedial Investigation (RI)/Feasibility Study (FS) Work Plan (DOE 2006) and concurrent with the RI field investigation, interviews in 2007 with a former plant worker identified potential areas of buried metal within the C-746-P and C-746-P1 Scrap Yards (SWMU 13). Consequently, the FSP addendum to the BGOU RI/FS Work Plan was prepared and approved for follow-on site evaluation.

To help meet the objectives stated in the FSP, a geophysical survey of the entire SWMU 13 scrap yard was completed in January and February 2009. Section 5.1 of the FSP contains a description of the implementation and results of that geophysical survey. Interpretation of the survey data indicated several areas that potentially contained buried metallic objects. Areas of interest in terms of apparent amount and extent of buried metal were used in the selection of borehole locations specified in the FSP.

In late June and early July 2010, field implementation of the FSP was executed. Vertical boreholes were drilled at 17 locations. Soil samples were collected from all locations and when water was encountered in sufficient quantity in the boreholes, it also was sampled. Additionally, piezometers were installed in three boreholes to provide information on depth-to-water and to determine whether potentially impacted shallow water within the Upper Continental Recharge System (UCRS) might infiltrate into the ditch. All samples collected during the investigation were received under chain-of-custody for analysis by approved fixed-base laboratories.

This SER presents the results of the sampling effort and includes the data generated from field activities, an evaluation of project data quality and usability, assessment of the potential risks to human health, and conclusions. For soils 10 ft or more bgs, the only pathway of concern is potential migration and impacts to groundwater. There is no complete pathway for direct exposure to human or ecological receptors to soils deeper than 10 ft. In addition, there is no complete migration pathway from these subsurface soils to nearby surface water discharge points; therefore, risk screening for surface water exposures (recreator or ecological receptors) is not applicable to this SER.

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2. AREA DESCRIPTION

2.1 SWMU 13

SWMU 13 occupies an area of approximately 294,000 ft² in the northwest quadrant of the secured area of PGDP (with maximum dimensions of 290 ft in a north-south direction and 1,076 ft in an east-west direction) (Figure 1). The SWMU consists of the former C-746-P Clean Scrap Yard, which was used for the storage of clean scrap metal prior to sale. It was divided into east (C-746-P) and west (C-746-P1) units to facilitate the movement and sale of scrap metal.

A PGDP scrap metal removal project 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. Subsequent geophysical surveys identified locations at which metallic objects potentially were buried at greater depths. Section 5.1 of the FSP contains a description of the implementation and results of these geophysical surveys.

2.2 GEOLOGY

PGDP and SWMU 13 are located in the Jackson Purchase Region of Western Kentucky, which represents the northern tip of the Mississippi Embayment portion of the Coastal Plain. The Jackson Purchase Region is an area of land that includes all of Kentucky west of the Tennessee River. The stratigraphic sequence in the region consists of Cretaceous, Tertiary, and Quaternary sediments unconformably overlying Paleozoic bedrock.

The continental deposits and the overlying loess and alluvium are the primary, shallow water-bearing units in the vicinity of PGDP. The continental deposits locally consist of an upper silt member, with lesser sand and gravel interbeds, and a thick, basal sand and gravel member, which fills a buried river valley. A subcrop of the Porters Creek Clay, located beneath and immediately south of PGDP, marks the southern extent of the buried river valley. Fine sand and clay of the McNairy Formation directly underlie the continental deposits. These continental deposits are continuous from beneath PGDP northward beyond the present course of the Ohio River.

2.3 HYDROGEOLOGY

PGDP and SWMU 13 are located in the western portion of the Ohio River drainage basin, approximately 15 miles downstream of the confluence of the Ohio River with the Tennessee River and approximately 35 miles upstream of the confluence of the Ohio River with the Mississippi River. Locally, PGDP is within the drainage areas of the Ohio River, Bayou Creek, and Little Bayou Creek.

PGDP is situated on the divide between the two creeks. Bayou Creek is a perennial stream on the western boundary of the plant that flows generally northward, from approximately 2.5 miles south of the plant site to the Ohio River. Little Bayou Creek becomes a perennial stream at the east outfalls of PGDP. The Little Bayou Creek drainage originates within the West Kentucky Wildlife Management Area (WKWMA) and extends northward and joins Bayou Creek near the Ohio River. The drainage basins for both creeks are located in rural areas; however, they receive surface drainage from numerous swales that drain residential and commercial properties, including WKWMA, PGDP, and Tennessee Valley Authority Shawnee Fossil Plant. The confluence of the two creeks is approximately 4.8 km (3 miles) north of the plant site, just

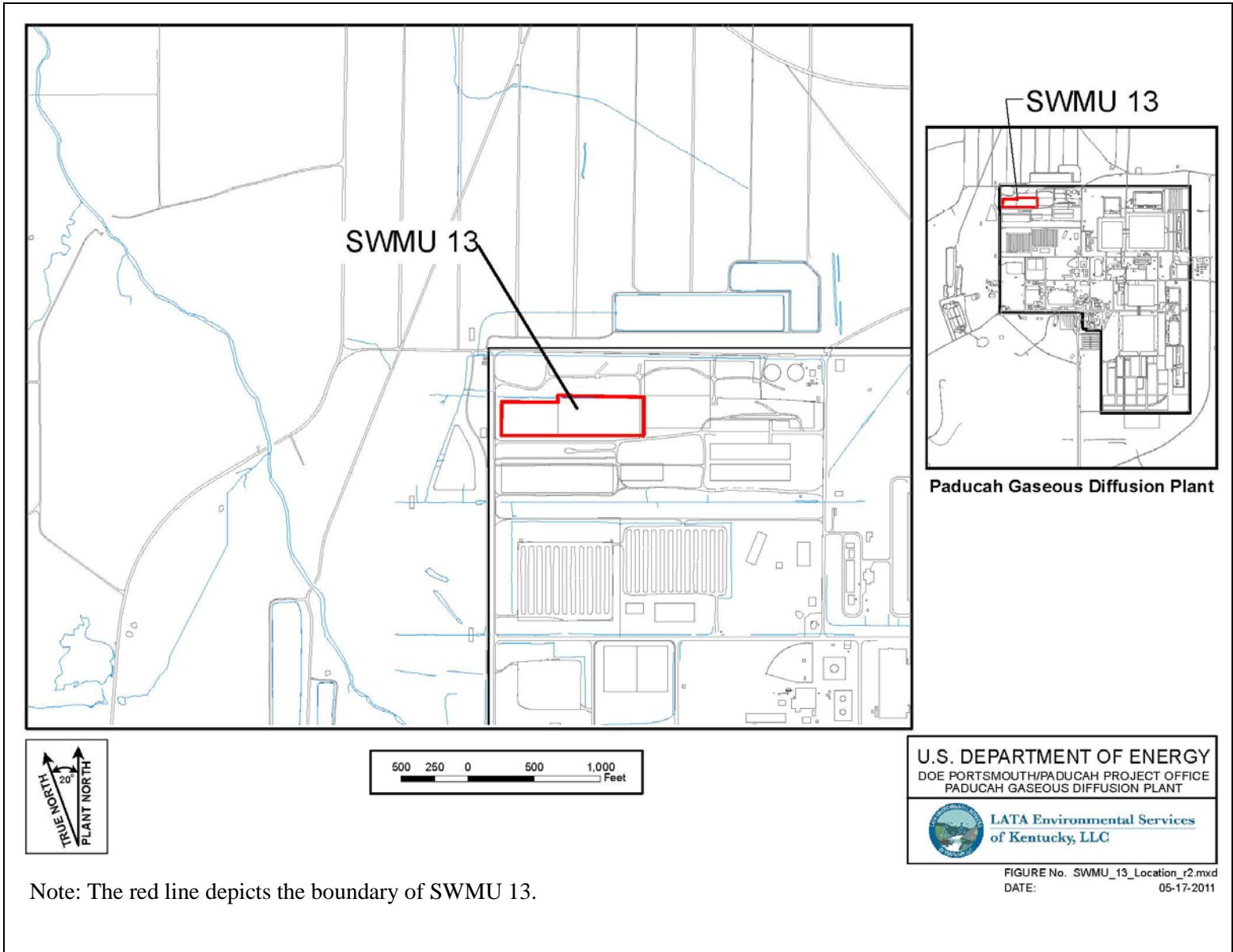


Figure 1. Location of SWMU 13 within the Paducah Gaseous Diffusion Plant

upstream of the location at which the combined flow of the creeks discharges into the Ohio River (DOE 2006).

Most of the flow within Bayou and Little Bayou Creeks is from process effluents or surface water runoff from PGDP. Contributions from PGDP comprise approximately 85% of flow within Bayou Creek and nearly 100% of flow within Little Bayou Creek. A network of ditches discharges effluent and surface water runoff from PGDP to the creeks. Plant discharges are monitored at the Kentucky Pollutant Discharge Elimination System outfalls prior to discharge into the creeks.

The local groundwater flow system at PGDP occurs within the sands of the Cretaceous McNairy Formation, Pliocene Terrace Gravel, Plio-Pleistocene lower continental gravel deposits and upper continental deposits, and Holocene alluvium. The primary local aquifer is the Regional Gravel Aquifer (RGA). The RGA consists of the Quaternary sand and gravel facies of the lower continental deposits and Holocene alluvium found adjacent to the Ohio River and is of sufficient thickness and saturation to constitute an aquifer. These deposits have an average thickness of 9.1 m (30 ft). Groundwater flow is predominantly north toward the Ohio River.

2.4 POTENTIAL SOURCES OF CONTAMINATION

SWMU 13 is a former scrap yard that was used for the storage of clean scrap metal prior to sale. The conceptual site model (CSM) presented in the FSP assumed that clean, inert material was buried at SWMU 13 and migration of contaminants derived from the buried material had not occurred. Alternately, some migration of dissolved metals may have occurred and, if the buried material was not clean, other associated contaminants may have migrated to the surrounding soil. Metals, PAHs, PCBs, and radionuclides are the primary contaminants identified in historical samples collected from surface and shallow subsurface soil in SWMU 13 and are considered typical contaminants associated with the site and possible COPCs for subsurface soils.

2.5 CONTAMINANT TRANSPORT MECHANISMS

The primary means of migration of chemicals from BGOU source material present in the deeper soil zone (10-20 ft bgs) is by dissolution and transport in groundwater. UCRS water moves downward at PGDP, percolating through UCRS sediments until encountering the RGA (approximately 55 ft bgs at SWMU 13). The rate of flux from the UCRS to the RGA is slow (estimated to be 6 to 10 inches of recharge per year), with significant attenuation occurring. Consistent with the Soils OU RI, a dilution attenuation factor (DAF) of 57 is used in this SER to estimate the potential decrease in chemical concentrations from the UCRS to the RGA at the SWMU boundary (DOE 2011c). The nearest downgradient discharge point for this RGA groundwater is in Little Bayou Creek, approximately two miles northeast of SWMU 13.

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3. FIELD AND ANALYTICAL METHODS

The sampling approach is detailed in the DOE-, EPA-, and Commonwealth of Kentucky-approved FSP. A summary of the sampling approach and other field activities is provided in the following sections.

3.1 SYSTEMATIC SAMPLING

3.1.1 Soil Boring Locations

Borehole locations for soil and groundwater sampling were selected based on the locations of potentially buried metal as determined by geophysical survey results and via conference call discussions with FFA parties. During the conference call discussions, it was agreed that boring locations should be selected to address the following (in priority order):

- A 150-ft sampling grid overlaid on the site
- Large distinct anomalies indicative of buried metal
- Small isolated anomalies indicative of buried metal
- Linear anomalies indicative of buried metal
- Areas with no anomalies indicative of buried metal

Figure 2 identifies the borehole locations, sample grid, and geophysical survey anomalies. Vertical borings advanced to a total depth of 20 ft bgs with direct-push technology were employed to collect soil and water samples. Two soil samples were collected from each borehole. Soil samples were collected from depth intervals of approximately 10-15 ft and 15-20 ft bgs. Water samples were collected whenever sufficient quantity was encountered in a borehole.

Sample analytes for this investigation included metals, PCBs, PAHs, SVOCs, VOCs, and radionuclides. Discrete VOC samples were collected from the soil core and contained before the remaining soil sample was homogenized and contained for the other analysis. All samples were delivered under chain-of-custody to fixed-base laboratories for analysis.

3.1.2 Piezometer Installation

To determine if UCRS water potentially might discharge into the surface water system around SWMU 13, three piezometers were installed near the ditch bordering the northern edge of the SWMU. The piezometers were installed to a depth of 15 ft with 10 ft of screen. Civil surveys established the elevation of the piezometers relative to sea level. Monthly water-level measurements taken in each piezometer were used to compare water levels in the UCRS to the elevation of the nearby drainage ditch. Water level measurements are presented in Section 5.4.

3.2 CONTINGENCY SAMPLING

The SWMU 13 sampling approach also included provisions for contingency sampling (up to 4 boreholes and 8 soil and 4 water samples) to allow for the collection of additional data if obvious contamination was observed in the deeper depth soil sample interval. Contingency samples were to be collected using the same methodology as the primary samples; however, no contamination was observed, and contingency samples were not collected.

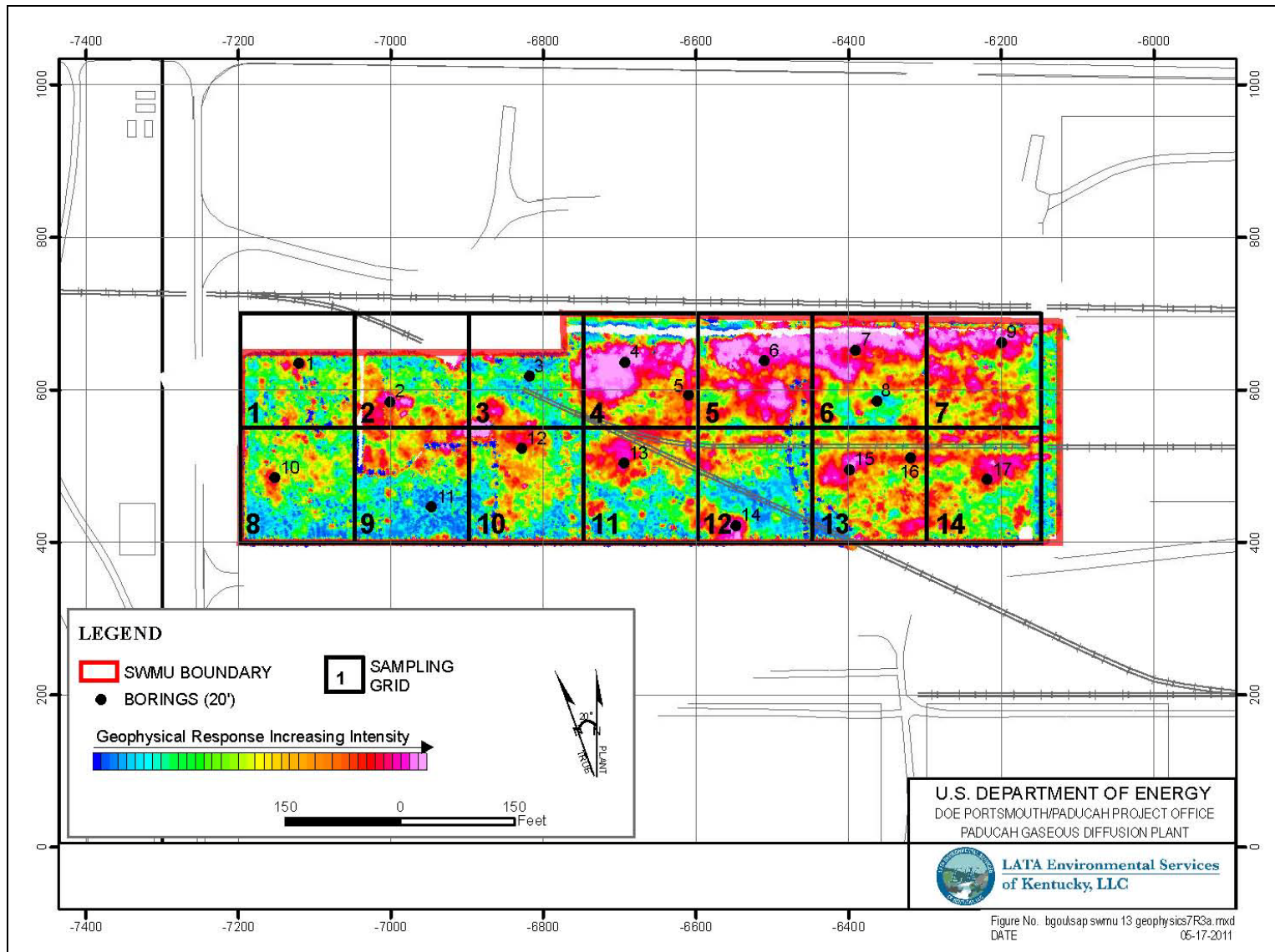


Figure 2. Boring Locations, Sample Grid, and Geophysical Anomalies

3.3 SAMPLING SUMMARY AND DEVIATIONS FROM THE FSP

The SWMU 13 FSP specified the collection and analysis of these samples.

- Thirty-four primary subsurface soil samples were to be collected from 17 boreholes, with 2 samples per borehole collected at depths ranging from 10-13 ft and 15-18 ft bgs.
- Up to 17 primary water samples were to be collected (1 per borehole).
- Primary QA samples were to include 3 field blanks, 3 field duplicates, 3 equipment blanks, and trip blanks (1 per cooler with VOC analysis).
- Eight contingency samples could be collected if obvious contamination was identified in deeper samples (up to 4 additional boreholes could be deepened with 2 additional samples per borehole).
- Contingency QA samples included 1 field blank, 1 field duplicate, and trip blanks (1 per cooler with VOC analysis).

During execution of SWMU 13 FSP, the total number of samples collected was as follows:

- Thirty-four primary subsurface soil samples.
- Two field duplicate subsurface soil samples.
- Seven primary water samples.
- One field duplicate water sample.
- Nine primary QC samples.
- No contingency or contingency QA samples.

All samples collected underwent fixed-base laboratory analysis. Soil samples were analyzed at the PGDP on-site laboratory. Some water samples were analyzed at the PGDP on-site laboratory; others were shipped to GEL Laboratories, LLC, in Charleston, SC, in order to achieve the approved reporting limits in the FSP.

Deviations from the FSP occurred because of the following factors.

- Actual soil sample intervals were increased to 10-14 ft and 15-19 ft bgs to provide an adequate soil volume for sample collection.
- No field blanks were collected and not all coolers containing VOC samples contained trip blanks. Additionally, one of the three planned equipment blanks was not collected. Section 4 of this report (Quality Assurance/Quality Control) concludes that collected QA samples were adequate to assure reliability of the analytical data.

3.4 FIXED LABORATORY ANALYSIS

A total of 36 subsurface soil samples (34 primary samples and 2 field duplicates), 8 water samples (7 primary samples and 1 field duplicate), and 9 additional QC samples (7 trip blanks and 2 equipment blanks) underwent fixed laboratory analysis. Each was analyzed in accordance with the method requirements outlined in Table 4 of the FSP. The results of the laboratory analysis are provided on a compact disc in Appendix A.

3.5 FIELD OBSERVATIONS

Prior to placement in laboratory-supplied glassware, the soil cores were screened with a photoionization detector (PID) for VOCs. The PID screenings detected no elevated levels of VOCs. Additionally, the soil core samples were screened for beta/gamma activity, and no elevated readings were recorded. No additional screening or analytical tests were conducted in the field with the exception of lithology descriptions recorded by the field geologist. Boring logs and construction details associated with the piezometer installation are included in Appendix B. No materials thought to be waste or metal were indentified in the sampled media, and there were no visual indications of contamination.

4. QUALITY ASSURANCE/QUALITY CONTROL

The following sections summarize the results of data verification, data validation, and reconciliation of measurement quality objectives obtained from the SWMU 13 site evaluation. Data quality is assessed in terms of the PARCC data quality indicators (precision, accuracy, representativeness, comparability, and completeness), analytical detection limits, and method sensitivity for each data set. Each of these parameters is described below.

4.1 PRECISION

Precision is a measure of the degree of reproducibility of an analytical value and is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Total precision is a measurement of variability introduced by both field and laboratory operations.

Precision of an analytical measurement is determined by calculation of a relative percent difference (RPD) between duplicate analytical results of a sample component, relative to the average of those results. Precision for SWMU 13 data was determined using laboratory control and laboratory control sample duplicates (LCS/LCSD), matrix spike and matrix spike duplicates (MS/MSD), field and laboratory duplicate samples, and any other laboratory replicates required by the methods utilized.

NOTE: Precision does not affect the quality or usability of organic analyses whose precision is measured by MS/MSD pairs. Precision results do not affect the data quality or data usability for PCB, SVOC, or VOC analytes. Where performance criteria for precision are exceeded, there is less confidence in the reported result because of error introduced from sampling or analysis caused by unequal representation of target compounds or analytes between the two sample pairs.

Field duplicate samples collected during this investigation were as follows.

Field Sample ID	Field Sample Duplicate ID	Matrix
013005SA015	013005SD015	soil
013010WA015	013010WD015	water
013015SA015	013015SD015	soil

In addition to the field duplicates identified above, the laboratories included a number of LCS/LCSD, MS/MSD, and laboratory duplicates.

Based on the review, validation, and assessment of these QC samples, the overall precision of the data was found to be within tolerable limits. Twelve analytes were found to be outside control criteria established in the Quality Assurance Project Plan (QAPP), Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006) in the field duplicate pairs. Eleven of these analytes can be attributed directly to the non-homogeneous nature of soil samples. The final analyte (2-butanone) represents a sample that had a “J” value detected result in the parent sample and a nondetected value in the duplicate. Samples with reported analyte concentrations above the method detection limit (MDL) but below the reporting limit (a “J” value) can produce greater variability, leading to greater RPDs. Additional items were noted during the review of MS/MSD sample results, LCS/LCSD sample results, and any additional duplicate analyses. In all cases, the RPD values were identified as nonrepresentative when the following conditions existed:

- Both the original and duplicate results were less than five times the reporting limit.
- One or both results were qualified as estimated or rejected or were suspected of blank contamination.
- Both results were not detected at the reporting limit.

Data that were affected by the review of precision QC samples were qualified “J,” “UJ,” or “U,” where appropriate, and can be seen in the laboratory analysis provided on a compact disc in the appendix.

4.2 ACCURACY

Accuracy is the degree to which a measurement agrees with the actual value (i.e., the amount of measurement bias). It includes components of variability due to imprecision (random error) and systemic error and, therefore indicates the total error associated with a measurement. A measurement is accurate when the reported value does not differ from the true value or known concentration.

Analytical accuracy is determined by the addition of a known amount of reference material (spike) to a standard matrix (e.g., LCS) or a field sample matrix (MS). The results are reported as percent recovery (%R). The LCS shows the bias of the analytical process in the absence of matrix effects, while the sample MS shows how the sample matrix affects the analytical results.

Additional measures of accuracy include the following:

- For organic chemical analyses that require it, surrogate spikes are added to each sample by the laboratory. Surrogate compounds have similar physical and chemical properties to various classes of organic compounds of interest, but are typically not found in environmental matrixes.
- For radiochemistry parameters that require it, radioactive tracers and carriers are added to each sample by the laboratory. Tracers and carriers provide for an evaluation of chemical separation.

Other criteria that must be considered when determining the accuracy of analytical measurements or bias of the resultant data include these: blank contamination, the use of the appropriate analytical methods, and sample holding times. Blank contamination may indicate the possibility of a high bias of positive site sample results with respect to the true sample concentration. Thus, the accuracy of sample results may be skewed. The appropriate analytical methods also may affect accuracy, as the method chosen will be directly related to the laboratory’s ability to obtain true and accurate sample concentrations. If holding times are exceeded, the accuracy of the analytical results potentially may be biased high or low, depending on the degree of sample concentration or degradation, respectively.

Based on the review, validation, and assessment of these QC samples, the overall accuracy of the data was found to be acceptable. There were outliers identified throughout the review process; however, the impact the outliers have on the data is minimal and they are used as reported.

4.3 REPRESENTATIVENESS

Representativeness is a measure of the degree to which data accurately and precisely represents the characteristics of a population at a sampling point, process condition, or environmental condition. Representativeness is a qualitative term evaluated to determine if sample measurements and physical sample locations result in data that appropriately reflects the population parameter of interest in the media and phenomenon measured or studied.

Representativeness is satisfied if the sampling network is properly designed and if the sampling and analysis plan (SAP) is followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded. Representativeness is then determined by assessing the combined aspects of the QA program, QC measures, and data evaluations. Although there were slight variations to the FSP, the data provide a good representation of the environmental conditions of SWMU 13 based upon data verification, validation, and assessment.

Groundwater samples were collected from open boreholes, and total concentrations are not considered representative of groundwater quality particularly for total metals and radionuclides. Literature suggests that well construction, development, and sampling protocols can influence concentrations, particularly of naturally occurring inorganic chemicals. Consistent with the FSP, filtered samples were collected, an approach commonly used to support interpretation of the groundwater quality for samples collected where particulates may be an issue. Dissolved metals (0.45 um filter) likely are more representative of potentially mobile concentrations of chemicals in groundwater, but also may include colloidal-sized material that is characteristic of the fine grained aquifer materials in the UCRS and not necessarily mobile constituents.

While the requirements of the sampling design were met with minimal variation, and representativeness is satisfied when assessing the combined aspects of the QA, QC, and data evaluations, the water collected and analyzed as part of this project is representative only of the water collected from the boreholes at the time of sampling and may not represent current groundwater quality.

4.4 COMPARABILITY

Comparability is the degree to which one data set can be compared to another when both are obtained from the same sample population. Comparability can be achieved only through the use of consistent sampling procedures, experienced sampling personnel, the same or comparable analytical methods, standard field and laboratory documentation, and traceable laboratory standards. In this case, all samples were collected using the same sampling techniques and equipment. Identical laboratory analytical methods were used for each group of analytes. As a result, the data are comparable.

4.5 COMPLETENESS

Completeness is defined as the number of valid data points obtained from a sampling effort compared with the total number of data points obtained. Valid data are those generated when analytical systems and the resulting analytical data meet all of the quantitative measurement objectives for the project.

Completeness for Sample Collection

Completeness for sample collection is defined as the percentage of specified samples listed in the FSP that actually were collected. Wells that were unable to be sampled because of limited water or other factors have been removed from the completeness calculation. An estimated 61 primary samples (including QC) were identified in the FSP. An additional 12 contingency samples (including QC) were anticipated, but are not included in the sample collection completeness calculation because they were not collected.

Fifty-three primary samples actually were collected. Based on the deviations from the FSP, 10 water samples were not collected due to limited water, and 4 QC samples (1 equipment blank and 3 field blanks) were not collected by the field staff. If the 10 missing water samples are removed from the

calculation due to a lack of water, then a total of 57 samples should have been collected. Completeness for sample collection is 86.9%. The calculation used to determine sample collection completeness is as follows:

$$\% \text{ Completeness} = C/n1 \times 100$$

Where C = number of samples collected
n1 = total number of measurements planned

Completeness for Acceptable Data

Completeness for acceptable data is defined as the percentage of acceptable data out of the total amount of data generated. Acceptable data include both data that passed all QC criteria and data that may not have passed all criteria, but that had appropriate corrective actions taken. This completeness is defined as 90% for each individual analytical method.

Based on the review, validation, and assessment of the data received from the fixed-base laboratories, each analysis type met the completeness requirements specified in the QAPP, Chapter 11 of the BGOU RI/FS Work Plan (DOE 2006), with a number of analytes qualified but usable, and no analytes were rejected. In terms of analytical completeness, acceptable data completeness is 100%. The calculation used to determine acceptable data completeness is as follows:

$$\% \text{ Completeness} = V/n \times 100$$

Where V = number of analytes judged valid and not rejected
n = total number of analytes measured

4.6 DETECTION LIMITS

To ensure the fixed-base laboratory data acquired for SWMU 13 supports the data quality objectives (DQOs), MDLs were preestablished for each analysis type and defined in the laboratory scope of work. The contract required that detection limits in the FSP were to be attained if possible; however, if not, the MDLs were to be low enough to compare to background. The MDLs were designed to ensure that sufficiently sensitive data were obtained from the contract laboratories to enable comparison to background and no action levels as defined in the approved Risk Methods Document at that time (DOE 2001).

The groundwater sample from station 013-005 was diluted due to the presence of 1,2,2-trichloro-1,1,2-trifluoroethane (Freon 113), a nontarget analyte for this project. Dichlorodifluoromethane was the only compound detected in the diluted sample.

4.7 FIELD QUALITY CONTROL SUMMARY

Field QC samples are independently generated samples from a predefined sampling scheme, designed to monitor the reproducibility, cleanliness, and accuracy of the sampling and analytical process. The following field QC samples were prescribed for the SWMU 13 investigation:

- Field duplicate samples (3)
- Field blanks (3)

- Trip blanks (1 per cooler with VOC analysis)
- Equipment blanks (3)

QC samples were required for SWMU 13 at a frequency of approximately 1 QC sample for every 20 samples collected or 5%. The collection frequency for QC samples applied to all samples undergoing fixed-base laboratory analysis.

Field duplicate samples were collected and analyzed to evaluate the reproducibility (precision) of sampling techniques, laboratory methods, and to monitor the natural variability of the sample matrix. Field duplicate samples were submitted as separate samples with separate field identification numbers to the contract laboratories. The prescribed collection frequency was met with field duplicate samples collected and analyzed at a frequency of approximately 7% for the investigation.

Field blanks normally are collected and analyzed to evaluate any cross contamination attributable to ambient conditions during the sampling sequence, such as exhaust from nearby combustion engines. Because field blanks were not collected, false positives in the data set resulting from ambient contaminants in the field cannot be ruled out. Analytes detected in the collected samples are similar to those detected in earlier sampling events (i.e., the 2001 and 2004 events) and are believed to accurately represent the condition of the sampled media.

Trip blanks are used to determine if samples were contaminated during storage and shipment to the laboratory. Trip blanks are used when samples are to be analyzed for VOCs. Aqueous trip blanks are commonly used for both water and soil/sediment samples. Prepared sample vials containing laboratory grade, organic-free water are placed in the sample cooler that contains the VOC samples. The trip blanks are kept with the investigative samples from the field to the laboratory and remain unopened. The FSP called for a trip blank to accompany each cooler containing VOC samples; however, only one of four coolers containing soil samples for VOC analysis was accompanied by a trip blank. The trip blanks were specified in the FSP to help identify false positives resulting from cross contamination during shipment and storage of the sample containers. VOC detections in samples from the coolers without trip blanks could be false positives.

Equipment blanks are collected prior to the successive use of sampling equipment. Equipment blanks provide a way to measure cross-contamination attributable to field equipment decontamination procedures. As noted previously, one of the three equipment blanks specified by the FSP was not collected (three were planned, but two were collected). The absence of contaminants from the two equipment blanks that were collected suggests equipment decontamination was successful and that contaminants found in environmental media are not false positives created by contaminated sampling equipment.

In summary, the QC samples collected during the field investigation, while different from those specified in the FSP, were adequate to assure reliability of the analytical results.

4.8 DATA QUALITY SUMMARY/FIXED LABORATORY DATA

The DQOs for the SWMU 13 investigation called for sufficient data of known quality to support decision making; therefore, analytical laboratories using industry standard analytical procedures were utilized to generate sample data that complied with the requirements of the laboratory statements of work and protocols specified in the SAP (FSP/QAPP). Project data underwent 100% Level III validation. Precision, accuracy, and completeness criteria were met for all fixed-base laboratory data, which indicates the data set will support decision making.

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5. DISCUSSION AND RESULTS

The following section discusses the results of the SWMU 13 investigation. It includes a discussion of the CSM. This section also compares the analytical data to screening values.

5.1 CONCEPTUAL SITE MODEL

The CSM for this SER, as illustrated in Figure 3, highlights the exposure pathways for soils and water greater than 10 ft bgs. SWMU 13 is a former scrap yard that was used for the storage of clean scrap metal prior to sale; this scrap metal is considered the potential source of contaminants present in the soils and shallow groundwater. Previous studies have identified some contaminants in the shallower soils, including metals, radionuclides, PAHs, and PCBs. Containers are not known to have been buried at SWMU 13.

The primary means of migration of chemicals present in the deeper soil zone (10–20 ft bgs) is by dissolution and transport in groundwater. The constituents detected at depths greater than 10 ft in this investigation do not migrate upward creating surface exposure routes. Similarly, the low hydraulic conductivity of the UCRS results in yields too low for typical residential or industrial groundwater use. The rate of flux from the UCRS to the RGA is slow (estimated at 6 to 10 inches of recharge per year), with significant attenuation occurring. Consistent with the Soils OU RI (DOE 2011c), a DAF of 57 is used in this SER to estimate the decrease in chemical concentrations at the SWMU boundary in RGA groundwater.

Exposure pathways for direct contact with constituent-impacted soils at depths greater than 10 ft are not complete. Typically, no direct contact with the deeper soils (below the water table) routinely would occur, and the focus of BGOU risk management decisions for impacts below the water table typically would be based on potential migration with groundwater. Default assumptions in the Risk Methods Document assume an outdoor worker would only contact soils at depths from 0-10 ft (DOE 2011a).

There is no complete pathway for exposure to ecological receptors to soils deeper than 10 ft and there is no nearby surface water discharge point.

Therefore, the future potable use of RGA groundwater by a hypothetical future resident is the exposure scenario applicable for BGOU risk management decisions.

5.2 EXTENT OF BURIED MATERIALS

The first objective of the SWMU 13 investigation was to determine the extent of buried materials (i.e., scrap metal) where present at SWMU 13. With regard to this objective, boreholes were located where earlier geophysical surveys recorded strong anomalies indicative of buried metal. During the ensuing investigation, 17 boreholes were installed at selected locations to a total depth of 20 ft bgs. Although the selected areas were expected to contain abundant buried metal, only one of the 17 boreholes encountered refusal (location 17). The refusal was encountered at a depth of only 2 ft bgs. The borehole was relocated 3 ft from the original location and advanced to a total depth of 20 ft without encountering metal, other waste, or disturbed soil. The most significant amount of metal identified during the investigation was encountered at a depth of less than 1 ft, while constructing the surface pad for piezometer 4. Further, disturbed subsurface soil was noted at only one borehole location (#6) to a depth of 15 ft, but there were

At depths greater than 10 ft bgs (BGOU),

- No primary source material (no buried waste)
- No direct contact exposures for protection of human receptors are applicable
- No complete pathways for ecological receptors.
- No upward gradients that would result in discharge to the drainageway where surface exposures could occur

Dissolution and migration to RGA groundwater is a complete pathway.

Receptors include potential future residents who would use RGA groundwater as a source of water.

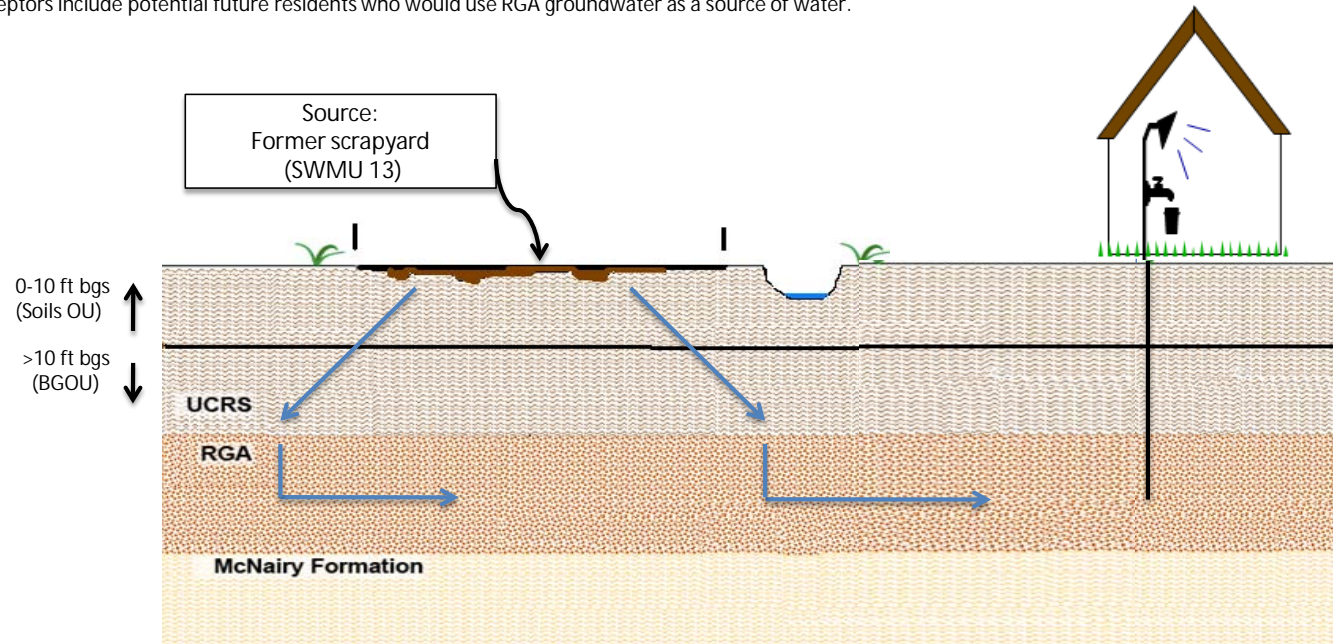


Figure 3. Pictorial Conceptual Site Model

no indications of buried material. Thus, the limited evidence of soil disturbance and lack of buried metal together indicate that it is unlikely that systematically buried material at SWMU 13.

5.3 NATURE OF RELEASES FROM BURIED MATERIAL

The second objective of this investigation was to determine the nature of releases from buried material in the SWMU. This objective was addressed by collecting samples from the 17 boreholes discussed in Section 5.2 for chemical analysis. COPCs previously identified in surface soils (to sample depths of 3.5 ft bgs) included metals, PAHs, PCBs, and radionuclides. The FSP required analyses for all of these COPCs. Analytical results reported for the submitted samples make up the project data set which is included in Appendix A.

Data collected during the 2010 Site Evaluation of SWMU 13 were used to support BGOU risk management decisions. Key considerations in the risk screening process included the following:

- Determine whether all or portions of the study area may be removed from the BGOU scope;
- Identify where risk characterization suggests actions may be needed; and
- Determine whether additional data gathering and/or risk assessments are warranted.

The Risk Methods Document (DOE 2011a) provides a foundation for interpretation of these results. The following discussions describe screening values used in the interpretation of results.

For soil samples, the following values were used for screening:

- Protection of Groundwater [soil screening levels (SSLs)]
 - UCRS SSLs. To represent potential hypothetical use of UCRS groundwater, the SSLs assumed a DAF of 1. Consistent with the Risk Methods Document (DOE 2011a) Tables A.7a, the SSLs used were those downloaded from the EPA Web site (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search—downloaded June 2011).
 - RGA SSLs. For potential future use of RGA groundwater, a DAF of 57 was applied to the UCRS SSL selected above. This is consistent with the approach used in the Soils OU RI Report for SWMU 13, that currently is under development.
- Background Soil (Risk Methods Document Subsurface Background Table A.12). For naturally occurring metals and radionuclides, the subsurface background levels were used for screening.

Direct contact with constituents in soils at depths below 10 ft is not a complete pathway. The NALs for the Outdoor Worker (Risk Methods Document Table A.4) are applicable to soil depths from 0-10 ft bgs, and assumes contact with these soils for 185 days/year for 25 years and represent values for carcinogens of 1E-6 and noncancer hazards at the Hazard Index (HI) of 0.1. These NALs are not applicable to the 10 to 20 ft bgs interval. Available screening values [NALs or EPA Regional Screening Levels (RSLs)] that consider direct contact are included in qualitative discussions only to clarify the limited threat posed by these constituents.

For groundwater, concentrations are compared to the following:

- Child Residential NAL (Risk Methods Document, Table A.5)
- MCLs (Risk Methods Document, Table A.14)

For four VOCs not included in Table A.5, Child Residential NAL values for groundwater were calculated consistent with the equations presented in the Risk Methods Document (DOE 2011a).

- The default exposure assumptions from the Risk Methods Document were used (e.g., Exposure Frequency—350 days/yr; Exposure Duration—6 yrs; Body Weight—15 kg; Ingestion Rate—1.5 L/day; Inhalation Rate—0.833 m³/hr; etc.).
- The toxicity values for the chemicals were obtained from the EPA Regional Screening Levels (RSLs) (EPA 2010) tables, representing current toxicity values recognized by EPA and Kentucky.
- The “DAevent” for dermal absorption intake was calculated using the spreadsheet downloaded for RAGS E Web site (<http://www.epa.gov/oswer/riskassessment/ragse/>). The Kow and molecular weight (MW) values from this source were used. Acetone was not on this spreadsheet, but the calculation was made using the MW and Log Kow from the Integrated Risk Information System toxicity profile: <http://www.epa.gov/iris/toxreviews/0128tr.pdf>.

EPA RSLs for tap water were considered given recent updates on the use of these values by the State of Kentucky.

5.3.1 Soil

5.3.1.1 Metals and Radionuclides

Thirty-four soil samples collected at depths of 10 to 20 ft bgs were analyzed for metals and radionuclides. The results for those parameters detected in one or more of these soil samples are summarized on Table 1. As shown on this table, metals concentrations in all samples were at or below background; therefore, these soils should not be a significant contributor to groundwater contamination or potential hazard for direct contact.

All radionuclides except neptunium-237 and uranium-238 were below background; however, these two chemicals are not contaminants of concern (COCs) and do not warrant further evaluation for the following reasons:

- There is no subsurface background concentration for neptunium-237, but the single detection (0.057 pCi/g) was below the following: surface soil background of 0.1 pCi/g, the lowest of the SSLs for protection of groundwater of 516 pCi/g, and the outdoor worker NAL of 0.328 pCi/g.
- Of the radionuclides, only uranium-238 was present above background and in only 1 of 34 samples. At a concentration of 1.49 pCi/g, this maximum was only slightly above the background concentration of 1.2 pCi/g, while the average of 0.48 pCi/g is well below background. The calculated SSL for a DAF of 1 (representing a risk of 1E-6 in the UCRS) is 0.718 pCi/g, a value below background concentrations. Direct contact is not a complete exposure pathway for these deeper soils, and, even so, the maximum concentration only slightly exceeds the stringent outdoor worker NAL, suggesting the concentration is negligible (not appropriate for concentrations below 10 ft bgs).

Table 1. Summary of Naturally Occurring Metals and Radionuclides in Soil

Analysis	Units	Subsurface Background	Detects	Total	Detects		Average	Detection Limits	
					Min	Max		Min	Max
Aluminum	mg/kg	12,000	34	34	2,820	8,700	5,413	34.8	39.8
Arsenic	mg/kg	7.9	18	34	0.89	3.65	1.48	0.87	0.99
Calcium	mg/kg	6,100	34	34	428	2,770	883	86.9	99.4
Chromium	mg/kg	43	34	34	2.94	12.7	7.99	2.17	2.48
Copper	mg/kg	25	8	34	2.43	4.69	3.61	2.17	2.48
Iron	mg/kg	28,000	34	34	2,170	13,800	6,063	17.40	19.90
Manganese	mg/kg	820	34	34	15.3	347	76.5	2.17	2.48
Mercury	mg/kg	0.13	9	34	0.01	0.05	0.02	0.01	0.02
Nickel	mg/kg	22	15	34	4.47	10.4	5.50	4.35	4.97
Uranium	mg/kg	4.6	1	34	0.93	0.93	0.94	0.87	0.99
Vanadium	mg/kg	37	34	34	3.59	22.1	9.92	2.17	2.48
Zinc	mg/kg	60	1	34	24.6	24.6	18.91	17.4	19.9
Cesium-137	pCi/g	0.28	1	34	0.03	0.03	-0.01	0.02	0.03
Neptunium-237	pCi/g	*	1	34	0.06	0.06	-0.01	0.03	0.05
Thorium-228	pCi/g	1.6	34	34	0.66	1.36	1.02	0.19	0.23
Thorium-230	pCi/g	1.4	34	34	0.51	1.30	0.88	0.18	0.23
Thorium-232	pCi/g	1.5	34	34	0.59	1.35	0.95	0.12	0.33
Uranium-234	pCi/g	1.2	34	34	0.30	0.99	0.49	0.14	0.17
Uranium-235	pCi/g	0.06	8	34	0.02	0.05	0.02	0.02	0.05
Uranium-238	pCi/g	1.2	34	34	0.25	1.49	0.48	0.15	0.17

Analytes in bold—maximum concentration exceeded background.

* Subsurface Background from Risk Methods Document (DOE2011a). No subsurface background concentration for neptunium-237; surface background is 0.1 pCi/g.

5.3.1.2 Organic Compounds

The detected organic chemicals are summarized on Table 2. Five organic chemicals were detected in one or more samples; and, in all cases, the maximum concentrations were below their SSLs (DAF=1), indicating that these do not pose a threat to UCRS or RGA groundwater, the pathway of concern for soils at these depths.

There is no complete exposure pathway for direct contact to soils at depths greater than 10 ft bgs. Screening values are used only to illustrate that the detected concentrations are at levels that do not require limits on contact with these soils.

Chemicals that are not typical COPCs at PGDP (di-n-butylphthalate, 2-butanone, acetone, and dichlorodifluoromethane) likely are laboratory or field contaminants. The RSLs (EPA 2011) for the industrial worker are 62,000, 20,000, 630,000, and 780 mg/kg, respectively; and the maximum soil

Table 2. Summary of Organic Chemicals Detected in Soil Samples

Analysis	Units	Protection of Groundwater		Detects	Total	Detects			Nondetects	
		SSL–UCRS	SSL–RGA			Min	Max	Average	Min	Max
Total PCB	mg/kg	0.782	44.57	2	34	0.38	0.57	0.12	0.09	0.10
Di-n-butylphthalate	mg/kg	92	5,244	5	34	0.49	1.70	0.54	0.47	0.50
2-Butanone	mg/kg	1.5	85.5	1	34		0.013	0.005	0.005	0.005
Acetone	mg/kg	4.5	257	4	34	0.0023 J	0.069	0.008	0.005	0.005
Dichlorodifluoromethane	mg/kg	0.61	34.77	1	34		0.0057 J	0.005	0.005	0.005

Notes:

SSL = Soil Screening Level [for UCRS, DAF=1; for RGA, DAF=57]

The SSL for PCBs was identified in the RMD Table A.7a, (value was obtained from the SSLs from the EPA Web site).

Other SSLs were downloaded directly from EPA Web site (June 2011) http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search, consistent with RMD Table A.7a.

J = estimated quantitation

concentrations are ~35,000-900,000 times below these default screening values used for qualitative comparison.²

The data also indicate there are no significant PCBs sources of concern. PCBs were detected in only 2 of 34 samples, with a maximum well below the outdoor worker action level of 16.2 mg/kg (Risk Methods Document Table A.1), and the average was below the outdoor worker NAL of 0.162 mg/kg (Risk Methods Document Table A.4).

The organic compounds detected do not pose a threat to use of groundwater, the pathway of concern for these deeper soils. Direct contact exposures are not a complete pathway, and screening illustrates no contamination sources of concern are present at these depths.

5.3.1.3 Conclusions for Soil

Soil samples were collected at 34 locations. None of the detected contaminants in these samples were at concentrations that would be expected to impact UCRS or RGA groundwater. Naturally occurring metals and radionuclides were at concentrations below or near background and do not suggest releases of these chemicals from a buried waste source.

Chronic long-term exposures to chemicals in soils at depths of 10 to 20 ft bgs would not occur. Although U-238 and total PCBs were reported at levels slightly above the outdoor worker NAL for exposures less than 10 ft bgs, the low frequency of exceedance and the fact that the maximum concentrations were below 3E-6 risk level for this stringent scenario, supports the conclusion that there are no contamination sources of concern at these depths.

5.3.2 Water

Water was not encountered in all borehole locations and, where encountered, it was limited in quantity; consequently, the water needed for the full suite of water analyses could be collected only from borehole # 3. At other locations, samples were collected for analysis in order of precedence as specified in the FSP. Analysis of the water samples from SWMU 13 included metals (total and dissolved), radionuclides, uranium (dissolved), PCBs, SVOCs, and VOCs.

Table 3 summarizes the borehole locations from which water samples were collected and the respective chemical groups for which samples were analyzed.

5.3.2.1 Organic Compounds

As shown in Table 3, PCBs and SVOCs were analyzed at one location and were not detected. Table 4 is a summary of the detections of organic compounds in the groundwater samples. *Cis*-1,2-dichloroethene, acetone, 2-butanone and toluene were reported at concentrations below the Residential Child NAL (HI=0.1) and therefore are not COPCs. Only a single result for dichlorodifluoromethane exceeds any residential child NAL. Because of the lack of yield from UCRS groundwater, limits on hypothetical use of the UCRS groundwater for a rural resident are not applicable.

² NALs are not included for these compounds on Table A.4. This is not a complete pathway, and the levels are clearly below the readily available conservative direct contact screening values (EPA RSLs) accepted by EPA and Kentucky; therefore, no NALs were calculated for these compounds for this qualitative comparison.

Table 3. Summary of Water Analysis

Borehole	Analytical Group						
	Metals	Dissolved Metals	Radionuclides	Dissolved Uranium	PCBs	SVOCs	VOCs
1-013-001	X	X	X	NS	NS	NS	X
3-013-003	X	X	X	X	ND	ND	X
4-013-005	NS	NS	NS	NS	NS	NS	X
6-013-008	X	X	NS	NS	NS	NS	X
7-013-009	X	X	X	NS	NS	NS	X
8-013-010	X	X	NS	NS	NS	NS	X
8-013-010 Duplicate	NS	NS	NS	NS	NS	NS	X
10-013-012	NS	X	NS	NS	NS	NS	NS

X = Indicates sample was collected for analysis and chemicals were detected.

ND = Indicates sample was collected for analysis and no chemicals in that analytical group were detected.

NS = No sample analyzed due to an insufficient volume of sample water.

A localized impact is suggested by the results from the sample collected from Station 013-005. Here a dichlorodifluoromethane (Freon-12) detection exceeds the NAL and is, therefore, a COPC. The laboratory diluted this sample due to the presence of Freon-113 (1,2,2-trichloro-1,1,2-trifluoroethane), which was not a target analyte and not quantified for this project. Dichlorodifluoromethane (Freon-12) was reported near the detection limit of the diluted sample at a concentration of 520 DJ ug/L, a concentration above the Child Residential NAL of 9.05 ug/L. These factors suggest residual of some Freon compounds may have been associated with scrap metal at this location; however, these results do not suggest potential for impact to the RGA that would limit potential future use of groundwater at the SWMU boundary.

Freon-113 has been detected in RGA groundwater at PGDP; however, it never exceeded 10% of the EPA RSL for tap water (59 mg/L) in 453 samples analyzed between 1995 and 2010. Freon-12, was detected in one UCRS sample at 520 DJ ug/L; however, it is not considered a COC for the following reasons:

- The arithmetic average of this result with the detection limits for Freon 12 in water samples collected at other locations is 87 ug/L. This is relevant for the preliminary evaluation of potential to impact the RGA (the aquifer of concern for use by the rural resident) at the SWMU boundary. At this concentration, the HI would be less than 1 for groundwater use by a rural resident.
- The RGA, not the UCRS, is considered the aquifer of concern for groundwater use by a rural resident. The screening groundwater concentrations reported in this study were collected in the UCRS. Applying the DAF of 57 for migration of chemicals from the UCRS to RGA used in the Soils OU for this SWMU, the estimated concentration in the RGA would be approximately 9 ug/L based on maximum concentration and 1.5 ug/L based on the average. These values that would not limit use of RGA groundwater.
- In addition, this compound has not been identified as a priority chemical in groundwater at PGDP. It was detected in only 1 of 1,323 RGA groundwater samples between 1995 and 2010 and, except as noted above, was not above screening values for potable use.
- This compound was detected in only 1 of 34 soil samples at a concentration 100 times below the SSL (DAF=1).

Table 4. Summary of Organic Chemicals Detected in UCRS Groundwater

Analysis	Residential Child NAL (HI=0.1)	EPA RSL Tap Water (HI=0.1)	MCL	Units	Number of Samples		Detected Values		Average
					Detects	Total	Min	Max	
<i>cis</i> -1,2-Dichloroethene	1.25	7.3	70	µg/L	2	5	0.33 J	0.88 J	0.84
<i>2-Butanone</i>	270	710	N/A	µg/L	4	5	1.33 J	2.42 J	2.46
<i>Acetone</i>	711	2,200	N/A	µg/L	3	5	2.29 J	3.24 J	3.69
<i>Toluene</i>	65.6	230	1,000	µg/L	2	5	0.36 J	2.03 J	1.08
<i>Dichlorodifluoromethane</i> ^b	9.05	20	N/A	ug/L	1	6	-	520 DJ	87

Notes:

^a The *cis*-1,2-dichloroethene NAL is from Table A.5 (DOE 2011a); all other NALs calculated as per the protocols in the RMD for child residential exposures for hypothetical future domestic use of groundwater.

^b Elevated detection limits were reported in Sample 013-005 (Section 4.6). Results for this sample are included in the above table only for the detected compound, dichlorodifluoromethane. Elevated detection limits for that sample (500 ug/L) are not included in average concentrations of other VOCs analyzed.

MCL = maximum contaminant level; J = estimated value; DJ = estimated value, diluted sample; N/A not applicable (no MCL for this chemical).

5.3.2.2 Inorganic Chemicals

As in the discussion of the data quality of the samples, it is recognized that obtaining representative groundwater data is challenging, even with proper development of wells. Water samples collected in open boreholes are expected to have variable results for total metals, based on the amount of particulates in the samples. Filtering samples can reduce artifacts of inclusion of naturally occurring metals from the aquifer matrix; however, there are fine particles in the UCRS that still may be in these samples. Figure 4 illustrates the comparison of the range of concentrations for aluminum and iron in the total and dissolved samples. This is consistent with expected patterns of naturally occurring metals in groundwater samples that are not collected from developed wells.

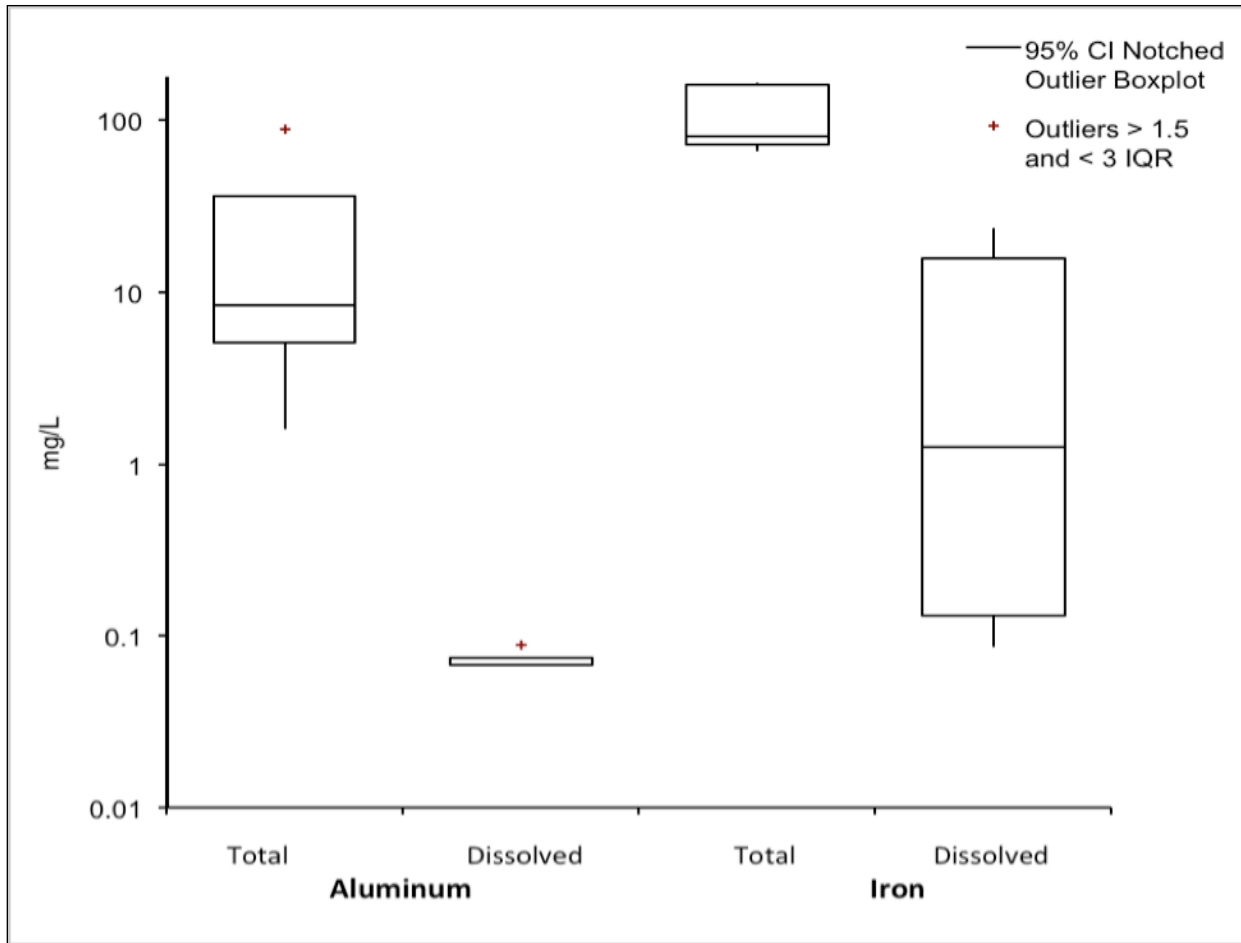


Figure 4. Comparison of the Total and Dissolved Analysis

Table 5 highlights the results of the detected radionuclides and dissolved metals in the water samples to help determine if the presence of these substances in the UCRS groundwater samples suggests a release from a buried waste source that could pose a hazard associated with UCRS or RGA groundwater use.

Some of the 22 metals that are considered potential PGDP COPCs (i.e., values included in Risk Methods Document, Table 2.1), have one or more exceedances of the Child Residential NAL for hypothetical future use of UCRS groundwater. These exceedances are considered not to reflect significant releases to groundwater and/or risks for the following reasons.

**Table 5. UCRS Groundwater Concentrations for Detected Dissolved Metals and Radionuclides,
Significant Chemicals of Potential Concern at PGDP**

Analysis	Residential Child NAL	MCL	Units	UCRS Boring Location					
				#1	#3	#8	#9	#10	#12
Dissolved Metals									
Aluminum	1.04	N/A	mg/L	0.068U	0.068U	0.089J	0.068U	0.068U	2.030
Antimony	4.15E-04	0.006	mg/L	0.003U	0.003U	0.003U	0.003J	0.003U	0.003U
Barium	0.206	2	mg/L	0.131	0.129	0.159	0.088	0.120	0.254
Chromium	1.03E-04	0.10	mg/L	0.001J	0.001J	0.001J	0.001U	0.001J	0.003J
Cobalt	0.0003	N/A	mg/L	0.007	0.073	0.013	0.008	0.016	0.015
Iron	0.729	N/A	mg/L	0.154	23.4	1.26	0.088J	12.2	0.971
Lead	0.015	0.015	mg/L	0.003U	0.003U	0.003U	0.003U	0.003U	0.010J
Manganese	0.0245	N/A	mg/L	1.150	2.910	1.290	0.629	2.040	1.420
Mercury	0.0003	0.002	mg/L	0.0009	0.0001J	0.0001J	0.0001U	0.0001U	0.0001U
Molybdenum	0.0052	N/A	mg/L	0.076	0.042	0.036	0.081	0.008J	0.006J
Nickel	0.0208	N/A	mg/L	0.039	0.125	0.049	0.047	0.106	0.029
Silver	0.0052	N/A	mg/L	0.001U	0.002J	0.001U	0.001U	0.001U	0.001U
Uranium	0.0031	0.03	mg/L	0.029J	0.010U	0.010U	0.010U	0.010U	0.010U
Vanadium	0.0001	N/A	mg/L	0.001U	0.001U	0.001U	0.001U	0.001U	0.002J
Zinc	0.313	N/A	mg/L	0.009J	0.025	0.006J	0.008J	0.008J	0.019
Radionuclides									
Technetium-99	34.3	900	pCi/L	9.96	1.31	NS	0.155U	NS	NS
Thorium-230	1.04	N/A	pCi/L	0.281	3.15	NS	0.377	NS	NS
Uranium-233/234	1.33	20	pCi/L	28.9	1.44	NS	-0.012U	NS	NS
Uranium-233/234, (Dissolved)	1.33	20	pCi/L	NS	-0.052U	NS	NS	NS	NS
Uranium-235/236	1.31	20	pCi/L	2.49	0.098U	NS	-0.025U	NS	NS
Uranium-235/236, (Dissolved)	1.31	20	pCi/L	NS	0U	NS	NS	NS	NS
Uranium-238	1.08	20	pCi/L	56.3	1.350	NS	0.083U	NS	NS
Uranium-238, (Dissolved)	1.08	20	pCi/L	NS	0.039U	NS	NS	NS	NS

MCL = Maximum Contaminant Level; NAL = No Action Level; Values in **Bold** exceed the NAL, **Bold and underlined** also exceed the MCL.

Child residential NAL for hypothetical future domestic use of groundwater (DOE 2011a). The detected values reported in this table are from UCRS groundwater, which is not a viable source of potable water.

MCLs are established for the RGA; the detected values reported in this table are not from the RGA but from the UCRS.

U for radionuclides = Value reported is < minimum detectable activity and/or total propagated uncertainty; U for other analytes = not detected; J- estimated quantitation; NA = not applicable (no MCL for this constituent); NS = no sample (insufficient volume of water)

- None of the metals were reported in soils above background,³ and the reported water concentrations are considered conservative based on the sampling method.
- For the six metals with MCLs, none of the dissolved metals concentrations exceeded the drinking water standards.
- Because speciation was not performed, the NAL for hexavalent chromium was used. The maximum contaminant level (MCL) for chromium includes all forms of chromium and would be applicable for this screening. The UCRS, where these samples were collected, has reducing conditions (as evidenced by anaerobic biodegradation products of chlorinated solvents present in this zone at sites where VOCs are present). Reduction to trivalent chromium, which is less toxic and mobile, would be rapid under these conditions. Because the detected values were below the MCL and chromium concentrations in soils were below background, chromium is not considered a potential COC.
- Two of the remaining metals, silver and zinc, have no exceedance of NALs, while two others, aluminum and vanadium, exceed the NAL in only 1 of the 6 samples, suggesting no general impacts to the UCRS.
- More abundant metals (e.g., iron and manganese) were detected more frequently and may reflect colloidal material in the sample or localized redox conditions that favor dissolution. Cobalt concentrations in natural waters frequently are controlled by coprecipitation or absorption by oxides of manganese and iron, suggesting a possible association of these metals, because the highest concentrations of each were detected in the same sample (Hem 1985).
- The UCRS is not a likely future source of potable water, and concentration reductions would occur during transport to the RGA.

Radionuclide results from nonfiltered water samples appear to be strongly influenced by particulates. Of the three water samples collected and analyzed for radionuclides, sample 013-001 appears to be significant in that the maximum detected values for several of the analytes are outliers. This is the same sample in which the dissolved aluminum concentration was less than 1% of the total aluminum concentration, suggesting the presence of particulates in the sample. When total and dissolved uranium were measured in sample 013-003, dissolved concentrations were significantly lower. Experience in modeling groundwater at PGDP indicates significant attenuation as chemicals migrate from the UCRS to the RGA (Section 5.1). Using the project-specific DAF (as discussed in section 5.1), none of these radionuclides would be expected to result in RGA groundwater concentrations above NALs.

5.3.2.3 Conclusions for Groundwater

Groundwater samples are helpful in identifying potential leachable constituents in the subsurface as compared to discrete soil samples. Water samples can provide credible information for VOCs, in particular. The results noted above suggest no unacceptable risks or hazards associated with the use of RGA groundwater.

Considerable uncertainty exists in the results from the inorganic testing because the presence of particulates can result in overestimating the groundwater concentrations. Regardless, dissolved metal

³ Cobalt was not analyzed in samples collected during the summer of 2010. For comparison, data collected in 2001 and 2004 were used.

concentrations suggest that potential impacts in the UCRS groundwater are limited, and no significant issue with migration to the RGA was identified, in part supported by the finding that all metals in the soil samples were below background.

The four radionuclides with a maximum concentration above screening levels all were below background in soils, with the exception of uranium-238 in 1 of 34 samples, where it was slightly above background. As with metals, these unfiltered samples likely are overestimating the presence of these compounds in groundwater. Using groundwater modeling information summarized in Section 5.1, the four radionuclides do not pose the potential for future impact in the RGA.

5.4 PIEZOMETERS AND WATER LEVEL

Piezometers were installed in three boreholes near the drainage ditch on the north side of SWMU 13 to provide information on depth-to-water and determine whether potentially impacted shallow water within the UCRS might infiltrate into the ditch. Figure 5 illustrates the piezometer locations, surface topography, and the water level measurements recorded as part of this evaluation.

Water level in the piezometers fluctuated as much as 5 ft in the 8-month observation period. The water table varied from 1 to 8 ft bgs in the observation period. The water table rose more than 3 ft above the invert of the adjacent drainage ditch; however, no seeps were observed in the ditch. The absence of seeps in the SWMU 13 ditch and other nearby ditches whose invert elevations are below the surrounding groundwater elevations suggests very little lateral migration occurs in the UCRS.

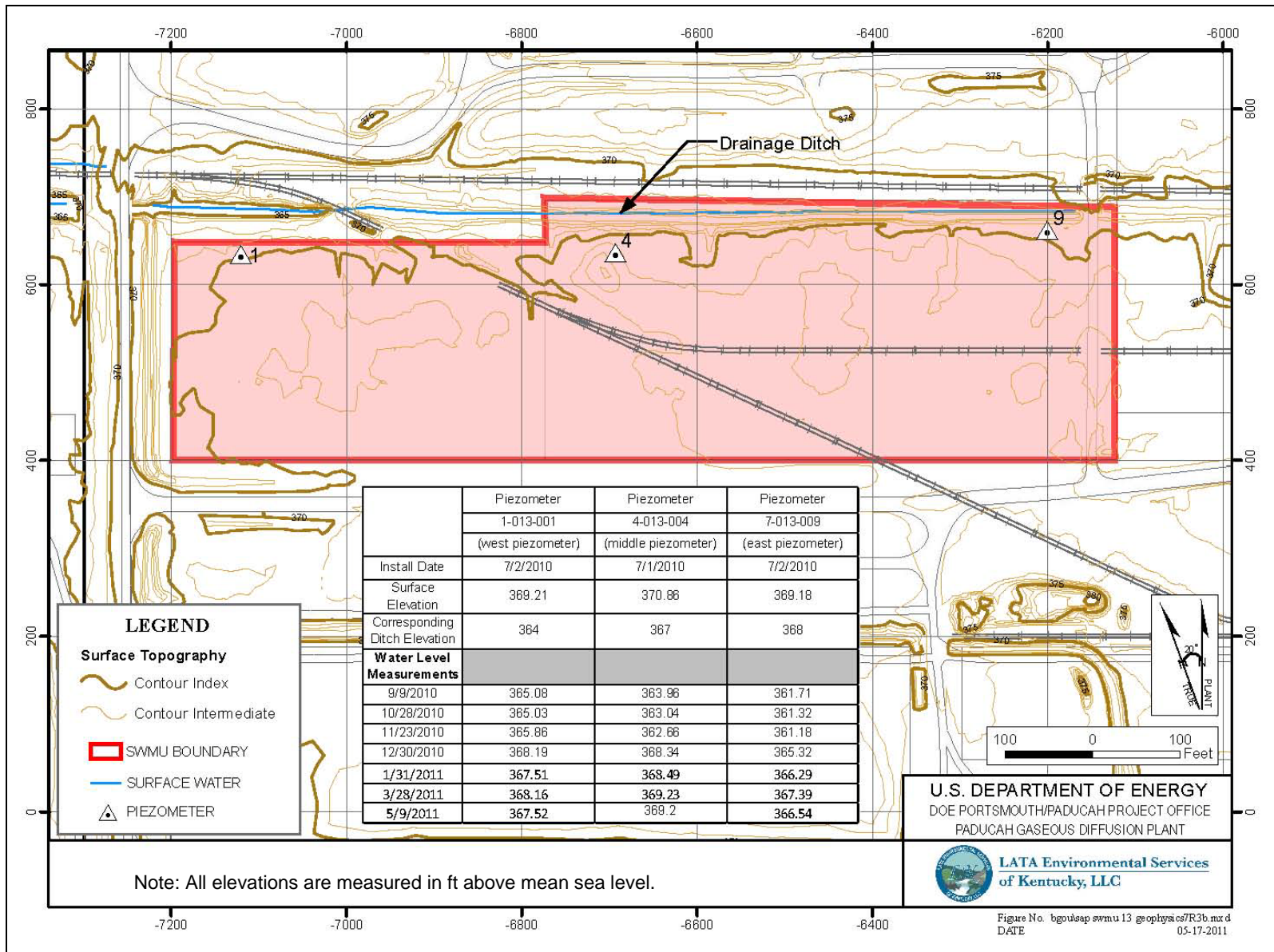


Figure 5. Piezometer Locations

6. CONCLUSIONS AND RECOMMENDATIONS

The objectives of the SWMU 13 evaluation are established in the FSP as follows:

- Determine extent of buried materials (i.e., scrap metal) where present at SWMU 13; and
- Determine the nature of any releases from buried materials located.

Based on the data acquired by the 2010 field sampling program, this SER concludes that there is no evidence of systematic burial of material based on visual observations as well as results of sample analysis. For purposes of the BGOU no additional action is needed to address SWMU 13. The information collected as part of this SER has been provided to the Soils OU program to support any evaluation as part of that program.

The analytical results suggest there is no significant release as evidenced by the following observations.

- Soils
 - No COCs are identified for the 34 soil samples.
 - All metals in soils were below background.
 - Radionuclides were below background in all cases with exception of a single slight exceedance of background for uranium-238 (maximum of 1.49 pCi/g and average of 0.48 pCi/g compared to the background of 1.2 pCi/g); therefore, uranium-238 is considered at background levels.
 - None of the chemicals in soils above background exceed the SSLs for protection of RGA groundwater when the appropriate adjustments for the rate of migration to the RGA are employed.
 - Because direct contact is not a complete pathway for soils at these depths, identification of COCs for this pathway is not applicable. A comparison of soil concentrations against a conservative worker scenarios (with direct contact exposure) demonstrates for risk managers that concentrations in soil do not warrant additional evaluation.
- Groundwater
 - Organics constituents from SWMU 13 are below concentrations that would restrict potential future uses of RGA groundwater.
 - Naturally occurring metals were detected in selected samples; however, no exceedances of MCLs were identified in dissolved metals in the UCRS. Metals concentrations were not elevated above background in soils and detections in the UCRS are considered conservative and not a significant source of potential impact in the RGA.
 - Unfiltered radionuclide concentrations are elevated; however, comparing between total and dissolved analyses indicates unfiltered sample results are strongly influenced by particulates and do not reflect mobility or potential presence of radionuclides in a developed well. Regardless, even these elevated concentrations do not suggest a SWMU 13 source that would migrate to the RGA at levels that would limit potable use.

This SER concludes that chemicals detected in soils encountered between 10 and 20 ft bgs are below background and/or relevant screening criteria for potential impacts to groundwater. Because of depth, they do not pose potential future direct contact risks to human health or risk for ecological receptors.

Consistent with Section 40 *CFR* § 300.415(b)(2) of the National Contingency Plan, the factors that should be considered for determining whether a BGOU removal action is appropriate for SWMU 13 are discussed below.

(i) **Actual or potential exposure to nearby human populations, animals, or food chain from hazardous substances or pollutants or contaminants.**

None, as outlined in Section 5.

(ii) **Actual or potential contamination of drinking water supplies or sensitive ecosystem.**

There is no use of groundwater for drinking water, feedstock watering, or crop irrigation near SWMU 13. There is no indication of a SWMU 13 source of constituents at levels that would cause contamination of drinking water.

(iii) **Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.**

There are no containers or tanks associated with SWMU 13.

(iv) **High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate.**

Relatively low concentrations of contaminants at or near background levels are found in soils greater than 10 ft bgs (i.e., the BGOU). These low concentrations coupled with the calculated DAF for PGDP will result in no unacceptable impact to the RGA.

(v) **Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.**

Precipitation will lead to a downward migration of the contaminants detected in the soils greater than 10 ft bgs (i.e., the BGOU). However the relatively low concentrations of the contaminants coupled with the calculated DAF for PGDP will result in no unacceptable impact to the RGA.

(vi) **Threat of fire or explosion.**

Residual waste material or chemicals present at SWMU 13 do not present a threat of fire or explosion.

(vii) **The availability of other appropriate federal or state response mechanisms to respond to the release.**

The potential need for a remedial action on the surface and shallow subsurface soils of the Soils OU will be evaluated in the Soil OU Remedial Investigation Report.

(viii) **Other situations or factors that may pose threats to public health or welfare of the United States or the environment.**

There are no other situations or factors in which the soils greater than 10 ft bgs (i.e., the BGOU) would pose a threat to public health or the environment.

Although the SMP currently characterizes SWMU 13 as both a BGOU SWMU and a Soils OU SWMU, this SER concludes that no BGOU response action is required at SWMU 13, and it should be removed from the BGOU SWMU list, but retained on the list of Soils OU SWMUs. Decisions related to SWMU 13 from this point forward should be within the purview of the Soils OU. Accordingly, Appendix C of the SER contains an updated SWMU Assessment Report for SWMU 13.

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7. REFERENCES

- DOE (U.S. Department of Energy) 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.
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APPENDIX A
ANALYTICAL DATA

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APPENDIX

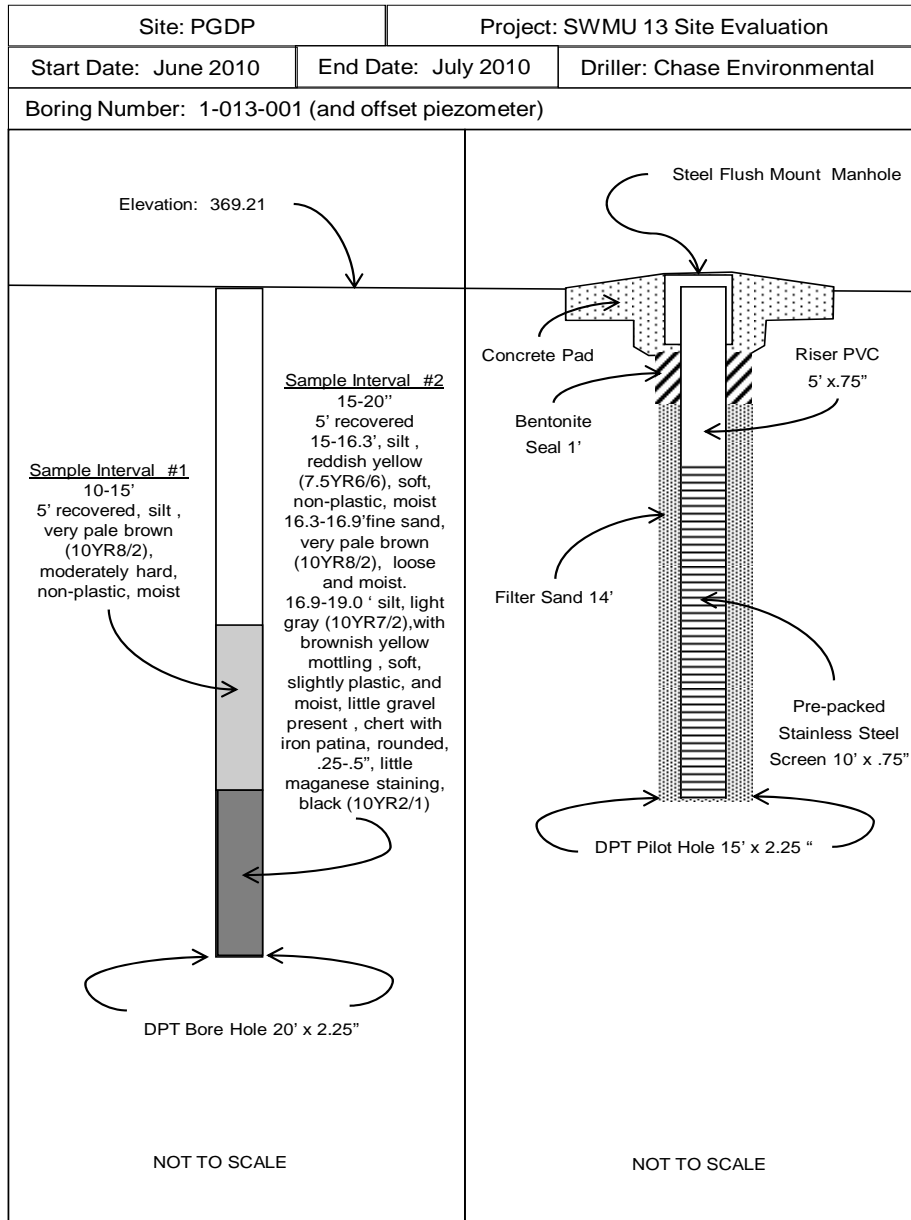
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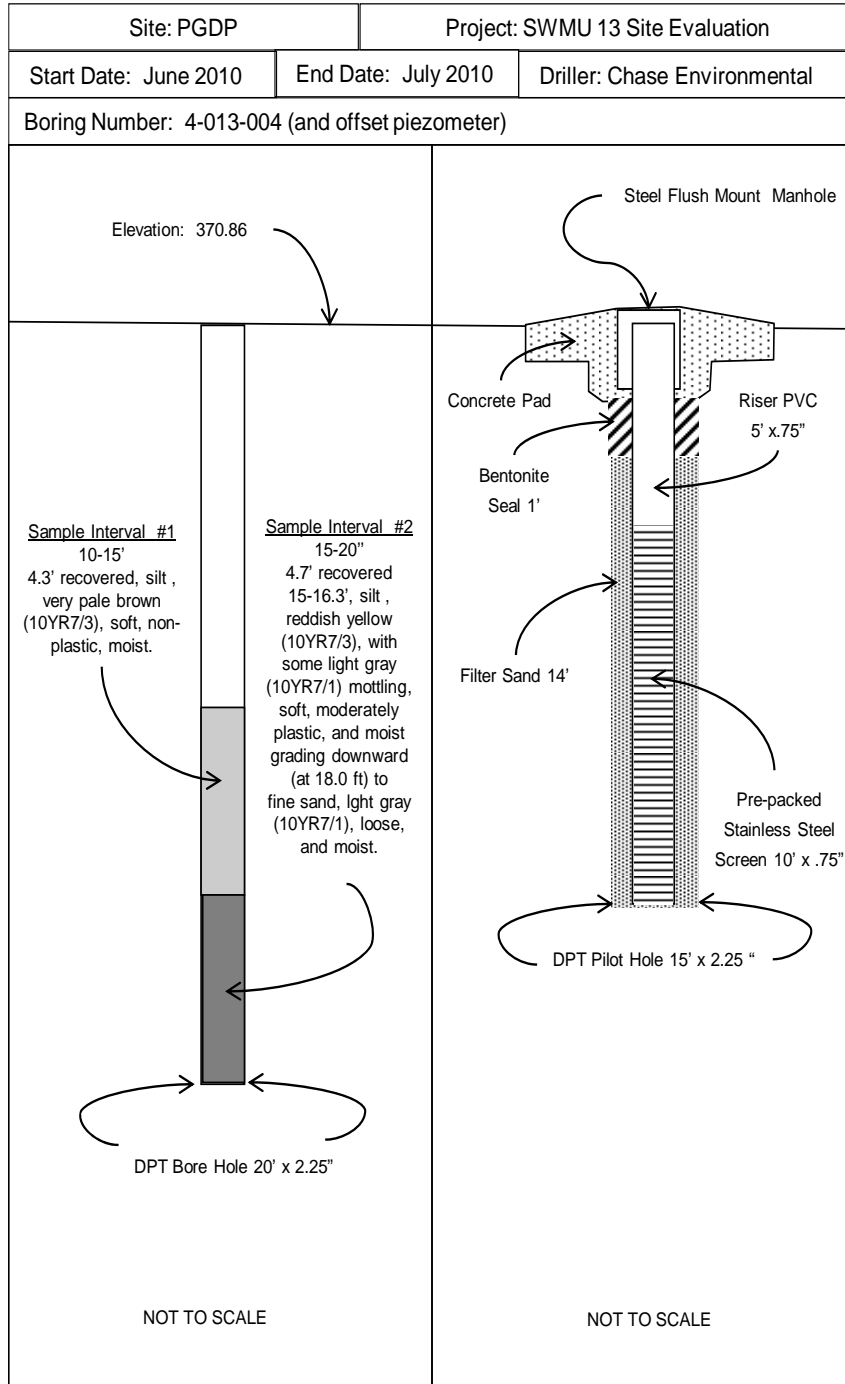
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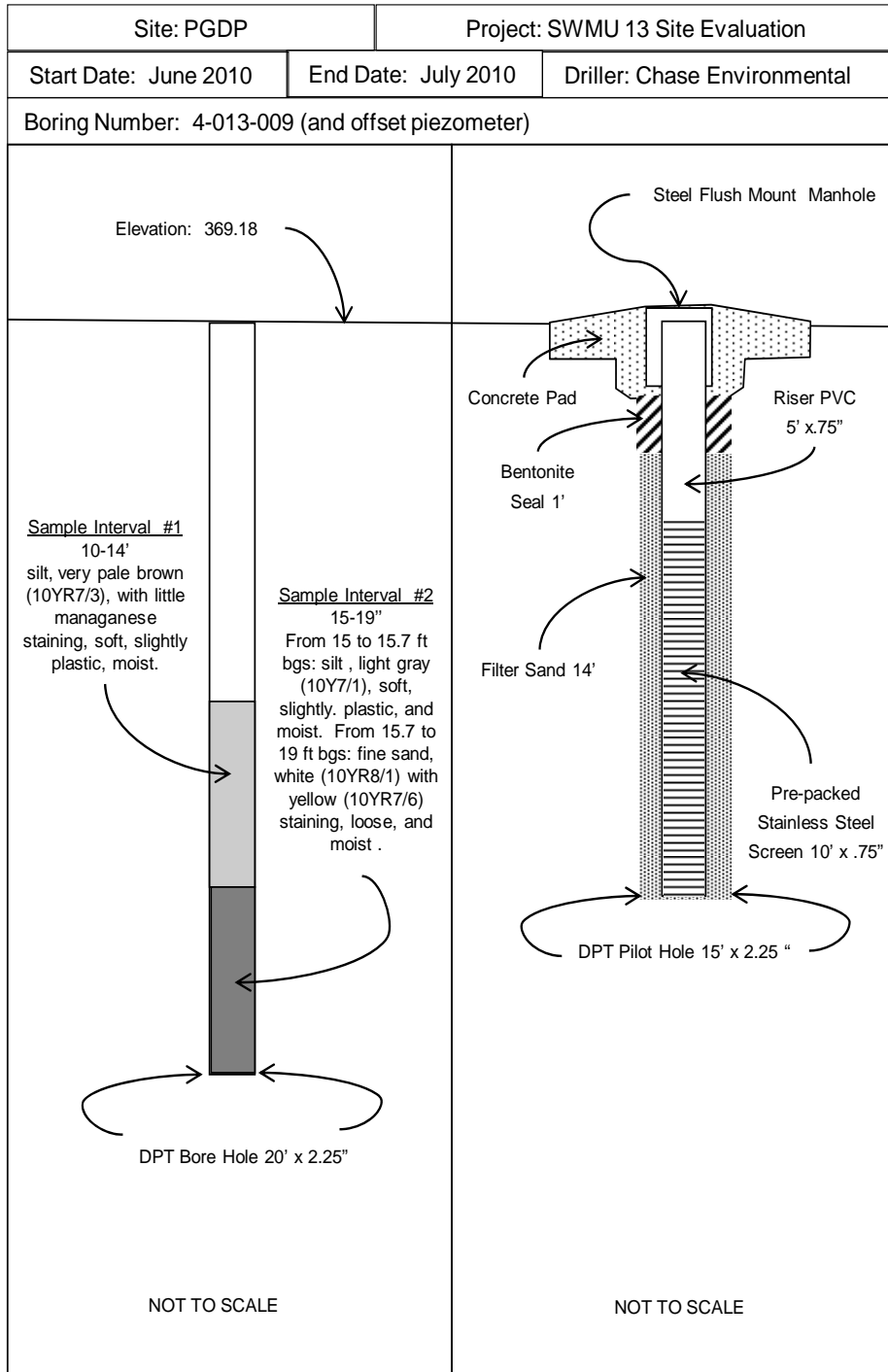
APPENDIX B

PIEZOMETER BORING LOGS AND CONSTRUCTION DETAILS

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APPENDIX C
SWMU 13 ASSESSMENT REPORT

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C-746-P AND C-746-P1 SCRAP YARDS SOLID WASTE MANAGEMENT UNIT (SWMU) ASSESSMENT REPORT

SWMU/AOC NUMBER: 13

DATE OF ORIGINAL SAR: 8/24/1987

DATE OF SAR REVISIONS: 12/31/07 and 7/22/11

REGULATORY STATUS: SWMU

LOCATION: SWMU 13 is bounded on the north by Patrol Road 2, on the east by 10th Street, on the west by Patrol Road 1, and by a drainage ditch south of the C-746-B Building. The SWMU includes the C-746-P and the C-746-P1 Scrap Yards located in the northwest section of the Paducah Gaseous Diffusion Plant. C-746-P1 is located to the west of the C-746-P yard.

APPROXIMATE DIMENSION OR CAPACITY: Approximately 294,000 ft² (290 ft by 1076 ft)

FUNCTION: This SWMU was used for scrap metal storage.

BRIEF HISTORY: The two scrap yards, C-746-P and C-746-P1 that comprise SWMU 13 were utilized from the 1950s to 2005. These scrap yards were used for the storage of scrap metal prior to the sale of the clean scrap metal to scrap metal reclaiming vendors. Scrap metal removal for both the C-746-P and C-746-P1 yards began in 2002. In 2005, metal from the C-746-D yard was temporarily staged in the C-746-P1 for shipment to an off-site disposal facility.

The removal of scrap metal aboveground under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was completed for the C-746-P1 yard in September 2005 and for the C-746-P yard in February 2006.

Prompted by a site employee interview in April 2007, geophysical surveys using an Electromagnetometer™ (EM)-61, were performed on three areas located within the boundaries of the SWMU during April and May 2007. According to the interviewed employee, some metal not reclaimed by outside vendors was buried.

The geophysical survey results confirmed the presence of metal in three areas at 2 ft below ground surface (bgs). Within one of those areas, metal was also detected at 4 to 6 ft bgs. (See attached map.) It was unclear whether this presence of metal was due to systematic burial activities.

The interviewed employee also recalled that small piles of metal were spread and covered with gravel in an effort to improve the appearance of the area. This is consistent with the results of the geophysical survey where metal was detected at depths of 2 ft bgs.

In 2010, borings advanced to a depth of 20 ft bgs at these locations did not encounter metal or other waste at depths greater than 2 ft bgs.

PRESENT OPERATIONAL STATUS: Inactive

DATES OPERATED: C-746-P Scrap Yard was in operation from the 1950s to 1999. C-746-P1 Scrap Yard was in operation from the 1950s to 2002.

SITE/PROCESS DESCRIPTION: This SWMU is a fenced open field that contains two yards, C-746-P and C-746-P1 that were used for the aboveground storage of scrap metal for approximately fifty years. A small amount of buried metal was discovered in April 2007.

WASTE DESCRIPTION: The C-746-P yard is currently empty of aboveground scrap metal. Prior to scrap metal removal, the yard contained switchgears (mostly clean-steam cleaned), a fuel-fired furnace, mounds of wire potentially contaminated with PCBs and/or asbestos-containing material, a small office trailer, railroad spikes in cans, and miscellaneous piles of scrap.

The C-746-P1 yard is currently empty of aboveground scrap metal. Prior to scrap metal removal, the yard contained clean metal scrap, drums, drained transformers, and railroad rails. Waste consisting of circuit boards and relays were discovered and transferred to a CERCLA storage area in January 2005.

WASTE QUANTITY: The following tonnages were generated and removed during the Scrap Metal Removal activities between October 2002 and February 2006:

C-746-P Scrap Yard

Aboveground Tonnage Removed: 2,280.11 tons

Aboveground Scrap Metal Removal From: October 2002 until February 2006

C-746-P1 Scrap Yard

Aboveground Tonnage Removed: 1,947.93 tons

Aboveground Scrap Metal Removal From: October 2002 until September 2005

An estimate of the amount of metal present in the shallow subsurface (0-2 ft bgs) is not available. In 2010, borings advanced to a depth of 20 ft bgs at these locations did not encounter metal or other waste at depths greater than 2 ft bgs; therefore, no metal or other waste is known to exist at depths greater than 2 ft bgs. The geophysical data combined with the boring information do not indicate evidence of systematic burial of wastes at SWMU 13.

SUMMARY OF ENVIRONMENTAL SAMPLING DATA: Potential contaminants associated with this SWMU include aluminum, antimony, cadmium, calcium, copper, neptunium-237, nickel, plutonium-239, technetium-99, uranium metal, uranium-234, uranium-238, and zinc.

After the majority of scrap metal had been removed, shallow soil samples were collected in 2004 for further characterization and soil waste profile development. In 2001, prior to scrap removal, samples were collected from surface soils to characterize areas for worker safety and for initial waste characterization. In 1996 as part of a RI for Waste Area Group (WAG) 22, sediment samples were collected from ditches that drained the scrap yards. (*Remedial Investigation Report for Solid Waste Management Units 7 and 30 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1604/V1&D2, U.S. Department of Energy, Paducah, KY, 1998*).

Data for the sampling events indicate the presence of aluminum, antimony, cadmium, calcium, copper, neptunium-237, nickel, plutonium-239, technetium-99, uranium metal, uranium-234, uranium-238, and zinc above background. The principal contaminants are considered to be calcium and cadmium because sample results indicated concentrations greater than 10x the background level.

Calcium results ranged from 781 to 3,000 mg/kg for surface soil and 778 mg/kg to 91,400 mg/kg for subsurface soils. The background level for calcium is 200,000 mg/kg in the surface and 6,100 mg/kg in the subsurface.

Cadmium results ranged from 1.8 mg/kg to 6.78 mg/kg in subsurface soils. The PGDP background level for cadmium in subsurface soil is 0.21 mg/kg.

In 2010, analyses of samples from borings advanced to a depth of 20 ft bgs typically did not identify concentrations of constituents at greater than No Action Levels.

Sampling results are located in the Paducah OREIS database, under the following data project codes: SY01-C746P, SYSSP04-C746P1, SYSSP04-C746P, and BGOU10-SWMU13.

DESCRIPTION OF RELEASE AND MEDIA AFFECTED:

GROUNDWATER:	See Below
SURFACE WATER:	See below
SOIL:	See below
ECOLOGY AFFECTED:	None known

DOCUMENTATION OF NO RELEASE: There are no known effects to ecology (i.e., endangered or threatened species). Data indicate that cadmium and calcium levels in subsurface soil samples are found at concentrations greater than 10 times the background levels. Potential contaminants from the C-746-P and C-746-P1 scrap yards include uranium and asbestos. The scrap yards also contained drums of “heels” of remnant fluids potentially contaminated by petroleum hydrocarbons and TCE. Prior to the removal of the scrap metal, contaminants associated with the scrap metal likely contributed to soils, groundwater (UCRS), and surface water contamination via storm water runoff.

IMPACT ON OR BY OTHER SWMUS OR AOCS: There is no evidence that this SWMU impacts or is impacted by other SWMUs.

PRG COMPARISON: N/A

RFI NECESSARY: Yes, as identified in the Resource Conservation and Recovery Act permit, conditions AAZZ1 T-99, T-145, and T-159, incorporating Appendix A-1, and the Federal Facility Agreement Site Management Plan, Appendix 4.

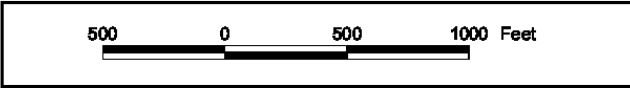
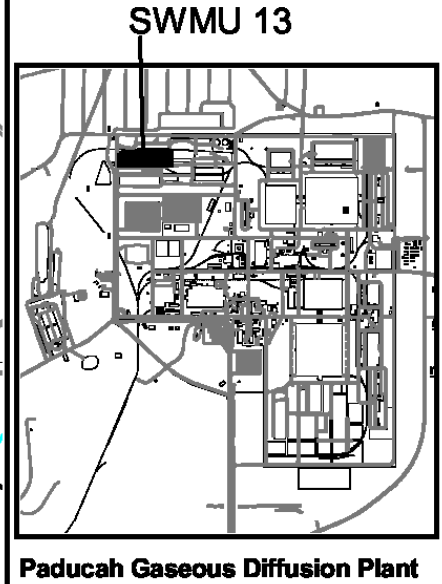
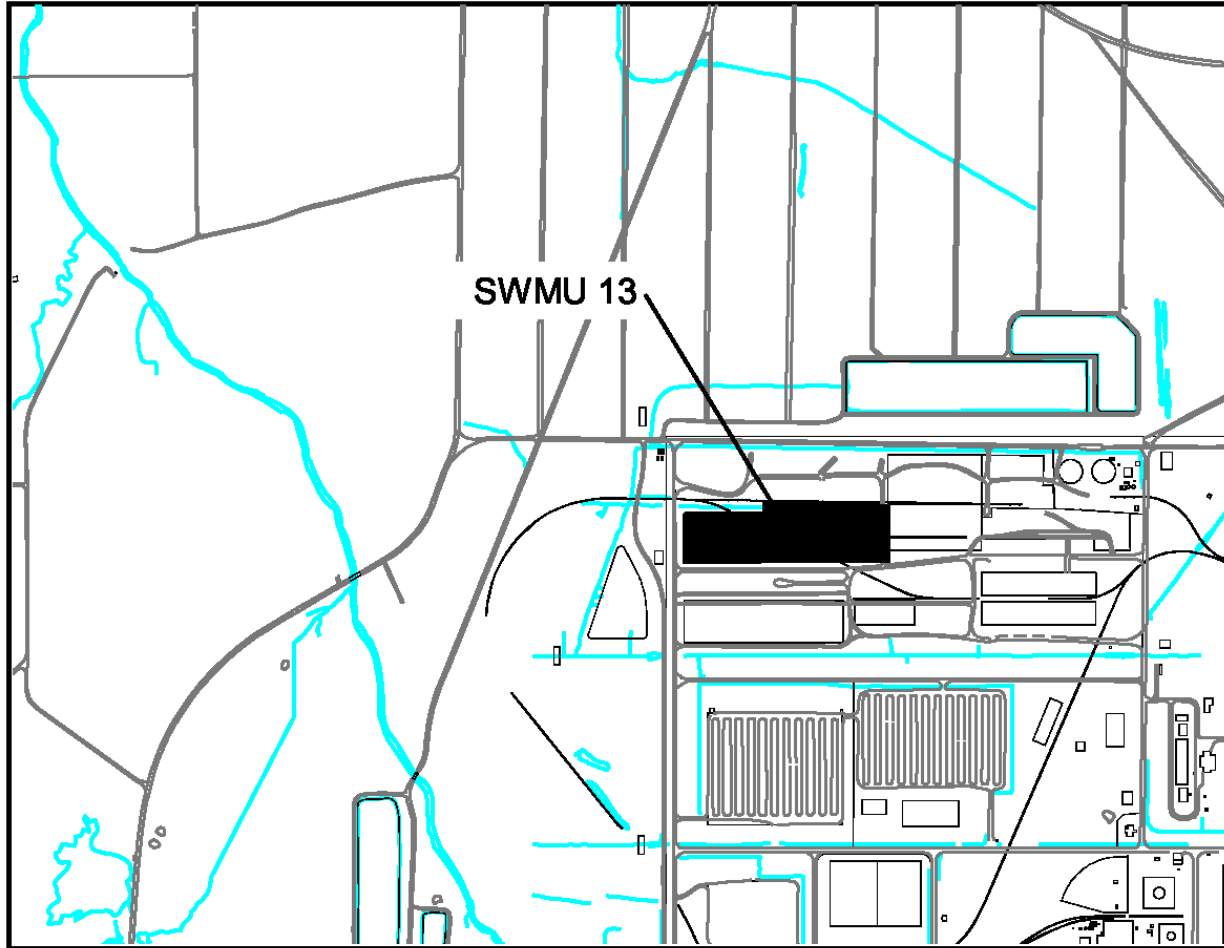
OPERABLE UNIT ASSIGNMENT: Soils Operable Unit. SWMU 13 has been removed from further consideration under the BGOU as a result of the conclusions in the July 2011 Site Evaluation Report for SWMU 13, DOE/LX/07-1259&D1.



C-746-P Scrap Yard



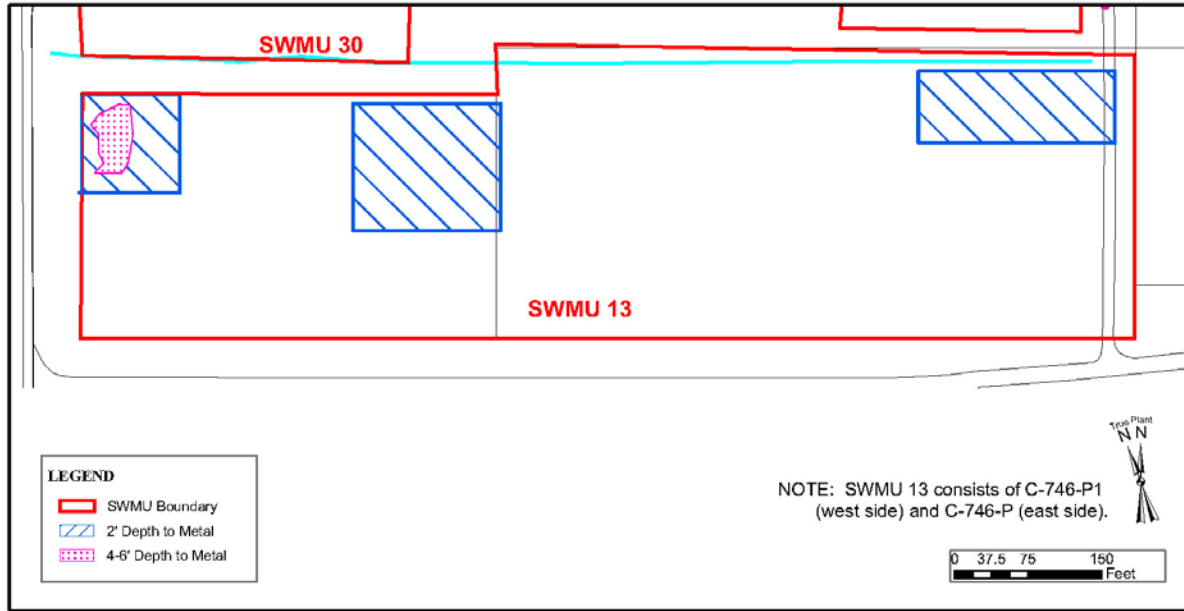
C-746-P1 Scrap Yard



SWMU 13

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

FIGURE No. c5ac90000sk387.apr
 DATE 07-13-11



SWMU 13 Geophysical Results for Buried Metal