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Mr. W. Turpin Ballard
U.S. Environmental Protection Agency, Region 4
Federal Facilities Branch
61 Forsyth Street
Atlanta, Georgia 30303

PPPO-02-208-09

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

Dear Mr. Ballard and Mr. Winner:

TRANSMITTAL OF THE WORK PLAN FOR THE SOILS OPERABLE UNIT REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/LX/07-0120&D1)

Enclosed is the D1 version of the *Work Plan for the Soils Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/LX/07-0120&D1) for regulatory review.

If you have any questions or require additional information, please contact David Dollins at (270) 441-6819.

Sincerely,

Reinhard Knerr
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosures:

1. Certification Page
2. D1 Soils OU RI/FS Work Plan

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CERTIFICATION

Document Identification: ***Work Plan for the Soils Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*** **(DOE/LX/07-0120&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 assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Paducah Remediation Services LLC

Mike Spry, President	3/5/09 Date Signed

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

U.S. Department of Energy (DOE)

Reinhard Knerr, Paducah Site Lead	3/5/09 Date Signed

DOE/LX/07-0120&D1
Primary Document

Work Plan for the Soils Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Primary Document

Work Plan for the Soils Operable Unit Remedial Investigation/Feasibility Study at Paducah Gaseous Diffusion Plant Paducah, Kentucky

Date Issued—March 2009

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

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

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ACRONYMS

%R	percent recovery
ACGIH	American Conference of Governmental Industrial Hygienists
ACO	Administrative Consent Order
AHA	activity hazard analysis
AIHA	American Industrial Hygiene Association
ALARA	as low as reasonably achievable
amsl	above mean sea level
ANSI	American National Standards Institute, Inc.
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
AT123D	Analytical Transient 1-,2-,3- Dimensional
BERA	Baseline Ecological Risk Assessment
BGOU	Burial Grounds Operable Unit
bgs	belowground surface
BHHRA	baseline human health risk assessment
BRA	baseline risk assessment
CAAS	criticality accident alarm system
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COE	U.S. Army Corps of Engineers
COPC	chemical of potential concern
CRZ	Contamination Reduction Zone
CSM	Conceptual Site Model
CSOU	Comprehensive Site Operable Unit
CZ	construction zone
D&D OU	Decontamination and Decommissioning Operable Unit
DCC	Document Control Center
DCN	Design Change Notice
DMC	Document Management Center
DMIP	data management implementation plan
DMSA	DOE Material Storage Area
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQO	data quality objective
EDD	electronic data deliverable
ELCR	excess lifetime cancer risk
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ES&H	Environment, Safety, and Health
EU	exposure unit
EZ	exclusion zone
FCN	Field Change Notice
FCR	Field Change Request
FFA	Federal Facility Agreement

FS	feasibility study
FSP	field sampling plan
FTM	Field Team Manager
GDP	gaseous diffusion plant
Ge	germanium
GIS	geographic information system
GPS	Global Positioning System
GWOU	Groundwater Operable Unit
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HF	hydrogen fluoride
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
HU	hydrostratigraphic unit
HVAC	heating, ventilation, and air conditioning
IDW	investigation-derived waste
ISMS	Integrated Safety Management System
ISOCS	*In Situ* Object Counting System
KAR	*Kentucky Administrative Record*
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
LBC	Little Bayou Creek
LCS	Laboratory Control Sample
LLW	low-level waste
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols
MARSSIM	Multi-Agency Radiological Survey and Site Investigation Manual
MDL	method detection limit
MEPAS	Multimedia Environmental Pollutant Assessment System Model
mrem	millirem
MS	matrix spike
MSD	matrix spike duplicate
MSDS	material safety data sheet
NA	not applicable
NCR	Nonconformance Report
ND	nondetect
NDA	non-destructive assay
NEPA	National Environmental Policy Act
NFA	No Further Action
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NSDD	North-South Diversion Ditch
OA	observational approach
OREIS	Oak Ridge Environmental Information System
ORPS	Occurrence Reportings System
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability

PCB	polychlorinated biphenyl
PEL	permissable exposure limit
PEMS	Project Environmental Measurements System
PGDP	Paducah Gaseous Diffusion Plant
pH	negative logarithm of the hydrogen-ion concentration
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
PRG	Preliminary Remediation Goal
PSS	Plant Shift Superintendent
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RADCON	radiation control
RAO	remedial action objective
RAR	Remedial Action Report
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RCW	recirculating water
RESRAD	Residual Radioactive Materials Model
RFD	Request for Disposal
RGA	Regional Gravel Aquifer
RGO	remedial goal option
RI	remedial investigation
ROD	Record of Decision
RTL	ready-to-load
RWP	Radiological Work Permit
SADA	Spatial Analysis and Decision Assistance
SAP	Sampling and Analysis Plan
SAR	SWMU Assessment Report
SE	Site Evaluation
SERA	screening-level ecological risk assessment
SESOIL	Seasonal Soil Compartment Model
S&H	safety and health
SHR	Safety & Health Representative
SI	site investigation
SMO	Sample Management Office
SMP	site management plan
SOP	standard operating procedure
SOU	Soils Operable Unit
SOW	statement of work
SRM	standard reference material
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWOU	Surface Water Operable Unit
SZ	support zone
TAL	target analyte list
TCA	trichloroethane
TCE	trichloroethene
TCL	target compound list

TCLP	Toxicity Characteristic Leaching Procedure
TLV	threshold limit value
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
UCRS	Upper Continental Recharge System
UF_4	uranium tetrafuoride
UF_6	uranium hexafluoride
USEC	United States Enrichment Corporation
USGS	U.S. Geological Survey
VOC	volatile organic compound
VSP	Visual Sampling Plan
WAC	waste acceptance criteria
WAG	Waste Area Group
WGP	Waste Generation Plan
WKWMA	West Kentucky Wildlife Management Area
WMC	Waste Management Coordinator
WMP	waste management plan
XRF	X-ray fluorescence

EXECUTIVE SUMMARY

The Paducah Gaseous Diffusion Plant (PGDP) is an active uranium enrichment facility that is owned by the U.S. Department of Energy (DOE). DOE is conducting environmental restoration activities at PGDP in accordance with the requirements of the Paducah Federal Facility Agreement (FFA), which coordinated the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup requirements. PGDP was placed on the National Priorities List in 1994. DOE, the U.S. Environmental Protection Agency (EPA), and the Commonwealth of Kentucky (Kentucky) entered into an FFA in 1998 (EPA 1998).

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan has been developed to outline the RI/FS requirements for the Soils Operable Unit (SOU) at PGDP. The solid waste management units (SWMUs) and Areas of Concern (AOCs) associated with the SOU are listed the Paducah Site Management Plan (SMP) (DOE 2008). The SWMUs/AOCs being investigated under this work plan are 1, 11, 12, 13, 14, 15, 16, 19, 20, 26, 27, 31, 32, 40, 47, 56, 57, 74, 75, 76, 77, 78, 79, 80, 81, 99, 135, 137, 138, 153, 154, 155, 156, 158, 160, 163, 165, 169, 170, 172, 176, 177, 180, 181, 194, 195, 196, 200, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 483, 488, 489, 493, 517, 518, 520, 531, and 561 and 3 AOCs 204, 492, and 541. Also included in this RI/FS Work Plan are a (PCB) Polychlorinated Biphenyl Evaluation and a Limited Area Radiological Survey.

PROJECT OBJECTIVES AND GOALS

The goals for the SOU RI/FS are consistent with those established in the Paducah FFA and the SMP (DOE 2008) negotiated among DOE, EPA, and Kentucky. The primary objectives for the SOU presented in the SMP are to protect human health and the environment by taking actions necessary to prevent both on-site and off-site human exposure that presents an unacceptable risk and implement actions that provide the greatest opportunities to achieve significant risk reduction before site closure.

The goals of this RI/FS are as follows:

- Goal 1: Characterize Nature of Source Zone—characterize the nature of contaminant source materials using existing data and, if required, by collecting additional data;

- Goal 2: Define Extent of Source Zone and Contamination in Soil—define the extent (vertical and lateral), and magnitude of contamination in soils and perform a multimedia evaluation to ensure that all exposure pathways for the subject units are assessed adequately to support cleanup decisions;

- Goal 3: Determine Soil Transport Mechanisms and Pathways—gather existing data and, if necessary, collect additional data to analyze contaminant transport mechanisms;

- Goal 4: Complete a baseline human health risk assessment and screening ecological risk assessment for the SOU; and

- Goal 5: Complete an Evaluation of Remedial Alternatives—determine if the existing data are sufficient to evaluate alternatives that will reduce risk to human health and the environment and, if possible, support a No Further Action (NFA).[1]

This document utilizes a compilation of sampling information collected on and around PGDP over the course of the last 20 years. The table below identifies the previously completed reports and/or investigations primarily used to prepare this document.

Summary of Historical Information

Year	Title	SWMUs/AOCs
1989	Inventory of Polychlorinated Biphenyls (PCBs) Volume 1 (MMES 1989)	75, 78
1991	Results of the Site Investigation, Phase I (CH2M HILL 1991)	1, 11, 12, 14, 15, 16, 20, 26, 27, 31, 32, 56, 57, 74, 75, 77, 78, 79, 80, 81, 99, 135, 137
1992	Groundwater Phase III Investigation (Clausen, et al. 1992)	99
1992	Results of the Site Investigation, Phase II (CH2M HILL 1992)	1, 11, 12, 13, 14, 15, 16, 19, 20, 26, 27, 31, 32, 40, 47, 56, 57, 74, 75, 77, 78, 79, 80, 81, 99, 135, 137
1993	Interim Corrective Measure Work Plan for Containment of Scrap Yard Sediment Runoff (DOE 1993)	12, 14, 15
1994	RFI Work Plan for Waste Area Group 13 at the Paducah Gaseous Diffusion Plant (DOE 1994a)	138
1994	Interim Corrective Measures Report & Operation and Maintenance Plan for Containment of Scrap Yard Sediment Runoff at the PGDP (DOE 1994b)	12, 13, 14, 15, 16
1994	Waste Area Group 13 and 6 Reprioritization and Special Requests (KDEP 1994)	138
1995	C-400 Process and Structure Review (DOE 1995a)	11, 26, 40, 47
1995	Final Site Evaluation Report for the Outfall 010, 011, and 012 Areas, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 1995b)	204
1995	Northeast Plume Preliminary Characterization Summary Report (DOE 1995c)	99, 194
1995	Treatability Study Report for Waste Area Group 23 PCB Sites at PGDP (DOE 1995d)	32, 56, 57, 74, 79, 80, 81
995	Work Plan for Phase I of the Waste Area Group 6 Remedial Investigation Industrial Hydrogeologic Study at Paducah Gaseous Diffusion Plant (DOE 1995e)	11, 26, 40, 47
1996	Feasibility Study for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant (DOE 1996a)	1, 32, 56, 57, 80, 81

[1] A portion of the SWMUs/AOCs investigated under this scoping process may not qualify as NFAs per CERCLA and may require additional characterization/remediation under the final Comprehensive Site Operable Unit (CSOU).

Year	Title	SWMUs/AOCs
1996	Phase I: Paducah Gaseous Diffusion Plant Waste Area Group 6 Industrial Hydrogeologic Study (DOE 1996b)	11, 26, 40, 47
1997	Action Memorandum for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27, PCB Sites, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 1997a)	1, 32, 56, 57, 74, 79, 80, 81
1997	Integrated Remedial Investigation/Feasibility Study Work Plan for Waste Area Group 6 (DOE 1997b)	11, 26, 40, 47
1997	Proposed Remedial Action Plan for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27, PCB Sites (DOE 1997c)	1, 56, 57, 80, 81
1997	Treatability Study Program Plan for Waste Area Group 6 at the Paducah Gaseous Diffusion Plant (DOE 1997d)	11, 26, 40, 47
1997	Sampling and Analysis Plan for the Site Evaluation of Waste Area Group 9 and 11 at the Paducah Gaseous Diffusion Plant (DOE 1997e)	19, 20, 27, 165, 170
1997	Information Package for Waste Area Grouping 16 & 19 at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky (DOE 1997f)	137, 153, 155, 156, 135, 154, 160, 163
1998	Work Plan for Waste Area Group 28 Remedial Investigation/Feasibility Study and Waste Area Group 8 Preliminary Assessment/Site Investigation at the Paducah Gaseous Diffusion Plant (DOE 1998a)	99, 194, 194
1998	Integrated Remedial Investigation/Feasibility Study Work Plan for Waste Area Group 27 at Paducah Gaseous Diffusion Plant (DOE 1998b)	1, 74, 196, 211
1998	Proposed Remedial Action Plan for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27, PCB Sites (DOE 1998c)	1, 74, 196, 211
1998	Sampling and Analysis, Quality Assurance, and Data Management Plan for the Site Evaluation of Waste Area Groupings 16 and 19 (DOE 1998d)	137, 153, 155, 156, 135, 154, 160, 163
1999	Remedial Investigation Report for Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 1999a)	1, 74, 196, 211
1999	Remedial Investigation Report for Waste Area Group 6 (C-400) at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 1999b)	11, 26, 40, 47
1999	WAGs 9 and 11 Site Evaluation Report at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 1999c)	19, 20, 27, 165, 170
1999	Engineering Evaluation/Cost Analysis (EE/CA) for Scrap Metal Removal at PGDP (DOE 1999d)	13, 14, 15, 16, 518, 520
1999	Engineering Evaluation/Cost Analysis for Drum Mountain at PGDP (DOE 1999e)	12
1999	Proposed Remedial Action Plan for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27, PCB Sites (DOE 1999f)	1, 74, 196, 211
1999	Remedial Investigation/Feasibility Study Work Plan for the Surface Water Operable Unit at PGDP (DOE 1999g)	1, 74, 165
1999	Residual Risk Evaluation Report for Waste Area Group 23 and Solid Waste Management Unit 1 of Waste Area Group 27, PCB Sites (DOE 1999h)	1, 74, 196, 211

Year	Title	SWMUs/AOCs
1999	Surfactant Enhanced Subsurface Remediation Treatability Study Report for the WAG 6 (DOE 1999i)	11, 26, 40, 47
2000	Action Memorandum for Drum Mountain at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 2000a)	12
2000	Remedial Investigation Report for Waste Area Group 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 2000b)	99, 194, 204
2000	Removal Action Work Plan for Drum Mountain at the PGDP (DOE 2000c)	12
2001	Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant (DOE 2001a)	12, 13, 14, 15, 16
2001	Baseline Human Health Risk Assessment and Screening Ecological Risk Assessment for the Proposed Site of the UF_6 Conversion Facility, Including the Eastern Portion of SWMU 194, McGraw Construction Facilities (South Side), at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 2001b)	194
2001	DUF_6 Conversion Facility Site Characterization Report, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (BJC 2001)	194
2002	Final Inventory/Characterization Report for the OS-02 (DOE 2002), OS-03 (DOE 2002), OS-04 (DOE 2002), OS-05 (DOE 2002), OS-06 (DOE 2004), OS-07 (DOE 2004), OS-09 (DOE 2002), OS-10 (DOE 2002), OS-11 (DOE 2002), OS-12 (DOE 2004), OS-13 (DOE 2002), OS-14 (DOE 2001), OS-15 (DOE 2004), OS-16 (DOE 2004), OS-17 (DOE 2004), OS-18 (DOE 2003) Department of Energy Material Storage Area at the Paducah Gaseous Diffusion Plant	213, 214, 215, 216, 217, 218, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229
2007	Engineering Evaluation/Cost Analysis for Soils Operable Unit Inactive Facilities at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky (DOE 2007b)	19, 40, 181

During development of this work plan, existing data were evaluated relative to the data quality objectives defined in this work plan. The evaluation shows what data gaps exist for each SWMU/AOC. The SWMUs/AOCs were divided into seven groups to assist in sampling plan development. These groups are Former Facility Site, PCBs, Soil/Rubble Pile, Scrap Yard, Underground/Tank, Storage Area, and Chromium Areas.

1. INTRODUCTION

The Paducah Gaseous Diffusion Plant (PGDP), located within the Jackson Purchase region of western Kentucky, is an active uranium enrichment complex that is owned by the U.S. Department of Energy (DOE). PGDP was owned and managed, first by the Atomic Energy Commission and the Energy Research and Development Administration, DOE's predecessors; DOE then managed PGDP until 1993. On July 1, 1993, the United States Enrichment Corporation assumed management and operation of the PGDP enrichment complex under a lease agreement with DOE. DOE, however, still owns the enrichment complex and is responsible for environmental restoration (ER) activities associated with legacy operation of PGDP (CERCLIS #KY8-890-008-982). DOE is the lead agency for remedial actions, and the U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) have regulatory oversight responsibilities.

In 1988, off-site groundwater contamination was detected in groundwater wells north of PGDP. Consequently, DOE and EPA Region 4 entered into an Administrative Consent Order (ACO) under Section 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1994, PGDP was placed on the National Priorities List (NPL), a list of sites designated by EPA as having the highest priority for site remediation. Additionally, Section 120 of CERCLA requires NPL sites to enter into a Federal Facility Agreement (FFA). An FFA was finalized among DOE, EPA, and the Commonwealth of Kentucky (Kentucky) in 1998.

Source units and areas of contamination at PGDP have been combined into operable units (OUs) for evaluation of remedial actions. These OUs include the Surface Water Operable Unit (SWOU), the Burial Grounds Operable Unit (BGOU), the Soils Operable Unit (SOU), the Groundwater Operable Unit (GWOU), and the Decontamination and Decommissioning Operable Unit (D&D OU). Each OU is designed to remediate contaminated media associated with PGDP. After completion of these activities, the Comprehensive Site OU (CSOU) evaluation will be conducted, with implementation of additional actions, as needed, to ensure long-term protectiveness.

For the SOU, a phased approach is used to meet the primary objectives. A phased approach is used because the complex soil contamination problems at the site (i.e., ongoing operational activities, multiple sources of contamination, and the potential for a complicated contaminant fate and transport process) prevent PGDP from implementing one comprehensive, cost-effective remedy at this time. Additionally, the phased approach allows the site to use information gained in earlier phases of the cleanup to refine and implement subsequent cleanup objectives and actions in support of final cleanup status. Slabs, subsurface structures, and underlying soils left after completing D&D of the operating gaseous diffusion plant (GDP), will be addressed in subsequent actions.

The following steps, illustrated in Figure 1.1, are being used at PGDP to implement the phased approach for the SOU [adapted from the Site Management Plan (SMP) (DOE 2008)]:

(1) Prevent human exposure to contamination presenting an unacceptable risk (short-term protection goal);

(2) Prevent or minimize further off-site migration (intermediate performance goals); and

(3) Reduce, control, or minimize contaminated soil hot spots contributing to off-site contamination (intermediate performance goals).

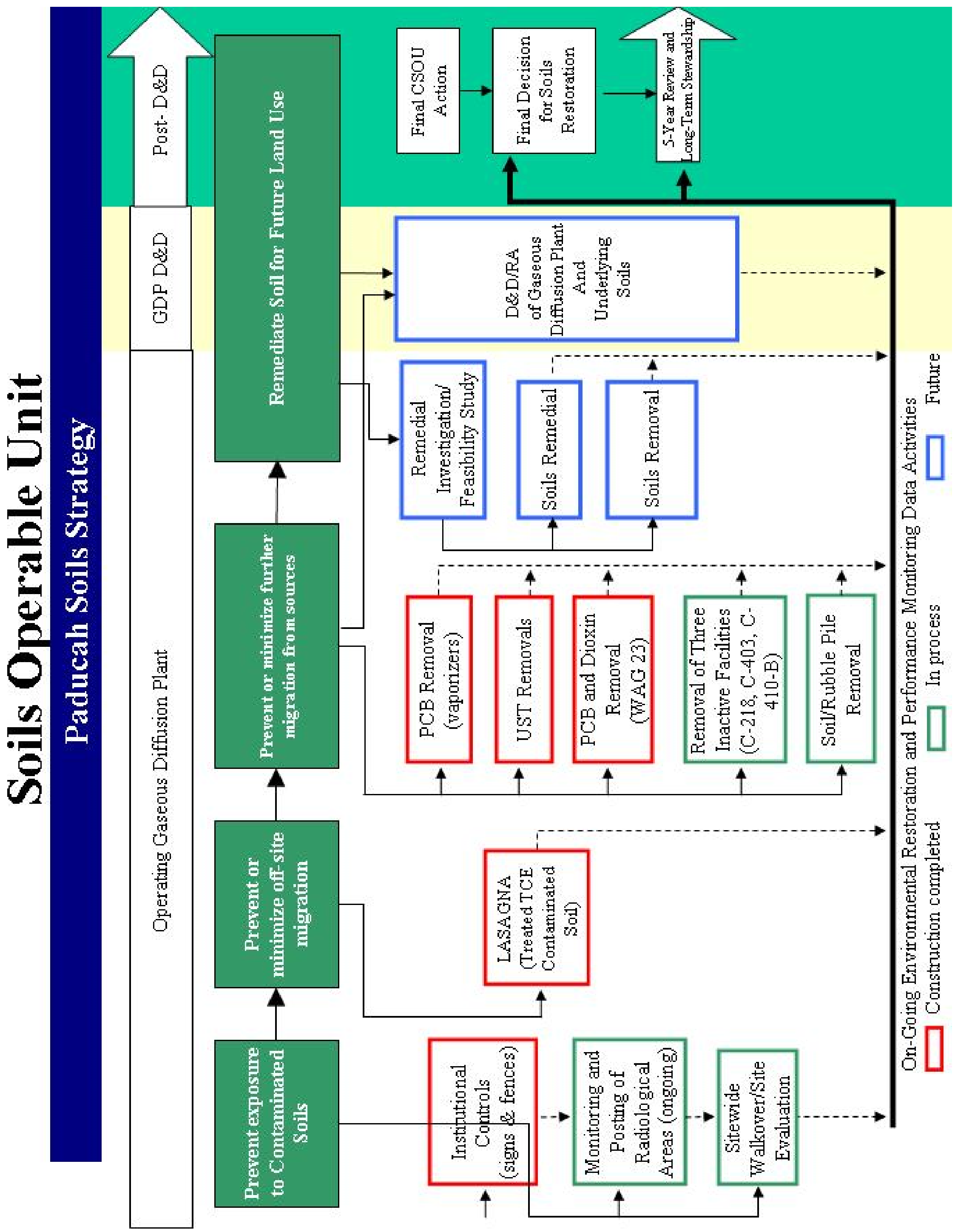

Figure 1.1. SOU Paducah Soils Strategy

Data collected during the Remedial Investigation/Feasibility Study (RI/FS) may be incorporated into the GWOU and SWOU and used in development of complex-wide models, as appropriate. Incorporation of these data will allow the significant sources of groundwater contamination to be considered in the human health risk assessment of the GWOU. For surface water, data collected during the RI/FS concerning contaminant migration to the surface water may be used along with the complex-wide surface water transport models developed for the human health and ecological risk assessments of the SWOU.

1.1 PROJECT SCOPE

The general scope of this work plan is to conduct an RI, baseline human health risk assessment (BHHRA), screening ecological risk assessment (SERA), evaluation of remedial alternatives, and remedy selection for solid waste management units (SWMUs)/areas of concern (AOCs) associated with the Soils OU. Also included in the scope of this work plan are a Polychlorinated Biphenyl (PCB) Evaluation and a Limited Area Radiological Evaluation. The primary focus of the SOU RI/FS will be to (1) collect field and analytical data necessary to determine the nature and extent of known PCB-contaminated soil, limited area radiological evaluation, and any soil contamination at SOU SWMUs/AOCs; (2) support the completion of a BHHRA; (3) and evaluate appropriate remedial alternatives for each targeted area.

This RI/FS Work Plan has been prepared to implement additional investigations for the SOU and to provide information to fill data gaps. The RI/FS Work Plan follows the outline prescribed in the FFA. The document utilizes a compilation of sampling information collected at, and around, PGDP over the course of the last 20 years. Data were compiled and screened against significant chemicals of potential concern (COPC) listed in the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* Volume *1: Human Health* (DOE 2001c).

The RI/FS process is an interactive one in which DOE, EPA, and Kentucky evaluate and conduct or revise work conducted during various stages of the investigation. To facilitate implementation of the RI/FS work plan, flexibility will be included in the sampling plans for each SWMU/AOC to allow some adjustments to be made in the field.

1.1.1 SOU SWMU/AOC Evaluation

The scope includes an RI, BHHRA, SERA, evaluation of remedial alternatives, remedy selection, and implementation of actions (i.e., early removal, radiological postings), as necessary, for protection of human health and the environment for the following SWMUs/AOCs.

No.	SWMU/AOC #	Location	Description	Work Plan Group
1	1	C-747-C	Oil Landfarm	Former Facility Site
2	11	C-400	C-400 Trichloroethylene Leak Site	Underground/Tank
3	12	C-747-A	UF_4 Drum Yard	Scrap Yard
4	13	C-746-P	Clean Scrap Yards	Scrap Yard
5	14	C-746-E	Contaminated Scrap Yard	Scrap Yard
6	15	C-746-C	Scrap Yard	Scrap Yard

No.	SWMU/AOC #	Location	Description	Work Plan Group
7	16	C-746-D	Scrap Yard	Scrap Yard
8	19	C-410-B	HF Neutralization Lagoon	Soil/Rubble Pile
9	20	C-410-E	Emergency Holding Pond	Soil/Rubble Pile
10	26	C-400 to C-404	Underground Transfer Line	Underground/Tank
11	27	C-722	Acid Neutralization Tank	Underground/Tank
12	31	C-720	Compressor Pit Water Storage Tank	Underground/Tank
13	32	C-720	Clean Waste Oil Tanks	Underground/Tank
14	40	C-403	Neutralization Tank	Underground/Tank
15	47	C-400	Technetium Storage Tank Area	Storage Area
16	56	C-540-A	PCB Staging Area	PCBs
17	57	C-541-A	PCB Waste Staging Area	PCBs
18	74	C-340	PCB Transformer Spill Site	PCBs
19	75	C-633	PCB Spill Site	PCBs
20	76	C-632-B	Sulfuric Acid Storage Tank	Underground/Tank
21	77	C-634-B	Sulfuric Acid Storage Tank	Underground/Tank
22	78	C-420	PCB Spill Site	PCBs
23	79	C-611	PCB Spill Site	PCBs
24	80	C-540	PCB Spill Site	PCBs
25	81	C-541	PCB Spill Site	PCBs
26	99	C-745	Kellogg Bldg. Site	Former Facility Site
27	135	C-333	PCB Soil Contamination	PCBs
28	137	C-746-A	Inactive PCB Area	PCBs
29	138	C-100	Southside Berm	Soil/Rubble Pile
30	153	C-331	PCB Soil Contamination (West)	PCBs
31	154	C-331	PCB Soil Contamination (Southeast)	PCBs
32	155	C-333	PCB Soil Contamination (West)	PCBs
33	156	C-310	PCB Soil Contamination (West Side)	PCBs
34	158	C-720	Chilled Water System Leak Site	Chromium Areas
35	160	C-745	Cylinder Yard Spoils (PCB soils)	PCBs
36	163	C-304	Bldg./HVAC Piping System (Soil Backfill)	PCBs
37	165	C-616-L	Pipeline & Vault Soil Contamination	Underground/Tank
38	169	C-410-E	HF Vent Surge Protection Tank	Chromium Area
39	170	C-729	Acetylene Bldg. Drain Pits	Underground/Tank
40	172	C-726	Sandblasting Facility	Former Facility Site
41	176	C-331	RCW Leak Northwest Side	Chromium Areas
42	177	C-331	Leak East Side	Chromium Areas
43	180	WKWMA	Outdoor Firing Range (WKWMA)	Soil/Rubble Pile
44	181	West Side	Outdoor Firing Range (PGDP)	Soil/Rubble Pile
45	194	DUF Facility	McGraw Construction Facilities (Southside)	Former Facility
46	195	SW PGDP	Curlee Road Contaminated Soil Mounds	Soil/Rubble Pile
47	196	C-746-A	Septic System	Former Facility
48	200	Central PGDP	Soil Contamination South of TSCA Waste Storage Facility	Storage Area
49	204	Dyke Road	Dyke Road Historical Staging Area	Soil/Rubble Pile
50	211	C-720	TCE Spill Site Northwest	Former Facility
51	212	C-745-A	Radiological Contamination Area	Storage Area

No.	SWMU/AOC #	Location	Description	Work Plan Group
52	213	C-745-A	OS-02	Storage Area
53	214	C-611	OS-03	Storage Area
54	215	C-743	OS-04	Storage Area
55	216	C-206	OS-05	Storage Area
56	217	C-740	OS-06	Storage Area
57	218	C-741	OS-07	Storage Area
58	219	C-728	OS-08	PCBs
59	220	C-409	OS-09	Storage Area
60	221	C-635	OS-10	Storage Area
61	222	C-410	OS-11	Storage Area
62	223	C-301	OS-12	Storage Area
63	224	C-340	OS-13	Storage Area
64	225	C-533-1	OS-14	Storage Area
65	226	C-745-B	OS-15	Storage Area
66	227	C-746-B	OS-16	Storage Area
67	228	C-747-B	OS-17	Storage Area
68	229	C-746-F	OS-18	Storage Area
69	483	C-603	Nitrogen Generating Facilities,	Former Facility
70	488	C-410 Trailers	PCB Contamination Area by C-410 Trailer Complex	PCBs
71	489	C-710 North	Septic Tank, North of C-710	Former Facility
72	492	Outfall 011	Contaminated Soil Area, North of Outfall 10	Soil/Rubble Pile
73	493	Outfall 001	Concrete Rubble Piles Near Outfall 001	Soil/Rubble Pile
74	517	West of PGDP	Rubble and Debris Erosion Control Fill Area	Soil/Rubble Pile
75	518	C-746-P1	Field south of C-746- P1 Clean Scrap Yard	Scrap Yard
76	520	C-746-A	Scrap Material West of C-746-A	Scrap Yard
77	531	C-746-A south	Aluminum Slag Reacting Area	Former Facility
78	541	Outfall 011	Contaminated area by Outfall 011	Soil/Rubble Pile
79	561	Near Outfall 2	Soil Pile I	Soil/Rubble Pile

Figure 1.2 shows the location of these SWMUs/AOCs. Project uncertainties that potentially could affect the scope and schedule include the amount and scope of RI characterization needed (e.g., field samples, test pits, borings, etc.) and whether additional actions beyond remediation will be required. The SMP includes a planning date for a D1 Record of Decision (ROD) of the Third quarter, 2012 (DOE 2008).

For all source units, the focus of the investigation will be surface area soil contamination to a depth of 4 ft below ground surface (bgs). If contamination at the 4 ft bgs is found, then secondary sources from the unit located in the subsurface soil, which extend to a depth of 10 ft bgs or 16 ft bgs at infrastructure (e.g., pipelines), will be investigated. Any contamination that is found to extend past the depths specified in this investigation will be addressed under another OU.

If interim remedial or removal actions are implemented at any of the SWMUs/AOCs addressed in this work plan before the development of a final remedy, they will be consistent with the anticipated final action for the SOU and will contribute to the final remediation of the site. Remedial alternatives will be screened at the time the remedial action objectives (RAOs) for the SOU are developed.

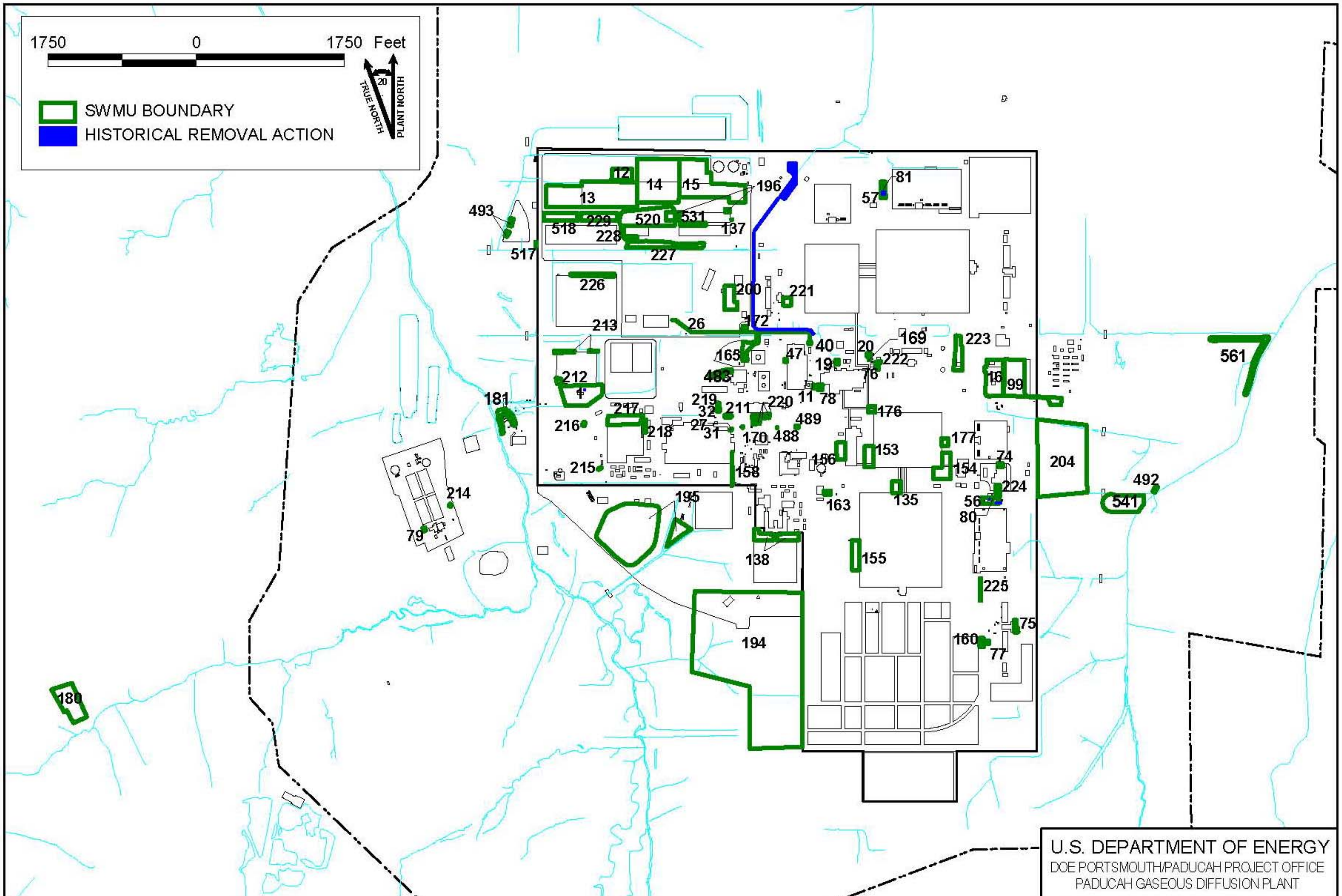

Figure 1.2 Location of SWMUs/AOCs

Figure No. \SoilsOU\SOU_SWMUsR2.apr
DATE 09-18-08

1.1.2 PCB Evaluation

The PCB-contaminated soils evaluation will focus on known sources of PCB contamination (e.g., transformers and drainages from switchyards) that have not already been targeted as part of previous investigations. The evaluation will include the sampling and analysis of PCBs to a depth of 1 ft. There are 86 identified previous PCB transformer locations on-site and 6,192 linear ft of ditches that capture runoff from switchyards. Figures 1.3a and 1.3b show the locations of switchyard ditches that will be investigated. It should be noted that the ditches on the north, south, and east sides of C-531-2 switchyard were evaluated as part of the SWOU (On-Site) assessment and will be addressed as part of the SWOU Remedial Investigation (Off-Site).

Investigations have shown that of the list of 86 PCB transformers the following is found:

- C-420 had two listed that were replaced with non-PCB transformers. This site is listed as SWMU 78.
- C-633 is listed as SWMU 75.
- 70 of these were located inside building C-337, which is an active facility. Currently, 66 PCB transformers still are in operation inside this facility.
- There are four that were located at C-537 and C-535 that were replaced with non-PCB transformers. These locations are currently switchyards and operational.
- The remaining 9 PCB transformers (2 at C-746-A, 1 at C-410, 2 at C-409, 4 at C-340) were located on concrete pads. C-410 had curbing around the concrete pad.

Based on these findings, the PCB transformer locations found at C-420 and C-633 will be investigated as part of this SOU RI. Slabs and underlying soils associated with facilities that have undergone D&D will be addressed as part of a subsequent action (e.g., additional soils OU project).

1.1.3 Limited Area Radiological Evaluation

The limited area radiological evaluation will consist of a radiological walkover utilizing field instruments capable of detecting contamination to a depth of 1 ft. The evaluation assumes survey of approximately 200 acres of plant area (inside the fence) and will take place in two phases. Phase I includes radiological walkover surveys using a sodium iodide detector and Global Positioning System (GPS) unit to identify hot spots. Phase II includes fixed point *In Situ* Object Counting System (ISOCS) measurements based on Phase I data. Phase II will involve segmenting the 200 acres into 5,000 m^2 survey units each. There are 162 survey units within the 200 acres. The area included in the scope for this work plan consists of grassy or dirt areas that do not have roads, gravel pads, buildings, or other infrastructure and has not been addressed under other investigations (i.e., Surface Water On-Site Investigation). Slabs and underlying soils associated with facilities that have undergone D&D will be addressed as part of a subsequent action (e.g., additional soils OU project).

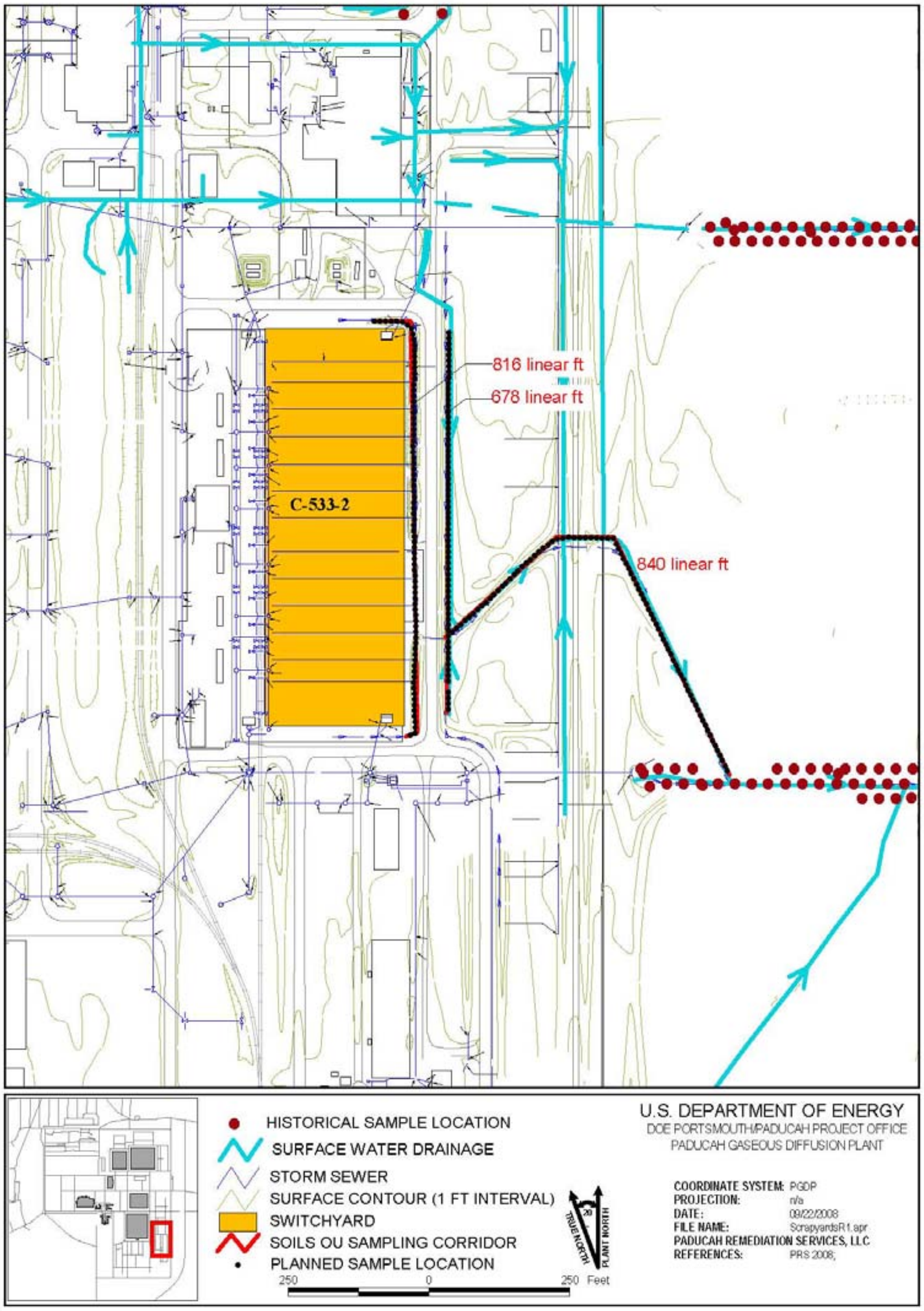

Figure 1.3a. Switchyard Ditches C-533-2

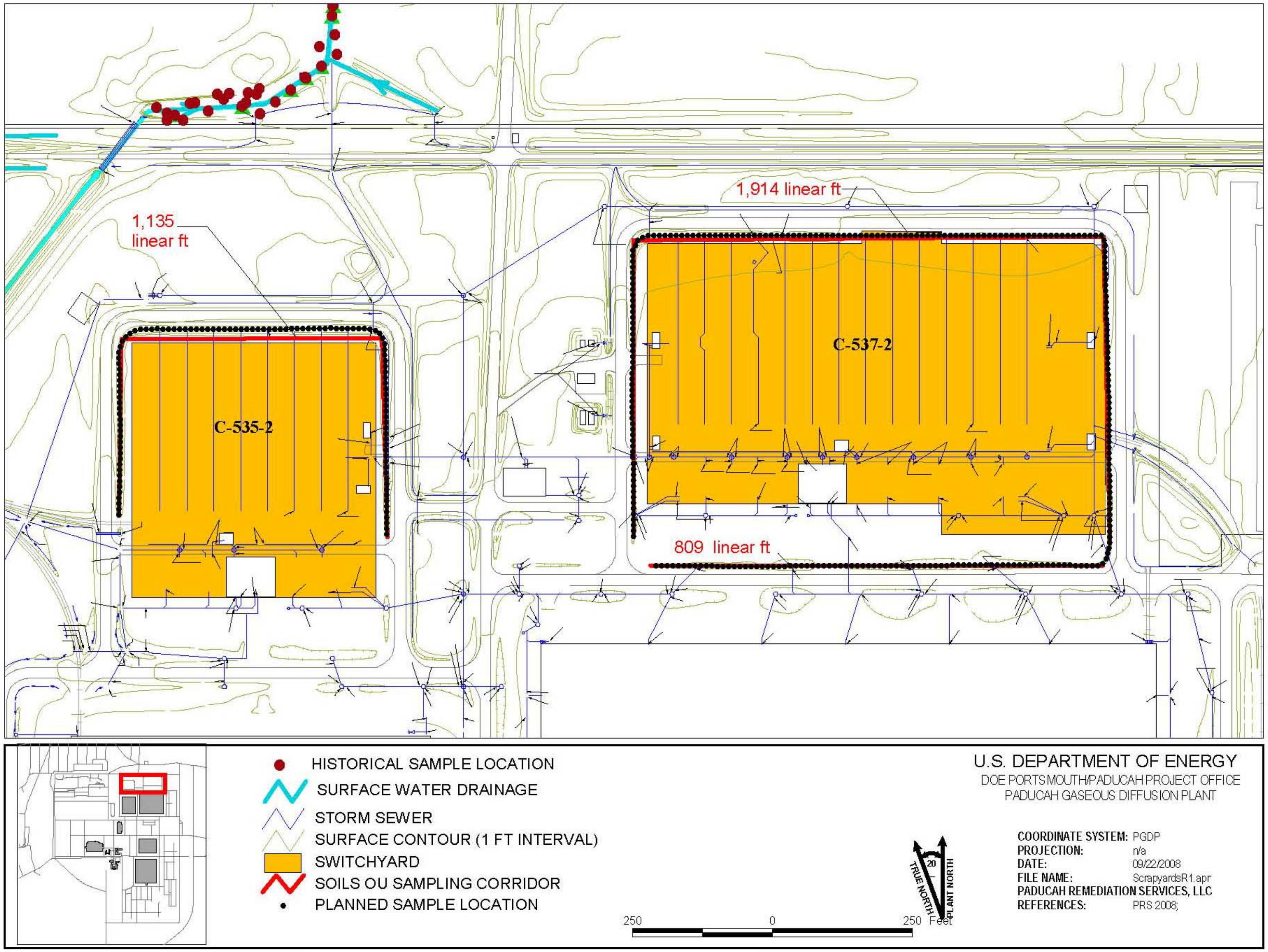

Figure 1.3b. Switchyard Ditches C-535 and C-537

1.2 PROJECT OBJECTIVES AND GOALS

The goals for the SOU RI/FS are consistent with those established in the Paducah Site FFA and the Paducah SMP (DOE 2008) negotiated among DOE, EPA, and Kentucky. The FFA requires that DOE identify, investigate, and remediate all AOC and SWMUs that potentially could pose a threat to human health and the environment. The goals of this RI/FS are as follows:

- Goal 1: Characterize Nature of Source Zone—characterize the nature of contaminant source materials using existing data, and if required, by collecting additional data;

- Goal 2: Define Extent of Source Zone and Contamination in Soil—define the extent (vertical and lateral), and magnitude of contamination in soils and perform a multimedia evaluation (e.g., groundwater, surface water) to ensure that all exposure pathways for the subject units are assessed adequately to support cleanup decisions;

- Goal 3: Determine Soil Transport Mechanisms and Pathways—gather existing data, and if necessary, collect additional data to analyze contaminant transport mechanisms and support a feasibility study;

- Goal 4: Complete a BHHRA and SERA for the SOU; and

- Goal 5: Complete an Evaluation of Remedial Alternatives—determine if the existing data are sufficient to evaluate alternatives that will reduce risk to human health and the environment; and if possible, support a No Further Action (NFA).

1.3 PROJECT DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is a planning tool, based on the scientific method, that identifies an environmental problem and defines the data collection process needed to support decisions regarding that problem [Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4 (2006)]. The steps outlined in the DQO process have been used in the development of the RI/FS work plan. These steps formulate a set of criteria that will achieve the desired control of uncertainty, allowing the decision to be made with acceptable confidence.

The first step in the DQO process is to identify the problem to be resolved. It is possible that contaminants originating from the SWMUs/AOCs have been released to the environment. The overall problem statement developed for the DQO process is as follows:

Past releases from the PGDP may have resulted in the contamination of soil found at the SWMUs and AOCs. The nature and extent of contamination has not been adequately defined, nor is it known whether these potential contaminants pose unacceptable risks to current and reasonably anticipated future receptors under some exposure scenarios.

Figure 1.4 shows the DQO process chart. In order to facilitate discussion, the seven steps of the DQO process have been initiated, in accordance with the above-referenced guidance (EPA 2006), and a set of decision rules and questions to be answered to complete the DQO process are provided in Table 1.1. As part of the process, meetings have taken place with DOE, EPA, and Kentucky to review and discuss the scoping document, these discussions included Table 1.1 in this document. Table 1.1 states the goals and outlines the decision rules, evaluation methods, and data needs that will determine the final action undertaken at the SOU SWMUs/AOCs.

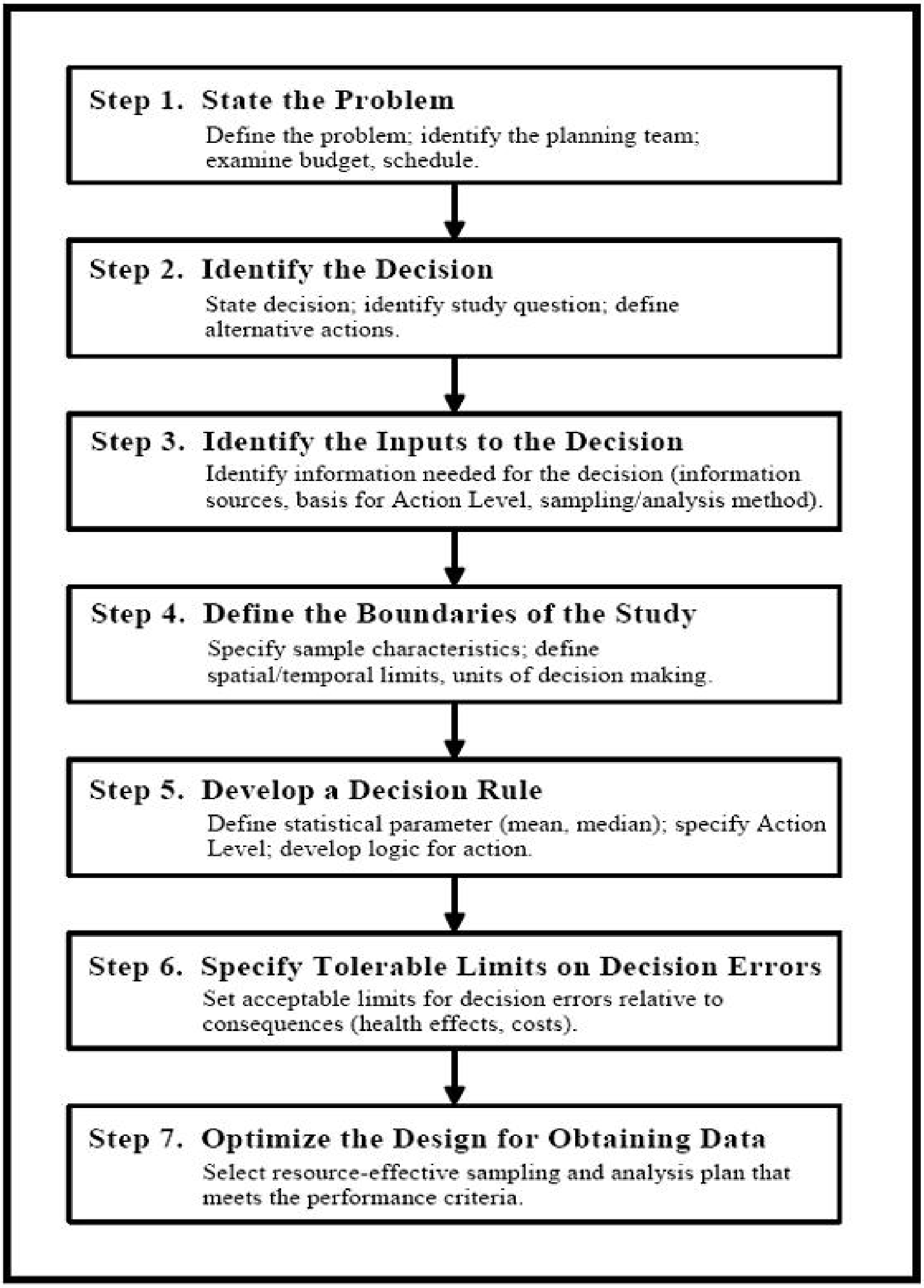

Figure 1.4. DQO Process

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU

GOAL 1: CHARACTERIZE NATURE AND EXTENT OF SOURCE ZONE AND CONTAMINATION IN SOIL

Decisions and questions

1-1: What are the suspected contaminants?

1-2: What are the plant processes that could have contributed to the contamination? When and over what duration did releases occur?

1-3: What are the concentrations and activities at the source?

1-4: What is the area and volume of the source zone? What is the vertical and lateral extent of contamination?

1-5: What are the chemical and physical properties of associated material at the source areas?

1-6: What are the past, current, and potential future migratory paths?

Decision rule	Evaluation method	Data needs
D1a: If the concentration of analytes found in the source zone could result in a cumulative excess lifetime cancer risk (ELCR) greater than 1 x 10^{-6} or a cumulative Hazard Index (HI) greater than 1 through contact with contaminated media, **or** if the concentration of analytes in the source zone could result in detrimental impacts to nonhuman receptors through contact with contaminated media as indicated by exceeding ecological screening criteria, **and** if the concentrations of analytes in the source zone are greater than those expected to occur naturally in the environment, then evaluate actions that will mitigate risk; otherwise pursue a "no further action" decision (see D1b and D1c).	Screening Quantitative comparisons by medium between maximum detected concentrations of analytes in the source zone and preliminary remediation goals (PRGs) (industrial worker scenario inside secure area and teen recreator scenario outside secure area) and background concentrations Quantitative comparison by medium between maximum detected concentrations of analytes and nonhuman receptor benchmarks Baseline Completion of baseline human health risk (BHHRA) and screening ecological risk assessments (SERA)	Results of previous investigations and reports to target sampling locations and analytical requirements Sampling data from each medium and subsurface characterization information including stratigraphy Site use and activity history Procedures and methods for human health and ecological risk assessments of source units

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU (Continued)

Decision rule	Evaluation method	Data needs
D1b: If concentrations of analytes found in the source zone exceed applicable or relevant and appropriate requirements (ARARs), then evaluate actions that will bring contamination within the source zone into compliance with ARARs; seek an ARAR waiver; or propose/obtain alternative standards.	Quantitative comparison by medium between analyte concentrations and ARARs	Results of previous investigations and reports to target sampling locations and analytical requirements Sampling data from each medium Site use and activity history List of chemical-specific ARARs Procedures and methods for performing comparisons
D1c: If contaminants found at the site are known to transform or degrade into chemicals that could lead to increased risks to human health or the environment or into chemicals for which there are ARARs, **and** if the concentrations of these contaminants could result in risks greater than those defined in D1a or concentrations greater than ARARs, then evaluate actions that will mitigate potential future risk or obtain compliance with ARARs; seek an ARAR waiver in accordance with EPA guidance; or propose/obtain alternative standards.	Completion of a BHHRA and SERA that considers transformation and degradation of contaminants found in the source zone Quantitative comparison by medium between analyte concentrations and ARARs	Results of previous investigations and reports to target sampling locations and analytical requirements Sampling data from each medium Site use and activity history Analyte degradation or transformation paths List of chemical-specific ARARs Geochemical and biological parameters that could affect chemical degradation and transformation Procedures and methods for human health and ecological risk assessments and comparison with ARARs

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU (Continued)

GOAL 2: DETERMINE SURFACE AND SUBSURFACE TRANSPORT MECHANISMS AND PATHWAYS

Decisions and questions

2-1: What are the contaminant migration trends?

2-2: What are the effects of underground pipelines and plant operations on migration pathways including ditches?

2-3: What are the physical and chemical properties of the formations and subsurface matrices?

Decision rule	Evaluation method	Data needs
D2a: If contaminants are found in the source zone, **and** if these contaminants are found to be migrating from the source zone at concentrations that result in a cumulative ELCR greater than 1 x 10^{-6} or a cumulative HI greater than 1 through use of contaminated media at downgradient points of exposure, **and** the concentrations of analytes are greater than those expected to occur naturally in the environment, then evaluate actions that will mitigate risk; otherwise do not consider risk posed by migratory pathways when evaluating remedial alternatives for the unit (see D3b).	<u>Screening</u> Quantitative comparisons by medium between modeled contaminant concentrations and PRGs (industrial worker scenario inside secure area and teen recreator scenario outside secure area) and background concentrations <u>Baseline</u> Completion of a BHHRA for exposure points located away from the unit to which contaminants may migrate	Results of analyses performed under D1a Procedures and methods for human health and ecological risk assessment of source units Current and expected land-use patterns Results of models [e.g., Multimedia Environmental Pollutant Assessment System (MEPAS), Residual Radioactive Materials (RESRAD), Seasonal Soil Compartment Model (SESOIL)] that can predict future soil contaminant concentrations at exposure points Modeling parameters including chemical parameters, mineralogy, reduction-oxidation potential, porosity, and stratigraphy

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU (Continued)

Decision rule	Evaluation method	Data needs
D2b: If contaminants are found in the source zone and if these contaminants are found to be migrating from the source zone at concentrations that exceed ARARs, then evaluate actions that will bring migratory concentrations into compliance with ARARs; waive ARARs or obtain alternate standards; otherwise, do not consider ARARs when examining migratory pathways during the evaluation of remedial actions (see D3a).	Quantitative comparison by medium between modeled analyte concentrations at downgradient exposure points and ARARs	Results of analyses performed under D1b List of chemical-specific ARARs Current and expected land-use patterns Results of models (e.g., MEPAS, RESRAD, SESOIL) that can predict future soil contaminant concentrations at exposure points (Geochemical equilibrium will be addressed in the RI report.) Modeling parameters including chemical parameters, mineralogy, reduction-oxidation potential, porosity, and stratigraphy

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU (Continued)

GOAL 3: COMPLETE A BASELINE RISK ASSESSMENT FOR THE SOU

Decisions and questions

3-1: Where do the contaminant concentrations exceed no action levels?

3-2: Are isolated areas of contamination present or is contamination general?

3-3: What are the contaminates of concern (COCs) that define the contamination?

3-4: What are the no action levels?

3-5: Are SWMUs/AOCs within the SOU similar enough to be addressed in the same manner?

Decision rule	Evaluation method	Data needs
D3a: Determine if isolated contamination exists or if contamination is general; if isolated contamination exists, determine its extent. Use this information to determine where action is required and where no further action is necessary.	Quantitative comparisons by medium between maximum detected concentrations of analytes in the source zone and PRGs (industrial worker scenario inside secure area and teen recreator scenario outside secure area) and background concentrations	Historical data Proposed no action levels
	Quantitative comparison by medium between maximum detected concentrations of analytes and nonhuman receptor benchmarks	Analytical levels Resource levels
	Quantitative comparison by medium between analyte concentrations and ARARs	

Table 1.1. Decision Rules, Evaluation Methods, and Data Needs for SOU (Continued)

GOAL 4: COMPLETE EVALUATION OF REMEDIAL ALTERNATIVES

Decisions and questions

4-1: What are the possible remedial technologies applicable for this unit?
4-2: What are the physical and chemical properties of media to be remediated?
4-3: Are cultural impediments present?
4-4: What is the extent of contamination (geologic limitations presented by the source zone)?
4-5: What would be the impact of action on and by other sources?
4-6: What would the impact of an action at the source be on the integrator units?
4-7: What are stakeholders' perceptions of contamination at or migrating from source zone?

Decision rule	Evaluation method	Data needs
D4a: If Decision D1a, D1b, D1c, D2a, or D2b indicates that response actions are needed, then evaluate response actions to attain ARARs and mitigate risk in the source zone.	Use of results of BHHRA and SERA to determine if action is needed	Data listed for D1a, D1b, D1c, D2a, and D2b
	Use of results of comparison of contaminant concentrations to ARARs to determine if action is needed	Methods for qualitative (or quantitative) analyses of decrease or increase in risk to human health and the environment as a result of implementation
	Qualitative (or quantitative) assessment of decrease or increase in risk to human health and the environment as a result of implementation	Additional physical parameters including compaction, grain size, cation exchange, thermodynamic conductivity, dielectric constants, chemical oxygen demand, pH, and moisture content of soils
	Evaluation of ARARs	
	Evaluation of existing risk management procedures or activities currently being conducted at the site	List of ARARs

1.4 OBSERVATIONAL APPROACH

The Observational Approach (OA) is a method for identifying and managing uncertainties. The OA emphasizes determining what to do next by evaluating existing information and iterating between collecting new data and taking further action. The name “Observational Approach” is derived from observing parameters during implementation. OA should be encouraged in situations where the uncertainty is large, the vision of what is expected or required is poor, and the cost of obtaining more certainty is very high.

The philosophy of OA, when applied to waste site remediation, is that a remedial action can be expedited. The approach provides a logical decision framework through which planning, design, and implementation of remedial actions can proceed with increased confidence. OA incorporates the concepts of data sufficiency, identification of reasonable deviations, preparation of contingency plans, observation of the systems for deviations, and implementation of the contingency plans. Determinations of performance measures and the quality of new data are completed as the steps are implemented.

The iterative steps of site characterization, developing and refining a site conceptual model, and identifying uncertainties in the conceptual model are similar to traditional approaches. The concept of addressing uncertainties as reasonable deviations is unique to OA and offers a qualitative description of data sufficiency for proceeding with site remediation.

To deal with uncertainties identified in the SOU, OA has been used to design the sampling strategy for the SOU RI/FS. The key concepts are as follows:

- The RI strategy is based on a specified “most probable site condition,” which, for the SOU RI/FS, assumes that contamination is limited to surface and near surface soil (0 to 4 ft bgs) and is potentially adversely impacting human health and welfare or an impact to the environment has occurred.

- Reasonable deviations from the most probable site condition are identified. One reasonable deviation for the SOU RI/FS is that no contamination is adversely impacting human health and welfare or the environment. Another reasonable deviation would be that contamination has migrated to either the SWOU or GWOU. Site conditions should not differ significantly from the postulated conditions shown in the conceptual models.

- Site assessment factors are identified for observation to detect contamination. These factors include sensory observation of contamination (sight and smell), field screening with portable instruments, geophysical surveys, historical data evaluation, and laboratory analysis of samples.

- The Field Sampling Plan (FSP), discussed in Chapter 9 of this document, presents the method by which the most probable site conditions will be investigated. It also presents a contingency plan to deal with deviations from the most probable site conditions.

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2. PROJECT ORGANIZATION AND MANAGEMENT PLAN

This section presents the project organization for this SOU RI/FS. The topics addressed in this section include project organization, project coordination, and project schedule.

2.1 PROJECT ORGANIZATION, RESPONSIBILITIES, AND STAFFING

The organization chart shown in Figure 2.1 outlines the management structure that will be used for implementing the SOU RI/FS. The responsibilities of key personnel are described in the following paragraphs.

2.1.1 DOE Project Manager

The DOE Project Manager will provide technical and management oversight for DOE for the SOU RI/FS. This individual also will be the primary interface between EPA and KDEP regulators and the DOE Prime Contractor.

2.1.2 DOE Prime Contractor ER Manager

The DOE Prime Contractor ER Manager will have overall programmatic responsibility for the Contractor for the technical, financial, and scheduling of matters related to the SOU RI/FS. This individual will interface with DOE and the regulators, as appropriate.

2.1.3 DOE Prime Contractor Data Manager

The DOE Prime Contractor Data Manager is responsible for long-term storage of project data and for transmitting data to external agencies according to DOE 1998e and the Paducah Data Management Policy. The DOE Prime Contractor Data Manager ensures compliance to policies and procedures relating to data management with respect to the project.

2.1.4 DOE Prime Contractor Lab Coordinator

The DOE Prime Contractor Lab Coordinator is responsible for contracting any fixed-base laboratory utilized during the SOU sampling activities. The DOE Prime Contractor Lab Coordinator also provides coordination for sample shipment to the laboratory, reviews the contractual screening section of data assessment packages, and transmits data packages to the Paducah Document Management Center (DMC).

2.1.5 DOE Prime Contractor RI Project Manager

The RI Project Manager will have overall responsibility for implementing the investigation, including all plans and field activities conducted as part of the RI/FS, including monitoring the work plan implementation, including sampling and waste management activities. This individual will serve as the RI technical lead and the principal point of contact. The RI Project Manager will track the project budget and schedules and will delegate specific responsibilities to project team members. This individual also is responsible for the preparation of any field change orders.

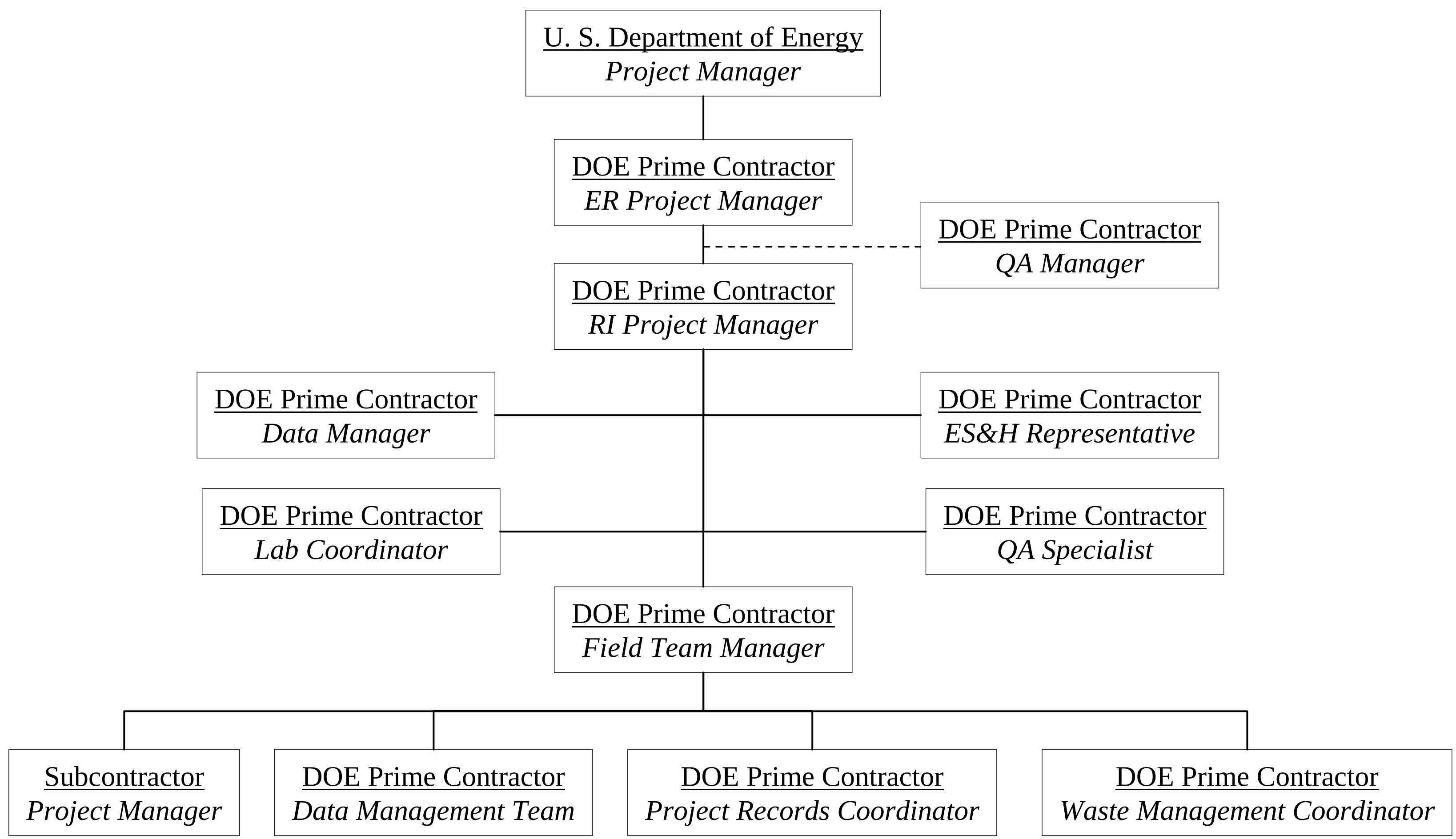

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Figure 2.1 SOU Project Organizational Chart

2.1.6 DOE Prime Contractor Safety & Health Representative

The Safety and Health Representative (SHR), oversees that health and safety procedures designed to protect project personnel are maintained throughout the field effort for this project. This individual will also ensure the implementation of an Integrated Safety Management System (ISMS) for all aspects of the assessment. ISMS is dedicated to the concept that all accidents are preventable. Accordingly, the DOE Prime Contractor, the RI Team, and all subcontractors will be expected to achieve and sustain "Zero-Accident Performance" through continuous improvement practices. "Zero-Accident Performance" includes zero unpermitted discharges or releases with respect to protection of the environment.

2.1.7 DOE Prime Contractor QA Specialist

The Quality Assurance (QA) Specialist will provide oversight and approval for the project. This individual also will conduct audits and surveillances and approve any field changes that may impact project quality.

2.1.8 DOE Prime Contractor Field Team Manager

The Field Team Manager (FTM) provides technical oversight for all field team activities during the investigation.

2.1.9 DOE Prime Contractor Project Records Coordinator

The Project Records Coordinator will be responsible for all activities relating to identification, acquisition, classification, indexing, and storage of project records related to the investigation. The project records will include data documentation materials, plans, procedures, and all project file requirements.

2.1.10 DOE Prime Contractor Waste Management Coordinator

The Waste Management Coordinator (WMC) will be responsible for ensuring adherence to the Waste Management Plan (WMP) that is described in Chapter 13 of this document and for documenting and tracking field-related activities, including waste generation and handling, waste characterization sampling, waste transfer, and waste labeling.

2.1.11 DOE Prime Contractor Data Management Team

The Data Management Team will be responsible for the coordination of all investigation-sampling activities, including coordination with the DOE Prime Contractor Sample Management Office (SMO). This group will ensure all quality control (QC) sampling requirements are met, chain-of-custody forms are properly generated, and that compliance with off-site shipping requirements is achieved. The Data Management Team also will be responsible for managing data generated during the investigation in accordance with the Data Management Implementation Plan (DMIP) described in Chapter 12 of this document.

2.2 PROJECT COORDINATION

Coordination and liaison between the DOE Prime Contractor and Subcontractor personnel will occur at various levels and among personnel appropriate to each level. Routine reports, such as monthly reports, will be prepared by the Subcontractor Project Manager and then submitted to the DOE Prime Contractor RI Project Manager, Contracts Procurement Office, Contracts Coordinator, or other designated recipient.

2.3 PROJECT TASKS AND IMPLEMENTATION PLAN

The RI/FS Implementation Plan for this project is shown in Figure 2.2. This plan represents a logical approach to implementation of the project, as described below.

(1) The first step in this process was initial scoping of the project internally and with EPA and Kentucky.

(2) The next step was preparation of this RI/FS Work Plan. As part of this task, existing data were evaluated to develop the conceptual models. In turn, the conceptual models were used to identify site unknowns, and a sampling strategy was designed to meet the FFA requirements and to address these unknowns.

(3) Implementation of the work plan will begin with procurement of subcontract services, such as sampling and surveying.

(4) Field activities will consist of several discrete activities, as outlined in this work plan, including sampling, sample handling, decontamination, waste management, and documentation. In addition, Environment, Safety, and Health (ES&H) and field QA coordination will occur concurrently with the other activities.

(5) Field and laboratory data will be reduced, validated, verified, and assessed. Data validation will be conducted by an independent third party and will be initiated once the first sample delivery group of data has been received and checked for completeness. Each of these steps will be handled separately and will follow prescribed procedures to ensure that defensible data are obtained. The data will be formatted for incorporation into the PGDP database and archived for future use.

(6) Technical exchange meetings will be conducted among personnel from EPA, KDEP, DOE, and DOE Prime Contractor to evaluate the existing and collected data and determine future actions.

(7) Non-field-related tasks that also will be performed during the RI/FS include coordination of community relations during the project, preparation of a BHHRA, SERA, implementation of the QA program, evaluation of remedial technologies, and implementation of treatability studies.

(8) An RI report, followed by an FS report, will be prepared and issued after samples and data have been processed.

(9) Project management, tracking, and reporting will be conducted concurrently with all activities.

2.4 PROJECT SCHEDULE

Figure 2.2 provides a schedule of the activities proposed for the SOU RI/FS Work Plan implementation. These schedules are estimates for planning and are included here for informational purposes only and are not intended to establish enforceable schedules or milestones. Enforceable milestones are contained in Appendix C of the FFA and Appendix 5 of the SMP (DOE 2008).

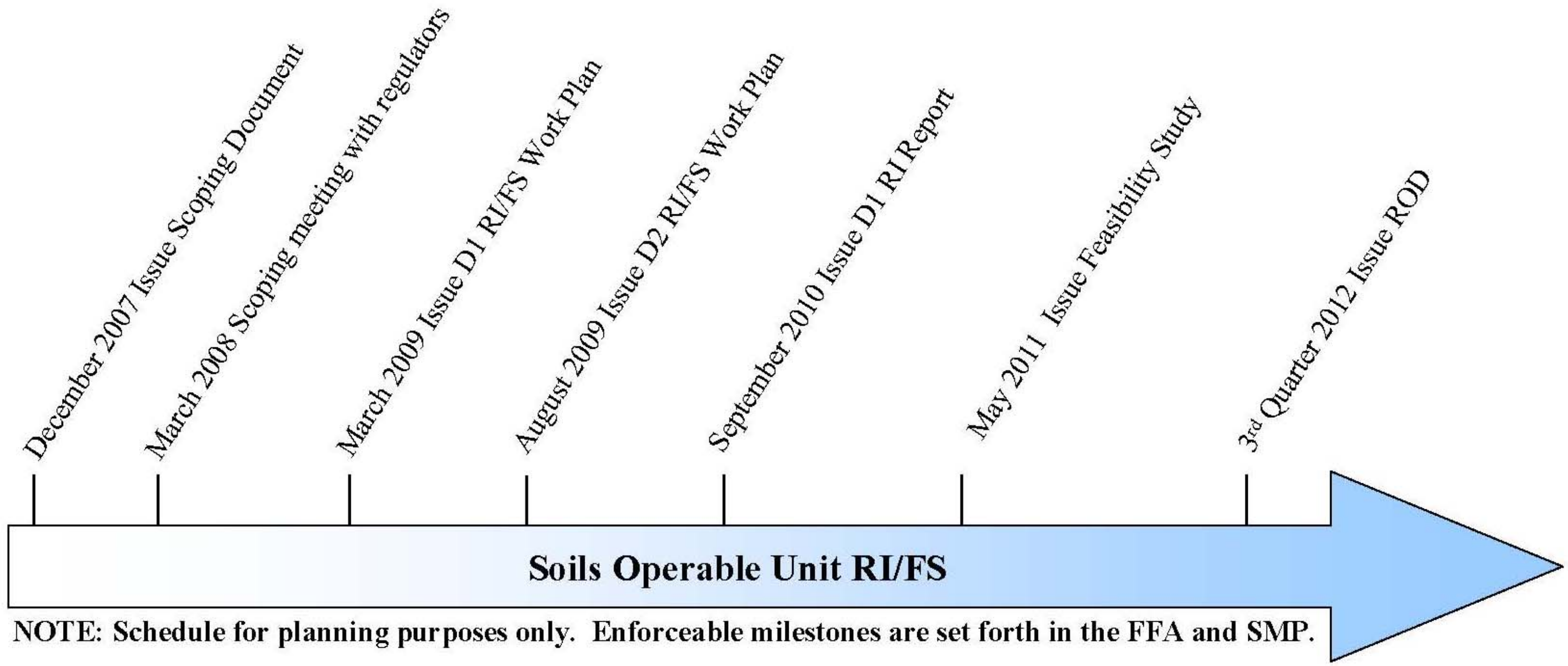

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Figure 2.2. Implementation Plan Schedule

The following assumptions were used to develop this schedule. Delays in or changes to any of these assumptions could result in overall scope delay.

- EPA and KDEP will approve the D2 SOU RI/FS Work Plan by September 14, 2009.
- The DOE Prime Contractor will initiate the procurement process to allow a Notice-to-Proceed, with field activities to be issued to the Subcontractor in Fiscal Year 2009 in accordance with current funding profiles.
- The schedule, as shown, does not account for schedule delays resulting from inclement weather conditions such as rain or snow.
- Laboratory analysis reports for individual data packages will be received within 60 days of the completion of all samples contained in that data package.
- Data verification, validation, and assessment activities for individual data packages will be available within 60 days of receipt of the laboratory analysis reports for the data package.
- If additional sampling is required, then the completion date of subsequent tasks will be delayed.

2.5 RI/FS WORK PLAN ACTIVITIES

2.5.1 Security Plan

A security plan will be written for the SOU RI/FS fieldwork. This plan will address security issues/concerns for the project, while working inside the security fence at PGDP. The classification status could result in restricting access during RI field activities, as well as additional reviews and oversight. This security plan will be completed prior to field mobilization. All field team members will be required to read the plan prior to participating in SOU field activities.

2.5.2 Field Preparation Activities

The FTM will ensure that a field planning meeting occurs before the internal field review and before work begins at the site so that all involved personnel, including employees of the subcontractors, DOE Prime Contractor, and DOE, as appropriate, will be informed of the requirements of the fieldwork associated with the project.

In addition, an internal field review will be held in accordance with DOE Prime Contractor procedures. Any contingency items identified during the review must be completed prior to the DOE Prime Contractor providing a notice to proceed to the Subcontractor for initiating fieldwork activities.

2.5.3 Field Investigation

Activities to be conducted during the field investigation include mobilization, implementation of Environment, Safety, and Health (ES&H) procedures, geophysical surveys, soil sampling, waste management, and implementation of QA procedures. In addition, surveying activities will be performed to provide horizontal and vertical references for characterizing of locations.

2.5.4 Data and Analytical Activities

Activities concerning the data and analytical assessments are discussed in the following chapters:

- Baseline Risk Assessment—Chapter 6
- Treatability Studies—Chapter 7
- FS—Chapter 8
- Data and Records Management—Chapter 12

Additionally, the following support the work to be conducted during this RI/FS:

- Community Relations—Chapter 14
- ARARs—Appendix A
- Sampling Strategy—Appendix B
- Document Outlines—Appendix C
- Historical Data Summary—Appendix D

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3. REGULATORY SETTING

The sections that follow provide a condensed version of the regulatory framework for PGDP. The summary in this chapter is intended to provide readers with general knowledge of the facility and the regulatory protocol that guides environmental management activities at PGDP. Detailed descriptions can be found in the *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2008).

3.1 ADMINISTRATIVE CONSENT ORDER

Kentucky, EPA, and DOE entered into the ACO effective November 23, 1988, after the discovery of contamination in residential wells north of PGDP. The ACO is a legally binding agreement for the participating parties that initiated the investigation into the nature and extent of the contamination in these wells. The contaminants are believed to have originated as process-derived wastes or commonly used materials employed during the operational history of PGDP.

The ACO initiated the investigative activities designed to determine the extent and sources of off-site contamination surrounding PGDP. The site investigation (SI) was completed in 1992 under the guidelines of the ACO. The prior requirements of the ACO were superseded by the execution of the FFA.

3.2 ENVIRONMENTAL PROGRAMS

Environmental sampling at PGDP is a multimedia (air, water, soil, sediment, direct radiation, and biota) program of chemical, radiological, and ecological monitoring and environmental monitoring that consists of two activities: effluent monitoring and environmental surveillance. Although the evaluation and assessment of unplanned releases are addressed in this plan, emergency monitoring and responsibilities for this activity are not included. As part of the ongoing ER activities, SWMUs and AOCs both on and off DOE property have been identified. Characterization and/or remediation of these sites will continue pursuant to the CERCLA, and the Hazardous and Solid Waste Amendments (HSWA) corrective action conditions of the Resource Conservation and Recovery Act (RCRA) Permit. RCRA and CERCLA requirements are coordinated by DOE, EPA, and Kentucky through the FFA.

3.3 RESOURCE CONSERVATION AND RECOVERY ACT

The primary purpose of RCRA is to protect human health and the environment through the proper management of hazardous wastes at operating sites.

RCRA requirements for PGDP are contained in PGDP’s Hazardous Waste Management Permit (KY8-890-008-982, originally issued July 1991, reissued September 2004). This permit originally was issued by both Kentucky and EPA. EPA’s portion of the RCRA permit was limited to the HSWA provisions of RCRA, which include corrective action requirements for SWMUs. Kentucky became authorized in 1996 for corrective actions; therefore, the reissued permit was issued solely by Kentucky. The RCRA permit contains regulatory provisions for treatment, storage, and disposal units, as well as provisions requiring corrective action for SWMUs.

3.4 CERCLA/NATIONAL PRIORITIES LIST

PGDP was placed on the NPL on May 31, 1994. In accordance with Section 120 of CERCLA, DOE entered into an FFA with EPA and Kentucky. The FFA established one set of consistent requirements for achieving comprehensive site remediation in accordance with RCRA and CERCLA, including stakeholder involvement.

Section XVIII of the FFA requires DOE to submit an annual SMP, which details the strategic approach for achieving cleanup under the FFA.

3.5 NATIONAL ENVIRONMENTAL POLICY ACT

The intent of the National Environmental Policy Act (NEPA) is to promote a decision-making process that results in minimization of adverse impacts to human health and the environment. On June 13, 1994, the Secretary of Energy issued a Secretarial Policy (Policy) on NEPA that addresses NEPA requirements for actions taken under CERCLA. Section II.E of the Policy indicates that to facilitate meeting the environmental objectives of CERCLA and respond to concerns of regulators consistent with the procedures of most other federal agencies, DOE hereafter will rely on the CERCLA process for review of actions to be taken under CERCLA and will address NEPA values. DOE CERCLA documents will incorporate NEPA values, such as analysis of cumulative, off-site, ecological, and socioeconomic impacts, to the extent practicable.

3.6 INVESTIGATIVE OVERVIEW

This SOU RI/FS Work Plan defines the additional sampling necessary to obtain sufficient data to complete the risk assessment and the FS for the SOU. Many of these SWMUs/AOCs have been investigated previously during an RI. The strategy for this work plan is to complete a characterization of the nature and extent of contamination for each SWMU/AOC.

4. PHYSICAL CHARACTERISTICS OF THE STUDY AREA

The sections that follow provide a condensed version of the environmental setting for PGDP. This summary provides an overview of information pertaining to location, demography, geology, hydrogeology, ecology, and climatology.

4.1 LOCATION AND DESCRIPTION

PGDP is located ~10 miles west of Paducah, Kentucky (population ~26,000), and 3.5 miles south of the Ohio River in the western part of McCracken County (Figure 4.1). The DOE site is composed of 652 acres of which are within a fenced security area, 785 acres are located outside the security fence, and the 1,986 acres that are licensed to Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA). Bordering the PGDP reservation to the northeast, between the plant and the Ohio River, is a Tennessee Valley Authority (TVA) reservation on which the Shawnee Steam Plant is located (Figure 4.2).

4.2 DEMOGRAPHY AND LAND USE

PGDP is surrounded by WKWMA and some sparsely populated agricultural lands. The closest communities to the plant are Heath, Grahamville, and Kevil, all of which are located within three miles of DOE Reservation boundaries. The closest municipalities are Paducah, Kentucky; Cape Girardeau, Missouri, which is ~40 miles west of the plant; and the cities of Metropolis and Joppa, Illinois, which are located across the Ohio River from PGDP. Figure 4.3 shows the locations of sensitive subpopulations such as schools and churches and their relative locations to PGDP.

Historically, the economy of western Kentucky has been based on agriculture, although there has been increased industrial development in recent years. The population of McCracken County is estimated to be ~65,000 with a population density of 885 to 3,188 persons per square mile and Ballard County has ~8,300 with a population density of 72 to 254 persons per square mile according to the 2000 U.S. Census, 2007 estimates.

In addition to the residential population surrounding the plant, WKWMA draws thousands of visitors each year for recreational purposes. This area is used by visitors, primarily for hunting and fishing, but other activities include horseback riding, hiking, and bird watching. According to WKWMA management, an estimated 5,000 fishermen visit the area each year.

4.3 SURFACE FEATURES

The dominant topographic features are nearly level to gently sloping dissected plains with shallow, narrow valleys and ridgetops and with steep ridge slopes and valley sides. The elevations of the stream valleys in the dissected plains are up to 30.5 m (100 ft) lower than the adjoining uplands.

Local elevations range from 290 ft above mean sea level (amsl) along the Ohio River to 450 ft amsl southwest of PGDP near Bethel Church Road. Generally, the topography in the PGDP area slopes toward the Ohio River at an approximate gradient of 27 ft per mile (CH2M HILL 1992). Ground surface elevations vary from 360 to 390 ft amsl within the PGDP plant boundary.

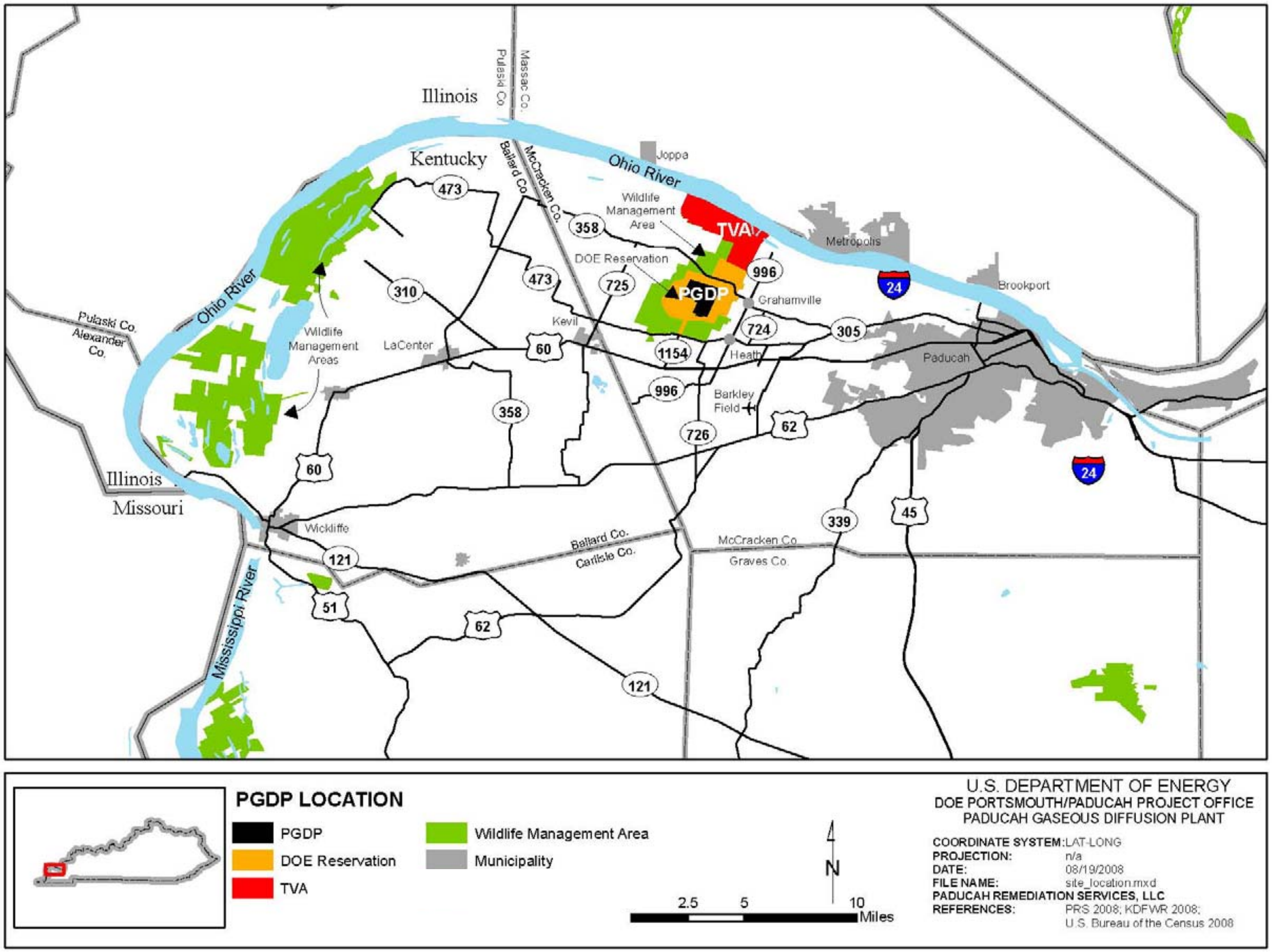

Figure 4.1 PGDP Site Location

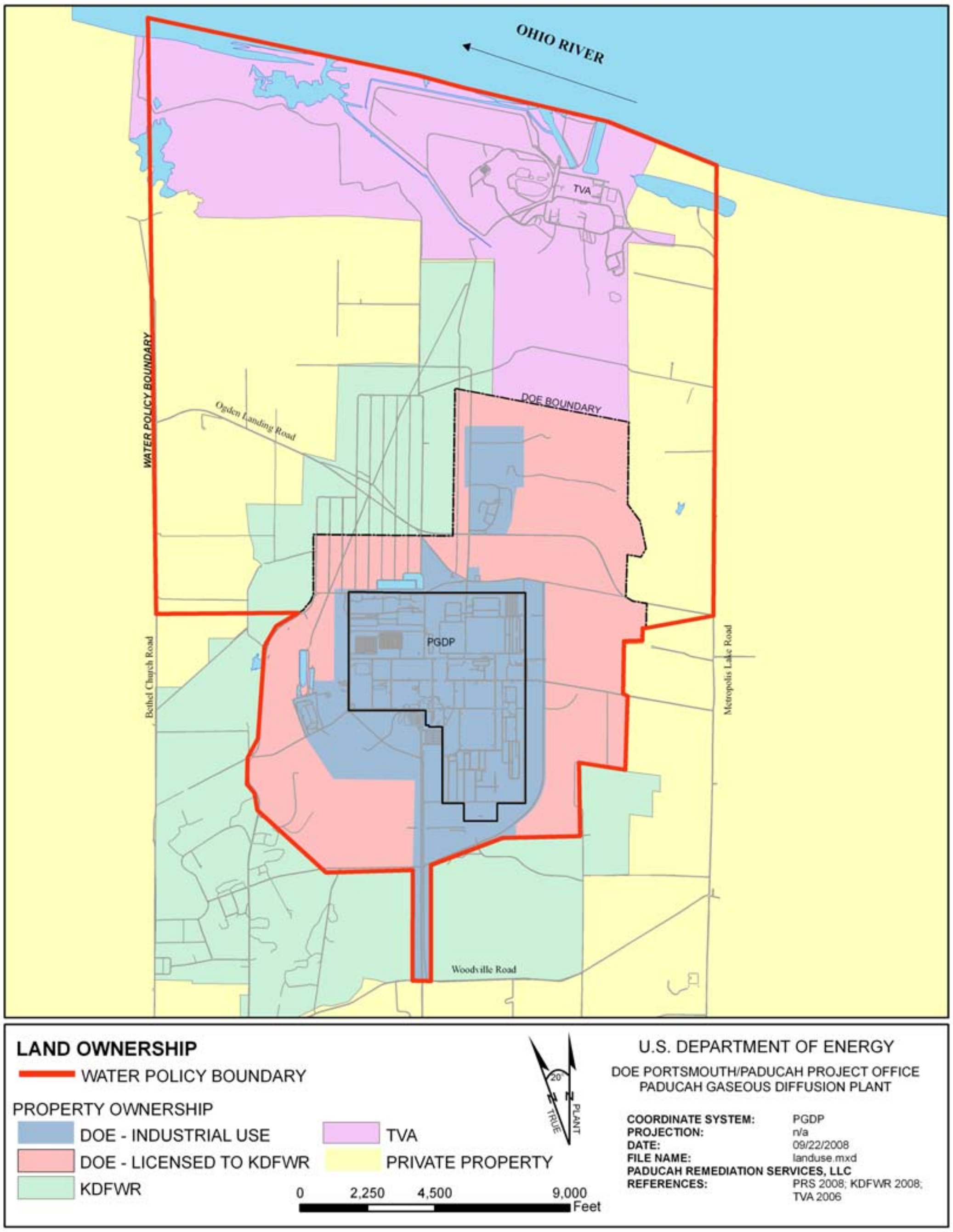

Figure 4.2. Land Ownership in Proximity to DOE Site

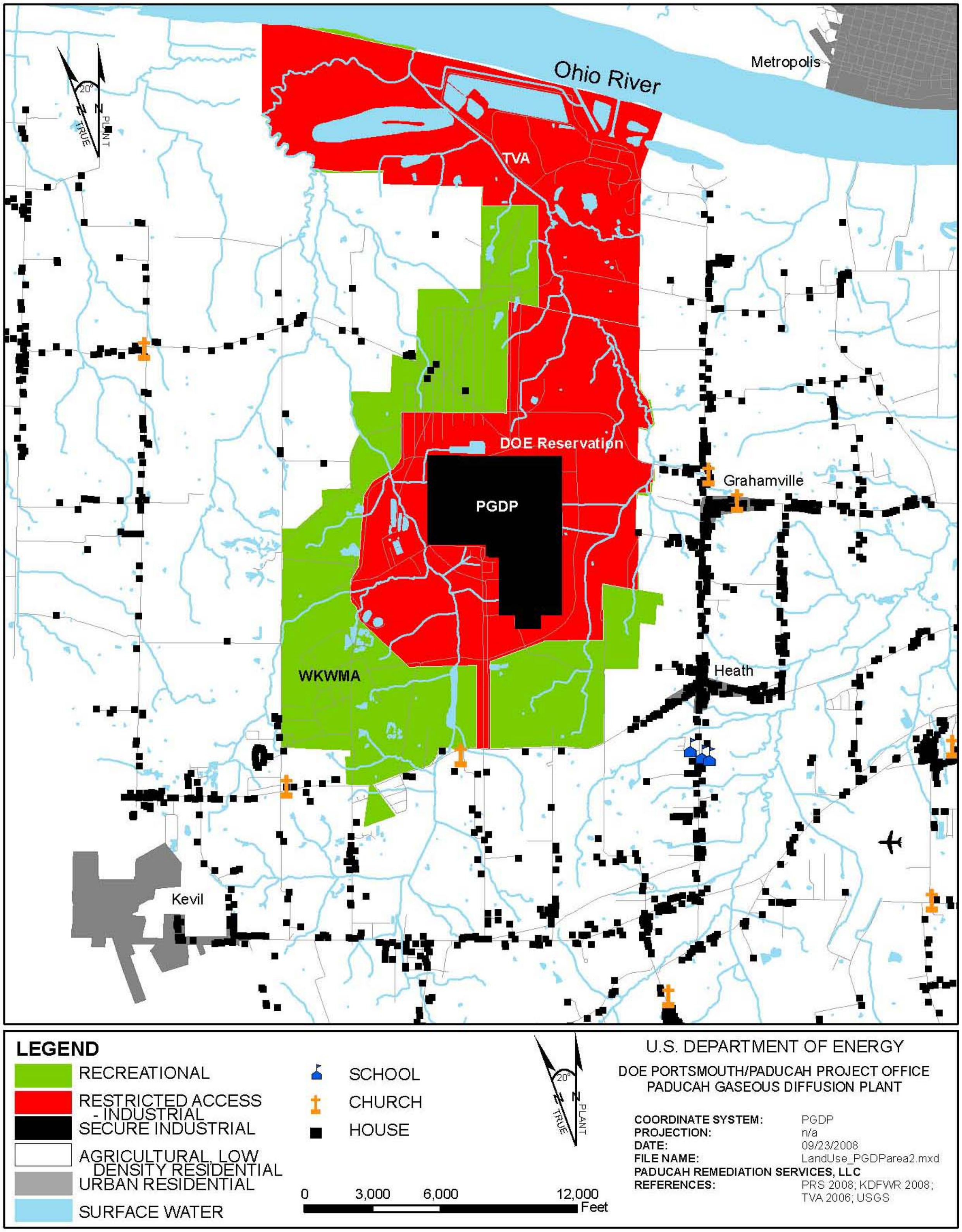

Figure 4.3. Sensitive Subpopulations in Proximity to DOE Site

4.4 METEOROLOGY

The climate of the region may be broadly classified as humid-continental. The term “humid” refers to the surplus of precipitation versus evapotranspiration that normally is experienced throughout the year. The “continental” nature of the local climate refers to the dominating influence of the North American landmass. Continental climates typically experience large temperature changes between seasons.

Current and historical meteorological information regarding temperature, precipitation, and wind speed/direction was obtained from the National Oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center. Additional data were obtained from the National Weather Service office at Barkley Regional Airport.

The 22-year average monthly temperature is 58.0°F, with the coldest month being January with an average temperature of 35.1 °F and the warmest month being July with an average temperature of 79.2 °F.

The 22-year average monthly precipitation is 4.00 inches, varying from an average of 2.73 inches in August (the monthly average low) to an average of 4.58 inches in April (the monthly average high). The total precipitation for 2005 was 37.45 inches, compared to the normal of 49.24 inches

4.5 SURFACE WATER HYDROLOGY

PGDP is located in the western portion of the Ohio River 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. Multiple groundwater aquifers underlie the PGDP. The shallowest aquifers occur in the Continental Deposits and the McNairy Formation, both of which discharge into the Ohio River north of PGDP. Surface water/groundwater relationships vary significantly across the SWOU. A large, downward, vertical hydraulic gradient across the shallow groundwater system typically limits the amount of groundwater discharge to the ditches of the PGDP and adjacent creeks. Gaining reaches in the creeks are found on Bayou Creek south of PGDP and on Little Bayou Creek (LBC) to the north of PGDP near the Ohio River. Bayou Creek also is a gaining stream north of the plant near the Ohio River.

Locally, PGDP is within the drainage areas of the Ohio River, Bayou Creek (also known as Big Bayou Creek) and LBC. The Ohio River is located approximately 3.5 miles north of the PGDP. It is the most significant surface-water feature in the region, carrying over 25 billion gal/day of water through its banks. Several dams regulate flow in the Ohio River. The Ohio River stage near PGDP is measured at Metropolis, Illinois, by a United States Geological Survey (USGS) gauging station. River stage typically varies between 293 and 335 ft amsl over the course of a year. Water levels on the lower Ohio River generally are highest in late winter and early spring and lowest in late spring and early summer. The entire PGDP is above the historical high water floodplain of the Ohio River (CH2M HILL 1991) and above the local 100-year flood elevation of the Ohio River (333 ft).

The plant is situated on the divide between Little Bayou and Bayou Creeks (Figure 4.4). Surface flow is east-northeast toward LBC and west-northwest toward Bayou Creek. 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 along a 9-mile course. An 11,910-acre drainage basin supplies Bayou Creek. LBC becomes a perennial stream at the east outfalls of PGDP. The LBC drainage originates within

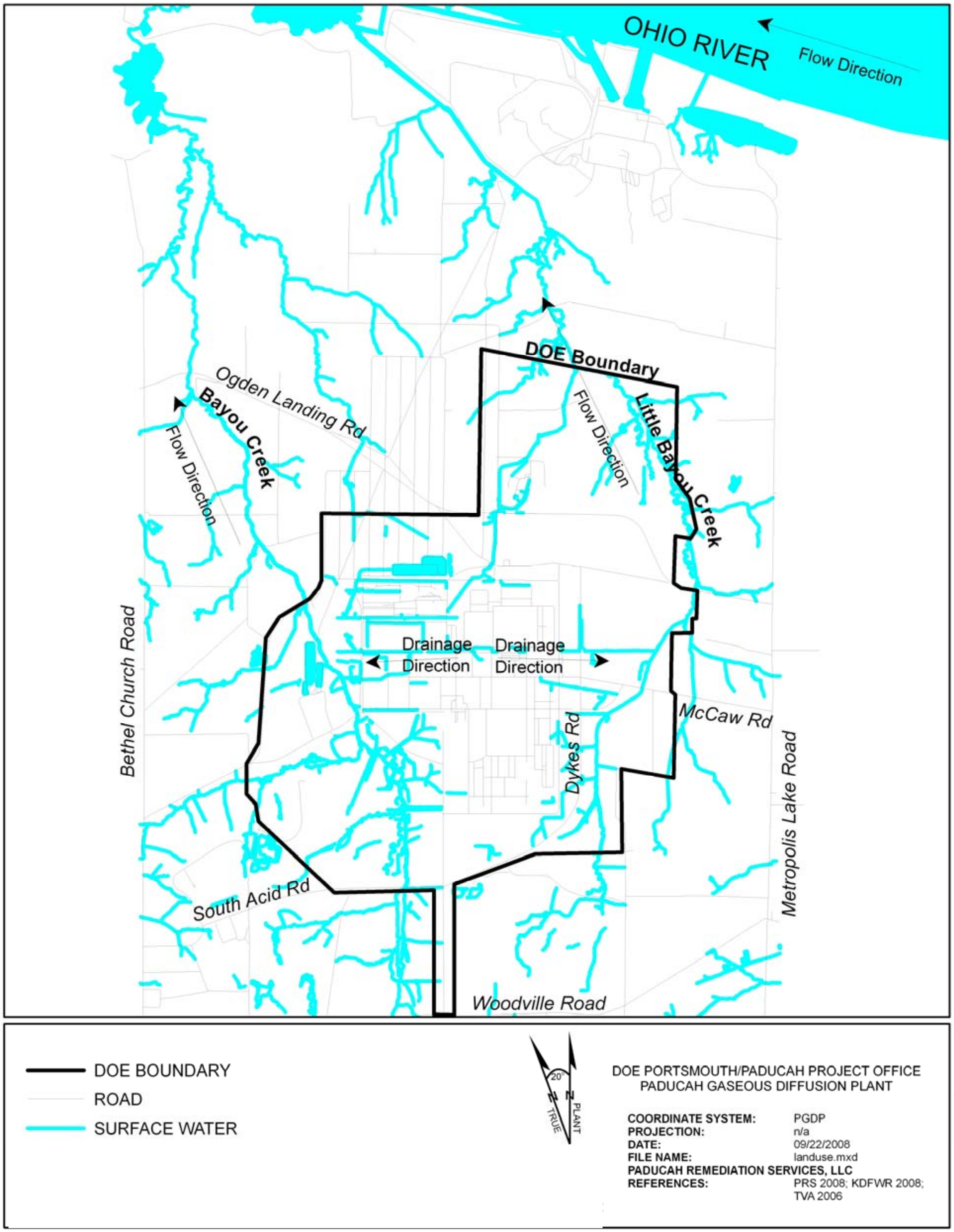

Figure 4.4. Surface Water Features in the Vicinity of the DOE Site

WKWMA and extends northward and joins Bayou Creek near the Ohio River along a 6.5-mile course within a 6,000-acre drainage basin. Drainage areas for both creeks are generally rural; however, they receive surface drainage from numerous swales that drain residential and commercial properties, including WKWMA, PGDP, and the TVA Shawnee Steam Plant. The confluence of the two creeks is approximately 3 miles north of the plant site, just upstream of the location at which the combined flow of the creeks discharge into the Ohio River.

The USGS maintains gauging stations on Bayou Creek at 4.1 and 7.3 miles upstream of the Ohio River and a gauging station on LBC at 2.2 miles upstream from its confluence with Bayou Creek. The mean monthly discharges vary from 20.5 to 38.8 million gal/day on Bayou Creek and from 0.7 to 20.5 million gal/day on LBC.

Most of the flow within Bayou and LBCs is from process effluents or surface water runoff from PGDP. Contributions from PGDP comprise approximately 85% of flow within Bayou Creek and 100% of flow within LBC. A network of ditches discharge effluent and surface water runoff from PGDP to the creeks. Plant discharges are monitored at the Kentucky Pollutant Discharge Elimination System (KPDES) outfalls prior to discharge into the creeks. Outfalls 002, 010, 011, 012, 013, and 018 receive water from the eastern-most portion of the plant and discharge to LBC. Water from the western portion of the plant drains to Bayou Creek through Outfalls 001, 006, 008, 009, 014, 015, 016, and 017. Outfall 019 monitors runoff discharge to the North-South Diversion Ditch (NSDD) from the C-746-U Landfill, located north of PGDP.

Several major surface water impoundments are located within the plant property and are utilized for various sanitary or process water management needs. The C-616 Lagoons are located near the northwest corner of the plant. Effluent from the plant's phosphate water processing facility is discharged into the C-616-F Lagoon, where sludge is allowed to settle. These lagoons discharge through Outfall 001 to Bayou Creek. The C-611 Lagoons are located to the southwest of the main plant complex. These lagoons serve as settling basins for effluent from the C-611 Sanitary Water Processing Plant. Water from the Ohio River is brought into the water plant where it is treated, primarily with water softening agents, and fed to PGDP for multiple uses. These lagoons discharge through Outfalls 006 and 014 to Bayou Creek.

In the fall of 2002 and winter of 2003, DOE constructed a sedimentation basin (C-613 Northwest Storm Water Control Facility) near the northwest corner of the plant to support removal and disposition of scrap metal. Effluent from the C-613 basin discharges through Outfall 001 to Bayou Creek. In March 2004, DOE completed construction of a detention basin in Section 2 of the NSDD (north central area of the plant). This detention basin contains storm-water runoff to the NSDD until it can be transferred to the C-616-F Lagoon for treatment, via the C-616-C Lift Station. Prior to the detention basin's construction, three culverts were plugged (Fall 2003) at the north security fence to prevent runoff from exiting the plant via the NSDD; therefore, no effluents from the industrialized areas of PGDP currently flow through Sections 3, 4, and 5 of the NSDD.

Other surface water bodies in the vicinity of PGDP include the following: Metropolis Lake, located east of the Shawnee Steam Plant; several small ponds, clay and gravel pits, and settling basins scattered throughout the area; and a marshy area just south of the confluence of Bayou Creek and LBC. The smaller surface water bodies are expected to have only localized effects on the regional groundwater flow pattern.

4.6 GEOLOGY OF PGDP

PGDP is located in the Jackson Purchase region of western Kentucky, which represents the northern tip of the Mississippi Embayment portion of the Coastal Plain Province. 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.

Information presented herein regarding the geologic setting at PGDP was derived from the *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III* (Clausen et al. 1992). Subsequent sections will briefly discuss the formations represented in Figure 4.5 to acquaint the reader with PGDP geology.

4.6.1 Bedrock

The entire PGDP area is underlain by Mississippian carbonates, consisting of dark gray limestone with some interbedded chert and shale.

4.6.2 Rubble Zone

A rubble zone of chert gravel commonly is encountered in soil borings at the top of the bedrock. The age and continuity of the rubble zone remain undefined.

4.6.3 McNairy Formation

The McNairy Formation consists of Upper Cretaceous sediments of grayish-white to dark-gray micaceous silt and clay with interbedded, gray to yellow to reddish-brown, very fine- to medium-grained sand. A basal sand member also is present at PGDP.

4.6.4 Porters Creek Clay/Porters Creek Terrace

The Paleocene Porters Creek Clay occurs in the southern portions of the site and consists of dark-gray to black silt with varying amounts of clay and fine-grained, micaceous, commonly glauconitic, sand. The Porters Creek Clay subcrops along a buried terrace slope that extends east–west across the site. Erosion into the Paleocene Porters Creek Clay, after the deposition of overlying Eocene through Pleistocene sediments (Eocene sands and terrace gravels), resulted in an important hydrogeologic feature known as the Porters Creek terrace. The Porters Creek terrace lies immediately south of PGDP; the terrace slope extends northward toward the southern boundary of the PGDP fenced security area. The Porters Creek terrace is hydrogeologically important because it is the southern extent of the lower continental deposits and the Regional Gravel Aquifer (RGA).

4.6.5 Eocene Sands

Eocene sands are found south of PGDP above the Porters Creek Clay. These sands are believed to be composed of undifferentiated sediments of the Claiborne Group and Wilcox Formation. Olive (1980) describes the sands as predominantly clear quartz with minor amounts of gray quartz and chert with interbedded and interlensing silts and clays. The Eocene sands thicken south of PGDP and may serve as a significant water-bearing unit south of the plant.

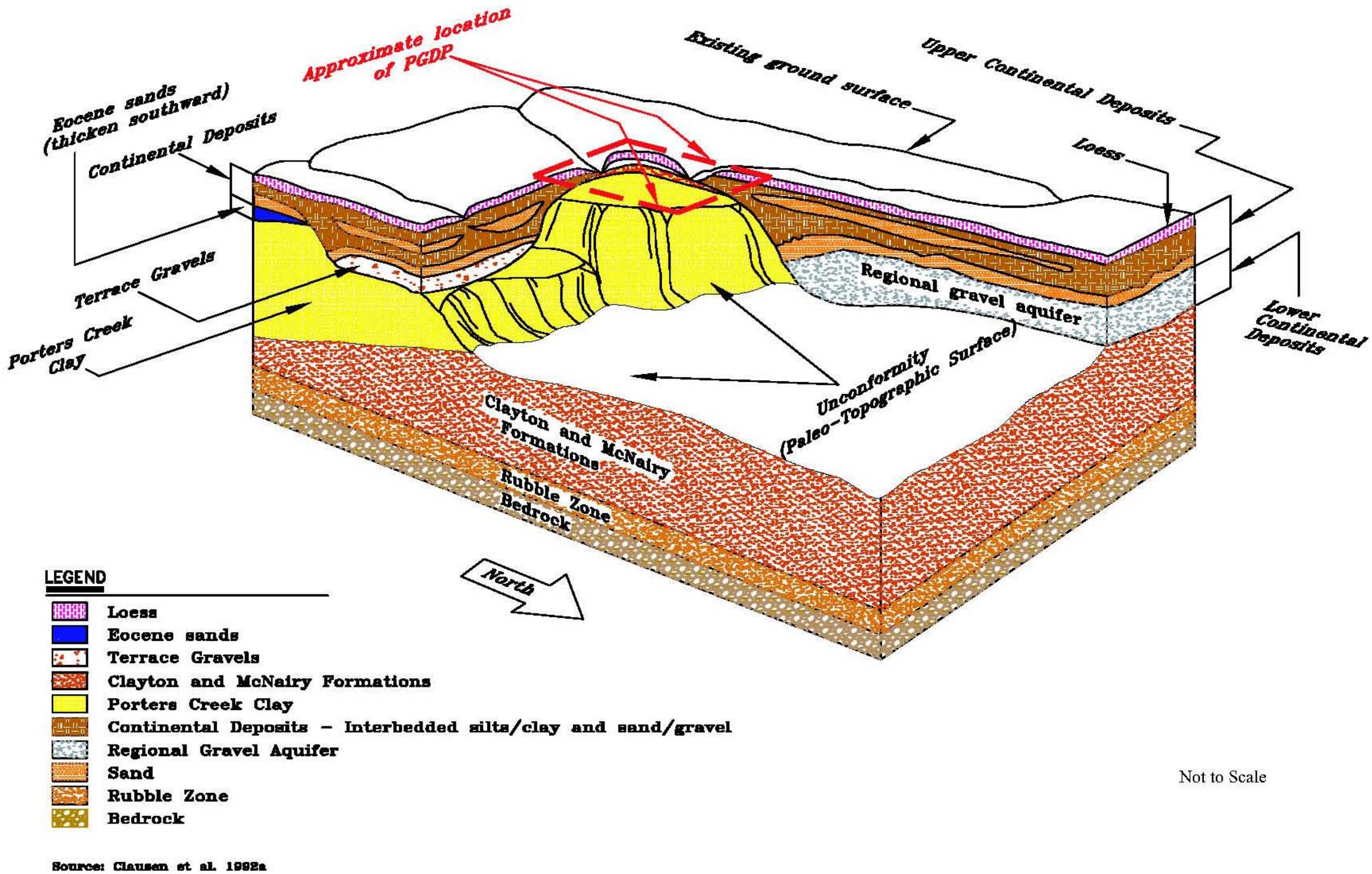

Figure 4.5. CSM for Geologic Formations at PGDP

4.6.6 Continental Deposits

Continental sediments [Pliocene(?) to Pleistocene—a question mark indicates uncertain age] unconformably overlie the Cretaceous through Eocene strata throughout the area. These continental sediments were deposited on an irregular erosional surface exhibiting steps or terraces. The thicker sequences represent valley fill sediments that comprise a fining-upward cycle. The continental sediments have been divided into the two distinct facies described below.

(1) Lower Continental Deposits. The lower continental deposits are a gravel facies consisting of chert pebbles to cobbles in a matrix of poorly sorted sand and silt. The lower continental deposits have been found at three distinct horizons in the PGDP area.

    The first horizon consists of the terrace gravels [consisting of a Pliocene(?) gravel ranging in thickness from 0 to 30 ft], occurring in the southern portion of PGDP area at elevations greater than 350 ft amsl, and overlying the Eocene sands and Porters Creek Clay. The Terrace Gravel is a potential source of the sediments forming the RGA.

    The second gravel horizon is terrace gravels located in the southeastern and eastern portions of the DOE boundary on an erosional surface at approximately 320 to 345 ft amsl. The thickness of this unit ranges from 15 to 20 ft.

    The third and most prominent of the three horizons consists of a Pleistocene gravel deposit resting on an erosional surface at approximately 280 ft amsl. This gravel is found throughout the plant area and to the north, but pinches out to the south along the slope of the Porters Creek terrace. The gravel deposit averages approximately 30 ft in thickness, but some thicker deposits (as much as 50 ft) exist in deeper scour channels that trend east–west across the site.

(2) Upper Continental Deposits. The upper facies is composed of fine-grained clastics varying in thickness from 15 to 55 ft. These upper continental deposits have been differentiated into three general horizons: (1) an upper silt and clay interval, (2) an inner-bedded sand and gravel interval, and (3) a lower silt and clay interval. The sand and gravel interval appears relatively discontinuous in cross-sections, but portions may be inner-connected.

4.7 SOILS

The surficial deposits found in the vicinity of PGDP are Pleistocene to Recent in age and consist of loess and alluvium. Both units are composed of clayey silt or silty clay and range in color from yellowish-brown to brownish-gray or tan, making field differentiation difficult.

The loess (wind-blown) deposits overlie the upper continental deposits over the entire PGDP area. Loess deposition probably occurred in upland areas during all stages of the glaciation that extended into the Ohio and Mississippi River Valleys.

4.8 HYDROGEOLOGY OF PGDP

Information presented herein regarding the groundwater setting was derived from the *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III* (Clausen et al. 1992). The discussion provides the reader with an overview of the groundwater flow regime for PGDP. The local groundwater flow system at the PGDP site occurs within the sands of the Cretaceous McNairy Formation, Pliocene terrace gravel, Pleistocene lower continental gravel deposits and upper continental deposits, and

Holocene alluvium. Four specific components have been identified for the groundwater flow system and are defined in the following paragraphs.

(1) **McNairy Flow System.** This component consists of the interbedded and interlensing sand, silt, and clay of the Cretaceous McNairy Formation. Sand facies account for 40–50% of the total formation's thickness of approximately 225 ft. Groundwater flow is predominantly north.

(2) **Terrace Gravel.** This component consists of Pliocene(?)-aged gravel deposits and later reworked sand and gravel deposits found at elevations higher than 320 ft amsl in the southern portion of the plant site; they overlie the Paleocene Porters Creek Clay and Eocene sands. These deposits usually lack sufficient thickness and saturation to constitute an aquifer.

(3) **RGA.** This component 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 are commonly thicker than the Pliocene(?) gravel deposits, having an average thickness of 30 ft, and range up to 50 ft along an axis that trends east-west through the plant site. The RGA is the primary local aquifer. Groundwater flow is predominantly north toward the Ohio River.

(4) **Upper Continental Recharge System (UCRS).** This component consists of the surficial alluvium and upper continental deposits. Sand and gravel lithofacies appear relatively discontinuous in cross-section, but portions may be interconnected. The most prevalent sand and gravel deposits occur at an elevation of approximately 345 to 351 ft amsl; less prevalent deposits occur at elevations of 337 to 341 ft amsl. Groundwater flow is predominantly downward into the RGA from the UCRS, which has a limited horizontal component in the vicinity of PGDP.

Five hydrostratigraphic units (HUs) proposed by Douthitt and Phillips (1991) explain groundwater flow at the PGDP site. In descending order, the HUs are as described below.

Upper Continental Deposits

— HU 1 (UCRS): Loess that covers the entire site.

— HU 2 (UCRS): Discontinuous, sand and gravel lenses in a clayey silt matrix.

— HU 3 (UCRS): Relatively impermeable clay layer that acts as the upper semiconfining-to-confining layer for the RGA. The lithologic composition of this unit varies from clay to sand, but is predominantly clay or silt.

— HU 4 (RGA): Predominantly continuous sand unit with a clayey silt matrix that directly overlies the RGA. This unit is in hydraulic connection with HU 5 and is included as part of the RGA.

Lower Continental Deposits

— HU 5 (RGA): Gravel, sand, and silt.

4.9 ECOLOGICAL SETTING OF PGDP

The following sections give an overview of the terrestrial and aquatic systems at PGDP. A more detailed description, including identification and discussion of sensitive habitats and threatened/endangered species, is contained in the *Investigation of Sensitive Ecological Resources Inside the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CDM 1994) and *Environmental Investigations at the Paducah Gaseous Diffusion Plant and Surrounding Area, McCracken County, Kentucky, Volume V: Floodplain Investigation, Part A: Results of Field Survey* (COE 1994). PGDP and the surrounding area have not had changes that would invalidate the findings of these reports since they were finalized.

4.9.1 Terrestrial Systems

The terrestrial component of the PGDP ecosystem includes the plants and animals that use the upland habitats for food, reproduction, and protection. The upland vegetative communities consist primarily of grassland, forest, and thicket habitats with agricultural areas. Important crops grown in the PGDP area include soybeans, corn, tobacco, and sorghum.

Most of the area in the vicinity of PGDP has been cleared of vegetation at some time, and much of the grassland habitat currently is mowed by PGDP personnel. A large percentage of the adjacent WKWMA is managed to promote native prairie vegetation by burning, mowing, and various other techniques. These areas have the greatest potential for restoration and for establishment of a sizeable prairie preserve in the Jackson Purchase area (KSNPC 1991).

Dominant overstory species of the forested areas include oaks, hickories, maples, elms, and sweetgum. Understory species include snowberry, poison ivy, trumpet creeper, Virginia creeper, and Solomon’s seal.

Thicket areas consist predominantly of maples, black locust, sumac, persimmon, and forest species in the sapling stage with herbaceous ground cover similar to that of the forest understory.

Wildlife commonly found in the PGDP area consists of species indigenous to open grassland, thicket, and forest habitats. The species documented to occur in the area are discussed in the following paragraphs.

Small mammal surveys conducted on WKWMA documented the presence of southern short-tailed shrew, prairie vole, house mouse, rice rat, and deer mouse (KSNPC 1991). Large mammals commonly present in the area include coyote, eastern cottontail, opossum, groundhog, whitetail deer, raccoon, and gray squirrel.

Typical birds of the area include European starling, cardinal, red-winged blackbird, mourning dove, bobwhite quail, turkey, killdeer, American robin, eastern meadowlark, eastern bluebird, bluejay, red-tail hawk, and great horned owl.

Amphibians and reptiles present include cricket frog, Fowler’s toad, common snapping turtle, green tree frog, chorus frog, southern leopard frog, eastern fence lizard, and red-eared slider (KSNPC 1991).

Mist netting activities in the area have captured red bat, little brown bat, Indiana bat, northern long-eared bat, evening bat, and eastern pipistrelle (KSNPC 1991).

4.9.2 Aquatic Systems

The aquatic communities in and around the PGDP area that could be impacted by plant discharges include two perennial streams (Bayou Creek and LBC), the NSDD, a marsh located at the confluence of Bayou Creek and LBC, and other smaller drainage areas. The dominant taxa in all surface waters include several species of sunfish, especially bluegill and green sunfish, as well as bass and catfish. Shallow streams, characteristic of the two main area creeks, are dominated by bluegill, green and longear sunfish, and stonerollers.

4.9.3 Wetlands and Floodplains

Wetlands were identified during the 1994 U.S. Army Corps of Engineers (COE) environmental investigations of 11,719 acres surrounding PGDP. These investigations identified 1,083 separate wetland areas and grouped them into 16 vegetative cover types encompassing forested, scrub/shrub, and emergent wetlands (COE 1994). Wetland vegetation consists of species such as sedges, rushes, spike rushes, and various other grasses and forbs in the emergent portions; red maple, sweet gum, oaks, and hickories in the forested portions; and black willow and various other saplings of forested species in the thicket portions.

At the PGDP, three bodies of water cause most area flooding: the Ohio River, Bayou Creek, and LBC. A floodplain analysis performed by COE (1994) found that much of the built-up portions of the plant lie outside the 100- and 500-year floodplains of these streams. In addition, this analysis reports that ditches within the plant area can contain the expected 100- and 500-year discharge. It should be noted that precipitation frequency estimates for the 100- and 500-year events were updated in 2004 in the NOAA's Atlas 14. For example, the mean precipitation estimate for the 100-year, 24-hour event in Atlas 14 for the Paducah area is 10.1% to 15% greater than the mean estimate in previous publications. As stated in Atlas 14, in many cases, the mean precipitation estimate used previously still is within the confidence limits of that provided in Atlas 14; therefore, it is assumed the plant ditches still will contain the 100- and 500-year discharges.

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5. CHARACTERIZATION OF SITE/PREVIOUS ANALYTICAL DATA

Several documents have been produced containing data pertinent to the various SWMUs/AOCs within the SOU. Additionally, data were downloaded from the Paducah Oak Ridge Environmental Information System (OREIS) database in March 2008. These data were binned for several statistical comparison scenarios.

The historical data set was used to compile various risk-screening tables required by the Risk Methods Document for scoping activities. Historical data is provided in Appendix D of this document. Historical information summarized in this section highlights the background of each SWMU/AOC. Some of the SWMUs/AOCs are under multiple OUs; this is noted in applicable area descriptions. For SWMUs/AOCs that are assigned to multiple OUs, only the portion of the SWMU/AOC that is 0 to 10 ft bgs or 16 ft bgs, where infrastructure (e.g., pipelines) is present, is addressed by this work plan. If data gathered during implementation of this work plan indicate that contamination extends beyond the bounds of this work plan, the data will be utilized in the other OUs.

Risk assessment results, which are included in the Previous Investigation Results, are documented as they were originally reported, consistent with the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* Volume *1: Human Health* (DOE 2001c).

Soil sample depth descriptions are as follows:

Description	Depth
Surface Soil	0 ft to 1 ft bgs
Shallow Soil	1ft to 16 ft bgs
Subsurface Soil	0 ft to 10 ft bgs
Vadose Zone	0 ft to watertable

5.1 EXISTING DATA/SITE DESCRIPTION

5.1.1 C-747-C Oil Landfarm (SWMU 1)

Area description

The C-747-C Oil Landfarm (SWMU 1) is located in the extreme west-central portion of the plant. This SWMU is part of the SOU and the GWOU.

Process history

SWMU 1 was used from 1975 to 1979 for the biodegradation of waste oils contaminated with trichloroethene (TCE), PCBs, 1,1,1-trichloroethane (TCA), and uranium. It is estimated that approximately 5,000 gal of waste oil were applied to the landfarm during its period of operation (DOE 1999a). These waste oils were believed to have been derived from a variety of plant processes. The landfarm consisted of two 1,125 ft^2 plots that were plowed to 1 to 2 ft depth. Waste oils were spread on the surface every 3 to 4 months, then limed and fertilized. The area now is mowed regularly as part of PGDP maintenance operations.

Previous investigation results

Investigations that have collected data on SWMU 1 include the Phase I and Phase II Site Investigations (SI) (CH2M HILL 1991, 1992). Additional sampling was performed to support the waste area group (WAG) 23 FS, the WAG 23 removal action (DOE 1998c), the WAG 27 RI, and the Southwest Plume SI. These investigations and actions identified solvents, PCBs, dioxins, semivolatile organic compounds (SVOCs), heavy metals, and radionuclides as potential COCs (DOE 1999a).

A summary of conclusions from the WAG 23 effort is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. In addition, the PCB ELCR at SWMU 1 also are below *de minimis*. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

The WAG 27 RI (DOE 1999a) found TCE in SWMU 1 soils. The area extent of TCE contamination in the vadose (vadose zone is defined as extending from the top of the ground surface to the water table) zone soils on the north side of the site is approximately 175 x 115 ft. The TCE-impacted soil was found to extend from 5 ft bgs to the top of the water table at 50 ft bgs. Metals also were detected in the subsurface soils at concentrations that were 27 times (silver) background levels. The metals are widely dispersed throughout the SWMU, but the highest metal concentrations generally are restricted to the upper 20 ft of vadose soil.

The primary COCs indentified in WAG 27 RI are beryllium and lead for surface and subsurface soils. Scenarios that were assessed in the WAG 27 baseline risk assessment (BRA) are current on-site industrial worker, future on-site industrial worker, future on-site excavation worker, future on-site recreational user, future off-site recreational user, future on-site rural resident, and future off-site rural resident. The following is an excerpt on land use scenarios from WAG 27 RI:

> At SWMU 1 and SWMU 91 all scenarios assessed are a land use scenario of concern for both systemic toxicity and ELCR. At SWMU 196 for all scenarios assessed, including lead as a contaminant of potential concern (COPC), only the future recreational user exposure to soil for both systemic toxicity and ELCR is not of concern. Possible exceptions at SWMU 196 are the current and future industrial worker exposure to soil which has a total hazard index which falls below 1 if contribution from lead is not considered. At C-720 all scenarios assessed are a land use scenario of concern for both systemic toxicity and ELCR except for the future excavation worker for systemic toxicity.

The maximum volume of soil contaminated by metals covers an area that is 290 x 200 x 28 ft for a volume of over 1,624,000 ft^3.

5.1.2 C-400 Trichloroethene Leak Site, Southeast of C-400 Building (SWMU 11)

Area description

The C-400 TCE Leak Site (SWMU 11) is located at the southeast corner of C-400, near the central portion of the plant. This SWMU is part of the SOU and the GWOU.

Process history

A leak of TCE from the sump in the C-400 degreaser area to the storm sewer was discovered in 1986. TCE was released at various times through broken pipes and joints in a leaking underground storm sewer pipe from the C-400 Building. It had not been known previously that the sump discharged to the sewer. After the leak was discovered, discharge lines from the sump in the basement of C-400 were disconnected from the storm sewer. TCE-contaminated soils were excavated from the area of the leak.

Previous investigation results

TCE concentrations as high as 700,000 μg/kg were reported in soil samples collected adjacent to and below the storm sewer line during removal of the contaminated soil in 1986 (EDGe 1988). Approximately 9,200 ft^3 of contaminated soil and bedding material were excavated, containerized, and stored as hazardous waste for future treatment and disposal. Some of the contaminated soil is known to have been left in place because of concerns about the structural integrity of 11th Street and the TCE Tank Pad, located to the west between the spill site and the C-400 Building (CH2M HILL 1992). The excavated area was backfilled with clean fill material and capped with a layer of clay after excavation activities were completed.

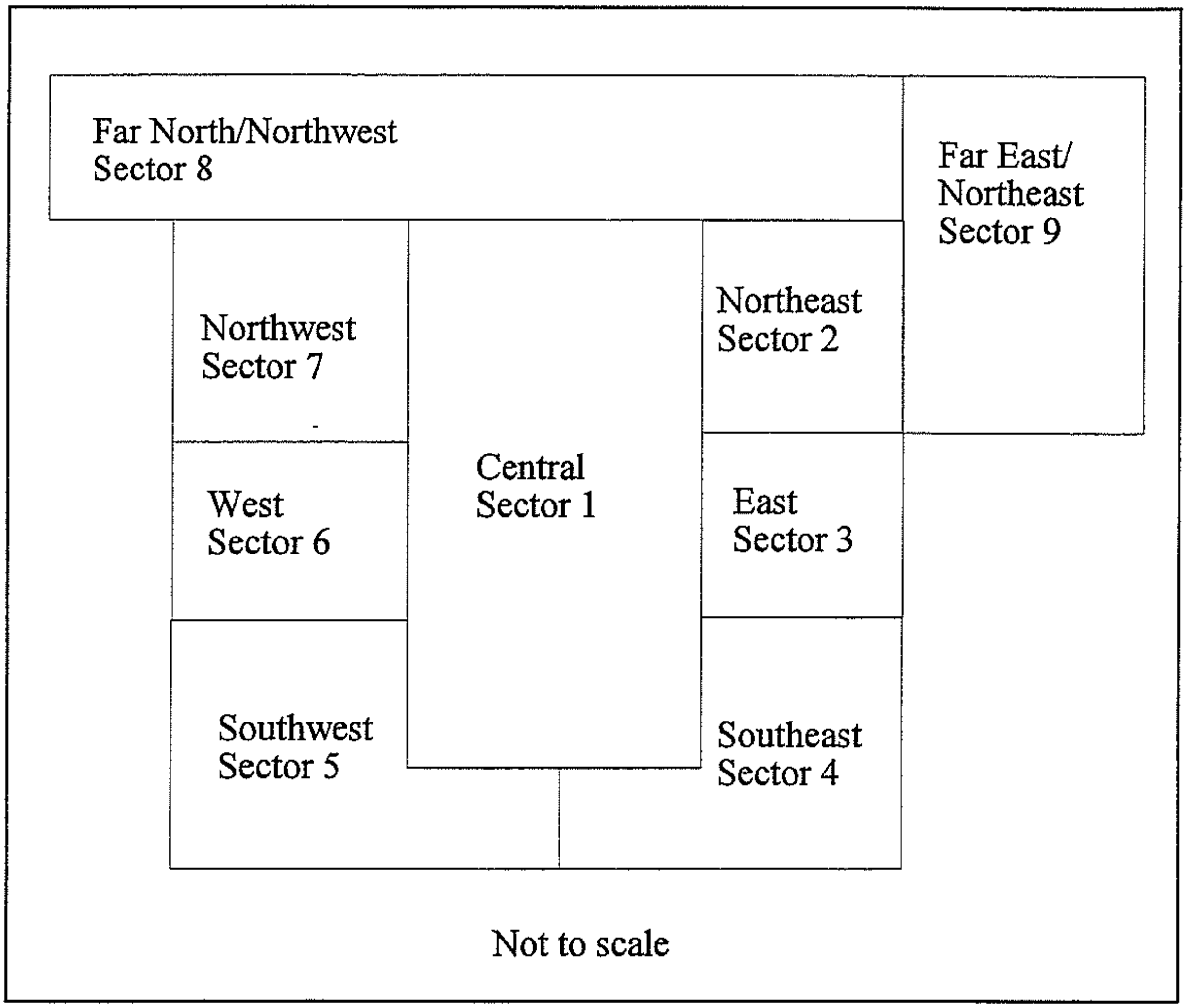
The Trichloroethylene Leak Site (SWMU 11) was investigated under the Phase I and Phase II SIs. The analytical results for the soil samples collected from the deep boring showed that TCE was detected in the soils at concentrations throughout the interval sampled (4 to 93 ft bgs) (DOE 1999b).

The WAG 6 RI (1999) placed SWMU 11 in Sector 4 of its investigation. The conclusions of the WAG 6 RI are presented using geographically related sectors. The Sectors and their definitions are as follows:

- Sector 1–the area under the C-400 Building.
- Sector 2–the area to the northeast of C-400 Building. This Sector contains the Neutralization Tank (SWMU 40).
- Sector 3– the area to the east of the C-400 Building. This Sector does not contain a SWMU.
- Sector 4–the area to the southeast of the C-400 Building. This Sector contains the Trichloroethene Leak Site (SWMU 11) and a trichloroethene (TCE) off-loading pump station.
- Sector 5–the area to the southwest of C-400 Building. This Sector does not contain a SWMU.
- Sector 6–the area to the west of C-400 Building. This Sector contains the Technetium Storage Tank (SWMU 47).
- Sector 7–the area to the northwest of the C-400 Building. This Sector contains the Waste Discard Sump (SWMU 203).

- Sector 8–the area to the far north and far northeast of the C-400 Building. This Sector contains the C-401 Transfer Line (SWMU 26).

- Sector 9–the area to the far east and far northeast of the C-400 Building. This Sector does not contain a SWMU.



Major borders of the Sector are formed by the East Sector (Sector 3) on the north, by 11th Street on the east, by Tennessee Avenue on the south, and by the C-400 Building on the west. In addition to SWMU 11, which is composed of an underground discharge line running from the C-400 Building and the associated soils, the Southeast Sector also contains the TCE Truck Unloading Pumps and storage tank, a parking lot, and a cylinder storage and handling area.

WAG 6 found a widespread TCE-impacted area located primarily between C-400 Building and 11th Street and north of Tennessee Avenue. In that area, a large zone of shallow soil contains greater than 225,000 µg/kg (5–9 ft bgs) TCE, indicating that the chlorinated solvent is present as a dense nonaqueous-phase liquid in the UCRS soil. The highest concentrations were found below the backfilled excavation at SWMU 11 [8,208,600 µg/kg (28–31.5 ft bgs)] and adjacent to the TCE off-loading pumps [11,055,000 µg/kg (5–9 ft bgs)]. The high TCE concentrations in the shallow zone of soil that extends south of the off-loading pumps probably are due to migration of TCE along the bedding material of the utility line that runs north-south through SWMU 11. Other WAG 6 COCs were arsenic, beryllium, dichloroethene, polycyclic aromatic hydrocarbons (PAHs), PCBs, vinyl chloride, cesium-137, aluminum, antimony, chromium, iron, manganese, and vanadium.

Summary table from the BRA for WAG 6 follows:

		Location (Sector Number)								
Scenairo	WAG 6	1	2	3	4	5	6	7	8	9
Results for ELCR										
Current Industrial Worker	X	–	X	X	X	X	X	X	X	X
Future Industrial Worker		–	X	X	X	X	X	X	X	X
Exposure to Soil	X									
Exposure to Water[a]	X									
Future Excavation Worker	X	X	X	X	X	X	X	X	X	X
Future Recreational User	X	–	–	X	–	X	X	–	X	–
Future On-site Resident		–	X	X	X	X	X	X	X	X
Exposure to Soil	X									
Exposure to Water[a]	X									
Results for systemic toxicity[b]										
Current Industrial Worker	X	–	–	–	–	X	X	X	–	X
Future Industrial Worker		–	–	–	–	X	X	X	–	X
Exposure to Soil	X									
Exposure to Water[a]	X									
Future Excavation Worker	X	X	X	–	X	X	X	X	X	X
Future Recreational User	–	–	–	–	–	–	–	–	–	–
Future On-site Resident		–	X	X	X	X	X	X	X	X
Exposure to Soil	X									
Exposure to Water[a]	X									

[a] In the BHHRA, the risk from exposure to water was assessed on a WAG 6 area basis; therefore, these risks are not summed with those from exposure to soil. Additionally, in the BHHRA, risks associated with use of water drawn from the RGA were assessed separately from risks associated with use of water drawn from the McNairy Formation. The value reported here is for use of water drawn from the RGA.

[b] For the future recreational user and the future on-site resident scenarios, the results for child exposure are presented.

Notes: Scenarios in which risk exceeded *de minimis* levels are marked with an "X". Scenarios in which risk did not exceed *de minimis* levels are marked with a "–".

5.1.3 C-747-A UF_4 Drum Yard (SWMU 12)

Area description

The C-747-A UF_4 Drum Yard (SWMU 12) is located in the northwest corner of the plant. SWMU 12, formerly known as "Drum Mountain," is approximately 20,000 ft^2. SWMU 12 also is sited within C-747-A Burial Ground (SWMU 7); therefore, any scrap metal identified by the SOU RI found to be 10 ft bgs or below will be investigated under the BGOU.

Process history

Between 1978 and 2000, the C-747-A UF_4 Drum Yard was used for the storage of UF_4 drums generated in the pulverizer and screener operation at C-400. These drums had been emptied, rinsed, and frequently crushed prior to storage.

The UF_4 drum pile was placed over Pit G, and was reported to contain noncombustible, contaminated, and uncontaminated trash and equipment of the SWMU 7 burial grounds.

These storage yards were emptied, as specified by the *Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant* (DOE 2001a).

Previous investigation results

"Drum Mountain" was sampled in 1996 and 2000 for various constituents, such as metals, volatiles, semivolatiles, and radionuclides. The area also was investigated as part of the BGOU RI (January–May 2007). The results of the BGOU investigation concluded that metal exists to a maximum depth of 16 ft bgs.

5.1.4 C-746 P and P1 Scrap Yards (SWMU 13)

Area description

The C-746-P and C-746-P1 Clean Scrap Yard (SWMU 13) are located in the northwest corner of plant site. SWMU 13 includes both scrap yards, C-746-P and C-746-P1, and is approximately 314,000 ft^2 (290 ft x 1,076 ft). This SWMU is part of the SOU and the SWOU.

Process history

SWMU 13, C-746-P Clean Scrap Yard, was an aboveground scrap yard used for storage from the 1950s to 2005 for clean scrap metal prior to sale to metal reclaimers. During the summer of 1989, some scrap at the yard was found to be contaminated by uranium. Based on this discovery, the site was divided into a contaminated scrap yard, comprising approximately the eastern two-thirds of the original waste management unit and designated as C-746-P, and a clean scrap yard, comprising approximately the western one-third of the original unit and designated C-746-P1. Suspected contaminants of the scrap metal include uranium and asbestos. The scrap yard also contained drums of "heels" of remnant fluids potentially contaminated by petroleum hydrocarbons and TCE.

These storage yards were emptied, as specified by the *Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant* (DOE 2001a).

Previous investigation results

The Phase II Site Investigation (1991) sampled shallow soils in the area. Suspected contaminants of concern for the SWMU soils include semivolatiles, metals, and radionuclides.

SWMU 13 has had geophysics performed on areas inside the C-746-P and C-746-P1 Scrap Yards as part of the BGOU RI. Geophysics was performed on these areas to assess if scrap metal was buried in them. The results of the geophysics survey indicated there was metal found in three areas. Metals were found in two locations at a depth of 2 ft bgs and in one location at a depth of 2 ft bgs with a center trough of 4 to 6 ft bgs.

5.1.5 C-746-E E Scrap Yard (SWMU 14)

Area description

The C-746-E Contaminated Scrap Yard (SWMU 14) is located in the northwest corner of plant site. SWMU 14 is approximately 265,000 ft^2. This SWMU is part of the SOU and the SWOU.

Process history

C-746-E was used for the storage of uranium-contaminated scrap metal, including ferrous alloys, copper and copper alloys, nickel-plated steel, Monel®, and aluminum from the 1950s through 2005. In addition, Burial Pit E is located under the northeastern section of C-746-E. Burial Pit E was investigated under the BGOU in conjunction with SWMU 7.

The storage yard was emptied as specified by the *Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant* (DOE 2001a).

Previous investigation results

The Phase II SI sampled surface and shallow soils in the area. Contaminants of concern include metals and radionuclides.

5.1.6 C-746-C C Scrap Yard (SWMU 15)

Area description

The C-746-C Scrap Yard (SWMU 15) is located in the northwest corner of plant site. SWMU 15 is approximately 250,000 ft^2. This SWMU is part of the SOU and the SWOU.

Process history

The C-746-C Scrap Yard originally was used to store uncontaminated scrap metal prior to being shipped off-site; however, it was subsequently converted to long-term storage of scrap metal after off-site shipments were discontinued. It is divided into north and south areas to segregate the space into two different storage yards. A large portion of the south section was used for storage of ingots produced in C-746 smelting operations and turnings from the machine shop. Most of the north section was used in the construction of the C-616 Chromate Treatment Facility and clarifiers.

The storage yard was emptied as specified by the *Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant* (DOE 2001a).

Previous investigation results

No investigations are available.

5.1.7 C-746-D D Scrap Yard (SWMU 16)

Area description

The C-746-D Scrap Yard (SWMU 16) is located in the east central portion of the plant site. SWMU 16 is approximately 59,400 ft^2 (180 ft x 330 ft). This SWMU is part of the SOU and the SWOU.

Process history

The concrete pad upon which C-746-D rests originally was constructed as a cleaning facility for the construction of the plant, known as the Kellogg Building. After the Kellogg Building was removed, the concrete pad was used to store decontaminated scrap metal from the cascade operations, including steel and nickel-plated steel.

The storage yard was emptied, as specified by the *Action Memorandum for Scrap Metal Disposition at the Paducah Gaseous Diffusion Plant* (DOE 2001a).

Previous investigation results

Process knowledge indicates radiological contaminant exists at SWMU 16. Not all process materials from the cascade buildings were fully decontaminated, and it is suspected that some process materials penetrated surface soils. The subsurface soils under the concrete pad at SWMU 16 were investigated in conjunction with SWMU 99 (that abuts SWMU 16) during the WAG 28 RI, which states: "Sampling of the soils within SWMU 99 detected a limited suite of metals above screening criteria and isolated occurrences of VOAs in the surface soils." Also noted in the BRA: "For all sites, the cumulative human health ELCR and systemic toxicity exceed the accepted standards of the KDEP and the EPA for one or more scenarios when assessed using default exposure parameters."

5.1.8 C-410-B HF Emergency Lagoon (SWMU 19)

Area description

The C-410-B hydrogen fluoride (HF) Emergency Lagoon (SWMU 19) is a below-grade impoundment with an earth/clay floor and wire-reinforced grout walls. SWMU 19 is located north of the C-410 Building in the central portion of the plant site. SWMU 19 is approximately 1,900 ft^2 (38 ft x 51 ft) and 7-ft deep. This SWMU currently is listed in the *Action Memorandum for the Soils Operable Unit Inactive Facilities at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/LX/07-0120&D1).

Process history

SWMU 19 received effluent from the C-410-C Neutralization Building, where lime was used for the neutralization of HF cell electrolyte from lead-acid batteries. In addition, trucks transporting fly ash to the C-746-T inert landfill were rinsed in this impoundment. All processes in the C-410 Building ceased in the late 1970s.

Previous investigation results

In 1991, the C-410-B HF Neutralization Lagoon was investigated as part of the Phase II SI, and sediment and soil samples were collected from the lagoon (CH2M HILL 1992). Analytical results indicated low-level concentrations of PAHs in soil samples from a single soil boring. TCE was detected in soil samples from the upper 15 ft of the boring. Surface water samples collected from the lagoon indicated traces of PAHs. In addition, the surface water samples contained detectable concentrations of technetium-99, uranium-235, uranium-234, uranium-238, barium, and nickel. Surface soil samples contained PAHs, as well as detectable concentrations of arsenic, chromium, mercury, selenium, barium, lead, nickel, silver, technetium-99, uranium-234, uranium-235, and uranium-238. Sludge samples taken from the C-410-B Lagoon in July 1991 for waste characterization also indicated detectable concentrations of total uranium and technetium-99.

In 1999, the C-410-B HF Neutralization Lagoon was investigated using soil borings to 15 ft bgs during the WAGs 9 and 11 Site Evaluation (SE). The SE found detected concentrations of technetium-99, uranium-234, uranium-235, and uranium-238 that were about 10 times their background concentration (DOE 1999c). The SE concluded that additional analyses (i.e., risk assessment) are necessary to determine the extent of risks to industrial workers and non-human receptors. Several organic compounds and inorganic chemicals were detected at concentrations that exceed their direct contact screening criteria.

5.1.9 C-410-E Emergency Holding Pond (SWMU 20)

Area description

The C-410-E HF Emergency Lagoon (SWMU 20) has grout and wire-reinforced walls and floor. SWMU 20 is located east of the C-410 Building in the central portion of the plant site and is approximately 600 ft^2 (20 ft x 30 ft) and 7-ft deep.

Process history

The lagoon was constructed to contain possible releases for the HF tank farm, though none occurred. A scrubber located near the pond sprayed continuously during normal operations to dilute any possible release and discharged to this holding pond. The lagoon discharged to the site storm drainage system. The lagoon currently discharges stormwater to the NSDD.

Previous investigation results

SWMU 20 was investigated and results are included in WAGs 9 and 11 SE. The SE determined that constituents that exceeded their systemic toxicity or cancer risk based screening value are aluminum, arsenic, beryllium, chromium, iron, manganese, vanadium, PCB-1254, PCB-1260, and Total PCBs.

The inorganic chemicals of Be and Cr were detected only at slightly above background concentrations (0.92 mg/kg versus 0.67 mg/kg, respectively, for Be; 28.8 mg/kg versus 16.0 mg/kg, respectively, for Cr). Of the organic compounds, the maximum cancer risk-based screening value to an unprotected industrial worker is between 1×10^{-6} and 1×10^{-5}.

A sample of sludge from the bottom of the pond also indicates the presence of radiological constituents, PCBs, and nickel.

The recommendation in the Site Evaluation is for additional site-specific analyses (i.e., risk assessment) to determine if site risks due to direct contact really exceed *de minimis* levels.

5.1.10 C-400 to C-404 4 inch Underground Transfer Line, 1,500 ft long (SWMU 26)

Area description

The C-400 to C-404 Underground Transfer Line (SWMU 26) is located in the central portion of the plant site. SWMU 26 is a 4-inch steel line, approximately 1,500 ft long.

Process history

From 1951 to 1956, SWMU 26 was used to transfer uranium-contaminated solutions from C-400 to C-404 for settling prior to discharge. The transfer line was abandoned in 1957.

Previous investigation results

The area surrounding the line was sampled during the Phase II SI and the WAG 6 RI, which located SWMU 26 in Sector 8 (refer to Section 5.1.2, "*Previous Investigation Results*"). Results of the investigation indicate metals, PAHs, and radionuclide contamination occurred from leaks in the pipeline.

Metals and radiological contaminants were found in high concentrations in soil samples collected directly beneath the pipeline, and nickel and copper were detected in a soil sample collected at 7.5 ft bgs in a boring adjacent to the excavated pipeline area. A shallow soil sample (4 to 8 ft bgs) at the western most boring exhibited an isolated occurrence of TCE and its degradation product, *cis*-1,2dichloroethene, at a low concentration and high radioactivity. The surface soil did not contain elevated radionuclide activity, which implies that the impact may be the result of a subsurface release.

The summary table from the BRA for WAG 6, showing which human health risk exceed *de minimis,* is located in the *"Previous Investigation Results"* of Section 5.1.2.

5.1.11 C-722 Acid Neutralization Tank (SWMU 27)

Area description

The C-722 Acid Neutralization Tank (SWMU 27) is an underground concrete tank lined with an acid-resistant membrane and acid brick. SWMU 27 is located at the northeast corner of the C-720 Building in the central portion of the plant site. The tank is approximately 180 ft^2.

Process history

The C-722 Acid Neutralization Tank was designed as a hold-up tank for instrument shop effluent from the 1950s. All lines were capped from the instrument shop. All sludge and water were removed after the lines were capped. Discharge to the tank was stopped in 1992.

Previous investigation results

A sludge sample from 1989 indicated a high level of mercury. The area soils were further sampled as part of the SE for WAGs 9 and 11, and it was determined that contamination present at SWMU 27 does not present risks that exceed *de minimis* levels to industrial workers, potential residential groundwater users, or non-human receptors. Direct contact risks are *de minimis* because contaminated media are not available for direct contact at SWMU 27. Risks from use of groundwater contaminated by the migration from soil are *de minimis* because the concentrations of all contaminants in soil were below the groundwater protection screening criteria. An NFA was proposed; however, the SE process was replaced with the OU strategy and SWMU 27 remains to be investigated under the SOU.

5.1.12 C-720 Compressor Pit Water Storage Tank (SWMU 31)

Area description

The C-720 Compressor Pit Water Storage Tank (SWMU 31) is located at the northeast corner of the C-720 Building in the central portion of the plant site. The tank designated as SWMU 31 was approximately 1,000 gal.

Process history

The storage tank held waste water containing uranium from C-720 Compressor Shop operations. The dates of operation are unknown. In 1985 the tank leaked when the concrete block dike was damaged and some material spilled onto the ground. The tank was removed in the early 1990s.

Previous investigation results

Historical knowledge indicates that radiological contamination of soil exists at SWMU 31.

5.1.13 C-728 2 Clean Waste Oil Tanks (SWMU 32)

Area description

The C-728 Clean Waste Oil Tanks (SWMU 32) is located north of the C-720 Building in the central portion of the plant site. SWMU 32 consisted of two, aboveground tanks approximately 8,000 gal and 4,000 gal, respectively. The tanks have since been removed.

Process history

The C-728 Clean Waste Oil Tanks were used to store waste oil and motor cleaning solvents (mineral spirits).

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs and during the WAG 23 RI. Results of these investigations indicate the presence of solvents and oil. COCs listed in the WAG 23 RI are PAHs, PCBs, dioxins, and uranium. The WAG 23 Remedial Action Report (RAR) states that the average PCB concentration at SWMU 32 is 0.2 parts per million (ppm), and the PCB ELCR is below *de minimis* for current industrial and future industrial workers.

5.1.14 C-403 Neutralization Tank (SWMU 40)

Area description

The C-403 Neutralization Tank (SWMU 40) is an in-ground concrete, open-top tank lined with two layers of acid bricks located northeast of the C-400 Building in the central portion of the plant site. The tank is approximately 25 ft square by 26 ft deep. This SWMU is currently listed in the *Action Memorandum for the Soils Operable Unit Inactive Facilities at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-0120&D1.

Process history

The C-403 Neutralization Tank received influent from the C-400 Building for the storage and treatment (i.e., neutralization) of acidic, uranium-bearing waste solutions generated during cleaning operations. During treatment, lime slurry was added to the wastewater from the C-402 Lime House to raise the pH and precipitate out the uranium in the form of a low-level radioactive sludge. Once the pH was raised to the proper level (10 to 12), the effluent was discharged to the C-404 Holding Pond where the sludge was allowed to settle out of the solution.

In 1957, the discharge from the C-403 Neutralization Tank was routed to the NSDD, where it flowed to the LBC. In the late 1970s, flow from the NSDD was routed into the C-616-F Full Flow Lagoon, and direct discharge to LBC was subsequently discontinued. Although neutralization was no longer carried out at C-403 after 1957, low-level, uranium-bearing wastewater continued to be discharged to C-403 until 1990. These discharges included UF_6 cylinder hydrostatic-test water, overflow and runoff from cleaning tanks, discharge from floor drains, and other unknown sources. After 1990, the C-403 Neutralization Tank was removed from service.

Previous investigation results

Soil boring and groundwater samples obtained during the Phase II SI and WAG 6 RI indicate the potential for radiological, PCB, metals, and PAH contamination.

In 1993, nine water and three sediment samples were collected from the C-403 Neutralization Tank. Analytical results indicated TCE concentrations in the nine water samples, and TCE concentrations in the three sediment samples (DOE 1999b). During the WAGs 6 RI, a water line located near the C-403 tank broke, and subsurface water flowed into the tank from one of the still existing fill lines. Approximately 198 m^3 (7,000 ft^3) of water accumulated in the tank. Samples of the water from the tank were analyzed in 1997 and were found to contain TCE. Resampling in 1998 indicated that TCE concentrations in water exceeds the risk-based action levels for the industrial worker exposure scenario (DOE 2000a).

The WAG 6 RI placed SWMU 40 into Sector 2 (refer to Section 5.1.2, *"Previous Investigation Results"* for a definition of Sectors used in WAGs 9&11 RI). Subsurface soil collected adjacent to the tank backfill at a depth of 30 ft bgs was found to be impacted by several radionuclides. Based upon available data, the extent of contamination around the C-403 Neutralization Tank appears to be limited to the area of the tank backfill. Elevated radioactivity also was detected at a few locations along the former storm sewer utility line that connects the C-403 Neutralization Tank to the HF Lagoon. High concentrations of two metals, silver and antimony, were associated with the area of elevated radioactivity detected along this line. Both metals were used in the plating process that was performed within the C-400 Building.

The summary table from the BRA for WAG 6, showing which human health risk exceed *de minimis*, is located in the Previous Investigation Results of section 5.1.2.

5.1.15 C-400 Technetium Storage Tank Area (SWMU 47)

Area description

The C-400 ^{99}Tc Storage Tank Area (SWMU 47) is located west of the C-400 Building in the central portion of the plant site. Prior to dismantling and disposal, the 4,000 gal tank was located on a concrete pad.

Process history

From the early 1960s to 1986, the C-400 ^{99}Tc Storage Tank was used in the technetium recovery process to store a waste solution of chromium and technetium-99.

Previous investigation results

The tank was emptied of liquids (approximately 200 gal of solution) and removed in 1986. Soil boring and groundwater samples were obtained during the WAG 6 RI, which placed SWMU 47 into Sector 6 (refer to Section 5.1.2, *"Previous Investigation Results"* for a definition of Sectors used in WAGs 9&11

RI). Results of this sampling indicate the potential for radiological, chromium, and PAH contamination. Shallow surface soil samples collected at 4.5 ft bgs in this boring contained the highest concentration of many of the identified radionuclides, but no PAHs. The radioactivity of the soil decreased substantially below 4.5 ft bgs. TCE was reported at high levels between 4.5 and 29.5 ft bgs (the deepest sample collected). The level of TCE in the subsurface soils remained relatively constant from near surface to the total depth. Other borings drilled and sampled within Sector 6 to assess the utility corridors and C-400 Area perimeter contained no contaminants of concern, or exhibited only isolated occurrences of contaminant concentrations.

The summary table from the BRA for WAG 6, showing which human health risk exceed *de minimis*, is located in the *"Previous Investigation Results"* of Section 5.1.2.

5.1.16 C-540-A PCB Staging Area (SWMU 56)

Area description

The C-540-A PCB Staging Area (SWMU 56) is located in the west central portion of the plant site.

Process history

SWMU 56 is made up of leaks and spills of oils containing PCBs as a result of past operations that contaminated the soils.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs and during the WAG 23 RI. Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 non-time-critical removal action, 23 yd^3 of soil contaminated with dioxins and 72 yd^3 of soil contaminated with PCBs were excavated for SWMUs 56 and 80. A summary of conclusions from the WAG 23 effort, based on the future use scenario of unrestricted industrial, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

5.1.17 C-541-A PCB Waste Staging Area (SWMU 57)

Area description

The C-541-A PCB Waste Staging Area (SWMU 57) is located in the northeast portion of the plant site.

Process history

SWMU 57 is made up of leaks and spills of oils containing PCBs as a result of past operations that contaminated the soils.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs and during the WAG 23 RI. Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 non-time-critical removal action,, 23 yd^3 of soil contaminated with dioxins and 32 yd^3 of soil contaminated with PCBs were excavated for SWMUs 57 and 81. A summary of conclusions from the WAG 23 RAR, based on the future use scenario of unrestricted industrial,, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

5.1.18 C-340 PCB Transformer Spill Site (SWMU 74)

Area description

The C-340 PCB Transformer Spill Site (SWMU 74) is located in the east central portion of the plant site.

Process history

SWMU 74 is the site of a PCB transformer spill.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II Site Investigations and during the WAG 23 RI. The WAG 23 FS retained, for the current and future industrial workers, no COCs, stating that neither the total pathway ELCR nor the chronic HI exceeds risk-based EPA thresholds (total pathway risk exceeding 10^{-4} ELCR or an HI of 1) at the SWMU.

5.1.19 C-633 PCB Spill Site (SWMU 75)

Area description

The C-633 PCB Spill Site (SWMU 75) is located in the southeast portion of the plant site.

Process history

In 1998, a release of non-PCB oil (3.8 ppm) per the Toxic Substances Control Act (TSCA) occurred when a transformer located in the C-633 Pump House lost an estimated 50 to 100 gal of oil. As part of the general operations at C-633, the spill area was quickly contained and cleanup commenced through removal of all visible traces of the spill from the affected area.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs. Results of these investigations, which were conducted to assess the surface migration pathway only, indicate the presence of PCBs and oil. PCBs were detected in the surface soils at a maximum concentration of 1 ppm.

5.1.20 C-632-B Sulfuric Acid Storage Tank (SWMU 76)

Area description

The C-632-B Sulfuric Acid Storage Tank (SWMU 76) is located in the central portion of the plant site. The tank itself is empty, but the unit includes a diked area surrounding the tank. This SWMU is located on the south end of DOE Material Storage Area (DMSA) OS-11, SWMU 222.

Process history

The tank was used for the storage of sulfuric acid. Spills of sulfuric acid inside the diked area are known to have occurred.

Previous investigation results

No previous samples have been taken at this location.

5.1.21 C-634-B Sulfuric Acid Storage Tank (SWMU 77)

Area description

The C-634-B Sulfuric Acid Storage Tank (SWMU 77) is located in the southeast portion of the plant site. The tank has been removed, but the concrete dike still is in place.

Process history

The tank was used for the storage of sulfuric acid. Spills and/or releases of sulfuric acid from the storage tank potentially occurred when the unit was in use.

Previous investigation results

No previous samples have been taken at this location.

5.1.22 C-420 PCB Spill Site (SWMU 78)

Area description

The C-420 PCB Spill Site (SWMU 78) is located in the central portion of the plant site and is approximately 5,000 ft^2.

Process history

C-420 PCB Spill Site is the result of a transformer rupture at the southwest corner of the C-420 Building in 1967. Some soils were excavated from the area at the time of the spill.

Previous investigation results

SWMU 78 was investigated as part of the Phase I and Phase II SIs. Results of these investigations show PCBs were detected in the surface soils at a maximum concentration of 12 ppm. Also detected were metals, SVOCs, VOCs, and radiological constituents.

5.1.23 C-611 PCB Spill Site (SWMU 79)

Area description

The C-611 PCB Spill Site (SWMU 79) is located within the C-611 Water Treatment Facility, west of the plant site.

Process history

The transformer bank for the C-611 water treatment plant may have released oils containing PCBs to the soils surrounding the transformers. The oils may have migrated downhill by gravity flow or contaminated soils may have been transported downhill in surface runoff during precipitation events. Some soils may have been carried as far as Bayou Creek and deposited in the creek sediments.

Previous investigation results

The C-611 PCB Spill Site was investigated during the Phase I and Phase II SIs and during the WAG 23 RI. The WAG 23 FS retained for the current and future industrial workers no COCs, stating that neither the total pathway ELCR nor the chronic HI exceeds risk-based EPA thresholds (total pathway risk exceeding 10^{-4} ELCR or an HI of 1) at the SWMU.

5.1.24 C-540 PCB Spill Site (SWMU 80)

Area description

The C-540 PCB Spill Site (SWMU 80) is located in the east central portion of the plant site.

Process history

SWMU 80 is made up of leaks and spills of oils containing PCBs as a result of past operations which contaminated the soils.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs and during the WAG 23 RI. Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 non-time-critical removal action, 23 yd^3 of soil contaminated with dioxins and 72 yd^3 of soil contaminated with PCBs were excavated for SWMUs 56 and 80. A summary of conclusions from the WAG 23 effort, based on the future use scenario of unrestricted industrial, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. In addition, the PCB ELCR at SWMU 1 also are below *de minimis.* These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

5.1.25 C-541 PCB Spill Site (SWMU 81)

Area description

The C-541 PCB Spill Site (SWMU 81) is located in the northeast portion of the plant site.

Process history

SWMU 81 is made up of leaks and spills of oils containing PCBs as a result of past operations which contaminated the soils.

Previous investigation results

Soil boring samples were obtained during the Phase I and Phase II SIs and during the WAG 23 RI. Results of these investigations indicate the presence of PCBs.

In 1997, as part of the WAG 23 non-time-critical removal action, 23 yds^3 of soil contaminated with dioxins and 32 yds^3 of soil contaminated with PCBs were excavated for SWMUs 57 and 81. A summary of conclusions from the WAG 23 effort, based on the future use scenario of unrestricted industrial, is as follows:

> Following the removal action at WAG 23 sites, the residual PCB ELCR based on a 250 day/year exposure scenario is 2×10^{-6} at SWMUs 56 and 80 and below *de minimis* (i.e., 1×10^{-6}) at SWMUs 57 and 81. In addition, the PCB ELCR at SWMU 1 also are below *de minimis*. These risk levels are well within the EPA's acceptable risk range of 1×10^{-4} to 1×10^{-6}, as required by the NCP.

5.1.26 C-745 Kellogg Building Site (SWMU 99)

Area description

The C-745 Kellogg Building Site (SWMU 99) is located in the east central portion of the plant site. Included in the SWMU are a former septic tank, leach field, and clay piping southeast of the former building location (concrete pad) and the gravel covered parking area. SWMU 99 totals approximately 2.7 acres.

Process history

The C-745 Kellogg Building Sites was constructed in 1951 as facilities for pipe fabrication and pipe cleaning activities during construction of the plant. The building was demolished in 1955, but the remaining concrete pads are used to store UF_6 cylinders and waste at the C-745-E Cylinder Storage Yard the C-746-D Scrap Yard (SWMU 16), respectively.

The area also contained a former septic tank and leach field used by the Kellogg Buildings. The tank and associated leach field were connected to the Kellogg Buildings by a vitreous clay drain line. The tank and the leaching field are believed to have been designed to receive sanitary waste from the buildings' operations; however, the actual configuration of the drainage system is unknown. No records exist as to what was done with the residual contents of the tank after the buildings were demolished or whether any closure or removal actions were taken. The lateral lines for the leaching field were found intact when they were encountered during construction activities in late 1994.

Previous investigation results

SWMU 99 was investigated during the Phase II SI. VOCs (primarily TCE), metals, and radionuclides were reported in the groundwater samples collected.

The WAG 28 RI/FS conducted in 1999 focused on potential metals contamination in soils of SWMU 99 based on previous studies and the process knowledge of the activities conducted in this area at the Kellogg Buildings. These studies noted the sporadic presence of some metals in soil at slightly above background levels for subsurface soils. These metals include antimony, barium, beryllium, cadmium, chromium, iron, lead, manganese, and vanadium.

The data from WAG 28 RI/FS was assessed for risk. The results are documented in *Remedial Investigation Report for Waste Area Grouping 28 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2000b). SWMU was divided into two 2 sections, 99a (Kellogg Building Sites) and 99b (septic system/leach field), in the risk assessment.

Landuse scenarios evaluated for 99a are current on-site industrial worker, future on-site industrial worker, future on-site excavation worker, future on-site recreational user, future on-site rural resident, and future off-site rural resident. COCs listed were beryllium; lead; chromium; barium; benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno (1,2,3,-cd)pyrene; PCB-1016; PCB-1254; neptunium-237; technetium-99; thorium-234; uranium-234; uranium-238; trichloroethene; radon-222; aluminum; arsenic; iron; manganese; vanadium; 1;1 dichloroethane; trichloroethene; carbon tetracholoride; *cis*-1,2-dichloroethene; *trans*-1,2-dichloroethene; 1,1-dichloroethene; and lithium.

Landuse scenarios evaluated for 99b are future on-site industrial worker, future on-site excavation worker, future on-site rural resident, and future off-site rural resident. COCs for 99b are beryllium, trichloroethene, lead, radon-222, and chromium.

Significant results of the BHHRA and baseline ecological risk assessment (BERA) pertinent to this investigation are as follows:

- Scenarios for which human health risk exceeds *de minimis* levels [i.e., a cumulative human health excess lifetime cancer risk of 1E-6 or a cumulative hazard index (HI) of 1]: future industrial worker exposure to RGA groundwater and McNairy groundwater; future on-site resident exposure to soil, RGA groundwater and McNairy groundwater; off-site resident exposure to groundwater; future excavation worker exposure to soil; current industrial worker exposure to soil; future industrial worker exposure to soil; future on-site residential exposure to soil; future recreational user exposure to soil; and future excavation worker exposure to soil.

- Although chromium and zinc exceed benchmarks for plants and soil invertebrates and barium exceeds benchmarks for plants, potential risks to plant and soil invertebrate communities from future exposure to surface soil at this site appear low.

- Estimated doses from exposure to radionuclides in soil are below recommended dose rate limits for wildlife, but dose rates for plants and soil invertebrates are higher than the recommended dose rate limit of 1 rad/day. Technetium-99 is the radionuclide of concern based on its occurrence in a single sample.

5.1.27 C-333 PCB Soil Contamination (SWMU 135)

Area description

The C-333 PCB Soil Contamination (SWMU 135) is located north of the C-333 Building in the east central portion of the plant site.

Process history

It is unknown how this area experienced a PCB spill.

Previous investigation results

Surface soil sampling prior to a pavement construction project in 1991 detected the presence of PCBs at a maximum concentration of 220 ppm in one location (DOE 1997f). Other detections include arsenic, barium, chromium, lead, nickel, and uranium.

5.1.28 C-746-A Inactive PCB Area (SWMU 137)

Area description

The C-746-A Inactive PCB Area (SWMU 137) is a sump inside a concrete dike and is located in the northwest portion of the plant site.

Process history

This concrete dike was for a transformer, which has been removed. The valve to the sump was tagged caution on September 14, 1990, to prevent any possible PCB-contaminated water from being released to the sewer system. There is no documentation of such a release.

Previous investigation results

No sample data is available for the area.

5.1.29 C-100 Southside Berm (SWMU 138)

Area description

The C-100 Southside Berm (SWMU 138) is located south of the C-100 Building, south of the plant site. SWMU 138 consists of two soil berms, each approximately 10,000 ft^2 (200 ft x 50 ft).

Process history

In 1979, a landscaping project used sludge dredged from the C-611 Lagoon, the potable drinking water treatment plant, and C-615 Sewage Treatment Plant on the south side of C-100 Building to construct the berm.

Previous investigation results

Characterization was performed on preliminary soil samples collected in September and October 1991 for WAG 13, and a draft screening assessment was prepared showing that the primary COCs for this SWMU are PCBs, radionuclides, mercury, and lead (Jacobs EM Team 1994).

5.1.30 C-331 PCB Soil Contamination (West) (SWMU 153)

Area description

The C-331 PCB Soil Contamination (West) (SWMU 153) is located west of the C-331 Building in the west central portion of the plant site. The area is approximately 100 ft wide by 420 ft long.

Process history

The SWMU was used as a dust palliative area to reduce the amount of dust taken in by the C-331 Building ventilation systems.

Previous investigation results

SWMU 153 was part of WAGs 16&19. Information obtained in the scoping information package for WAGs 16&19 project identified surface sampling that detected PCBs at a maximum concentration of 0.6 mg/kg. Uranium also was detected (DOE 1997f).

5.1.31 C-331 PCB Soil Contamination (Southeast) (SWMU 154)

Area description

The C-331 PCB Soil Contamination (Southeast) (SWMU 154) is located southeast of the C-331 Building in the east central portion of the plant site. The area consists of three distinct areas: area 1–south side, 100 ft wide by 160 ft long; area 2–southeast corner 100 ft wide by 160 ft long; and area 3–east side 100 ft wide by 210 ft long (all approximate dimensions).

Process history

The SWMU was used as a dust palliative area to reduce the amount of dust taken in by the C-331 Building ventilation systems.

Previous investigation results

SWMU 154 was part of WAGs 16&19. Information obtained in the scoping information package for WAGs 16&19 project identified surface samples detected PCBs at a maximum concentration of 3.2 mg/kg. Uranium also was detected (DOE 1997f).

5.1.32 C-333 PCB Soil Contamination (West) (SWMU 155)

Area description

The C-333 PCB Soil Contamination (West) (SWMU 155) is located in the south central portion of the plant site. SWMU 155 consists of two areas that are approximately 100 ft wide by 150 ft long each.

Process history

The area historically was used as a dust palliative area to reduce the amount of dust taken in by the C-331 Building ventilation systems.

Previous investigation results

SWMU 155 was part of WAGs 16&19. Information obtained in the scoping information package for WAGs 16&19 project identified surface samples that detected PCBs at a maximum concentration of 17 mg/kg. Uranium, arsenic, barium, chromium, lead, and nickel also were detected (DOE 1997f).

5.1.33 C-310 PCB Soil Contamination (West) (SWMU 156)

Area description

The C-310 PCB Soil Contamination (West Side) (SWMU 156) is located in the central portion of the plant site. The approximate dimension of SWMU 156 is 100 ft wide by 160 ft long.

Process history

The area historically was used as a dust palliative area to reduce the amount of dust taken in by the C-331 Building ventilation systems.

Previous investigation results

SWMU 156 was part of WAGs 16&19. Information obtained in the scoping information package for WAGs 16&19 project identified surface samples that detected PCBs at a maximum concentration of 0.3 mg/kg. Uranium was also detected (DOE 1997f).

5.1.34 Chilled-Water System Leak Site (SWMU 158)

Area description

The Chilled-Water System Leak Site (SWMU 158) is located in the central portion of the plant site, southeast of the C-720 Building. The SWMU consists of chilled waterlines located under the concrete pad near the C-720 Truck Alley. The SWMU 158 area is approximately 10 ft wide by 30 ft long.

Process history

The primary function of the system was to provide cooling water for computer systems and heating ventilation and air conditioning (HVAC) systems in various plant buildings. The site is an area where approximately 3,500 gal of chromated water from the chilled water system leaked into an adjacent electrical vault and spilled over to another connected vault. Suspected contamination is hexavalent chromium due to process knowledge.

Previous investigation results

No previous investigation results are available.

5.1.35 C-745 Cylinder Yard Spoils (PCB Soils) (SWMU 160)

Area description

The C-745 Cylinder Yard Spoils (PCB Soils) (SWMU 160) is located in the southeast portion of the plant site. SWMU 160 is approximately 300 ft wide by 500 ft long.

Process history

Historically, this area was used as storage of excavated soils and soils for fill from other projects at the PGDP.

Previous investigation results

Surface samples detected PCBs at a maximum concentration of 1.9 mg/kg. Uranium, arsenic, barium, chromium, lead, silver, selenium, cadmium, thallium, and nickel also were detected (DOE 1997f).

5.1.36 C-304 HVAC Piping System (Soil Backfill from C-611) (SWMU 163)

Area description

The C-304 Building/HVAC Piping System (Soil Backfill) (SWMU 163) is located in the central portion of the plant site. SWMU 163 is approximately 100 ft wide by 200 ft long.

Process history

Soils from the C-611-V Lagoon borrow area were used for fill material for C-304 construction activities. The fill material was used as a base for the HVAC piping system and as a heat sink; it is located approximately 6 ft bgs.

Previous investigation results

The borrow area itself has not been characterized, but the lagoon was sampled, resulting in the identification of PCBs to a maximum of 8.4 mg/kg, as noted in the 1998-*Sampling and Analysis, Quality Assurance, and Data Management Plan for the Site Evaluation of Waste Area Groupings 16 and 19*, DOE/OR/07-1745&D1, and the SWMU Assessment Report (SAR).

5.1.37 C-616-L Pipeline and Vault Soil Contamination (SWMU 165)

Area description

The C-616-L Pipeline and Vault Soil Contamination (SWMU 165) are located in the central portion of the plant site. The SWMU dimensions consist of two areas: area 1 is 105 ft wide by 210 ft long; and area 2 is 30 ft wide by 130 ft long.

Process history

The C-616-L Vault historically served as an effluent collection system. The area collects runoff from the C-600 Coal Pile. This runoff was transferred to the NSDD.

Previous investigation results

Past sampling events occurred in 1989, 1990, 1991, 1994, and 1995. Analysis of soil samples detected low-levels of PCBs and radionuclides. Subsurface soil samples also were obtained and analyzed as part of the SE for 9 and 11. Characterization of the area has identified elevated levels of PCBs, uranium, and technetium-99.

Summary excerpts from the SE are as follows:

It is concluded that the contamination present at SWMU 165 does not present risks to industrial workers, potential residential groundwater users, or non-human receptors that exceed *de minimis* levels. Direct contact risks are regarded acceptably low even though a confirmatory sample determined that PAHs may be present at SWMU 165 at concentrations that exceed *de minimis* levels.

None of the PAHs was detected at a concentration that exceeds the systemic toxicity RBC calculated using a hazard index (HI) or the KYDEP soil screening value. However, six PAHs were detected at a concentration that exceeds the cancer risk RBC calculated using a excess lifetime cancer risk (ELCR) of 1×10^{-7}, and five of these six PAHs were detected at a concentration that exceeds the KYDEP soil screening value. Significantly, two PAHs, benzo(a)pyrene and dibenz(a,h)anthracene, were detected at concentrations that were greater than l00X the cancer risk RBC, or at a concentration that may result in risks to an unrestricted worker that approach $1 \times l0^{-4}$. However, of these two PAHs, one, benzo(a)pyene, was reported detected at the detection limit.

5.1.38 C-410-E HF Vent Surge Protection Tank (SWMU 169)

Area description

The C-410-E HF Vent Surge Protection Tank (SWMU 169) is located in the east central portion of the plant site. The tank has an approximate volume of 150 gals and was operated from 1952 to 1977.

Process history

The tank is an aboveground tank that was used for surge protection. It is part of a system that produced hydrogen fluoride for the feed facility. Visual observation of staining on the ground indicated probable release of materials from the tank.

The 1992 SAR indicates that sampling of the aboveground tank found chromium present.

Previous investigation results

No previous investigations are available.

5.1.39 C-729 Acetylene Building Drain Pits (SWMU 170)

Area description

The C-729 Acetylene Building Drain Pits (SWMU 170) is located in the central portion of the plant site. The two pits are approximately 16 ft long by 8 ft wide by 3 ft deep

Process history

The two pits were operational from 1954 to the mid 1970s. Acetylene was generated for maintenance activities by combining calcium carbide and water. The residual from the operation drained to two outside concrete pits. Standpipes in the pits allowed sediments to settle out with the effluent draining to the storm sewer system.

Previous investigation results

A sludge sample was obtained and analyzed from each of the pits in 1993. Results indicated a high pH, volatiles, and uranium contamination. Surface and subsurface sampling results from the WAGs 9&11 SE showed no VOCs present. An excerpt from the SE is as follows: "From the SE for SWMU 170, it is concluded that the contamination present does not present risks to industrial workers, potential residential groundwater users, and non-human receptors that exceed *de minimis* levels. Direct contact risks are *de minimis* because contaminated media are not available for direct contact at SWMU 170. Risks from the use of groundwater where contamination has migrated from soil are also regarded acceptably low even though two detections of, ^{238}U exceed background. These exceedances are deemed to be of little significance because the magnitude of the exceedance is minor. (i.e., 1.40 and 2.55 pCi/g verses a background of 1.20 pCi/g) and because previous work has determined that uranium has limited mobility in the subsurface at PGDP."

5.1.40 C-726 Sandblasting Facility (SWMU 172)

Area description

The C-726 Sandblasting Facility (SWMU 172) is located in the central portion of the plant site. SWMU 172 is approximately 45 ft long by 40 ft wide. This SWMU is part of the SOU and the D&D OU.

Process history

The original facility was a concrete pad with a roof, and it was used for cleaning and sandblasting of plant equipment. The facility was shutdown in 1989; it was restarted in March of 1991 and modified to meet air emissions requirements. Modifications included partial enclosure and installation of an air filtering system. The facility has not undergone D&D. Process knowledge indicates that activities may have included cleaning radiologically contaminated equipment.

Previous investigation results

No previous investigations are available.

5.1.41 C-331 Recirculating Water Leak Northwest NW Side (SWMU 176)

Area description

The C-331 Recirculating Water (RCW) Leak Northwest Side (SWMU 176) is located in the central portion of the plant site. The SWMU dimensions are approximately 75 ft by 75 ft.

Process history

Chromated water from the recirculating cooling water system leaked from an underground vault. In the1990s, the chromium-based corrosion inhibitor was replaced with a phosphate-based inhibitor in the recirculating cooling water. An estimated 200 gals of RCW spilled, with an estimated 0.014 lbs of hexavalent chromium being released into the environment. Sampling data indicates the presence of chromium as noted in the 1992 SAR.

Previous investigation results

No previous investigations are available.

5.1.42 C-331 Leak East Side (SWMU 177)

Area description

The C-331 Leak East Side (SWMU 177) is located in the east central portion of the plant site. The SWMU dimensions are approximately 100 ft long by 75 ft wide.

Process history

Chromated water from the RCW system leaked from an underground vault. In 1990s, the chromium-based corrosion inhibitor was replaced with a phosphate-based inhibitor in the recirculating cooling water. Of the approximately 6,000 gals of RCW that was spilled, it was estimated that approximately 0.493 pounds of hexavalent chromium was released into the environment. The 1992 SAR indicates sampling that showed the presence of chromium.

Previous investigation results

No previous investigations are available.

5.1.43 Outdoor Firing Range Western Kentucky Wildlife Management Area (SWMU 180)

Area description

The Outdoor Firing Range Western Kentucky Wildlife Management Area (WKWMA) (SWMU 180) is located in the WKWMA, southwest of the plant site.

Process history

The Outdoor Firing Range is controlled by the WKWMA. It is used by the Kentucky State Police as a firing range. Lead bullets are present in the berm.

The unit is not used by PGDP.

Previous investigation results

No sampling data is available.

5.1.44 Outdoor Firing Range PGDP (SWMU 181)

Area description

The Firing Range (SWMU 181) is located west of the plant site.

Process history

SWMU 181 was operational from the early 1980s until 1992 when it was shut down and classified as a SWMU. The plant force security used the facility as a training ground for small arms target practice during the facility's operational lifetime. Suspected contaminants include lead and other potential metals.

Previous investigation results

In April of 1993, the surface soil from the Firing Range was sampled for TSCA, RCRA bulk metals, and radiological components. Bulk lead concentrations in the samples ranged from 1,774.2 mg/kg to 14,880.0 mg/kg.

Characterization of the C-218 Firing Range occurred during soil pile sampling in 2008. Soil was tested for radiological, metals, and PCBs. Ten locations were sampled based upon 50 ft centers, with one surface sample and multiple subsurface samples to be collected at three ft intervals (e.g., 1 to 4 ft) to grade. Preliminary results for surface samples show all analytes detected above background are less than there no action values; therefore, risk is <1E-06 for all receptors. Preliminary results for subsurface samples show analytes detected and above nonzero background are Ca and Mg and the Total PCB hit is near the detection limit and below 1 ppm. Pending removal of the lead contaminated soil on the berm face as part of the Soil Inactive Removal Action, the berm appears to pose no risk.

5.1.45 McGraw Construction Facilities (South Side) (SWMU 194)

Area description

The McGraw Construction Facilities (South Side) (SWMU 194) is an open field located southwest of the plant site. SWMU 194 is approximately 540,000 ft^2 (600 ft x 900 ft). This SWMU is part of the SOU and the D&D OU.

Process history

The McGraw Construction Facility was constructed in 1951 as buildings for support of original plant construction. Buildings located in this area included an administration building, a cafeteria, a boiler house, guard headquarters, a hospital, and a purchasing building. The facilities were demolished following completion of PGDP construction. The area was graded and has been maintained as a grassy area since that time. A portion of the site east of the Hobbs access road and south of the C-100 Parking Lot is the location of the depleted uranium hexafluoride (DUF_6) Conversion Facility. Concrete footers and debris possibly may remain below grade, although no known disposal of hazardous constituents have occurred.

Previous investigation results

The Northeast Plume Investigation was conducted in 1995 to identify possible sources of contamination associated with various buildings and operations within SWMU 194. The results of this investigation indicated potential metal contamination. The WAG 28 RI/FS conducted in 1999 focused on potential metals contamination of SWMU 194 based on the previous study and the process knowledge of the activities conducted in this area by the McGraw Construction Facilities. This study noted the sporadic presence of some metals at slightly above background levels. These metals include aluminum, beryllium, cadmium, calcium, iron, lead, magnesium, sodium, vanadium, and zinc.

Additional site characterization was conducted in 2000 in support of the DUF_6 Conversion Project. The results of this investigation are documented in *DUF_6 Conversion Facility Site Characterization Report, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC 2001).

The data contained in the aforementioned studies have been assessed for risk. The results are documented in *Baseline Human Health Risk Assessment and Screening Ecological Risk Assessment for the Proposed*

Site of the UF_6 Conversion Facility, Including the Eastern Portion of SWMU 194, McGraw Construction Facilities (South Side), at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 2001b).

Significant results of the BHHRA and screening ecological risk assessment (SERA) were the soil at the proposed site of the UF_6 Conversion Facility and that portion of SWMU 194 overlain by the proposed site have been well characterized, the risks to the health of the most likely future users of the proposed site from exposure to soil containing site-related COCs fall within the acceptable risk range, and adverse impacts from contamination in soil to ecological receptors are not expected.

The risk assessment supports an NFA recommendation for the proposed site of the UF_6 Conversion Facility if the site is developed and maintained as an industrial area.

The SERA identified 12 inorganic chemicals and 14 organic compounds but no radionuclides in surface soil as contaminants of potential concern for ecological receptors. The inorganic chemicals were aluminum, arsenic, barium, beryllium, calcium, chromium, copper, lead, nickel, silver, vanadium, and zinc. The organic compounds included several PAHs and phthalates. The SERA also determined that the proposed site (i.e., open grassy field) contained no critical habitat for wildlife found at the PGDP. The construction of the UF_6 Conversion Facility and supporting structures would cover the site surface and modify habitat to such an extent that the presence of these chemicals would be of little ecological concern.

5.1.46 Curlee Road Contaminated Soil Mounds (SWMU 195)

Area description

The Curlee Road Contaminated Soil Mounds (SWMU 195) is located in the southwest portion of the plant site. The site consists of two mounds of soil approximately 10–15 ft in height and covers 370,000 ft^2 in area. Historical knowledge indicates that potential COCs for SWMU 195 are radionuclides.

Process history

The area was created during original construction of the plant. The soil was unusable for fill due to its characteristics and was placed in this location. Some soil also came from excavation of drainage ditches and cleaning of the ditches.

Previous investigation results

No previous investigations are available.

5.1.47 C-746-A Septic System (SWMU 196)

Area description

The C-746-A Septic System (SWMU 196) is located in the northwest portion of the plant site. The C-746-A Septic System consists of two systems: System 1, on the northwest corner of C-746-A, is a 500-gal tank and System 2, on the northeast corner of C-746-A, is a 950-gal concrete tank and a drainage field 60 ft by 20 ft.

Process history

Both systems were used to process the sanitary waste coming from C-746-A. The system was abandoned in place in 1980. The contents of the septic tanks were removed. The empty tanks were backfilled with clean sand and the site was graded to the surface.

Previous investigation results

Subsurface soil samples and groundwater samples were obtained during the WAG 27 RI/FS. The COCs from WAG 27 are lead, antimony, beryllium, and iron.

The area impacted by metals at the NE septic system is approximately 70 ft x 60 ft (includes septic tank and leachfield) and extends to approximately 10 ft bgs. The area impacted by the metals contamination along the NW drain lines is more extensive and is approximately 100 ft x 10 ft along the line extending north-south to the west of the building and 180 ft x 10 ft along the line extending east-west to the west of the septic tank. The contamination extends to approximately 10 ft bgs along both of these lines.

Scenarios that were assessed in the WAG 27 BRA are current on-site industrial worker, future on-site industrial worker, future on-site excavation worker, future on-site recreational user, future off-site recreational user, future on-site rural resident, and future off-site rural resident. An excerpt on land use scenarios from WAG 27 RI follows:

> At SWMU 196 for all scenarios assessed, including lead as a COPC, only the future recreational user exposure to soil for both systemic toxicity and ELCR is not of concern. Possible exceptions at SWMU 196 are the current and future industrial worker exposure to soil which has a total hazard index which falls below 1 if contribution from lead is not considered.

5.1.48 Soil Contamination South of TSCA Waste Storage Facility (SWMU 200)

Area description

The Soil Contamination South of TSCA Waste Storage Facility (SWMU 200) is located in the central portion of the plant site. This area is approximately 282 ft wide by 304 ft long.

Process history

Past practices utilized the SWMU 200 area for placement of dredged material from the NSDD.

Previous investigation results

Site characterization sampling was performed prior to construction of a TSCA Waste Storage Facility. The surface sampling showed elevated levels of PCBs and radiological contaminants to be present.

5.1.49 Dyke Road Historical Staging Area (AOC 204)

Area description

The Dyke Road Historical Staging Area (AOC 204) is located between the eastern boundary of the plant and Dyke Road and between Outfalls 010 and 011. AOC 204 is a mounded area with heavy vegetation and several trees consisting of approximately 3 acres. A small ditch (approximately 4 ft wide and 3 ft deep) is situated across the mound from north to south.

Process history

During construction of the PGDP, (approximately 1951 through the mid 1950s), AOC 204 is suspected of having been a staging area or construction debris burial ground.

Previous investigation results

The types of debris identified on the mound include asphalt, concrete, telephone poles, railroad ties, and cable. Debris was not reported in subsurface samples collected during the drilling of WAG 28 borings within the mound. A geophysical survey conducted during the SI using electro magnetometers indicated four anomalies in the AOC 204 area, but not the presence of a landfill.

The AOC was sampled during the SE at KPDES Outfalls 010, 011, and 012 in September 1995 and again as part of the WAG 28 RI/FS in 1999, which shows TCE is of concern at this location.

A BHHRA was performed on AOC 204. It was evaluated under different scenarios for which human health risk exceeds de minimis levels (i.e., a cumulative human health excess lifetime cancer risk of 1E-6 or a cumulative HI of 1). Results from the BHHRA indicated the following scenarios were exceeded: industrial worker exposure to RGA groundwater; future on-site resident exposure to RGA groundwater; off-site resident exposure to groundwater; future industrial worker exposure to RGA groundwater; industrial worker exposure to RGA groundwater resident exposure to RGA groundwater; future off-site resident exposure to groundwater; and future excavation worker exposure to soil. A BERA ecological evaluation was not required due to the potential source of contamination being contained within the subsurface.

5.1.50 C-720 TCE Spill Site Northwest (SWMU 211)

Area description

The C-720 TCE Spill Site Northwest (SWMU 211) is located northeast of the C-720 Building in the central portion of the plant site. This SWMU is part of the SOU and the GWOU.

Process history

Suspected past practices were to rinse and clean parts with TCE and to dispose of the solvent on the ground.

Previous investigation results

Subsurface soil borings and groundwater samples were collected and analyzed as part of the WAG 27 RI/FS for the C-720 complex. Results of the investigation detected the presence of arsenic, beryllium, and vinyl chloride in subsurface soils. WAG 27 stated that surface soils were not evaluated since most of the surface surrounding the C-720 was covered with asphalt and concrete. Conclusions from WAG 27 are the ELCR and systemic toxicity exceed the accepted standards of KDEP and EPA for future excavation worker.

5.1.51 C-745-A Radiological Contamination Area (SWMU 212)

Area description

The C-745-A Radiological Contamination Area (SWMU 212) is located in the west central portion of the plant site. The area is approximately 2,500 ft^2.

Process history

While the exact history is unknown, supposition is that the area may have been used as an unloading site near railroad tracks, and a release of radiological contaminants may have occurred.

Previous investigation results

Subsurface soil samples were obtained in support of the C-745-A Cylinder Storage Yard construction project. Results of the sampling effort indicated the following were detected contaminants: technetium-99, thorium-230, plutonium-239/240, americium-241, cesium-137, neptunium-237, uranium-234, uranium-235 and uranium-238.

5.1.52 DMSA OS-02 (SWMU 213)

Area description

U.S. Department of Energy Material Storage Area (DMSA) OS-02 (SWMU 213) is located north of C-745-A in the west central portion of the plant site. SWMU 213 is approximately 7,000 ft^2.

Process history

SWMU 213 was used to store excess or unused material. Storage at this location included a spill storage tank; an old “drop test” cylinder with over pack, metal parts from forklifts, cranes, cylinder slings and carts; and wood to make cylinder saddles.

The spill tank has three closed valves located near the bottom. The tank was used extensively during a 1979 No. 2 fuel oil spill to “decant” the water from the fuel oil/water mixture and possibly utilized to contain other spills.

Previous investigation results

This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2002a).

5.1.53 DMSA OS-03 (SWMU 214)

Area description

DMSA OS-03 (SWMU 214) is located at C-611 west of the plant site. SWMU 214 is 384 ft^2 (16 ft x 24 ft).

Process history

This DMSA was created by PGDP Utilities Operations for storage of DOE materials upon transition from DOE to United States Enrichment Corporation (USEC) operations. Prior to 1994, the area was a partially gravel and grass covered area. The material stored is covered by a 16 ft x 24 ft aluminum carport type shed without walls. Materials stored within the SWMU are as follows:

- 55-gal drums of absorbent pads and other solid waste generated by PGDP Utilities Operations at C-611 and from a clean-up at KPDES Outfall 008;
- 55-gal drums of ferric sulfate marked for reuse;
- Fiberglass panels removed from either the C-611-C Flocculator or the C-611-U Chemical Storage Area in 1993;
- A small quantity of scrap metal banding material;
- One out-of-use fuel oil tank that was removed from the basement of C-611 that fed the back-up diesel generators (empty);
- One pole type electrical disconnect;
- Scrap pieces of lumber;
- Several wooden pallets;
- Several 55-gal drums marked empty; and
- Two empty plastic oil containment dikes

All RCRA-regulated items and other waste have been dispositioned properly (DOE 2002b).

Previous investigation results

There have been no known spills or releases of materials from this facility to the environment. A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.54 DMSA OS-04 (SWMU 215)

Area description

DMSA OS-04 (SWMU 215) included a rail tank car located west of the C-743 Trailer Complex in the west central portion of the plant site. The roped area defining SWMU 215 is approximately 480 ft^2 (40 ft x 12 ft).

Process history

The history of this railcar could not be definitively ascertained. It was likely brought on-site to deliver an acid compound. Subsequent uses may have included water storage for fire fighting, spill control (storage), and/or fire training. In August of 2005, as part of the DMSA characterization and remediation project, the railcar was removed.

Previous investigation results

The railcar, valves, and ground beneath the rail car were surveyed for radiological contamination in April 1999. Results indicated contamination on randomly selected rock from beneath the valve. In addition, results from sampling the liner of the railcar in February 2006 indicated uranium contamination. This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2002c).

5.1.55 DMSA OS-05 (SWMU 216)

Area description

DMSA OS-05 (SWMU 216) is located north of C-206 in the west central portion of the plant site. SWMU 216 is approximately 7,000 ft^2.

Process history

This area was controlled by Fire Services and used to store excess material and supplies, primarily fire extinguishers. The initiation of this area as a storage area for fire extinguishers is unknown; however, in 1997 or 1998, the majority of the fire extinguishers were placed in a covered metal bin located next to the roped portion of the DMSA.

Additional material stored within SWMU 216 include a motor, pallets, three 5-gal containers, three 55-gal drums (one labeled "metal-C-310"), wheels, and miscellaneous scrap metal and equipment. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2002d).

Previous investigation results

No evidence of a release was found and process knowledge indicates none has occurred. Vegetation in the area is flourishing. A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.56 DMSA OS-06 (SWMU 217)

Area description

DMSA OS-06 (SWMU 217) is located at C-740 in the west central portion of the plant site. SWMU 217 is approximately 57,600 ft^2.

Process history

Beginning in the late 1970s, this area was originally used as an excess material and/or staging area for C-720. Over time, DMSA OS-06 became a storage area for excess materials from various areas within the plant. In 2001, DOE began characterization and remediation of the materials in the DMSA. Material stored within the SWMU includes rechargeable batteries, nickel arc-welding rods, wood pallets, hoses, empty buckets and containers, scrap metal, water heaters, a wash basin, commodes, grass seeder, ingots, motors, gear boxes, piping, paint color mix machine, jib crane boom, scaffolding, a sand blasting tank, and sump pumps. All RCRA-regulated items and other waste have been dispositioned properly (DOE

2004a). DMSA OS-06 currently is used as a hot shop and loading area. It is set up for size reducing large equipment and loading and staging shipping containers.

Previous investigation results

There are no known releases associated with this SWMU. A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.57 DMSA OS-07 (SWMU 218)

Area description

DMSA OS-07 (SWMU 218) is located west of the C-741 Equipment Storage Shed in the west central portion of the plant site. SWMU 218 is approximately 6,000 ft^2.

Process history

Beginning in 1993, the C-720 shops segregated material during the transition operations to be returned to DOE, (i.e., not leased by USEC). In 2001 DOE began characterization and remediation of the materials in the DMSAs. Material stored within the SWMU included fuses, fluorescent light bulbs, nickel cadmium batteries, sealed beam headlight, 55-gal drum of carburizing material, container of water mixed with oil and grease, circuit boards, light bulbs, vacuum tubes, wooden pallets, drums of miscellaneous materials (i.e., metal parts, steel, concrete, personal protective equipment, trash, asbestos containing materials, oily rags, paper, plastic, etc.), a dumpster, metal storage cabinets, motors, and miscellaneous equipment/parts. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2004b).

This SWMU currently houses a break trailer for field crews and also is used to store equipment utilized by the DMSA field teams.

Previous investigation results

There is no evidence of any historical releases that may pose a threat to the environment. A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.58 DMSA OS-08 (SWMU 219)

Area description

DMSA OS-08 (SWMU 219) is located east of C-728 in the central portion of the plant site. SWMU 219 is an empty 4,722 ft^3 fiberglass tank.

Process history

DMSA OS-08 was used to store PCB contaminated water prior to disposal. PCB spill documentation indicates this tank was used to store PCB contaminated rainwater that had collected in a pit in the C-537 switchyard. Two transformer spills in 1989 resulted in rainwater collecting in the pit that was subject to TSCA rules. This tank was documented as leaking inside the present location, a diked area covered with hypolon, in November 1991. The water from the diked area was sampled with results of PCBs at <0.1 mg/L. The tank was drained and cleaned according to existing TSCA requirements. Additionally, personnel recall this tank was possibly used to cleanup a recirculating cooling water spill in C-333. The spill would have been subject to TSCA regulations because it came into contact with PCB troughing and gaskets.

Previous investigation results

No previous investigations are available.

5.1.59 DMSA OS-09 (SWMU 220)

Area description

DMSA OS-09 (SWMU 220) is located south of C-409 in the central portion of the plant site. SWMU 220 is approximately 10,500 ft^2.

Process history

Beginning in 1993, this area was used to store vehicles and equipment not being transitioned to USEC. Most of the vehicles themselves had been excess prior to then. In 2001, DOE began characterization and remediation of the materials in the DMSAs. Material previously contained within this SWMU include a fluorescent light starter, fuses, a battery post connector, sealed beam headlights, indicator lamps, collection drums of antifreeze, various light bulbs and vehicle bulbs, wheel weights, scrap Cushmans and golf carts, tires, metal, an industrial washing machine, wooden pallets, eight passenger vehicles, one tow motor, and fluids that had been drained from the vehicles. This DMSA is located outside and formerly contained vehicles that had been drained of fluids. All materials previously located in SWMU 220 have been either properly disposed or are currently located in permitted storage (DOE 2002e). This SWMU is currently being utilized to store Sealands and other shipping containers that are pending disposition.

Previous investigation results

A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management “determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005” (Webb 2007). An NFA is pending.

5.1.60 DMSA OS-10 (SWMU 221)

Area description

DMSA OS-10 (SWMU 221) is a 750 ft^2 area located east of the C-635 RCW Pump House in the central portion of the plant site.

Process history

This DMSA was initially classified as a Phase I DMSA (expected to have no fissionable material but not fully characterized). The area contained approximately 414 ft^3 of scrap metal and an empty sulfuric acid tank. The items were properly characterized and dispositioned.

Previous investigation results

This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2002f).

5.1.61 DMSA OS-11 (SWMU 222)

Area description

DMSA OS-11 consists of both SWMU 76 and SWMU 222 at the south and north ends, respectively. SWMU 222 is located east of the C-410 facility and west of the C-651 Pump House and Cooling Tower near the central portion of the plant site. SWMU 222 is approximately 1,738 ft^2.

Process history

This area was probably created around 1993 during the USEC/DOE transition. Miscellaneous materials were placed in this area, the majority of which were radiologically surveyed and sent to the scrap yards around 1998. In 2001, DOE began characterization and remediation of the materials in the DMSAs. Material found within this area included a light bulb base, a collection container for antifreeze, ladders, wooden pallets, railroad ties/pieces, hoses, waste water, a gasoline engine, a generator, a motor, and gasoline and fluids drained from equipment.

All materials previously located in SWMU 222 either have been properly disposed of, or currently are located in permitted storage (DOE 2002g).

Previous investigation results

A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.62 DMSA OS-12 (SWMU 223)

Area description

DMSA OS-12 (SWMU 223) is located in the east central portion of the plant site. The C-301 Building is located within the southern portion of the DMSA. SWMU 223 is approximately 11,120 ft^2.

Process history

The C-301 Building, located within the DMSA, was used as a Fire Services training facility until 1985. The area then became storage for excess electrical equipment and cooling tower wood. The excess electrical equipment included electrical motors, transformers, electrical supplies, asbestos, scrap metal and spill cleanup material. Waste Management also has utilized this area for the storage of low-level waste (LLW). Some of the LLW drums managed by Waste Operations were observed leaking during routine inspections. The drums were over-packed to prevent further release. None of the material from the drums came in contact with the storage pad (i.e., the leaks were observed on the side of the drum).

All RCRA-regulated items and other waste have been dispositioned properly (DOE 2004c).

Previous investigation results

A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.63 DMSA OS-13 (SWMU 224)

Area description

DMSA OS-13 (SWMU 224) is located south of C-340 in the east central portion of the plant site. SWMU 224 is approximately 800 ft^2.

Process history

Empty vendor drums used for the C-340 re-roofing project were stored here, beginning in 1996. During 1997 or 1998, the drums were removed.

Previous investigation results

This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2002h).

5.1.64 DMSA OS-14 (SWMU 225)

Area description

DMSA OS-14 (SWMU 225) consists of four tanker cars, three empty flatbeds, and one flatbed with three tanks/containers on it located south of C-533-1, west of the C-633 Cooling Towers in the southeast portion of the plant site. The area containing SWMU 225 is approximately 7,800 ft^2 (390 ft x 20 ft).

Process history

Rail tank cars and liquid containers were used as material storage areas. The tanker cars may have been brought on-site containing acid product, lube oil, or Freon®. Some personnel recall the three containers on the flatbed being used to hold water for fire-fighting purposes.

Previous investigation results

This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2001d).

5.1.65 DMSA OS-15 (SWMU 226)

Area description

DMSA OS-15 (SWMU 226) is located north of C-745-B, in the west central portion of the plant site. SWMU 226 is approximately 10,170 ft^2 (339 ft x 30 ft).

Process history

This DMSA was used for the storage of process coolers and excess equipment, beginning during the Process Equipment Modification program: 1976-1979. In April 2000, during a routine inspection, two UF_6 tails cylinders stored within the SWMU were observed to have plugs missing. Green oxide material was observed on the ground under one of the cylinders. This material was sampled and found to be radioactive. These cylinders and all but two of the tails cylinders and one other cylinder with unknown contents were relocated. Excavation of the soil around the area where the UF_6 tails material contaminated the ground was completed in November 2000, as documented in the SAR issued on December 1, 2000.

Previous investigation results

Radiological surveys of the ground in 1995, prior to the discovery of the green oxide material, indicated soil contamination exists. This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2004d).

5.1.66 DMSA OS-16 (SWMU 227)

Area description

DMSA OS-16 (SWMU 227) is located south of the C-746-B Warehouse, in the northwest portion of the plant site. SWMU 227 is approximately 37,000 ft^2.

Process history

This area was used for many years as a storage area for miscellaneous excess process equipment and UF_6 cylinders since the 1970s. Materials stored within this area included wood/metal pallets, stainless steel tanks, air conditioners, scrap metal, miscellaneous equipment/parts, office furniture, floor buffers, empty poly tanks, spools of wire and cable, incandescent light bulbs, fluorescent light tubes, a broken fluorescent light tube, and light bulb bases. In 2001, DOE began characterization and remediation of the materials in the DMSAs. All RCRA-regulated items and other waste have been dispositioned properly (DOE 2004e).

Previous investigation results

A certified RCRA Closure report was approved by Kentucky on February 13, 2007, for this DMSA. The Division of Waste Management "determined that the characterization, removal and disposal of hazardous waste meets the applicable requirements of the approved Agreed Order Closure Plan for DMSAs, dated December 23, 2005" (Webb 2007). An NFA is pending.

5.1.67 DMSA OS-17 (SWMU 228)

Area description

DMSA OS-17 (SWMU 228) is located west of C-747-B in the northwest portion of the plant site. SWMU 228 is approximately 10,800 ft^2.

Process history

SWMU 228 has been used for the storage of excess mobile industrial equipment, which originally was slated for auction. Equipment at this location includes forklifts, tow motors and miniature pump trucks, and concrete culverts. The equipment has remained in storage at this location since the termination of off-site property sales around 1985. The exact operational dates for this site are unknown, although the last equipment was probably placed in this area in 1996.

Previous investigation results

This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2004f).

5.1.68 DMSA OS-18 (SWMU 229)

Area description

DMSA OS-18 (SWMU 229) is located in the north of C-746-F in the northwest portion of the plant site. SWMU 229 is approximately 35,112 ft^2.

Process history

This area was established soon after plant construction to store excess railroad supplies, parts, components, etc. Later it became an area in which to store various excess material. Material found to have been stored within the SWMU includes scrap metal, concrete, fireproof safes, portable work platform, empty trash cans, empty 55-gal drums, miscellaneous equipment and parts, road signs, manhole covers, scaffolding, railroad ties, fans, chain link fencing, two small buildings, parts from railroad cars, oils, light bulbs, circuit boards, fuses, and batteries.

Previous investigation results

In 2001, DOE began characterization and remediation of the materials in the DMSAs. RCRA-regulated items have been removed from the SWMU and placed in proper storage. This DMSA now qualifies as a Phase 3 DMSA because it has been fully characterized and contains no fissionable material (DOE 2003b).

5.1.69 Nitrogen Generating Facilities (Soils Under Facility) (SWMU 483)

Area description

SWMU 483 is the area of soil located under the C-603 Nitrogen Facility in the central portion of the plant site.

Process history

This facility was part of the 17 inactive facilities currently identified in the SMP. Nitrogen was produced by a cryogenic generator located at C-603. This facility was abandoned in the late 1970s. In September 2002, a Generator Staging Area was established to house asbestos containing material during removal work on C-603 tanks. In October 2005, C-603-A, C, D, H, and I were decommissioned and removed as part of a maintenance action with a categorical exclusion for NEPA.

Previous investigation results

C-603 was removed by DOE in 2005 as part of a routine maintenance activity due to the detection of lead and PCBs in the paint. No soil samples have been collected from this site; however, paint chip samples were taken from the C-603 surfaces and analyzed for PCBs, metals, and radiological contaminants. These results indicated the presence of lead, chromium, and PCBs. During D&D, most paint chips (from the nitrogen tower) that fell onto soil surfaces around the C-603 facilities were collected for disposal. As a result, there is a potential for subsurface soil migration of paint chips that were too small to be collected or spotted by a walkover inspection.

5.1.70 PCB Contamination Area by the C-410 Trailer Complex (SWMU 488)

Area description

The PCB Contamination Area by the C-410 Trailer Complex (SWMU 488) is a PCB soil contamination area located in a grassy drainage swale in the central portion of the plant site. SWMU 488 is approximately 25 ft^2.

Process history

It is unknown how this area experienced a PCB spill.

Previous investigation results

The contamination area was discovered as a result of a surface soil sampling and characterization event for the placement of the support trailers for the DMSA characterization/disposition activities in the field north of the C-710 Laboratory. In May 2001, radiological surveys of this area and materials were performed. Results of this survey indicate no radiological contamination is present. Soil samples were obtained as part of site characterization. The only contaminant above background detected in the soil was PCBs.

5.1.71 Septic Tank, North of C-710 (SWMU 489)

Area description

The Septic Tank, North of C-710 (SWMU 489) is constructed of cement blocks and located in the central portion of the plant site. SWMU 489 is approximately 200 ft^3 (8 ft x 5 ft x 5ft). The tank is below a doublewide trailer.

Process history

Due to the construction materials and the manner in which it was constructed, it is believed that the septic tank was associated with the original construction activities of the PGDP in the early 1950s. SWMU 489 was discovered on June 1, 2001, as a result of a construction project for the DMSA trailers in the field north of the C-710 Laboratory. During excavation, what appeared to be an abandoned septic tank was discovered. The tank appeared to have had the top removed, contents removed, and backfilled with sand prior to burial in place. When the septic tank was uncovered, water was present in the interior of the tank from past rainfall events. A sample of the sand was obtained from the interior of the tank. The septic tank has been backfilled, compacted, and graded, and also has 9–10 inches of dense grade aggregate on top of the tank area.

Previous investigation results

In May 2001, radiological surveys of this area and materials were performed. Results of this survey indicate no radiological contamination is present. Additionally, a sample of the sand showed no results above background.

5.1.72 Contaminated Soil Area, North of Outfall 10 (AOC 492)

Area description

The contaminated soil area, north of Outfall 11 (AOC 492) is located east of the plant site. SWMU 492 is approximately 450 ft^2 (15 ft x 30 ft).

Process history

AOC 492 was discovered during routine radiological surveys in support of sampling activities. This area likely was generated from past plant maintenance activities.

Previous investigation results

An area with elevated radiological readings was detected on July 30, 2001. This area was sampled (surface) and analytical results received on August 29, 2001, indicated the presence of elevated levels of PCBs and radiological constituents. Data from three locations sampled in the AOC were evaluated. Analytical results indicate the presence of metals (chromium); PCBs; and radionuclides (uranium-238). The area also was sampled in 2008 by the Kentucky Research Consortium for Energy and Environment and as part of the Addendum I-B to the Sampling and Analysis Plan for Soil Piles at the Paducah Gaseous Diffusion Plant (DOE/LX/07-0015/B).

5.1.73 Concrete Rubble Piles Near Outfall 001 (SWMU 493)

Area description

The concrete rubble piles near Outfall 001 (SWMU 493) are two concrete rubble piles located west of the plant site. The two piles making up SWMU 493 are approximately 450 ft^2 and 270 ft^2, respectively.

Process history

Two concrete rubble piles were found during a site inspection for the construction of the Scrap Yard Infrastructure Storm Water Collection Basin in November 2001. The concrete rubble piles appear to have been placed along the bank for erosion control. It is unknown where the concrete originated from but it is assumed to be from the PGDP.

Previous investigation results

After being surveyed by Health Physics, the concrete debris and soil near the concrete debris were found to be clean. In order for construction of the Scrap Yard Infrastructure Storm Water Collection Basin to continue, the concrete was relocated to SWMU 474. Per a request from Kentucky, the first ft of soil under the concrete was excavated, relocated to SWMU 474, and placed on plastic. After removal of the concrete, excavation and relocation of the first ft of soil began; the excavated soil was surveyed routinely throughout the excavation. Pieces of metal shavings and filings, such as that from a machine shop, and other pieces of scrap metal, along with a few gaskets and litter, were discovered in the relocated soil. Some fixed radiological activity was present on these materials, but were below release limits. These items were surveyed, packaged, and placed into proper storage. As a result of this discovery, the excavation of the area was discontinued and the site inspected visually. Minute amounts of metal shavings, filings, and litter were observed on the ground. In addition, a valve cap was discovered at this location during this inspection. Fixed radiological contamination was detected on the valve cap. The valve cap was removed from the area, packaged, and placed into proper storage. The area was radiologically posted.

Data obtained during a preliminary soil sampling event from locations near the SWMU did not indicate the presence of any contamination by hazardous or radiological constituents. After discovery of the concrete rubble piles, the piles were radiologically scanned and determined to be clean prior to removal to SWMU 474. Other materials found were radiologically surveyed, removed, and placed in appropriate storage.

5.1.74 Rubble and Debris Erosion Control Fill Area (SWMU 517)

Area description

The rubble and debris erosion control fill area (SWMU 517) is a rubble pile located west of the plant site. SWMU 517 is approximately 653 ft^2.

Process history

The fill area is believed to have used rubble and debris for erosion control.

Previous investigation results

Prior to the beginning of construction of the Scrap Yard Infrastructure Storm Water Collection Basin, a magnetometer survey was performed via a metal detector, which resulted in the discovery of several anomalies at the construction site. A drainage pipe excavation was to be performed at the location of one of the anomalies, now identified as SWMU 517. During the excavation of this area, concrete rubble was found. The concrete rubble was surveyed by Health Physics and was determined to be uncontaminated. In accordance with a request by DOE that was approved by Kentucky, the concrete was to be excavated, relocated to SWMU 474, and placed on plastic. After removal of the concrete, excavation of the area continued. During removal of the first bucket of the second truckload, additional concrete debris was discovered. The soil and debris were surveyed by Health Physics and were found to be contaminated. Small pieces of radiologically contaminated concrete and soil were removed from the SWMU by Health Physics personnel and placed in appropriate storage. The remaining soil and debris in the bucket were placed back in the SWMU. The excavation was discontinued. The area was graded and backfilled with gravel before being posted as radiological and covered with plastic.

Data obtained during a preliminary soil sampling event from locations near the SWMU did not indicate the presence of any contamination of hazardous or radiological constituents. Additional surface sampling of the excavated soils occurred on February 9, 2002. The sampling analyses from this event indicated four COCs [nickel, zinc, neptumium-237, and uranium-238] greater than twice background that may pose some risk.

5.1.75 Field South of C-746-P1 Clean Scrap Yard (SWMU 518)

Area description

The field south of the C-746-P1 Clean Scrap Yard (SWMU 518) is an open field located south of the C-746-P Yard in the northwestern portion of the plant. SWMU 518 is approximately 35,000 ft^2.

Process history

The field south C-746-P1 is believed to have been used as a temporary storage area for heavy equipment.

Previous investigation results

Analytical results from pre-characterization sampling, performed by collecting subsurface composite samples within four grid areas, indicated the presence of PAHs in three of the grids. A second round of sampling was conducted by collecting grab samples within the previously discussed grids. The presence of PAHs was confirmed.

A radiological walkover survey performed in the area indicated results ranging from 15,000 to 35,000 counts per minute.

5.1.76 Scrap Material West of C-746-A (SWMU 520)

Area description

The Scrap Material west of C-746-A (SWMU 520) is located in the northwestern portion of the PGDP. SWMU 520 is approximately 152,000 ft^2.

Process history

The area west of C-746-A has been used as a storage area for old equipment and materials since the 1970s. Material stored in this area include old pallets, old equipment, (such as tow motors, forklifts, welding rigs and fixtures, vehicles, and vehicle trailers), and wooden saddles from the cylinder yards.

Previous investigation results

Annual surveys of the perimeter of this area are performed. The area currently is posted as a radioactive materials area; although no known releases have occurred.

5.1.77 Aluminum Slag Reacting Area (SWMU 531)

Area description

The Aluminum Slag Reacting Area (SWMU 531) is a concrete pad located adjacent to the south side of C-746-A, Hazardous and Mixed Waste Storage Facility, which is located in the northwestern portion of the PGDP. SWMU 531 is approximately 9,000 ft^2 (30 ft x 300 ft).

Process history

The Aluminum Slag Reacting Area was used for treatment of stored aluminum slag from the aluminum smelter. Aluminum slag was brought from a sweat furnace in the west end of C-746-B smelter. Water was slowly added to dumpsters and possibly drums to react with the aluminum slag. Slag was allowed to react with no agitation for several days. Hydrogen that was produced from the reaction escaped to the atmosphere. The slag was dewatered, and the resulting waste was placed in the C-746-F Landfill. It is unknown how long this operation was in practice.

Previous investigation results

From analyses of samples collected from SWMUs 139 and 196A, which are located near SWMU 531, some elevated concentrations of metals (aluminum, calcium, iron, and magnesium) in soils were noted as presented in the 1992 SAR.

5.1.78 Contaminated Area by Outfall 011 (AOC 541)

Area description

The Contaminated Soil Area South of Outfall 011 (AOC 541) is located in an area of heavy undergrowth, approximately 75 ft from the south bank of Outfall 011. AOC 541 is located east of the PGDP, is outside of the secure area, and is approximately 100,800 ft^2 (480 ft x 210 ft).

Process history

AOC 541 was discovered during routine radiological surveys in support of sampling activities. The area contained soil piles that were likely generated as a result of past maintenance activities.

Previous investigation results

This area was sampled in September 2002. Analytical results indicate the presence of metals (chromium); PCBs; semivolatiles; and radionuclides (uranium-238).

5.1.79 Soil Pile I (SWMU 561)

Area description

This SWMU was identified on November 2, 2006, as noted in the SWMU notification letter dated February 16, 2007. This SWMU is located east of the PGDP fence and is adjacent to LBC between McCaw Road and Outfall 002 ditch. The dimensions of this SWMU cover approximately 7 acres. The footprint of the soil piles within the 7 acre area is approximately 30 ft wide x 700 ft long by an average of 8 ft tall along Outfall ditch 002 and 30 ft wide x 700 ft long by an average of 8 ft tall along LBC for an estimated total volume of ~12,000 yd^3.

Process history

There appears to be no function for the soil piles within the SWMU; however, the piles most likely were dredged material produced as a result of maintenance activities performed within/along the ditch and creek.

A key potential source of contaminants in the PGDP surface water drainage system is the C-340 facility. Historical leaks and spills at C-340 likely resulted in releases that traveled from floor drains through the storm sewer system, into Outfall 011, and discharged to LBC. Recorded spills and releases from C-340 include COPCs such as PCB oil, as documented in Occurrence Reporting and Processing System (ORPS) reports, Plant Shift Superintendent (PSS) logs, and Annual Site Environmental Reports.

Primary processes in the C-340 Reduction and Metals Facility were the reduction of UF_6 to UF_4 and the conversion of UF_4 to metallic uranium. The facility became operational in 1956 and continued operating until 1977, when shut down of primary processes began. After shutdown, C-340 was used as a training school, a valve test facility, a pilot plant for the study of liquid/gas scrubber systems, and a waste pilot plant for the stabilization of uranium chips. A uranium metal remolding project was conducted in the mid-1980s at C-340. The building was closed in 1991.

The following are the primary chemicals employed at C-340 during active operations: $UF_{6,}$ hydrogen, magnesium fluoride, magnesium, and TCE. PCBs were used in electrical and hydraulic systems.

Outfall 010 is likely a primary source of historical releases to LBC and may have contributed to observed conditions at Soil Pile I. Its associated ditches drain several PGDP facilities including the following: C-331 Process Building, C-531 Complex, and C-617-B Lagoon.

In general, COPCs carried through internal ditches to Outfall 010 mirror those transported throughout the PGDP surface water management system. Key COPCs include radionuclides, VOCs, SVOCs, and heavy metals.

Previous investigation results

The soil piles along LBC contain uranium and PCBs.

On November 2, 2006, Paducah Remediation Services, LLC, (PRS) radiological control technicians (RCTs) observed and completed a radiological survey on Soil Pile I. Field radioactivity measurements greater than twice area background were observed in several of the soil piles, ranging from twice to more than seven times area background.

Similarly in 2006, following the discovery of the soil piles and subsequent completion of a gamma walkover survey, biased surface samples were acquired from Soil Pile I. The samples were collected from the five locations exhibiting the highest field radioactivity measurements. Initial sampling was completed in this way, to provide a “worst-case” picture of conditions at Soil Pile I.

The following are the results from the 2007 evaluation.

Distribution of constituents that can be directly attributed to PGDP processes, including the majority of the radionuclides and PCBs, are found along LBC and are primarily confined to the soil pile itself. Uranium and uranium daughters show more widespread distribution, with elevated levels along LBC. Levels at or above no action levels for recreational users are generally confined to the northern half of the soil pile along LBC. Similarly, PCBs exceeding the high occupancy without restriction Toxic Substances Control Act (TSCA) limit are confined to the northern half of the soil pile along LBC, with two results at the high occupancy limit in the southern third of the LCB soil pile.

At locations where COPCs were measured at levels of concern in surface samples, levels generally decrease with depth, decreasing to *de minimis* levels below the 4 ft interval in most cases. Elevated concentrations of plant related COPCs diminish down to the 1-4 ft interval and below regulatory and/or risk-based action/no action levels beyond the upper 4 ft of Soil Pile I.

6. INITIAL EVALUATION

6.1 RISK ASSESSMENT

Using the presentations and interpretations of the results, the decision rules developed during the DQO process will be addressed, and the various statistical assumptions forming the basis of the sampling plan will be verified. Appendix C presents the general report outlines for the RI and FS.

To support the risk evaluation, and consistent with the PGDP Risk Methods Document (DOE 2001c), probabilistic fate and transport modeling may be employed. The use of this modeling helps account for uncertainties in the size of the source zones and transport parameters and allows an evaluation of error bounds. These modeling tools may include the Statistical Analysis and Decision Assistance (SADA), Seasonal Soil Compartment (SESOIL); and Analytical Transient 1-,2-,3- Dimensional (AT123D). SADA is used to refine source zones. SESOIL is a leaching model used to estimate the time-variant contaminants loading from each source area to the RGA. AT123D is used to complete saturated flow and contaminants transport modeling.

6.1.1 Data Evaluation

When fieldwork is completed and data have been verified, validated, assessed, and evaluated, a RI report followed by a FS report will be written. The primary purpose of these reports will be to present the results from the field investigation and evaluate alternatives to the extent necessary to select a remedy.

Documentation for the SOU RI/FS also will include a BRA. The BRA will include, at minimum, a complete BHHRA that is consistent with methods presented in Chapter 3 of Volume 1 of the PGDP Risk Methods Document (DOE 2001c) and a SERA consistent with methods presented in Volume 2 of the PGDP Risk Methods Document (DOE 2001c). The BRA will use all historical data representative of current site conditions, as well as the data collected during the field investigation described in this work plan. The objectives of the BRA will include the following:

- Evaluate the potential threat to human health in the absence of any action.
- Provide at least a preliminary evaluation of harm to ecological resources in the absence of any action.
- Provide a basis for determining if a response action is necessary or justified.
- Provide the information needed to determine what concentrations of chemicals and radionuclides are considered protective of human health and the environment.
- Provide a baseline for comparing the level of protection from various response alternatives relative to potential human health and ecological effects.

To meet these objectives, the risk assessment will identify and characterize the following items:

- Levels of hazardous substances present in relevant media, including a review of relevant biological and chemical information, and the potential changes in concentration and activities of hazardous substances in relevant media over time.
- Potential exposure pathways and routes and the extent of actual or predicted exposure.

- Potential human receptors by defining the size, characteristics, and location of human populations that may be exposed to contaminants at or migrating from the study areas.

- Extent of potential impact by quantifying potential carcinogenic risk and noncarcinogenic risk.

- Potential ecological harm within the study area from exposure to contaminants at or migrating from the study areas.

- Levels of uncertainty associated with the assessment, including a summary of the strengths and weaknesses of site characterization, toxicity assessment, exposure assessment, and health risk characterization. The summary will include a discussion of the effect of the major assumptions made during risk characterization upon the resulting risk values. Uncertainty analysis may include sensitivity or other quantitative analyses if these are deemed necessary for forthcoming response action decisions.

The BRA will include completion of fate and transport modeling consistent with the PGDP Risk Methods Document (DOE 2001c) modeling matrix and generation of information that can be incorporated in the PGDP sitewide risk assessment model (DOE 2003a).

6.1.2 Exposure Assessment

This section of the BRA will delineate the pathways through which the receptors may be exposed under both current and future conditions. The exposure assessment will be conducted in accordance with *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, and* Volume *1: Human Health* (DOE 2001c). This section will present conceptual site models and supporting text. Also, each pathway will be described in terms of source, route of exposure, exposure point, and receptor. This format will be followed, because all four must be present for a complete pathway to exist.

Exposure assessments in BHHRAs completed in the past indicate that at least 24 exposure pathways should be considered as potential pathways in all assessments. Further, exposure assessments will be performed on a range of worker exposure times if the selected exposure time deviates significantly from the assumptions in the Methods Document.

6.1.3 Toxicity Assessment

The primary purpose of this section of the BHHRA will be to report the toxic effects of the COPCs on exposed populations. The toxicity assessment will be conducted in accordance with *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* Volume *1. Human Health* (DOE 2001c). In addition, this section will briefly describe the methods used by EPA, and in the toxicity assessment, to develop toxicity parameters, delineate the sources used to acquire the toxicity parameters, and present tables summarizing the toxicity information used in the risk assessment. In closing, this section will summarize the amount of toxicity information available on the COPCs in the risk assessment and discuss general toxicity assessment uncertainties.

6.1.4 Risk Characterization

The primary purpose of this section of the BHHRA will be to integrate the information developed in the exposure assessment with the effects information presented in the toxicity assessment to characterize the risks and hazards posed by environmental contamination at PGDP. The risk characterization will be conducted in accordance with *Methods for Conducting Risk Assessments and Risk Evaluations at the*

Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume *1: Human Health* (DOE 2001c). In this section, the following items will be presented: the methods used to integrate the information to characterize risks and hazards and the tables and a narrative summarizing the risk characterization for each exposure unit under each current and potential future use scenario. This section will conclude with a listing of use scenarios of concern for each location and a listing of COCs, pathways of concern, and mediums of concern for each use scenario of concern.

6.1.5 Preliminary Remediation Goals

Chemical-specific PRGs are concentration goals for individual chemicals in specific medium and land use combinations, which are used by risk managers as long-term targets during the analysis and selection of remedial alternatives. Chemical-specific PRGs are from two general sources. These are (1) concentrations based on ARARs and (2) concentrations based on risk assessment. The chemical-specific PRGs discussed in this document are concentrations based on human health risk assessment. However, concentrations based on ARARs and ecological risk assessment are discussed and presented elsewhere within the Risk Assessment Information System.[1]

Chemical-specific PRGs also can be used as screening tools. Screening against chemical-specific PRGs and other limiting criteria is discussed in the RI Report as a preliminary step in the RI/FS process. Comparisons can be used to focus concern on a specific medium or COPC and support "no further action" recommendations. PRGs for this project will be the lesser of the no action cancer- and no action hazard-based PRGs for the appropriate future use taken from Appendix A of *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1: Human Health* (DOE 2001c).

6.1.6 Evaluation of Uncertainties

Uncertainties are associated with each of the steps of the BRA. Following a general discussion of uncertainties in risk assessment, this section presents the uncertainties that will be addressed in BHHRAs prepared for PGDP and provides a format for summarizing this information (when a qualitative uncertainty analysis or sensitivity analysis is performed). The uncertainty evaluation will be conducted in accordance with *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1: Human Health* (DOE 2001c).

The potential effect of the uncertainties on the final risk characterization must be considered when interpreting the results of the risk characterization, because the uncertainties directly affect the final risk estimates. The types of uncertainties that must be considered can be divided into four broad categories. These are uncertainties associated with data and data evaluation (i.e., identification of COPCs), exposure assessment, toxicity assessment, and risk characterization. Specific uncertainties under each of these broad categories that will be addressed in the BHHRAs completed for PGDP are listed in the following material.

At minimum, all BRAs will contain a qualitative uncertainty analysis that will include a quantitative sensitivity analysis of salient uncertainties. In the qualitative uncertainty analysis, the magnitude of the uncertainty on the risk characterization will be categorized as small, moderate, or large. Uncertainties categorized as small will be those that should not cause the risk estimates to vary by more than one order

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[1] The risk assessment information system is a website sponsored by the DOE Office of Environmental Management, Oak Ridge Operations Office, through a contract with Bechtel Jacobs Company LLC. The site provides risk assessment tools (guidance, toxicity values, PRGs, etc.) and is evaluated monthly to ensure that information is current. See http://rais.ornl.gov/ for additional information.

of magnitude; uncertainties categorized as moderate will be those that may cause the risk estimates to vary by between one and two orders of magnitude; and, uncertainties categorized as large will be those that may cause the risk estimates to vary by more than two orders of magnitude.

In the qualitative uncertainty analysis, it will be noted that the uncertainties listed and evaluated are neither independent, nor mutually exclusive; therefore, it will be concluded that the total effect of all uncertainties upon the risk estimates is not the sum of the estimated effects of each uncertainty evaluated.

6.1.7 Ecological Assessment Methods

The SERA will quantitatively evaluate potential ecological risks using the methods presented in Volume 2 of the PGDP Risk Methods Document (DOE 2001c). At minimum, this will include the following items:

- Identification of receptors that may be impacted by contaminants migrating from source areas;
- Discussion of the effects identified contamination may have on receptor populations;
- Summary of the threatened and endangered species known to be present at, or near, PGDP and the potential impacts upon them; and
- Comparison of medium-specific analyte concentrations and activities found at the site with ecological toxicity benchmarks.

The SERA may include additional steps of the baseline ecological risk assessment process outlined in DOE 2001c, as appropriate. The level of effort for these additional steps will be dependent on the ecological information available from historical environmental monitoring activities at PGDP and on the need for derivation of cleanup criteria to be used for the protection of ecological receptors. No specific sampling has been identified to supplement ecological risk assessment process as part of this work plan.

6.2 EVALUATING EXISTING DATA AND DEVELOPING THE CONCEPTUAL SITE MODEL

Existing data and information for each SWMU/AOC forms the basis for determining the amount of additional characterization data necessary to reach an action/NFA determination. In addition to analytical data, process knowledge, personnel interviews, and records/document searches, are all useful in that determination. The site conceptual model for contaminant transport determines the applicability of each type of preliminary information/data which in turn is used in support of a risk assessment.

All existing information about the SWMU/AOC and relevant surrounding area are collected including but not limited to the following:

- Compiling facility records, personnel interview records, and process description information for each SWMU/AOC;
- Defining processes and materials used, where chemicals and materials were used/disposed, and where and how potential contaminants may have been introduced to the SWMU/AOC and subsequently released to the environment;

- Compiling all analytical data for the SWMU/AOC and surrounding area, including radiological surveys, geophysical surveys, sample results, geotechnical information, historical photographs, maps, and drawings; and

- Collecting and evaluating any existing computational assessments (risk assessment) or conceptual evaluations and the results and conclusions of any previous investigations.

The conceptual site model will be the working basis for planning the SWMU/AOC sampling requirements. The conceptual site model (CSM) presented in Figure 6.1 identifies the probable and potential contaminant migration and exposure pathways at SOU SWMUs/AOCs outside the secure area. Figure 6.2 identifies the probable and potential contaminant migration and exposure pathways at SOU SWMUs/AOCs inside the secure area. From the source, two probable pathways are identified with solid lines: (1) subsurface soil, and (2) surface soil. These probable pathways will be the focus of the investigation activities.

6.3 SAMPLING STRATEGY

This section describes the approach for using various characterization tools, survey methods, and sampling processes to classify and characterize residual contamination to support an action/NFA decision. Characterization approaches are included in the following discussion.

6.3.1 Identifying Data Gaps and Defining Program Requirements

Evaluation of the adequacy and representativeness of existing information is determined by the following criteria:

- Will existing data support the SWMU/AOC decision making; and

- Are data sufficient to support a risk assessment. Specifically, there must be analytical data of sufficient and appropriate quality for the full set of COCs and COPCs to determine if there is a threat to the industrial worker.

If data are not adequate and representative, the data gaps are identified and additional sampling is planned to ensure adequate, sufficient, and representative data to support the decision for action/NFA for each SWMU/AOC. QA data considerations made to ensure that data quality requirements are met include sample point density, number of samples, analyses required, locations, depth of samples, and compositing methodology. QC considerations include adherence to field and laboratory procedures/protocols and data validation/management procedures as described in the appropriate chapters.

6.3.2 Limited Radiological Survey

This radiological survey has been prepared using guidance provided in *Multi-Agency Radiological Survey and Site Investigation Manual* (MARSSIM) as a framework. In accordance with that guidance, historic site data and information were reviewed; the goal of identifying locations of radiologically contaminated areas for further investigation was established; and a methodology for achieving that goal was developed. The graded approach, recommended by MARSSIM, was applied in developing this plan to achieve efficient use of resources. The goal is to perform a scoping survey and to determine the scanning percentages of the areas for final status surveys per MARSSIM.

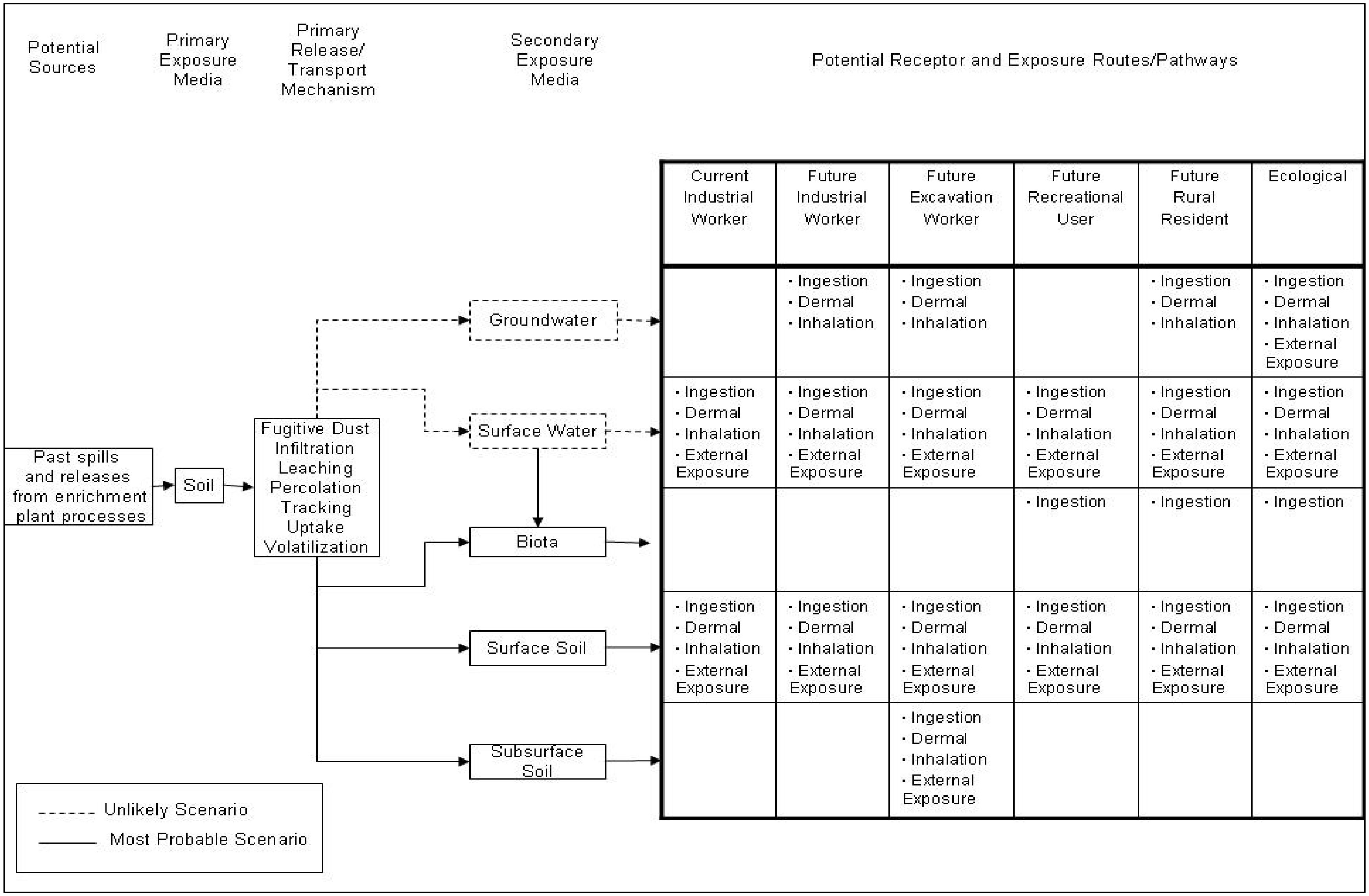

Figure 6.1. CSM Outside Secure Area

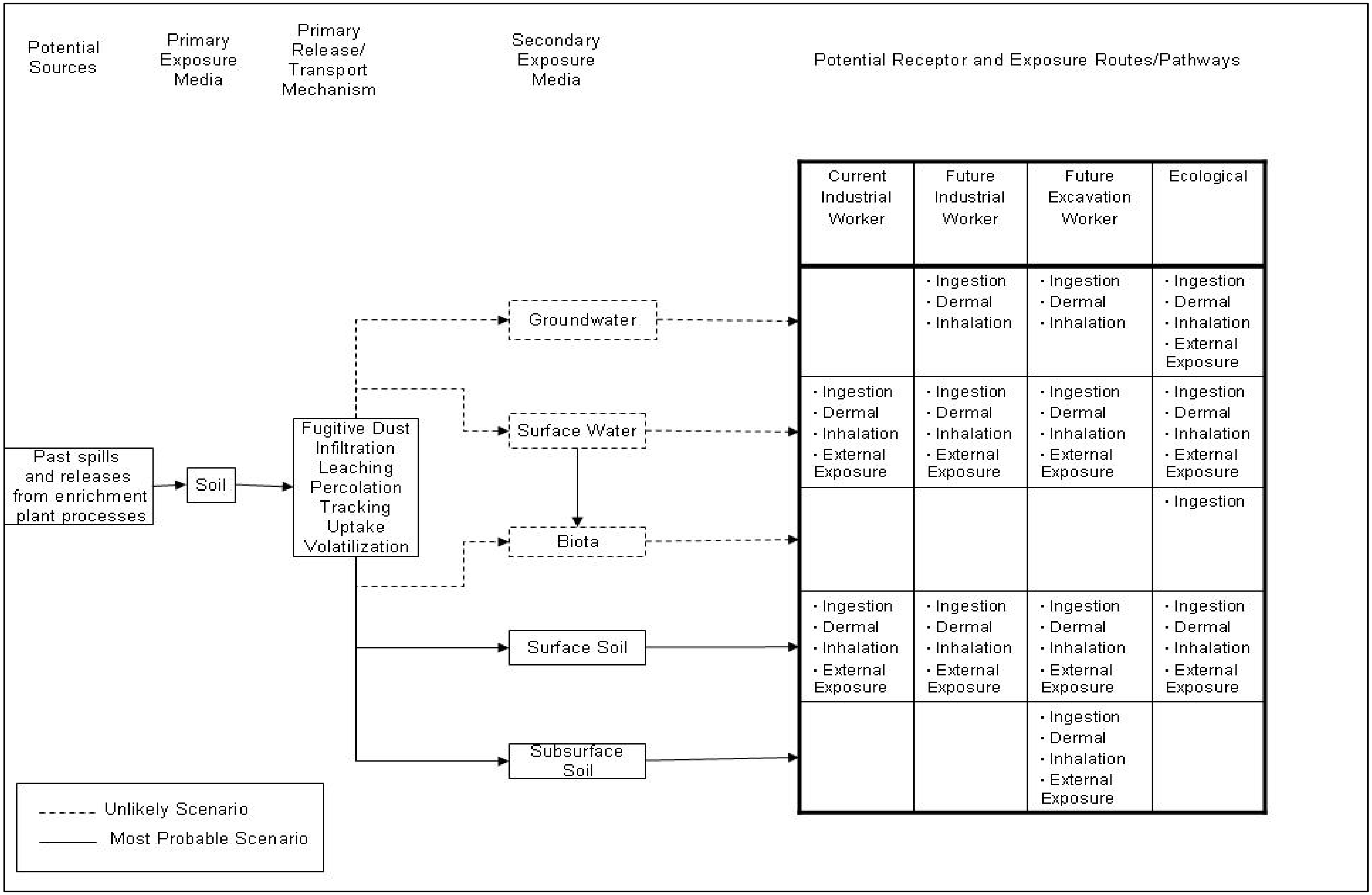

Figure 6.2. CSM Inside Secure Area

6.3.3 PCB Evaluation

The PCB evaluation will characterize known contaminated locations by defining the nature of soil contamination using a systematic and biased sampling strategy. SWMUs 75 and 78 will be investigated with the same sampling plan as other SWMUs/AOCs in the work plan. The switchyard ditches will be evaluated for PCBs using field test kits with fixed laboratory confirmatory sampling.

7. TREATABILITY STUDIES

Treatability studies involve testing technologies to assess their performance on specific wastes or media. This section includes a discussion of the treatability study process. No treatability studies have been identified at this time for the SOU; however, as the RI/FS is implemented and remedial actions are evaluated, additional studies may be identified.

7.1 IDENTIFICATION OF TREATABILITY STUDIES NEEDED

Treatability studies involve testing one or more technologies to gain qualitative or quantitative information to assess their performance on specific wastes or media at the site. Treatability studies are conducted primarily to do the following:

- Provide sufficient data to allow treatment options to be fully developed and evaluated during the detailed analysis and to support the FS and remedial design of a selected action,
- Reduce cost and performance uncertainties for remedial actions to acceptable levels so that a remedy can be selected,
- Support remedy screening,
- Support remedy selection, and
- Support remedy implementation.

Treatability studies are conducted, as appropriate, to collect data on technologies identified during the development process, thus, providing additional information for their evaluation. The RI/FS contractor and DOE’s project manager must review the existing site data and available information on technologies to determine if treatability investigations are needed.

The need for treatability testing should be identified as early in the RI/FS process as possible. A decision to conduct treatability testing may be made during project scoping if information indicates that such testing is desirable. However, the decision to conduct these activities must be made by weighing the cost and time required to complete the investigation against the potential value of the information in resolving uncertainties associated with selection of a remedial action. In some situations, a specific technology that appears to offer a substantial savings in costs or significantly greater performance capabilities may not be identified until the later phases of the RI/FS. Under such circumstances, it may be advantageous to postpone completion of the RI/FS until treatability studies can be completed. In other situations, treatability investigations may be postponed until after the remedial design phase.

The design process for treatability studies is shown, conceptually, in Figure 7.1 and consists of the following four steps:

(1) Determination of data needs;

(2) Review of existing data on the site and available literature on technologies to determine if existing data is sufficient for the evaluation of alternatives;

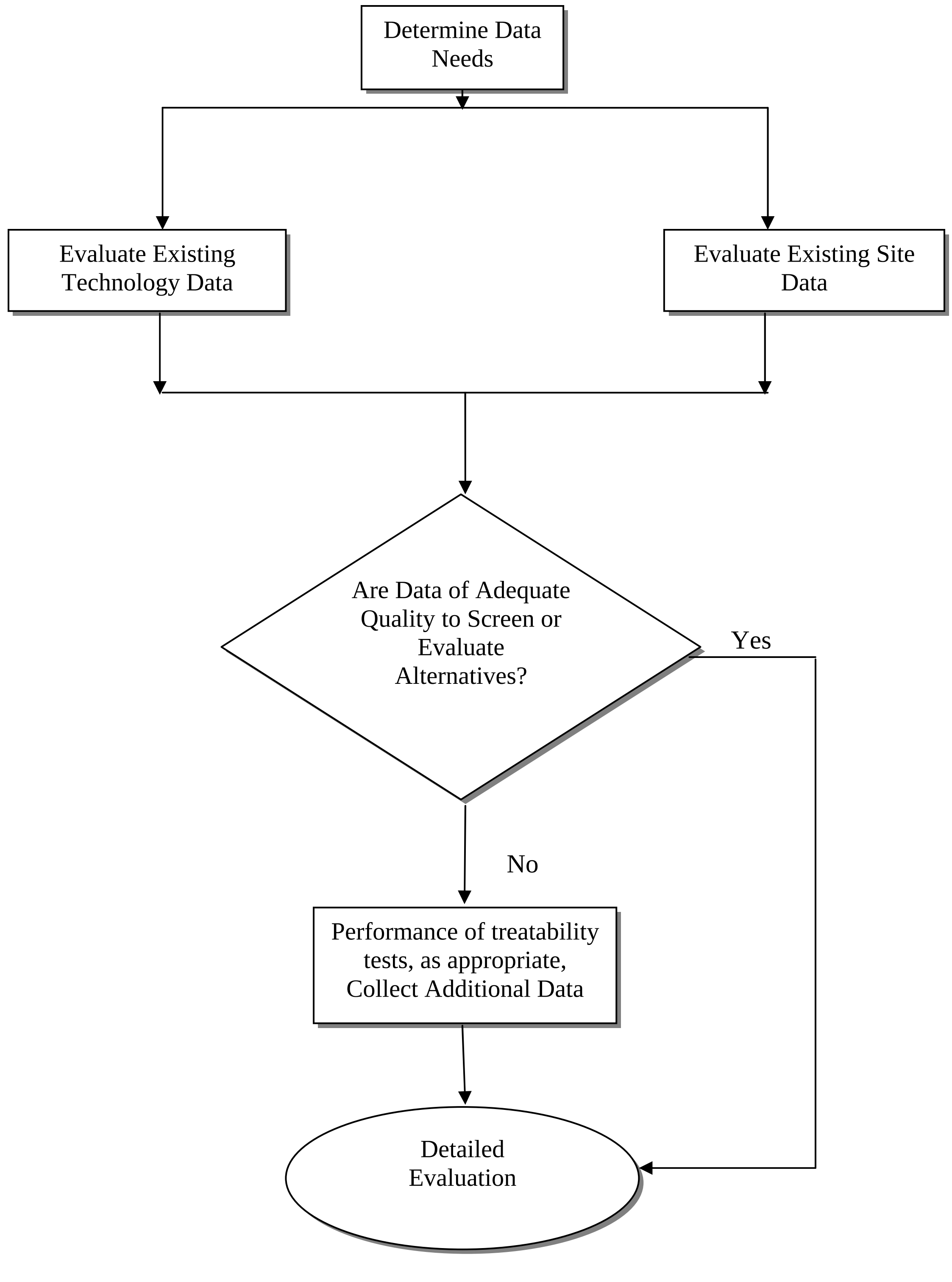

Figure 7.1. Flowchart for Treatability Study

(3) Performance of treatability tests, as appropriate, to determine performance, operating parameters, and relative costs of potential remedial technologies; and

(4) Evaluation of the treatability data to ensure that DQOs are met.

Certain technologies have been demonstrated such that site-specific information collected during the site characterization is adequate to evaluate and determine the cost of these technologies without conducting treatability testing. Situations where treatability testing may not be necessary include the following:

- A developed technology has been well proven in similar applications;

- A technology previously has been used extensively to treat well-documented waste materials (e.g., stripping or carbon adsorption for groundwater containing organic compounds for which treatment previously has proven effective); or

- Relatively low removal efficiencies are required (e.g., 50% to 90%), and data are already available.

Frequently, technologies have not been demonstrated sufficiently or characterization of the waste alone is insufficient to predict treatment performance or to estimate the size and cost of appropriate treatment units. Furthermore, some treatment processes are not understood sufficiently for performance to be predicted, even with a complete characterization of the wastes. For example, often it is difficult to predict biological toxicity in a biological treatment plant without pilot tests. When treatment performance is difficult to predict, an actual testing of the process may be the only means of obtaining the necessary data. In fact, in some situations, it may be more cost-effective to test a process on the actual waste than it would be to characterize the waste in sufficient detail to predict performance.

7.2 DESCRIPTION OF STUDY TO BE PERFORMED

Treatability testing performed during an RI/FS is used to evaluate technologies, including evaluation of performance, determination of process-sizing, and estimation of costs, in sufficient detail to support the remedy-selection process. Treatability testing can be performed using bench-scale or pilot-scale techniques that involve implementing and evaluating the performance of a small-scale system in order to determine the potential benefits in construction and operation of a large-scale system. Treatability testing in the RI/FS is not intended solely to develop detailed design or operating parameters that are more appropriately developed during the remedial design phase.

In general, treatability studies will include the following steps:

(1) Preparation of a work plan (or modification of the existing work plan) for bench or pilot studies;

(2) Performance of field sampling, bench testing, and/or pilot testing;

(3) Evaluation of data from field studies, bench testing, and/or pilot testing; and

(4) Preparation of a report documenting the test results.

7.3 ADDITIONAL SITE DATA NEEDED FOR STUDY OR EVALUATION

Before evaluation for remedy selection in the FS, sufficient data must be available to allow treatment alternatives to be fully developed and evaluated. Additional data are needed to do the following:

- Determine whether the performance of the technologies under consideration has been documented sufficiently on similar wastes, considering the scale (e.g., bench, pilot, or full) and the number of times that the technologies have been used;

- Gather information on relative costs, applicability, removal efficiencies, operation and maintenance requirements, and implementability of the candidate technologies;

- Determine site geology and geochemistry;

- Determine whether characterization of the waste is sufficient to predict treatment performance or to estimate size and cost of the appropriate treatment system; and

- Determine power needs and differences in performance among competing manufacturers.

7.4 SCHEDULE FOR SUBMISSION OF ADDITIONAL TREATABILITY STUDY WORK PLANS

Technologies that may be applicable to the SOU that require treatability studies will be identified as early as possible during the RI/FS process. When possible, treatability studies will be coordinated across the site where unit characteristics appear similar. At any time during the RI/FS process that a treatability study is determined to be necessary, the issue will be discussed with EPA and KDEP.

As the RI/FS process progresses, a determination will be made as to whether the performance of treatability studies is necessary. At this time, there is no need to perform a treatability study based on an evaluation of potential remedial alternatives and sufficient lessons learned and information available from other sites that have implemented remedial actions for soils. If the performance of treatability studies is required, a treatability study work plan will be submitted. Treatability studies generally require 6 to 24 months to complete. If the performance of treatability studies is deemed necessary, DOE will notify EPA and KDEP of the study schedule.

8. ALTERNATIVES DEVELOPMENT

This section explains the process that will be used to develop and evaluate alternatives during the SOU FS. Topics addressed in this section of the work plan include the following:

- A description of the general approach to investigating and evaluating potential remedies;
- The overall objective of the study, a discussion of preliminary identification, general response actions, and remedial technologies;
- A remedial alternatives development and screening; and
- A detailed analysis of remedial alternatives.

A discussion of the format for the FS and the schedule, or timing for conducting the study also is provided.

8.1 DESCRIPTION OF THE GENERAL APPROACH TO INVESTIGATING AND EVALUATING POTENTIAL REMEDIES

Under CERCLA, an FS is completed in conjunction with an RI. The process for conducting a CERCLA FS begins with scoping the RI/FS. Development and screening of alternatives are performed after the site characterization or RI. Treatability studies may be performed, if necessary, to evaluate adequately the alternative's effect on particular site-specific waste streams. Then, before the selection of a remedy, the alternatives undergo a detailed evaluation using the nine evaluation criteria outlined in 40 *CFR* § 300.430(e) (9) (iii).

The draft generic baseline schedule, Figure 2.2, includes an activity titled, "Prepare Draft FS Report." Five steps are identified under this report preparation activity: (1) alternatives development, (2) preliminary technology screening, (3) detailed evaluation of alternatives, (4) document consolidation, and (5) issuance of a FS report to regulators. The first three steps are intended to parallel the CERCLA FS process, and the last two lead to preparation of an FS report.

8.2 OVERALL OBJECTIVES OF THE FEASIBILITY STUDY

The primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated so that relevant information concerning the remedial action options can be presented to a decision maker and an appropriate remedy can be selected [40 *CFR* § 300.430(e)(1)]. This information must be adequate to ensure that an appropriate remedy can be selected and provide protection of human health and the environment by recycling waste or by eliminating, reducing, or controlling risks.

8.3 PRELIMINARY IDENTIFICATION OF GENERAL RESPONSE ACTIONS AND REMEDIAL TECHNOLOGIES

This section will summarize the identification of potential remedial technologies for the SOU. Additional technologies will be identified and screened, as necessary, during review of the RI report. In accordance with the requirements of the National Contingency Plan, DOE will consider the following remedial alternatives:

- No action
- Institutional controls
- Containment
- Treatment
- Excavation

For each general response action, technology types will be identified (Table 8.1). Potentially applicable technologies will be identified by referring to the alternatives evaluation section of the draft *Summary of Alternatives for Remediation of Off-site Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 1991). Additionally, databases, such as the Electronic Encyclopedia of Remedial Action Options and the Vendor Information System for Innovative Treatment Technologies, will be queried to develop additional technologies. Alternatives for remediation will be developed by assembling combinations of technologies and the media to which they would be applied into alternatives that address contamination identified for the SOU. This process will consist of development of alternatives, screening of alternatives, and detailed analysis of alternatives. Tools, such as the Remedial Action Assessment System, may be used.

Table 8.1. Potential Remedial Actions for Primary Sources

	Soil
Institutional Controls	• Land use restrictions • Easements • Deed notice
Containment	• Low-permeability capping • Erosion control • Surface water control
Excavation	• Excavation/storage • Excavation/disposal
Treatment	• *In situ* physical/chemical treatment • *Ex situ* physical/chemical treatment (assumes excavation/pumping)

8.4 REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING

The primary objective of the alternatives development and screening phase is to generate a list of potential remedial alternatives. The alternatives developed are to protect human health and the environment, to identify potentially suitable technologies (including innovative technologies), and to assemble the technologies into alternative remedial actions. These alternative remedial actions then will undergo a detailed analysis during the next phase of the FS.

Consistent with the EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*; Interim Final, NTIS PB89-184626, EPA 540-G-89-004, OSWER 9355.3-01, October, (EPA 1988), the remedial alternatives development and screening phase will consist of six general steps, which follow:

(1) **Development of remedial action objectives.** COCs, exposure pathways, PRGs and remedial goal options (RGOs) will be taken into account to allow for the development of a range of treatment and containment alternatives.

(2) **Development of general response actions.** Response actions will be identified that satisfy the remedial action objectives for the SOU sites (e.g., excavation).

(3) **Identification of volume or area.** The volume or area to which general response actions may be applied will be identified.

(4) **Identification and screening of technologies applicable to each general response action.** Those technologies that cannot be technically implemented at the site will be eliminated. Definitions of the general response also will be modified to specify remedial technology types.

(5) **Identification and evaluation with technology process options.** A representative process for each remaining technology type will be selected to represent the technology type for alternative development and evaluation.

(6) **Assembly of the selected representative technologies.** The technologies will be assembled into alternatives that represent a range of remedial options, including treatment and containment.

In addition, one or more innovative technologies will be developed for detailed evaluation, to the extent required by, [40 *CFR* § 300.430(e) (5)]. A no action alternative also will be evaluated [40 *CFR* § 300.430(e) (6)].

The alternatives that are developed will undergo a screening evaluation. As appropriate, and to the extent sufficient information is available, the screening evaluation will consist of an effectiveness assessment, an implementability appraisal, and a cost evaluation [40 *CFR* § 300.430(e) (7)].

The remaining alternatives then will undergo a detailed evaluation [40 *CFR* § 300.430(e) (9)].

8.5 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The detailed analysis of alternatives involves evaluating each of the alternatives remaining after the screening described in *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, OSWER 9200.1-23.P, Office of Emergency and Remedial Response, Washington, DC, (EPA 1999), using the nine evaluation criteria. The alternatives then are compared. The results of the detailed analysis will allow an appropriate remedy to be selected.

CERCLA requires that nine criteria be used to evaluate the expected performance of remedial actions. The criteria are categorized as threshold, balancing, and modifying criteria. The nine criteria are identified in the following discussion.

8.5.1 Threshold Criteria

In accordance with 40 *CFR* § 300.430(f) (1) (I) (A), these threshold criteria must be met. An alternative must allow for the following in order to be selected as the remedy.

(1) **Overall protection of human health and the environment.** This criterion requires that the alternative adequately protect human health and the environment [40 *CFR* § 300.430(e) (9) (iii) (A)].

(2) **Compliance with ARARs (unless a specific ARAR is waived).** Congress specified in CERCLA §121 that remedial actions for cleanup of hazardous substances, pollutants, or contaminants that

will remain on-site must comply with requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or circumstances at a site [40 *CFR* § 300.430(e)(9)(iii)(B)]. The potential ARARs for the SOU are presented in Appendix A.

8.5.2 Balancing Criteria

These criteria are considered in determining which alternative best achieves or comes closest to achieving the threshold criteria [40 *CFR* § 300.430(f) (1) (I) (B)]. The balancing criteria evaluate the alternatives in terms of the following five qualities.

(3) **Long-term effectiveness and permanence.** This criterion focuses on the magnitude and nature of the risks associated with untreated waste/treatment residuals. This criterion includes consideration of the adequacy and reliability of any associated engineering controls, such as monitoring and maintenance requirements [40 *CFR* § 300.430(e) (9) (iii) (C)].

(4) **Reduction of contaminant toxicity, mobility, or volume through treatment.** This criterion evaluates the degree to which the alternative employs treatment to reduce the toxicity, mobility, or volume of contamination [40 *CFR* § 300.430(e) (9) (iii) (D)].

(5) **Short-term effectiveness.** This criterion evaluates the effect of implementing the alternative relative to potential risks to the general public, potential threat to workers, and time required until protection is achieved [40 *CFR* § 300.430(e)(9)(iii)(E)].

(6) **Implementability.** This criterion reviews potential difficulties associated with implementing the alternative. These difficulties may involve technical feasibility, administrative feasibility, and availability of services and materials [40 *CFR* § 300.430(e) (9) (iii) (F)].

(7) **Cost.** This criterion weighs the capital cost, annual operation and maintenance, and the combined net present value [40 *CFR* § 300.430(e) (9) (iii) (G)].

8.5.3 Modifying Criteria

These criteria allow for the influences of the community and the state.

(8) **Community acceptance.** This criterion requires the consideration of any formal comments by the community regarding any action to be performed [40 *CFR* § 300.430(e) (9) (iii) (I)].

(9) **State acceptance.** This criterion requires the consideration of any formal comments by the state regarding any action to be performed [40 *CFR* § 300.430(e) (9) (iii) (H)].

The selections will be based on analysis of technical, human health, and environmental criteria. The remedy selection process must follow the requirements of 40 *CFR* § 300.430(e), including the proposed plan, community involvement, and preparation of a ROD.

8.6 FORMAT FOR THE FEASIBILITY STUDY REPORT

Appendix C contains the draft “Integrated FS/CMS Report” outline, as specified in Appendix D of the FFA. This outline will be the basis for the SOU FS report, the text of which will incorporate NEPA values, consistent with the DOE 1994 Secretarial Policy on NEPA.

8.7 SCHEDULE/TIMING FOR CONDUCTING THE STUDY

Feasibility studies will be conducted after the fieldwork is completed (Figure 2.2).

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9. FIELD SAMPLING PLAN

The primary focus of the SOU RI/FS will be to (1) collect field and analytical data necessary to determine the nature and extent of known PCB-contaminated soil, a limited area radiological evaluation, and any soil contamination at SOU SWMUs/AOCs; (2) complete a BHHRA and SERA; (3) and evaluate appropriate remedial alternatives for each targeted area.

This section describes how each field sampling strategy will be implemented. If field conditions encountered differ from those anticipated, SWMU/AOC strategy, if appropriate, will be discussed and revisions to sampling plans will be made as needed.

9.1 SAMPLING MEDIA AND METHODS

This section identifies the different media to be sampled during the investigation and specifies methods for collecting the samples. Two types of sampling and data collection activities will be performed—nonintrusive data collection (surveys) and intrusive media sampling (surface and subsurface soil). Investigation activities will use DOE Prime Contractor-approved procedures that are consistent with EPA procedures and protocols.

9.1.1 Nonintrusive Data Collection–Surveys

Surveys to be conducted include radiological walkover, field test kits, nondestructive assay (NDA), PCB wipe, and visual inspection.

9.1.1.1 Radiological Walkover Survey

Radiological walkover survey will be conducted using a field instrument (NaI detector) coupled with a GPS device. Specific details of these activities are provided in Appendix B.

9.1.1.2 Field Test Kits

Field methods will include RCRA metals and uranium analysis by *ex situ* X-ray fluorescence (XRF) at the SWMUs/AOCs and PCBs by immunoassay/colorimetric test kits at the SWMUs/AOCs and drainage ditches. All samples will be field scanned for alpha, beta, and gamma activity using hand held instruments as part of preparations for transport and/or shipment. Other field test kits may be utilized for the SWMU/AOC sites after being approved by DOE, EPA, and Kentucky.

To support field XRF analysis, three types of QC samples will be analyzed with each batch of 20 samples. These will include (1) blanks, (2) duplicates, and (3) standard reference materials (SRMs). The XRF blanks will be vendor-provided. Three SRMs will be analyzed daily to monitor XRF accuracy. They will represent low [National Institute of Standards and Technology (NIST) 2709], moderate (NIST 2711), and high (NIST 2710) level standards for soil analysis for metals.

To ensure PCB data can be fully evaluated, the HACH system will be calibrated daily. The PCB measurements are colorimetric in nature and acquire semiquantitative results by employing a field grade photometer. As a result, calibration standards and calibration verification standards and blanks will be prepared weekly and stored in accordance with the procedure. Calibration standards and blanks will be analyzed daily or at the end of a sample group, whichever is more frequent, to monitor instrument drift during analysis. They will be analyzed sequentially: (1) calibration verification and (2) blank, and will follow the 20^{th} natural sample analyzed or at the end of a group of samples, whichever is more frequent.

If other models, vendors, or contractor procedures are employed for field methods, the procedure for those operations will be added to the required reading for this FSP and the associated work package. All field methods shall be completed by a properly trained/qualified technician and will meet detection limits set forth in Table 11.9 and Table 11.11.

9.1.1.3 Nondestructive Assay

NDA devices may be used at those SWMUs/AOCs and during the radiological walkover survey where radiological contamination is known or suspected to be present. ISOCS will be used as needed for the radiological walkover survey when contamination is indicated by the NaI detector results. More details are contained in Appendix B.

9.1.1.4 PCB Wipe

If an oil stain is found during the visual survey of locations that are concrete/asphalt covered, the stain will be tested for the presence of PCBs utilizing a PCB wipe.

9.1.2 Intrusive Sampling

Various media samples will be collected to characterize areas that have been evaluated as having data gaps. The samples will be collected using DOE Prime Contractor-approved procedures and will be analyzed using field test methods and selected samples will be submitted to an SMO-approved, fixed-base, analytical laboratory for analysis. Field screening instruments (e.g., photoionization detector and radiological pancake-type probes) will be used to measure volatile organic compound (VOC) and radiological contamination of drill cuttings as the boring is advanced to evaluate conditions for the workers. Work will be stopped if 10% of the lower explosion limit is reached.

9.1.2.1 Surface/Sediment Soil Sampling

Surface soil shall be collected at depths between 0- and 1-ft bgs with the use of a stainless-steel sampler, hand auger, spoon, trowel, spade, or scoop.

9.1.2.2 Shallow Soil Borings

Shallow Soil borings will be continuously collected from 1- to 4 ft bgs and will be composited except if the sample has been randomly selected for fixed laboratory VOC analysis. The VOC sample will be collected prior to the field compositing. For shallow soil borings collected down to 10/16 ft bgs, samples will be collected from the required interval as prescribed in Section 9.3.1.

The entire length of the sample collected from the sampler will be field-screened for radioactivity using portable radiation detection instruments, assessed using NDA equipment, and visually classified. The depth interval and radiation reading in cpm will be recorded in the samplers’ logbook for any portion of the sample where radiation is detected above background. If refusal is encountered prior to reaching the 10-ft depth, or 16 ft depth at infrastructure (e.g., pipelines), an alternate location will be selected at a distance not to exceed 5 ft from the original location at which refusal is met. A maximum of two alternate locations will be attempted at each sampling point. If sufficient sample quantity can be collected, samples from locations with shallow refusal may be collected at the discretion of the sampling team leader.

The specific sample equipment selected will be dependent on the drilling technology being used. Any remaining soil after samples are collected will be handled as investigation-derived waste (IDW). Upon the completion of sampling in each borehole, the field crew will abandon the boreholes by filling them with (dry) bentonite pellets (soil moisture will hydrate the pellets) or uncontaminated IDW.

9.2 SAMPLE ANALYSIS

Sample analysis for this investigation consists of analysis of surface, and shallow soil samples and characterization of project-generated waste materials. Specific analytical requirements, methods, and procedures are described in the Quality Assurance Project Plan (QAPP), Chapter 11.

Data acquisition for all SWMUs/AOCs will rely on both field measurements and fixed laboratory data to determine if contamination exists.

Following is a summary of sampling depth intervals.

Soil Sampling Locations	**Depth**
All SWMUs/AOCs unless otherwise specified	
Surface	0 ft to 1 ft bgs
Subsurface[1]	1 ft to 4 ft bgs
SWMU/AOC with sewer or recirculating water (RCW) pipeline	
Surface	0 ft to 1 ft bgs
Subsurface[1]	1 ft to 4 ft bgs
Shallow[2]	1 ft below pipeline
SWMU DOE Material Storage Area (DMSA) pending RCRA No Further Action (NFA)[3]	
Surface	0 ft to 1 ft bgs
PCB Evaluation	
Surface	0 ft to 1 ft bgs
Radiological Evaluation	
Surface	0 ft to 1 ft bgs

[1] If contamination is detected from 1 ft to 4 ft bgs, additional subsurface contingency samples will be collected below 4 ft at 4 ft intervals (e.g., 4 ft to 8 ft bgs). Only those parameters detected from 1 ft to 4 ft bgs will be analyzed.
[2] Shallow samples will be collected from the bottom of the pipeline/tank to 1 ft below the bottom of the pipeline/tank.
[3] An NFA is pending which may affect the work for this SWMU if approved.

9.3 SITE-SPECIFIC SAMPLING PLANS

9.3.1 SOU SWMUs/AOCs

A review of existing data for each of the SOU SWMUs/AOCs has been conducted to determine the following:

- SWMU AOC COPCs,
- Extent and quality of existing data, and
- Sufficiency of data to support an FS for remedial options.

Where data are absent or insufficient to fully characterize the nature and extent of contamination and to support remedy selection, specific data gaps were identified. These data gaps are the basis for additional sampling under this work plan. Appendix B addresses each SWMU/AOC individually and identifies historical samples that will be utilized for this investigation. Contamination has been defined as concentrations exceeding background.

The SWMUs/AOCs have been grouped into the following seven categories to simplify the sampling approach: Former Facility Site, PCBs, Soil/Rubble Piles, Scrap Yards, Underground/Tank, Storage Areas, and Chromium Areas. Each SWMU/AOC was divided into 0.5 acre Exposure Units (EU) and sampling points were determined within each EU. The initial samples at each SWMU/AOC will be random locations determined by Visual Sampling Plan™ (VSP). Because sampling locations shown in Appendix B figures are estimated, it is probable that some of these locations will be adjusted based on geophysical survey results or other site information obtained.

Co-contamination analyses and statistical evaluation for sample size were conducted as part of the Surface Water OU Work Plan (DOE 2005). The evaluation concluded that four samples be collected per 0.5-acre EU for the internal ditches. Sediments found in the internal ditches are expected to be more heterogeneous, with contamination more diversely distributed than surface and near surface soils within the Soils OU SWMUs/AOCs. The number of samples, (four) per 0.5-acre EU used to characterize the SWOU internal ditches, can be applied conservatively to characterize the Soils OU SWMUs/AOCs.

<u>Surface Samples (0 ft to 1 ft bgs)</u>

SWMUs/AOCs that are one EU: Four samples will be taken at 0 ft to 1 ft bgs and all will have fixed-base laboratory and field analysis.

SWMUs/AOCs that are 2 or 3 EUs: Four surface samples will be taken in each EU; all will have field analysis. Four of the surface samples from the SWMU/AOC will be selected randomly to have fixed-base laboratory analysis with a minimum of one selected from each EU.

SWMUs/AOCs that are 4 EUs and larger: Four surface samples will be taken in each EU; all will have field analysis. One surface sample from each EU will be randomly selected to have fixed-base laboratory analysis.

<u>Shallow Samples (1 ft to 4 ft bgs)</u>

Each EU will have four shallow samples from 1 ft to 4 ft bgs; all will have field analysis. One shallow sample from each EU will be randomly selected to have fixed-base laboratory analysis.

Deviations:

SWMUs/AOCs that have a pipeline: The pipeline will have a minimum of one shallow soil sample at a depth of 1 ft below the pipeline that will have field analysis performed. Additional depth samples will be collected every 30 ft along the pipeline within the SWMU/AOC boundary and a minimum of 10% will have fixed-base laboratory analysis. Surface and shallow samples will be collected as described above with a maximum of one being co-located with a pipeline sample.

SWMUs pending RCRA NFA: There are 8 DMSAs that historically have no documented spills and no staining or other indications of contamination. These locations will be sampled from 0 to 1 ft bgs at four random locations per EU, with all samples having fixed-base and field analysis. An NFA is pending which may affect the work for this SWMU if approved.

SWMUs/AOCs covered with concrete/asphalt: The SWMU/AOC will be visually surveyed for staining, and if staining is present, a PCB wipe will be obtained and the location of the staining will be documented.

Total number of SWMUs/AOCs	79
SWMUs/AOCs needing additional sampling	52
SWMUs/AOCs with enough data for FS	17
SWMUs/AOCs with concrete/asphalt cover	10

Table 9.1 displays the summary of sampling totals. Table 9.2 displays and summarizes the sampling required for each SWMU/AOC by group. A total of 1,723 samples is required with a total of 1,653 additional samples will be taken to support the RI/FS. Contingency samples are not included in the sample totals. Contingency samples will equal no more than 10% of the total samples required. If more than 10% are required, DOE will notify the regulators.

Contingency Samples:

(1) Sampling at a planned location fails (e.g., sample is rendered unusable while in the field by bottle breakage, equipment failure, etc.) (Note: “Failure” in this context does not indicate an exceedance of a level.). Result: collection of “replacement” sample.

(2) During field activities, an area with obvious staining is discovered, but a sample from this area is not part of the previously determined sampling plan. The Prime Contractor Project Manager (PM) will be contacted to make a determination as to whether or not the “stained” area should be sampled. Result: collection of “observation” samples (biased/judgmental) upon direction from project management.

(3) Preliminary results from sampling indicate elevated levels of cesium-137, PCBs, or uranium (U) at the 1 ft to 4 ft bgs when screened against those levels cited for the outfalls/ditches and areas in the previously approved SWOU SI and/or EE/CA. Result: collection of depth sample will be performed at the 4 ft to 8 ft bgs.

Table 9.1. Summary of Sampling

	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base Laboratory	Historical Shallow Fixed-base Laboratory	Historical For Field Laboratory
Total:	312	772	228	951	30	19	70

Fixed-base Laboratory Samples needed:	540
Historical Fixed-base Samples:	49
Total New Fixed-base Laboratory Samples:	**491**
Field Laboratory Samples needed:	1723
Historical for Field Samples:	70
Total New Field Laboratory Samples:	**1653**

Table 9.2. Summary of Samples by Group

Group - Former Facility Site (9)

SWMU /AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical For Field Laboratory
1	C-747-C Oil Land Farm (disposal of waste oil)[p]	4	4	16	16	38	2	-	5
99	C-745 Kellogg Building Site (WAG 28)[p]	4	4	16	5	24	-	-	-
172	C-726 Sandblasting Facility[a]	1	-	-	-	-	-	-	-
194	DUF Facility McGraw Construction Facilities	40	40	160	40	160	3	3	6
196	C-746-A Septic System, WAG 27 proposed NFA[b]	2	-	-	-	-	-	-	-
211	C-720 TCE Spill Site Northwest, WAG 27[p]	1	4	4	2	5	-	-	-
483	C-603 Nitrogen Facility concrete slab[a]	1	-	-	-	-	-	-	-
489	C-710 North Septic Tank	1	4	4	1	4	-	-	-
531	C-746-A South Aluminum Slag Reacting Area	1	4	4	1	4	-	-	-
	Total:	**55**	**60**	**204**	**65**	**235**	**5**	**3**	**11**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - PCBs (18)

SWMU/ AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
56	C-540-A PCB Staging Area[b]	1	-	-	-	-	-	-	-
57	C-541-A PCB Waste Staging Area[b]	1	-	-	-	-	-	-	-
74	C-340 Transformer Spill Site[b]	1	-	-	-	-	-	-	-
75	C-633 PCB Spill Site[p]	1	4	4	2	6			
78	C-420 PCB Spill Site[p]	1	4	4	2	5	1	1	2
79	C-611 PCB Spill Site[b]	1	-	-	-	-	-	-	-
80	C-540 PCB Spill Site[b]	1	-	-	-	-	-	-	-
81	C-541 PCB Spill Site[b]	1	-	-	-	-	-	-	-
135	C-333 PCB Soil Contamination[a]	1	-	-	-	-	-	-	-
137	C-746-A Inactive PCB Area	1	4	4	1	4	-	-	-
153	C-331 PCB Soil Contamination (west)[p]	1	4	4	2	5	-	-	-
154	C-331 PCB Soil Contamination (southeast)[p]	2	4	8	6	41	-	-	-
155	C-333 PCB Soil Contamination (west)[p]	1	4	4	3	22	-	-	-
156	C-310 PCB Soil Contamination (west)[p]	1	4	4	2	9	-	-	-
160	C-745 Cylinder Yard (PCB soils) Spoils	1	4	4	1	4	-	-	-
163	C-304 HVAC Piping System (soil backfill from C-611)	1	4	4	1	4	-	-	-
219	C-728 DMSA OS-08, empty fiberglass tank	1	4	4	1	4	-	-	-
488	C-410 Trailers PCB Contamination Area	1	4	4	2	5	-	-	-
	Total:	**19**	**44**	**48**	**23**	**109**	**1**	**1**	**2**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - Soil/Rubble Pile (12)

SWMU/ AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
19	C-410-B HF Emergency Lagoon[c]	1	-	-	-	-	-	-	-
20	C-410-E Emergency Lagoon[a]	1	-	-	-	-	-	-	-
138	C-100 Southside Berm[p]	2	4	8	3	9	-	-	-
180	WKWMA Outdoor Firing Range	5	5	20	5	20	-	-	-
181	West Side PGDP Security Force Firing Range[c]	1	-	-	-	-	-	-	-
195	SW PGDP Curlee Road Contaminated Soil Mounds	20	20	80	20	80	-	-	-
204	Dyke Road Historical Staging Area, WAG 28[p]	24	24	96	25	113	6	-	8
492	Outfall 011 Contaminated Soil Area[b]	1	-	-	-	-	-	-	-
493	Outfall 001 Concrete Rubble Piles	2	4	8	2	8	-	-	-
517	West of PGDP Rubble and debris, erosion control fill area	1	4	4	1	4	-	-	-
541	Outfall 011 Contaminated Soil Area[b]	4	-	-	-	-	-	-	-
561	Soil Pile I[b]	2	-	-	-	-	-	-	-
	Total:	**64**	**61**	**216**	**56**	**234**	**6**	**0**	**8**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - Scrapyard (7)

SWMU/ AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
12	C-747-A UF4 Drum Yard (Drum Mountain)	1	4	4	1	4	-	-	-
13	C-746 P&P1 Scrap Yards	14	14	56	14	56	4	14	34
14	C-746 E Scrap Yard	12	12	48	12	48	1	-	1
15	C-746 C Scrap Yard[p]	11	11	44	13	67	-	1	1
16	C-746 D Scrap Yard	4	4	16	4	16	3	-	3
518	C-746-P1 Field south of P1 yard	1	4	4	1	4	4	-	4
520	C-746-A Scrap Material	6	6	24	6	24	-	-	-
	Total:	**49**	**55**	**196**	**51**	**219**	**12**	**15**	**43**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - Underground/Tank (10)

SWMU/ AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
11	C-400 (SE) C-400 TCE Leak Site, SE of C-400 building[p]	1	4	4	2	5	-	-	-
26	C-400 to C-404 4" Underground Transfer Line, 1500' long[p]	1	4	4	7	60	-	-	-
27	C-722 Acid Neutralization Tank[b]	1	-	-	-	-	-	-	-
31	C-720 Compressor Pit Water Storage Tank[a]	1	-	-	-	-	-	-	-
32	C-728 Clean Waste Oil Tanks (removed)[b]	1	-	-	-	-	-	-	-
40	C-403 Neutralization Tank[c]	1	-	-	-	-	-	-	-
76	C-632-B Sulfuric Acid Storage Tank	1	4	4	1	4	-	-	-
77	C-634-B Sulfuric Acid Storage Tank[a]	1	-	-	-	-	-	-	-
165	C-616-L Pipeline and Vault Soil Contamination[b]	1	-	-	-	-	-	-	-
170	C-729 Acetylene Building Drain Pits[b]	1	-	-	-	-	-	-	-
	Total:	**10**	**12**	**12**	**10**	**69**	**0**	**0**	**0**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - Storage Area (19)

SWMU/ AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
47	C-400 TCE Storage Tank Area	1	4	4	1	4	4	-	4
200	Central PGDP TSCA Waste Storage Facility	1	4	4	1	4	-	-	-
212	C-745-A Radiological Contamination Area[p]	1	4	4	2	10	-	-	-
213	C-745-A DMSA OS-02	2	4	8	2	8	-	-	-
214	C-611 DMSA OS-03, RCRA NFA pending[d]	1	4	4	-	-	-	-	-
215	C-743 DMSA OS-04, rail tank car	1	4	4	1	4	-	-	-
216	C-206 DMSA OS-05, RCRA NFA pending[d]	1	4	4	-	-	-	-	-
217	C-740 DMSA OS-06, RCRA NFA pending[d]	2	4	8	-	-	-	-	-
218	C-741 DMSA OS-07, RCRA NFA pending[a d]	1	-	-	-	-	-	-	-
220	C-409 DMSA OS-09, RCRA NFA pending[a d]	1	-	-	-	-	-	-	-
221	C-635 DMSA OS-10[p]	1	4	4	2	8	-	-	-
222	C-410 DMSA OS-11, RCRA NFA pending[d]	2	4	8	-	-	1	-	1
223	C-301 DMSA OS-12, RCRA NFA pending[a d]	1	-	-	-	-	-	-	-
224	C-340 DMSA OS-13, empty drum storage[p]	1	4	4	2	6	-	-	-
225	C-533-1 DMSA OS-14, rail cars[p]	1	4	4	2	5	-	-	-
226	C-745-B DMSA OS-15	1	4	4	1	4	-	-	-
227	C-746-B DMSA OS-16, RCRA NFA pending[d]	2	4	8	-	-	1	-	1
228	C-747-B DMSA OS-17	1	4	4	1	4	-	-	-
229	C-746-F DMSA OS-18	1	4	4	1	4	-	-	-
	Total:	**23**	**64**	**80**	**16**	**61**	**6**	**0**	**6**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

Table 9.2. Summary of Samples by Group (Continued)

Group - Chromium Areas (4)

SWMU /AOC	Location	# EU(s)/ SWMU/ AOC	Surface Fixed-base Laboratory	Surface Field Laboratory	Shallow Fixed-base Laboratory	Shallow Field Laboratory	Historical Surface Fixed-base	Historical Shallow Fixed-base	Historical for Field Laboratory
158	C-720 Chilled Water System Leak Site[p]	1	4	4	2	6	-	-	-
169	C-410-E HF Vent Surge Protection Tank	1	4	4	1	4	-	-	-
176	C-331 Ricirculating Water (RCW) Leak NW Side[p]	1	4	4	2	9	-	-	-
177	C-331 Leak East Side[p]	1	4	4	2	5	-	-	-
	Total:	**4**	**16**	**16**	**7**	**24**	**0**	**0**	**0**

[a] Sites are covered with concrete/asphalt and will be investigated as part of a future action. Refer to Appendix B.
[b] Location has enough data to proceed to FS.
[c] Location is part of Removal Action.
[d] An NFA is pending which may affect the work for this SWMU if approved.
[p] Pipeline is located underground in SWMU/AOC.

9.3.2 PCB Survey

The PCB evaluation will include the sampling and analysis of locations to a depth of 1 ft bgs. A total of 6,192 linear ft of ditches that capture runoff from switchyards has been identified. For the ditches, samples will be collected along a centerline every 10 ft. SWMUs 75 and 78 (former transformer locations) are included with the SOU SWMU/AOC sampling plan.

PCB field screening will be performed on each of the five discrete subsamples and one composite in accordance with the *HACH Pocket Colormeter™ II Test Kit Instruction Manual* along with 10% confirmatory fixed-base laboratory sampling. If another test kit is selected and approved by DOE, EPA, and Kentucky, then the manufacture's instructions will be followed.

9.3.3 Limited Radiological Walkover

The objective of the radiological evaluation is to identify locations of radiologically contaminated soil and other materials on the PGDP that may have radionuclide concentrations exceeding the levels associated with an annual dose of 15 millirem (mrem) to an industrial worker. Newly identified areas of radiologically contaminated soil or materials will be posted to restrict access.

The radiological survey of the DOE Reservation will be performed using a survey approach which was modeled using NUREG-1575, *Multi-Agency Radiological Survey and Site Investigation Manual*, (NRC 1997) guidance. Additional details of these activities are provided in subsequent chapters.

9.3.3.1 Radiological Contaminants and Criteria

The principal radiological contaminant likely to be in the areas to be surveyed is depleted uranium (i.e., ^{238}U with lesser amounts of ^{234}U and ^{235}U). Analyses and operational history indicate the potential presence of other radionuclides, including ^{99}Tc, ^{137}Cs, ^{230}Th, ^{232}Th, ^{237}Np, ^{238}Pu, $^{239/240}$Pu, and ^{241}Am. Numerous soil and sediment samples have been collected from areas outside the PGDP. *Radiation Dose Assessment Under Current Conditions for Exposure to Radionuclides in Sediment, Soil, Deer, Surface Water, and Fish in Off-site Areas Near the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC 2002) summarizes radionuclide concentrations by general area outside the PGDP. Concentrations in individual samples of soil and sediment differ significantly, as do the relative ratios of the various contaminants. This variability is due largely to the differences in operations and in-plant areas from which storm drainage to the different off-site directions originates. Table 9.2 presents a summary of the radionuclide contaminants for selected locations on the DOE Reservation.

Radionuclide contaminants, associated with potential doses and actions for various current and future land uses, are presented in *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1, Human Health* (DOE 2001c). The referenced document includes dose-based action and no-action screening values based on various exposure scenarios. Based on land use maps presented in DOE 2001c and in the PGDP Site Management Plan (DOE 2008), the industrial worker is the most likely exposure scenario for the areas to be surveyed under this plan.

Since ^{238}U is the primary contaminant and is collocated with the other contaminants, as shown in Table 9.2, it functions as a surrogate for potential radionuclide contaminants for the surveys to identify areas of contaminated soil/sediment for the investigation.

The objective of the survey is to identify anomalies that may have radionuclide concentrations exceeding the levels associated with an annual dose of 15 mrem to an industrial worker. The annual 15 mrem dose is equivalent to a ^{238}U concentration of 528 pCi/g, which is greater than the minimum detectable activity of the gamma scanning instrument and technique discussed later (i.e., 40 pCi/g).

Table 9.3. Summary of Contaminants in Samples from Selected Areas on the DOE Reservation*

General Location and References on DOE Reservation	Primary Contaminants	Other Associated Contaminants	Comments
North side drainages	Technetium-99, Th-230	U-238, Np-237, Am-241, Pu-239	Primarily areas adjacent to the North-South Diversion Ditch
South side drainages	U-238	Technetium-99, Cs-137, Th-230, Pu-239	Limited operations and data in this area
East side drainages	U-238	Technetium-99, Th-230	Primarily adjacent to and north of Outfall 11
West side drainages	U-238	Technetium-99, Cs-137	Drainage area includes C-400, C-720, C-404, and Scrap Yards

*From OREIS data retrieved April 2007.

9.3.3.2 Survey Approach

This radiological survey has been prepared using guidance provided in MARSSIM as a framework. In accordance with that guidance, historic site data and information were reviewed; the goal of identifying locations of radiologically contaminated areas for further investigation was established; and a methodology for achieving that goal was developed. The graded approach, recommended by MARSSIM, was applied in developing this plan to achieve efficient use of resources.

The DOE Prime Contractor radiological control organization is responsible for design and implementation of this survey. To assure quality data, surveys will be performed by personnel who are trained and qualified in radiological monitoring and use properly calibrated instrumentation in accordance with DOE Prime Contractor-documented procedures.

9.3.3.3 Classification by Contamination Potential

The graded approach used for this radiological survey distributes the level of survey effort in proportion to the potential for contamination. MARSSIM recommends a classification process for describing areas according to their radiological characteristics. Areas initially are classified by contamination potential as impacted and nonimpacted. MARSSIM also provides a mechanism for reclassification of areas based on survey results, resulting in increased survey rigor being applied to specific areas. Areas that have no reasonable potential for contamination from site operations are classified as nonimpacted areas, and areas with some potential for contamination are classified as impacted areas. All areas addressed by this survey are considered to have some potential for radioactive contamination and are, therefore, classified as *impacted*.

Impacted areas are further divided into one of following three classifications:

- Class 1 Areas—Areas that have a potential for radioactive contamination at levels above established criteria.

- Class 2 Areas—Areas that have a potential for radioactive contamination, but at levels that are not expected to exceed established criteria.

- Class 3 Areas—Impacted areas that are not expected to contain any radioactive contamination, or, if radioactive contamination is present, the levels are expected to be at a small fraction (typically ≤ 10%) of the established criteria.

Class 1 areas have the greatest potential for contamination and, therefore, receive the highest degree of survey effort, followed by Class 2 and Class 3 areas, respectively.

MARSSIM application of these classifications is for defining the areas and survey coverage for Final Status Surveys; however, they also provide a framework for determining the level of effort for other categories of surveys.

9.3.3.4 Quality Assurance/Quality Control

DOE Prime Contractor radiological survey procedures incorporate quality assurance/quality control provisions. In addition, approximately 5% of the individual survey subunits will be selected randomly for confirmatory resurvey.

9.3.3.5 Evaluation of Survey Results

For logged data with location coordinates, data will be displayed graphically, overlying a map of the surveyed surface. Color differentiation of radiation levels will be provided, adequate to distinguish areas with levels above 1.5 times ambient background.

9.4 SAMPLING PROCEDURES

Fieldwork and sampling at PGDP will be conducted in accordance with DOE Prime Contractor-approved work instructions or procedures consistent with *Environmental Investigation Standard Operating Procedure and Quality Assurance Manual*, EPA Region 4, November 2001. DOE Prime Contractor will approve any deviations from these work instructions and procedures. The DOE Prime Contractor will document changes on Field Change Request forms as detailed in the QAPP. Table 9.3 provides an example list of investigation activities that may require work instructions or procedures.

9.5 DOCUMENTATION

Field documentation will be maintained throughout the SOU RI/FS in various types of documents and formats, including the field logbooks, sample labels, sample tags, chain-of-custody forms, and field data sheets. Additional information is contained in the DMIP (Chapter 12).

Field Planning Meeting

A field planning meeting will occur before work begins at the site, so that all involved personnel will be informed of the requirements of the fieldwork associated with the project. Additional planning meetings will be held as needed or if the scope of work changes. Each meeting will have a written agenda and attendees must sign an attendance sheet, which will be maintained on-site and in the project files. The following example topics will be discussed at these meetings:

- Project- and site-specific health and safety, objectives and scope of the fieldwork, equipment and training requirements;
- Procedures;
- Worker feedback;
- Required QC measures; and
- Documents covering on-site fieldwork.

Table 9.4. Example Fieldwork and Sampling Activities Requiring Work Instructions or Procedures

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

Readiness Checklist

Before implementation of the field program, project personnel will review the work control documents to identify field activities and materials required to complete the activities, including, but not limited to, the following items:

- Task deliverables,
- Required approvals and permits,
- Personnel availability,
- Training,
- Field equipment,
- Sampling equipment,
- Site facilities and equipment, and
- Health and safety equipment.

Before fieldwork begins, appropriate DOE Prime Contractor personnel will concur that readiness has been achieved.

9.6 SAMPLE LOCATION SURVEY

A coordinate survey of sampling locations will be conducted upon completion of RI/FS field activities. Where possible, temporary markers consisting of flagging or of wooden or metal stakes will be used to mark sample locations. A thorough description of each location will be made during field sampling activities and will be documented using field maps. A member of the field sampling crew will accompany the survey crew to provide information regarding the location of sampling points. Each sample point will have coordinates obtained with a GPS unit. Coordinates will be entered into Paducah Project Environmental Measurements System (PEMS) and will be transferred with the station's ready-to-load (RTL) file to Paducah OREIS.

10. ENVIRONMENTAL, SAFETY, AND HEALTH PLAN

10.1 PURPOSE

This ES&H Plan has been developed to discuss the general ES&H requirements associated with the SOU RI/FS Work Plan and identify some potential hazards. Site specific hazards and controls will be established for each task and location prior to performing work. These hazards and controls will be documented in the form of Site Specific Health and Safety Plan (HASPs), Activity Hazard Assessments (AHAs), work packages, and procedures. Personnel will be familiar with these work control documents prior to performing work in the affected areas.

10.2 INTEGRATED SAFETY MANAGEMENT/ENVIRONMENTAL MANAGEMENT

The SOU Project will utilize an ISMS, which integrates the Safety Management System, the Environmental Management System (EMS), and the Quality Management System, to ensure personnel and environmental safety and quality are integrated into management and work practices at all levels so that missions are accomplished while protecting the public, the workers, and the environment. The concepts of the ISMS/EMS will be utilized to provide a formal, organized process to ensure the safe performance of work. The ISMS/EMS Plan identifies the methodologies that will be used to address previously recognized hazards and how the hazards are mitigated using Contractor accepted ES&H practices.

The core functions and guiding principles of ISMS/EMS will be implemented by incorporating applicable programs, policies, technical specifications, and procedures from the DOE, U.S. Occupational Safety and Health Administration (OSHA), EPA, and other applicable regulatory guidance. Brief descriptions of the five ISMS/EMS core functions are provided below.

10.2.1 Define Scope of Work

Defining and understanding the scope of work is the first critical step in successfully performing any specific activity in a safe and compliant manner. Each member of the project team will participate in discussions conducted to understand the scope and contribute to the planning of the work. The SOU RI/FS project team will meet with personnel to ensure that everyone understands the scope of work and the technical and safety issues involved. These meetings are conducted to ensure all parties are in agreement on the scope and approach to complete the work.

10.2.2 Analyze Hazards

In the course of planning the work, the project team will identify hazards including personnel safety and environmental risks associated with the performance of the work. Hazards may be identified and assessed by performing a site visit, reviewing lessons learned, and reviewing project plans or historical data. The hazard assessment process will be prescribed by the DOE Prime Contractor procedures and policies.

Once the hazards have been identified and assessed, measures will be identified to minimize risks to workers, the public, and the environment. These measures are described in the project-specific AHAs, which serve to provide a control mechanism for all work activities. AHAs are detailed, activity-specific evaluations that address each step of the task and/or activity that will be performed. The AHA development process entails a detailed evaluation of each task to identify specific activities or operations required to successfully complete the scope of work and define the potential chemical, physical, radiological, and/or biological hazards that may be encountered; the media and manner in which they may occur; and how they are to be recognized, mitigated, and controlled. Appropriate hazard controls may include engineering controls, administrative controls, and the use of personal protective equipment (PPE). The SOU RI/FS project team is responsible for the preparation, revision, and implementation of AHAs.

Applicable AHAs will be reviewed with the personnel who will perform the work. Participants in this review will sign and date the AHA to signify that they understand all hazards, controls, and requirements in the AHAs. Copies of the AHAs with appropriate signatures shall be maintained at the work location.

Following completion of an activity, employees will provide feedback, and "lessons learned" will be documented.

10.2.3 Develop/Implement Controls

The primary mechanisms used to flowdown ISMS/EMS controls to the project team are project-specific plans and technical procedures. Other mechanisms include program/project management systems, employee training, communication, work site inspections, independent assessments, and audits. These mechanisms are communicated in the following:

- Pre-Job meetings
- Orientations
- Training
- Plan-of-the-day/pre-job briefings
- AHAs
- Radiological work permits (RWP)

The plan-of-the-day/pre-job briefing incorporates the principles of ISMS/EMS. The specific steps within ISMS/EMS are emphasized to each employee. It is emphasized that no employee will be directed or forced to perform any task that they believe is unsafe, puts their health at risk, or that could endanger the public or the environment. One of the key elements of ISMS/EMS is that all personnel are permitted to stop work or decline to perform an assigned task because of a reasonable belief that the task poses an imminent risk of death, serious physical harm, or other serious hazard to workers or the environment.

Employee involvement is emphasized in all training sessions, beginning with initial orientation training, and is then periodically reinforced in refresher training, as applicable, and in ES&H briefings/meetings. Employees are encouraged to participate in the selection, development, and presentation of training/meeting topics and their full and constructive input is encouraged in all communication sessions.

10.2.4 Perform Work

After the project team has been given approval to proceed, the project-specific plans and procedures will be implemented and adherence will be accordance with PRS-WCE-0044, *Adherence to Performance Documents*. The SOU RI/FS project team will verify that all applicable plans, procedures, forms, and records are contained in the project files and accessible by approved personnel. If any conflict arises between documents, work will stop until issue is resolved by appropriate Subject Matter Experts. Actions that will be taken during the performance of the work to incorporate ISMS/EMS principles include the following:

- Plan-of-the-day/pre-job briefings
- Monthly project safety meetings

- ES&H oversight/inspections
- Safety inspections
- Equipment inspection
- Stop work authority

10.2.5 Feedback/Improvement

Feedback and improvement is accomplished through several channels, including ISMS/EMS audits, self-assessments, employee suggestions, lessons learned, and post-job briefings.

SOU RI/FS project management will encourage employees to freely submit suggestions that offer opportunities for improvement and constructive criticism on the program. Project management will conduct periodic inspections and meetings with project personnel at the work site to discuss safety issues, environmental issues, and/or concerns as well as other relevant topics.

During field activities, meetings and briefings will provide opportunities for project personnel to communicate the following:

- Lessons learned and any other topics relevant to the work performed
- How work steps/procedures could be modified to promote a safer working environment
- How communications could be improved within the project team
- Overall issues or concerns they may have regarding how the work was performed

10.3 FLOWDOWN TO SUBCONTRACTORS

The ISMS/EMS approach to ES&H ensures that personnel, including subcontractors, are aware of their roles, responsibilities, and authorities for worker/public safety and protection of the environment. All organizations will be responsible for compliance with the Prime Contractor's Worker Safety and Health (S&H) Program, ISMS Program, Radiation Protection Program, Environmental Protection Program, and QA Program. In addition, subcontract requirements will flow down to lower-tier subcontractors, as applicable. Personnel will have the appropriate health and safety training required by OSHA 29 *CFR* § 1910 and § 1926, but will also undergo site-specific pre-job training including safety and environmental to ensure that ES&H issues related to the activities to be performed or specific to the work site are clearly understood. Documentation of training will be available for review prior to starting work.

10.4 SUSPENDING/STOPPING WORK

In accordance with 10 *CFR* 851.20 and the DOE Prime Contractor's Worker Safety and Health Program and procedures, employees and subcontractors have suspend/stop-work authority. Individuals involved in any aspect of the project have the authority and responsibility to suspend or stop work for any perceived threat to the S&H of the workers, the public, or to the environment. Concerns shall be brought to the attention of the FTM and SHR, they will be evaluated by Project Management personnel, and actions will be taken to rectify or control the situation. In the case of imminent danger or emergency situations, personnel should halt activities immediately, and instruct other affected workers to pull back from the hazardous area. The FTM and/or SHR should be notified immediately, at which time Management and/or emergency responders will be notified.

10.5 ISMS BRIEFINGS AND ORIENTATIONS

Plan-of-the-day/pre-job briefings detailing the specific hazards of the work to be performed and safety precautions and procedures specific for the job shall be conducted by the FTM and/or SHR at the beginning of each shift. During these briefings, work tasks and the associated hazards (personnel safety and environmental risks) and mitigating controls will be discussed using task-specific AHAs, project documents, and/or Lessons Learned as guidance.

Prior to performing work on the site, personnel shall be required to read, or be briefed, on the DOE Prime Contractor's Worker Safety and Health Program, applicable AHAs, the work package and other applicable documents. This shall be documented as required reading, acknowledgement forms, or briefing sheets. Visitors will also be oriented to the applicable plans and potential hazards that they may encounter.

10.6 KEY PROJECT PERSONNEL AND RESPONSIBILITIES

One of the primary underlying principles of a successful project organization is the establishment of clearly defined roles and responsibilities and effective lines of communication among employees and between the Prime Contractor, subcontractors and other organizations involved in the project. Ensuring that personnel fully understand their roles and responsibilities and that they have a thorough understanding of the scope of work and other project requirements will provide the foundation for successful and safe completion of the project.

The roles and responsibilities of key field team members are briefly described as follows:

- The Environmental Restoration PM oversees the implementation of the project plans and provides the resources for the project.

- The RI Project Manager oversees the project plans and work activities while ensuring that operations are conducted in accordance with the DOE Prime Contractor procedures, regulatory requirements and Worker Safety and Health Program and is responsible for coordinating and assigning resources needed for the project. The RI Project Manager also performs management audits and inspections.

- The QA Specialist provides support and oversight to the project to ensure that work is performed in accordance with the work package and other applicable plans and procedures.

- The FTM coordinates field activities and logistics and provides the communications between the project team and the field team as well as other support groups. The FTM also ensures that on-site personnel comply with the Worker Safety and Health Program, work packages and applicable procedures.

- The SHR provides S&H support and oversight to the project to ensure that work is being performed safely and in accordance with the Worker Safety and Health Program, applicable regulations, 10 *CFR* § 851, DOE directives, and applicable plans and procedures.

- The Radiological Control Group provides support and guidance to the project and assists the FTM and SHR with implementation of radiological controls and as-low-as-reasonably-achievable (ALARA) principles. The Radiological Control Technician observes the work area before/during activities for radiological hazard and authorizes entry into and exit from the radiological work area.

- Environmental Compliance organization provides environmental support and oversight to the project to ensure that the planning and fieldwork is being performed properly and in accordance with all applicable regulations, DOE directives, and relevant plans and procedures.

- The Waste Management Coordinator provides waste management support to the project to coordinate waste containers and removal of waste from the worksite while complying with the Worker Safety and Health Program, as well as ES&H and work control requirements.

- Field Team/Subcontractors – Samplers, drillers, operators, maintenance mechanics, and electricians perform work as specified in work packages, adhering to the Worker Safety and Health Program, HASP, RWPs, project procedures and AHAs. Field Team personnel also participate in the identification of the hazards and development of the work controls to be utilized during the work.

10.7 SITE CONTROL

Work zones will be utilized to control access. These areas will be controlled by the SHR and/or FTM to minimize the number of individuals potentially exposed to site hazards and to ensure that individuals who enter follow the required procedures. The following is a description of the different types of zones that will be established at the site.

- Exclusion Zone (EZ)—The area where work is being performed and chemical, physical, and/or radiological hazards exist. Entry into this area is controlled and the area clearly marked with barrier tape, rope, or flagging. Signage required by OSHA will be posted. Unauthorized entry into these areas is strictly prohibited. Permission to enter the EZ is granted by the SHR.
- Contamination Reduction Zone (CRZ)—The area between the EZ and the Construction Zone (CZ). It serves as a buffer to reduce the possibility of the Construction Zone becoming contaminated. It also is the area where decontamination of personnel and equipment is conducted. Entry into this area is controlled and the area clearly marked with barrier tape, rope, or flagging. Signage required by OSHA will be posted.
- CZ—The area outside of potential contamination, but still encompassing work activities and possible hazards associated with fieldwork activities. Entry into this area is controlled and the area clearly marked with barrier tape, rope, or flagging. Signage required by OSHA will be posted.
- Support Zone (SZ)—The area immediately outside of the work zones. This area serves as an administrative area, a storage area for noncontaminated equipment, a break area, and an area for the consumption of food and beverages. This area does not require delineation by barricade tape/ropes.

10.7.1 Visitors

Visitors to the site shall abide by the following:

- "Visitor" means persons not involved in routine site work activities.

- Visitors shall be instructed to stay outside of the EZ and CRZ and remain within the SZ during the extent of their stay.

- Visitors requesting to observe work conducted in the EZ must wear appropriate PPE prior to entry into that zone. Visitors who with to enter the EZ must produce evidence that they have medical clearance, and appropriate HAZWOPER training that is up-to-date. Visitors also must have received the required training for the tasks being performed and entry must be approved by the SHR and/or FTM.

10.7.2 Site Communications

PGDP plant radios, plant phones and cell phones will be used for on-site and off-site communications. Project personnel will be orientated to the use of plant radios and emergency numbers. Hand signals may also be utilized; these will be covered with project personnel if necessary.

10.7.3 Authorization to Enter

Personnel shall adhere to site entry and control procedures identified in the RWP AHAs and this site-specific HASP, personnel must wear the appropriate PPE, and enter the work area only after receiving permission of the FTM, SHR, and Radiological Control Technician (RCT). The FTM (or designee) will verify that the appropriate training and briefing requirements are met prior to entry.

As a requirement for work on this project, workers entering the EZ or CRZ will be required to take a 40-hour HAZWOPER training. This training must cover the requirements in 29 *CFR* § 1910.120, HAZWOPER. In addition, workers must receive annual 8-hour refresher training (if applicable) and 3-day on-site supervision under a trained, experienced supervisor. The FTM shall receive additional 8-hour training in hazardous waste operations supervision. Workers and visitors entering the EZ or CRZ will be briefed in the provisions of this HASP and be required to sign the HASP Acknowledgment Form found in Attachment B. Workers entering radiological posted work areas also will be required to complete Radworker II training.

10.8 PERSONAL PROTECTIVE EQUIPMENT

When engineering controls are not feasible, when the administrative controls in place are not adequate, or when otherwise indicated (such as for ALARA), PPE will be specified by the AHA and/or RWP. At a minimum, personnel performing work in work zones may be required to wear the following standard safety apparel:

- Hard hats meeting the requirements of American National Standards Institute (ANSI) Z89.1 as prescribed in 29 *CFR* § 1910.135, *Head Protection*. Hard hats will be worn with the suspension properly installed. Hard hats will not be damaged, painted or deformed.

- Safety glasses with firm side shields will meet the requirements of ANSI Z87.1 as prescribed in 29

CFR §1910.133, *Eye and Face Protection*. Prescription glasses also will meet the ANSI standard and be provided with fixed or firm clip-on side shields. Cover glasses used over prescription glasses will be permitted. Safety glasses will be worn in any area where construction activities are taking place. Face shields will not be worn in lieu of safety glasses.

- Sturdy safety toed work shoes or boots meeting the requirements of ANSI Z41, as prescribed in 29 *CFR* §1910.136, *Foot Protection,* shall be worn.

The required level of protection is specific to the activity being conducted. The levels of PPE apply only to activities conducted inside an established EZ. Work conducted within CRZs will vary, but generally are one level of protection lower than the EZ. Activities conducted within SZs should require normal work clothes and PPE unless specified by the FTM or SHR.

10.8.1 Task-Specific Levels of Protection

The levels of protection will be determined by the task and/or proximity of the task being performed and will be identified in the task specific AHAs and RWPs.

10.8.2 Respiratory Protection

Respiratory protection requirements will be determined by air monitoring and survey results. Personnel required to wear respiratory protection will be trained and quantitatively fit-tested prior to use of the respirator, as prescribed in accordance with DOE Prime Contractor procedure. Personnel required to wear respirators will inspect their respirators before and after each use and any deficiencies will be reported to the FTM or SHR immediately. Respirators will be properly stored in a bag in a clean, dry environment and routinely cleaned. Damaged respirators shall not be used.

10.9 MEDICAL SURVEILLANCE

The medical surveillance program provides for baseline, annual, and termination medical examinations for the following employees in accordance with 29 *CFR* § 1910.120, HAZWOPER. Each employee who is or may be exposed to hazardous substances or health hazards at or above the permissible exposure limit (PEL) for 30 days or more per year and each employee who wears a respirator for 30 days or more per year will receive a medical examination before assignment, approximately 12 months later, and at termination of employment or at reassignment. Employees who develop signs or symptoms indicating overexposure or are injured or exposed above the PEL in an emergency situation will be examined medically as soon as possible following the incident.

Personnel performing HAZWOPER activities on this project must complete an annual HAZWOPER physical. The examining physician will document the worker's fitness for work. In addition, the physician will ensure personnel are capable of wearing a respirator through medical examination and conducting a pulmonary function test.

Radiation workers, working under an RWP, may be required to submit a baseline bioassay, periodic bioassay during the project and exit bioassay at the end of the project.

10.9.1 Exposure Monitoring

Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection needed on-site.

10.9.2 Routine Air Monitoring Requirements

Air monitoring will be performed during the following activities:

- Intrusive activities such as soil excavation;
- Activities where there is a potential for exposure to heavy metals (lead, arsenic, beryllium, etc.) and silica dust;
- Personnel are opening waste containers that contain potentially contaminated material.

10.9.3 Industrial Hygiene Monitoring

The Industrial Hygiene monitoring and sampling will be performed by assigned project S&H support personnel. Monitoring will use direct-reading instruments, air-sampling equipment, environmental-monitoring equipment, and assessment techniques as determined appropriate by the S&H Group based on professional judgment and in accordance with OSHA, National Institute for Occupational Safety and Health (NIOSH) and American Conference of Government Industrial Hygienists (ACGIH).

Personnel sampling will be conducted to assess the potential exposure to individual employees and to ensure that the proper level of PPE has been selected for the assigned task(s). Samples will be collected in the employee’s breathing zone using personnel sampling pumps and the appropriate collection media. For tasks with the potential for exposure to significantly elevated chemical concentration, it is expected that the sampling frequency will increase.

If direct reading instruments indicate levels of vapors or particulates that exceed the action level for over 15 minutes in the work area, then personnel sampling will be initiated immediately. Sampling will be conducted, at a minimum, on the worker with the highest expected exposure. Monitoring will continue until levels recorded by direct reading instruments return below the action level.

Once initiated, sampling will always continue for a period long enough to collect a volume of air sufficient to allow the laboratory to achieve an analytical detection limit no greater than one-half the OSHA PEL or ACGIH threshold limit value (TLV), whichever is the more stringent of the two. The samples will be collected in accordance with the approved NIOSH or OSHA methodology and analyzed for the appropriate contaminant(s) of concern. All personnel exposure samples shall be analyzed by a laboratory accredited by American Industrial Hygiene Association (AIHA) in accordance with the appropriate NIOSH or OSHA methodology.

10.9.4 Radiological Monitoring

Radiological Control will perform personnel air monitoring during work in contamination areas and potentially at the boundary. Scanning of equipment and personnel will also be performed to minimize the possibility of the spread of contamination. Personnel working on the SOU RI/FS project will also be monitored through Dosimetry and required to wear a dosimeter when working in radiological zones and submit bioassays as required. A neutron dosimeter may be required if working in and around UF_6 cylinder storage yards, as determined by Radiological Control Organization.

10.10 EMERGENCY RESPONSE

10.10.1 Responsibilities

The PM, FTM and SHR are responsible for the SOU RI/FS project emergency management program and ensuring that the appropriate emergency response equipment is readily available at the work site and in proper working order. Equipment and supplies to be maintained at the work site include, at a minimum:

- First-aid kit
- Emergency eyewash station
- Absorbents for spill control
- Fire extinguisher

In the event of an emergency, all site personnel shall follow the requirements and provisions of the PGDP Emergency Management Plan. Emergency response shall be provided by the PGDP emergency response organization. The SHR will be in charge of personnel accountability during emergency activities. All personnel working on-site will be trained to recognize and report emergencies to the SHR or the FTM. The SHR or FTM will be responsible for notifying the PGDP emergency response organization.

The PGDP emergency response organization will be contacted for emergency response to all medical emergencies, fires, spills, or other emergencies. The Plant Shift Superintendent (PSS) will coordinate 24-hour emergency response coverage. The requirements of this section will be communicated to site workers. Any new hazards or changes in the plan also will be communicated to site workers.

The DOE on-scene coordinator will provide oversight on an ongoing basis for emergency management/recovery activities.

10.10.2 Reporting an Emergency

10.10.2.1 Discovery

The person who discovers an emergency should immediately report it, then attempt to establish control ONLY if the incident is minor in magnitude. Where such measures are obviously inadequate or not successful in controlling the incident or for emergency conditions, personal injuries, or other unusual events with potential for causing personal injury, environmental releases, or property damage, the employee will initiate notification of appropriate emergency response personnel.

SOU RI/FS project personnel will maintain a radio, telephone, or other reliable means of notifying emergency response personnel and the PSS.

10.10.2.2 Emergency Contacts

- ***Fire:*** Fire alarm pull box, plant telephone Bell System 333, or plant radio channel 16
- ***Medical:*** Plant telephone Bell System 333 or plant radio channel 16
- ***Security:*** Plant telephone Bell System 6246 or plant radio channel 16
- ***PSS:*** Plant telephone Bell System 6211 or plant radio channel 16.

If using a cell phone: 270-441-6333 for emergency, for NON-emergency use 270-441-6211.

10.10.2.3 Initial Emergency Response

When an emergency occurs, the SHR or FMT will assume responsibility for the management of the scene and the protection of the personnel. Personnel are to be evacuated from the immediate danger area, as appropriate. Depending on the degree of emergency, RADCON controls may need to be adhered to during the emergency. For personnel injury or illness, there will be at least one person with current training in first aid and cardiopulmonary resuscitation present on-site during all field activities. This individual will provide minor first aid until other emergency personnel arrive and assume emergency response duties or it is determined to transport the injured to the hospital or medical provider.

10.10.2.4 Paducah Gaseous Diffusion Plant Alarms

The alarms can be heard by calling 6161 on a Bell phone.

These include the following:

- ***Radiation Emergency/Criticality Accident Alarm System (CAAS):*** Continuous blast on a high-pitched air whistle or electronic horn
  ACTION: Evacuate area immediately and stay away from effected building, Report to an assigned plant assembly point.

- ***Attack Warning/Tornado Warning:*** Intermittent 2-second blast on plant horns
  ACTION: Take cover.

- ***Evacuate Signal:*** Continuous blast on plant horns
  ACTION: Evacuate building

- ***Plant Emergency:*** Hi-Lo Tones
  ACTION: Listen to plant public address system/radio for instructions

- ***Cascade Buildings:*** Three blasts on building horns or howlers
  ACTION: Call area control room.

- ***Other Buildings:*** One 10-second blast on building horns or sirens
  ACTION: Follow local emergency procedures.

During field activities all personnel must participate in all PGDP accountability/assembly drills by sending all on-site project personnel to the appropriate assembly station for accountability. The FTM, SHR, or designee will be responsible for accounting for all field personnel (including sub-tier subcontractor personnel) and reporting any unaccounted-for personnel to the emergency coordinator.

10.10.3 Reporting a Spill

When a spill is discovered, the FTM or SHR will immediately contact PSS and the PM and convey as much information as possible (e.g., material involved, estimated quantity spilled/affected, location, affected personnel, other hazardous conditions).

10.10.4 Protective Actions for Spill

An effort will be made to stop the release and contain the spill using materials in the on-site spill response kit, only if it is safe to do so and if no unprotected exposures occur. A telephone contact list will be available for emergency notification.

In the event that personnel are exposed to hazardous chemicals or radioactive materials, appropriate emergency response action will be taken to remove the contaminated clothing. An emergency shower and eyewash station will be used to flush exposed skin and eyes, respectively. This emergency equipment will be maintained in a readily accessible location adjacent to the active work area.

If an acute exposure to airborne chemicals occurs or is suspected and the affected personnel are unable to escape the work zone, the FTM or SHR will immediately contact PSS for assistance. Rescue operations will not be performed unless the rescuers are dressed in the appropriate protective equipment.

SOU RI/FS Project Management will be responsible for ensuring all spills of hazardous materials are properly cleaned up and disposed of, including any material generated from the spill, unless otherwise directed.

The FTM or SHR has the following responsibilities:

- Ensure that spill containment is performed safely
- Provide all known information to PSS to ensure proper response
- Ensure that decontamination measures for exposed personnel are conducted safely and promptly
- Ensure that, if personnel are exposed to airborne chemicals and are unable to escape the work zone, rescue is not attempted unless rescue personnel are dressed in the appropriate protective equipment.

During field activities all personnel must participate in all PGDP accountability/assembly drills by sending all on-site project personnel to the appropriate assembly station for accountability. The FTM, SHR, or designee will be responsible for accounting for all field personnel (including sub-tier subcontractor personnel) and reporting any unaccounted-for personnel to the emergency coordinator directing the drill.

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11. QUALITY ASSURANCE PROJECT PLAN

The following QA elements are contained in *EPA Requirements for QA Project Plans* (QA/R-5). This locator is a crosswalk between those elements and the related sections of this QA plan for the SOU RI/FS field activities.

QA/R-5 LOCATOR PAGE

QA/R-5	**Section Number and Title in Quality Assurance Plan**
A1 Title Page and Approval Sheet	Approval Page
A2 Table of Contents	Contents
A3 Distribution List	Distribution List
A4 Project/Task Organization	Project QA Responsibility
A5 Project Definition/Background	11.1 Project Description
A6 Project/Task Description	11.1 Project Description
A7 Quality Objectives and Criteria	11.5 QA Objectives for Measurement of Data
A8 Special Training/Certification	11.3 Personnel Qualifications and Training
A9 Documents and Records	11.4 Document Control and Records Management
B1 Sampling Process Design B2 Sampling Methods	11.6 Sampling Procedures
B3 Sample Handling and Custody	11.7 Sample Custody
B4 Analytical Methods	11.9 Analytical Procedures
B5 Quality Control	11.11 Internal Quality Control Checks
B6 Instrument/Equipment Testing, Inspection, and Maintenance	11.13 Preventive Maintenance
B7 Instrument/Equipment Calibration And Frequency	11.8 Instrument Calibration and Frequency
B8 Inspection/Acceptance of Supplies and Consumables	11.17 Inspection of Materials
B9 Non-direct Measurements	11.10 Data Review and Reporting
B10 Data Management	11.10 Data Review and Reporting
C1 Assessment and Response Actions	11.12 Audits and Surveillances

QA/R-5	Section Number and Title in Quality Assurance Plan
C2 Reports to Management	11.15 QA Reports to Management 11.16 Field Changes
D1 Data Review, Verification, and Validation	11.10 Data Review and Reporting
D2 Verification and Validation Methods	11.10 Data Review and Reporting
D3 Reconciliation with User Requirements	11.14 Reconciliation with User Requirements

Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA

(EPA/540/G-89/004 OSWER Directive 9355.3-01October 1988)

LOCATOR PAGE

Note: Due to the fact the QAPP is embedded in the RI/FS Work Plan, many of the QAPP guidance elements are located throughout the body of the RI/FS WP. Any RI/FS location in section 11 of the RI/FS WP is within the QAPP.

GUIDANCE ELEMENTS	QAPP or RI/FS WP LOCATION
Title Page/Signature Page	RI/FS WP Title Page and RI/FS Signature Attached with Letter
Table of Contents	RI/FS WP Page iii
Project Description	RI/FS WP Sections 1 and 2
Project Organization and Responsibilities	RI/FS WP Section 2.1
QA Objectives for Measurement	RI/FS WP Sections 1.3, 11.5 and 11.6
Sampling Procedures	RI/FS WP Section 11.6
Sample Custody	RI/FS WP Section 11.7
Calibration Procedures	RI/FS WP Section 11.8
Analytical Procedures	RI/FS WP Section 11.9
Data Reduction, Validation and Reporting	RI/FS WP Section 11.10
Internal Quality Control	RI/FS WP Section 11.11
Performance and Systems Audits	RI/FS WP Section 11.12
Preventive Maintenance	RI/FS WP Section 11.13
Specific Routine Procedures Used to Assess Data (Precision, Accuracy and Completeness)	RI/FS WP Sections 11.5 and 11.14
Corrective Actions	RI/FS WP Section 11.12.4

11.1 PROJECT DESCRIPTION

This QAPP has been developed specifically for the SOU RI/FS work plan. Previous sections of this document present the basic strategies and procedures that will apply to sampling conducted as part of the SOU RI/FS field activities.

11.2 PROJECT ORGANIZATION

Adherence to the QA/QC requirements in this QAPP will require coordination and integration between QA representatives from Paducah Remediation Services and the field team. The QA Specialist will assume responsibility for day-to-day QA activities associated with the investigation project and all QA issues related to the QA program. The DOE Prime Contractor QA Manager will provide QA oversight and coordination with DOE and the regulatory agencies on all QA issues. Both project team and QA representative responsibilities are listed in Table 11.1.

11.3 PERSONNEL QUALIFICATIONS AND TRAINING

Personnel assigned to the project, including field personnel and subcontractors, will be qualified to perform the tasks to which they are assigned. Resumes of project personnel will be provided to the DOE Prime Contractor RI Project Manager to document their initial and continuing (if required) training and experience. In addition to education and experience, specific training may be required to qualify individuals to perform certain activities. All personnel qualifications and training records will be recorded and maintained in accordance with PRS-TRN-0702, *Conduct of Training*. Project personnel will receive an orientation to the following documents, as well as to their responsibilities, before participating in project activities.

- FSP
- Site-Specific HASP
- QAPP
- DMIP
- WMP

A field-planning meeting will be the forum for the orientation. Personnel assigned to the project subsequent to the initial orientation will be required to read and familiarize themselves with these documents before performing any work at the site. A copy of these documents will be available to all personnel while in the field. The field supervisor will be responsible for ensuring the most current copy of these documents is available. All sampling procedures will be performed in compliance with the FSP.

A training profile (required training for each work assignment) will be established for each position description. Changes in controlled documents will be monitored and training assignments will be issued to individuals as changes occur.

Table 11.1. Roles and Responsibilities

Role	Responsibility
DOE Project Manager	Responsible for project oversight. This individual also will be the primary interface between the EPA and KDEP regulators.
DOE Prime Contractor ER Manager	Responsible programmatically for technical, financial, and scheduling matters; will interface with the DOE and regulators, as appropriate.
DOE Prime Contractor RI Project Manager	Responsible for management and integration of subcontractor implementation of this investigation. Responsible for implementing the investigation, including all plans and field activities conducted as part of the RI including monitoring the performance of sampling and waste management activities; serves as the technical lead and principal point of contact with the DOE Project Manager; tracks project budget and schedules and delegates specific responsibilities to project team members; responsible for preparing any field change orders.
Site S&H Representative	Ensures that health and safety procedures designed to protect personnel are maintained throughout the field effort for this project; ensures the implementation of an ISMS for all aspects of the RI.
QA Manager	Responsible for coordination with the project QA staff to ensure an appropriate level of QA oversight. Schedules audits and surveillances needed to verify compliance with quality commitments and requirements. Has overall responsibility of approving, tracking, and evaluating effectiveness of corrective actions. Receives copies of field changes and approves field changes related to quality. The QA Manager is independent of the project.
QA Specialist	Provides QA oversight for all day-to-day QA activities associated with the investigation project and all QA issues related to the QA program.
Front Line Manager	Oversees all field activities and verifies that field operations follow established and approved plans and procedures. Supervises the field team activities and field data collection. Ensures that all field activities are properly recorded and reviewed in the field logbooks and on any necessary data collection forms. Responsibilities include identifying, recording, and reporting project non-conformances or deviations. Interfaces with the RI project manager during field activities.
Subcontractors	Responsible for providing the labor and expertise in conducting the investigation.
WMC	Ensures adherence to the WMP documents and tracks field-related activities, including waste generation and handling, waste characterization sampling, waste transfer, and waste labeling. The WMC will perform the majority of waste handling field activities.
Data Management Team	Responsible for the coordination of all investigation-sampling activities, including coordination with the DOE Prime Contractor SMO. This group will ensure that all quality control samples are populated in PEMS and chain-of-custody forms are generated properly. The Data Management Team will be responsible for managing data generated during the investigation in accordance with the DMIP.

11.4 DOCUMENT CONTROL AND RECORDS MANAGEMENT

Document control and records management plans will be implemented according to PRS-DOC-1009, *Documents and Records*.

11.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

11.5.1 Data Quality Objectives

DQOs are qualitative statements developed by data users to specify the quality of data from field and laboratory data collection activities to support specific decisions or regulatory actions. The DQOs describe what data are needed, why the data are needed, and how the data will be used to address the problems being investigated. DQOs also establish numeric limits to ensure that data collected are of sufficient quality and quantity for user applications. The principal study questions and decision statements for this investigation are discussed in Table 1.1 of the SOU Work Plan.

11.5.2 Data Categories

Two descriptive data categories have been specified by EPA in *DQO process guidance* (EPA 2006). These two data categories supersede the five QC levels (Levels I, II, III, IV, and V) defined in EPA's *Data Quality Objectives for Remedial Response Activities, Development Process* (1987). The two new data categories are associated with specific QA/QC elements and may be generated using a wide range of analytical methods. The two data categories are described below.

- **Screening data with definitive confirmation.** Screening data provide analyte identification and quantification using rapid, less precise analytical methods than definitive data. At least 10% of the screening data must be confirmed with definitive data in order to be recognized as being of known data quality. The primary difference between screening data and definitive data is the level of QA/QC required. The following are the QA/QC requirements for screening data.

— Sample documentation (location, date and time collected, batch, etc.)
— Sample chain-of-custody (when appropriate)
— Sampling design approach
— Initial and continuing calibration
— Determination and documentation of detection limits
— Identification of compounds and analytes detected
— Quantification of compounds and analytes detected
— Analytical error determination
— Definitive confirmation

- **Definitive data.** Definitive data are generated using EPA-approved or other nationally recognized analytical methods. Data are compound- or analyte-specific; the identity and concentration of the analyte are confirmed. Data can be generated on-site or at an off-site, fixed-base laboratory as long as the following QA/QC elements are satisfied.

— Sample documentation (location, date and time collected, batch, etc.)

— Sample chain-of-custody (when appropriate)

— Sampling design approach

— Initial and continuing calibration

— Determination and documentation of detection limits
— Identification of compounds and analytes detected
— Quantification of compounds and analytes detected
— QC blanks (trip, method, equipment rinseates)
— Matrix spike (MS) recoveries
— Analytical error determination (measures precision of analytical method)
— Total measurement error determination (measures overall precision of measurement system from sample acquisition through analysis)

Definitive data will be collected and analyzed according to the sampling plan by a SMO-approved fixed-base laboratory. These samples will be planned through the Paducah SMO and sent to a laboratory that has been audited under the Department of Energy Consolidated Audit Program (DOECAP) and, if required, is certified by KDEP to perform the requested analyses. The SMO continually reviews the performance of approved laboratories and evaluates the impact on project samples if problems arise. In the event that an approved laboratory is decertified, the SMO will direct samples to a different SMO-approved laboratory for analyses. Field measurements collected during the SOU RI/FS will be measured in the field using appropriate field instruments. Table 11.2 summarizes the data uses, data users, data categories, and data deliverable QC levels for each of the media and sample types that will be collected during this investigation.

Table 11.2. Data Uses and QC Levels

Field activity/media	Intended uses	Intended users[a]	Data category
Health and Safety Monitoring	Determination of appropriate protection levels for field personnel.	Field Personnel Project Technical Support	None specified
Field Measurements	Field analysis of soil for contaminants	Project Manager Field Personnel Project Technical Support	Screening with definitive confirmation
Field Screening	Screening samples for radionuclides before off-site shipment. Field analysis to determine presence and concentration of radiological-indicator chemicals.	Project Manager Field Personnel Project Technical Support	Screening with definitive confirmation
Water Samples	Determine presence and concentration of contamination.	Project Manager Project Technical Support	Definitive
Soil Samples	Determine presence and concentration of contamination.	Project Manager Project Technical Support	Definitive

[a] Secondary data users are listed. Primary data users include DOE, DOE Prime Contractor, EPA, and KDEP personnel.

11.5.3 Intended Uses of Acquired Data

The intended uses of the acquired data are to meet the DQOs and address the data gaps associated with SWMUs 1, 11, 12, 13, 14, 15, 16, 19, 20, 26, 27, 31, 32, 40, 47, 56, 57, 74, 75, 76, 77, 78, 79, 80, 81, 99, 135, 137, 138, 153, 154, 155, 156, 158, 160, 163, 165, 169, 170, 172, 176, 177, 180, 181, 194, 195, 196, 200, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 483, 488, 489, 493, 517, 518, 520, 531, and 561 and 3 AOCs 204, 492, and 541, known PCB locations and Radiological walkover, as identified in Chapter 1.

11.5.4 Intended Users of Data

The primary users of the data acquired during the SOU RI/FS will be the following groups or organizations.

- DOE, KDEP, and EPA, will use data to select the remedial alternative.
- The Project Team will use the data to address the data gaps described in Section 11.5.3 of this QAPP.
- The Project Team will present the results of the investigation in a report to DOE. In consultation with DOE, EPA, and the KDEP, the Project Team will make a decision as to whether further action is required.
- The data management team will add these data to OREIS.

11.5.5 PARCC Parameters

Precision, accuracy, representativeness, completeness, and comparability (PARCC), and sensitivity parameters are tools by which data sets can be evaluated. Evaluation of PARCC parameters helps ensure that DQOs are met. Table 11.3 displays QA objectives for laboratory measurements.

- **Precision** refers to the level of agreement among repeated measurements of the same characteristic, usually under a given set of conditions. To determine the precision of the laboratory analysis, a routine program of replicate analyses is performed. Duplicate field samples will be collected to determine total measurement (sampling and analytical) precision. The precision of field instrument measurements will be based on manufacturers' data (see Table 11.4).
- **Accuracy** refers to the nearness of a measurement to an accepted reference or true value. To determine the accuracy, the evaluation is applied over the entire range of concentrations. To determine the accuracy of an analytical method and/or the laboratory analysis, a periodic program of sample spiking is conducted (minimum 1 spike and 1 spike duplicate per 20 samples).

In addition, a Laboratory Control Sample will be performed for each batch and plotted on control charts. Accuracy of the Laboratory Control Sample will be evaluated in accordance with laboratory statistical guidelines.

Accuracy and precision of data collected in the investigation will depend on the measurement standards used and their meticulous, competent use by qualified personnel. Objectives for laboratory accuracy and precision for this project are shown in Table 11.3 for fixed-base laboratory measurements and Table 11.4 for field measurements. The compound-specific precision and accuracy objectives will be included in the laboratory QAPP and will be reviewed for appropriateness. Accuracy of field instruments will not be determined; however, frequent calibration and operational checks will be performed (see Sections 11.8.1 and 11.8.2 of this QAPP) to ensure the accuracy of instrument measurements.

- **Representativeness** is the degree to which discrete samples accurately and precisely reflect a characteristic of a population, variations at a sampling location, or an environmental condition. Representativeness is a qualitative parameter and will be achieved through careful, informed selection of sampling sites and analytical parameters, and through the proper collection and handling of samples to avoid interference and minimize contamination and sample loss.

Table 11.3. QA Objectives for Fixed-base Laboratory Measurements

Parameter	Method	Matrix	Precision[a]	Accuracy	Completeness
TCL volatiles	SW-846[b] 8260	Soil	22%	80–100%	90%
TCL volatiles	SW-846 8260	Water	13%	80–100%	90%
TCL semi volatiles	SW-846 8270	Soil	38%	80–100%	90%
TAL metals	SW-846 6010, 6020, and 7000 series	Soil	35%	80–100%	90%
TCL PCBs	SW-846 8082	Soil	43%	80–100%	90%
TCL PCBs	SW-846 8082	Water	21%	80–100%	90%
Gross alpha	EPA 900/HASL-300[c]	Soil	30%	80–100%	90%
Gross beta	EPA 900/HASL-300	Soil	25%	80–100%	90%
Uranium-234, Uranium-235, and Uranium-238	HASL-300	Soil	20%	80–100%	90%
Uranium-234, Uranium-235, and Uranium-238	HASL-300	Water	20%	80–100%	90%
Technetium-99, Thorium-230, Plutonium-99, Cesium-137, and Neptunium-237	HASL-300	Soil	50%	80–100%	90%
Particle-size distribution	ASTM D422[d]	Soil	NA	NA	90%
Moisture content	ASTM D2216	Soil	NA	NA	90%
pH	SW-846 9045	Soil	10%	NA	90%
Flash point	40 *CFR* § 261.21	Soil	NA	NA	90%
Specific gravity	ASTM D954	Soil	NA	NA	90%
Unit weight	No method specified[e]	Soil	NA	NA	90%
Reactivity	SW-846 Section 7.3	Soil	NA	NA	90%
Corrosivity	SW-846 Section 7.2	Soil	NA	NA	90%

Precision and accuracy values shown for radionuclides represent levels of 15 pCi/L and 15 pCi/g and above. Lower levels will have substantially wider precision and accuracy limits.
[a]Precision given as a relative percent difference based on replicates.
[b]EPA 1994. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, Second Edition, Final Update II, SW-846, September.
[c]This procedure is derived from a variety of sources including, but not limited to, *Environmental Measurements Laboratory Procedures Manual*, HASL-300 (EML 1997) and *Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (900 Series) (EPA 1980). Equivalent laboratory methods may be used for radiological analyses if the laboratory standard operating procedures have been approved by DOE.
[d]*Annual Book of ASTM American Standards American Society for Testing and Materials* (ASTM 1996).
[e]Unit weight can be calculated from moisture content data.
NA = Not applicable ND = Not determined
TAL = Target Analyte List TCL = Target Compound List

Table 11.4. QA Objectives for Field Measurements and Field Screening

Parameter	Matrix	Accuracy	Precision	Completeness
Total organic vapors (air monitoring)[a]	Gas	ND	—	90%
Radiation screening (health and safety monitoring)	Solid	ND	—	90%
Gross alpha/gross beta (shipping)	Wipe of sample	ND	Instrument counting	90%
High purity Ge detector	Soil	ND	Instrument counting	90%
Groundwater field parameters	Water	ND	ND	90%

[a]Direct reading instrument, incapable of reproducing a value without an air standard because atmospheric concentration varies and is unknown. Users will rely on calibration results to verify proper functioning of instrument.
Ge = germanium
ND = not determined

- **Completeness** is a measure of the percentage of valid, viable data obtained from a measurement system compared with the amount expected under normal conditions. The goal of completeness is to generate a sufficient amount of valid data to satisfy project needs. For this project, the completeness objective for field and laboratory measurements is 90%.

- **Comparability** is the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. Comparability will be assessed in terms of field standard operating procedures (SOPs), analytical methods, QC, and data reporting. In addition, data validation assesses the processes employed by the laboratory that affect data comparability.

- **Sensitivity** is determined primarily by the analytical method, calibration range employed, any dilutions required, and the sample matrix and instrumentation that is available. During the development of DQOs, the required reporting limits are determined based on project requirements and regulatory restrictions. Reporting limits are frequently defined at the level of the lowest calibration standard employed, or represent the 95% confidence level when the compound or analyte is present.

11.6 SAMPLING PROCEDURES

The Project Team will perform sampling work in accordance with DOE Prime Contractor-approved procedures and work instructions. The following subsections provide a brief summary of the key sampling procedure elements for this project.

11.6.1 Sampling Logbook Requirements

Logbooks are used to record field sampling activities and sample records, equipment calibrations, equipment decontamination activities, shipping documentation, health and safety-related notes, and general day-to-day field notes. These logbooks must be bound and have sequentially numbered pages. The PM shall review the logbooks monthly. Field documentation shall conform to the DOE Prime Contractor-approved logbook procedure, PRS-ENM-2700, *Logbooks and Data Forms*. Additional information regarding logbooks is provided in the DMIP, Chapter 12.

11.6.2 Field Measurement Requirements

Field measurements may be recorded on appropriate data log sheets or in logbooks. Copies of the data log sheets, if used, will be numbered sequentially, and the number will be tracked in the field logbooks. Data log sheets will specify the appropriate type of information to be placed in each field on the sheet. The project manager or designee will review and document data log sheets for completeness and will check the sheets against field logbooks. Field measurement data will be entered manually into Paducah PEMS using appropriate sample tracking and handling guidance procedures including, but not limited to, PRS-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*.

11.6.3 Sample Collection

During the sample event, three types of analytical samples, (1) field screening samples, (2) characterization samples, and (3) field QC samples, shall be collected and submitted for analysis. Field screening samples, characterization samples, and field QC samples shall be collected as specified in the SOU RI/FS Work Plan and PRS-ENM-2300, *Collection of Soil Samples*, and PRS-ENM-2704, *Trip Equipment and Field Blank.*

All samples shall be collected on or around the PGDP site. Specific equipment for taking samples shall be determined by the sampling team and approved by the FTM, and will be collected per PRS-ENM-2300, *Collection of Soil Samples*, but must be consistent with EPA Region 4 sampling methodologies and must be documented in the appropriate sampling logbook. The FTM and the samplers shall determine which sampling methods shall be used; and any deviations shall require the project manager's approval, and must be documented in the appropriate sampling logbook.

Sample container, preservation, and holding time requirements shall be in accordance with the project-specific analytical statement of work (SOW). Trip blanks shall be shipped to the field in pre-preserved condition. Any necessary field preservation of samples shall be documented in the field logbooks and on the chain-of-custody forms.

11.6.4 Field QC Samples

The number of required QC samples is based on requirements that shall be specified in this QAPP. To ensure reliability of the analytical data to meet the data quality objectives for the project, the following QC samples shall be obtained during sample collection.

- Trip Blanks—Trip blanks are used to detect cross-contamination by VOC during sample shipping and handling. Trip blanks are prepared before sampling and consist of ASTM Type II water, or other similar characteristic water, in VOC bottles. One trip blank shall accompany each rigid container (i.e., cooler) shipped to the laboratory containing samples for volatile organic analysis. Trip blanks are analyzed for VOCs only.

- Field Blanks—A field blank serves as a check on environmental contamination at the sample site. Distilled, deionized water is to be transported to the site, opened in the field, transferred into each type of sample bottle, and returned to the laboratory for analysis of all parameters associated with that sampling event. It also is acceptable for field blanks to be filled in the field support area of sample staging area, transported to the field, and then opened. A field blank may be used as a reagent blank, as needed. Field blanks will be collected at a frequency of one in 20 samples (5%) for each sample matrix.

- Field Duplicate Samples—Field duplicate samples help determine sampling variance. Samples submitted for VOC analyses shall not be homogenized. Field duplicates will be collected, as specified, in PRS-ENM-2300, *Collection of Soil Samples*, and PRS-ENM-2704, *Trip Equipment and Field Blank.* One duplicate for every twenty samples (5%) per matrix shall be analyzed for the same set of analytical parameters as the sample it is duplicating.

- Equipment Blanks or Rinseate Samples—An equipment blank or rinseate sample is a sample of deionized water passed through, or over, decontaminated sampling equipment. Equipment blanks are used as a measure of decontamination process effectiveness and are analyzed for the same parameters as the samples collected with the equipment. Equipment blanks also may be used as reagent blanks, as needed. Equipment blanks are required only when nondisposable equipment is being used. Equipment blanks will be collected at a frequency of one for every 20 samples (5%).

11.6.5 Laboratory QC Samples

The laboratories that will be used to perform all fixed-base laboratory analyses on this project must be approved by DOECAP and the DOE Prime Contractor SMO. The SMO will utilize DOECAP to specify and audit the conformance of the laboratory to ensure good laboratory practices and regulatory standards.

11.6.6 Sample Identification, Numbering, and Labeling

Sample identification, numbering, and labeling shall be consistent with the requirements identified in the DMIP, Chapter 12, and shall be applied to sample labels and will follow DOE Prime Contractor-approved procedure PRS-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*.

11.7 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Requirements for handling, shipping, and storing samples are specified in PRS-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*, and PRS-ENM-2300, *Collection of Soil Samples*. Handling, shipping, and storage procedures will ensure that sample integrity is maintained for analytical purposes. T

During transport of samples from the field to the laboratory, the chain-of-custody requirements, specified in PRS-ENM-2708, *COC Labels and Custody Seals*, and PRS-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*, shall be met. All laboratory samples collected during this project will be transported to the approved laboratory. For shipment of samples to an off-site laboratory, DOT shipping and handling regulations will be met and performed according to PRS-WSD-9503, *Off-site Sample Shipping*. Gross alpha and gross beta screenings of all samples will be performed if sufficient process knowledge does not exist to allow for sample shipment.

11.8 INSTRUMENT CALIBRATION AND FREQUENCY

11.8.1 Field Equipment Calibration Procedures and Frequencies

The calibration of field instruments will be checked in the field in accordance with PRS-QAP-1020, *Control and Calibration of Measuring and Test Equipment*, or manufacturer instructions. Field calibration records will be documented in logbooks or on field data sheets. Calibration frequency is summarized in Table 11.5.

11.8.2 Laboratory Equipment Calibration Procedures and Frequencies

The laboratories will use written, standard procedures for equipment calibration and frequency. These procedures are based on EPA-approved analytical methods and manufacturers' recommendations and are listed in the EPA-approved analytical methods. Supplemental calibration details, such as documentation

Table 11.5. Field Equipment and Calibration/Functional Check Frequencies

Equipment check Frequency	Field usage	Frequency	Calibration/check	Calibration/functional material	Calibration check procedure
Hand-held PID	Health and safety	Daily before use	At end of day	Traceable calibration gas	Manufacturer specifications
Radiation detectors	Field screen, health and safety	Daily before use[a]	Daily before use[a]	Alpha, gamma, and beta radioactive sources	Manufacturer specifications
Combustible gas indicator	Health and safety	Daily before use[a]	At end of day	Traceable methane	Manufacturer specifications
Immuno assay detector[b]	Field analysis	Daily before use	Manufacturer Specifications	Manufacturer specifications	Manufacturer specifications
High purity Ge detector	Field analysis	Daily before use	Before and after analytical runs	Manufacturer specifications	Manufacturer specifications
Water quality meter for groundwater parameters	Field analysis	Daily before use	Before and after analytical runs	Manufacturer specifications	Manufacturer specifications

[a]These instruments are calibrated by the manufacturer. The equipment will be checked daily for a qualitative determination per the manufacturer's procedures to confirm the equipment is performing the analysis within the calibration range specified by the manufacturer.
[b]Any field instrument producing quantitative results at the detection levels listed in Table 11.11 may be used.
PID = photoionization detector

and reporting requirements, are given in the laboratory QA plan. The laboratory QA plan will be reviewed and approved by the DOE Prime Contractor, as part of the laboratory review process. The appropriate references for all analytical parameters are included in the reference section of this document. Standards used for calibration will be traceable to the NIST or another nationally recognized standardization entity. Corrective action procedures for improperly functioning equipment will be addressed in the laboratory QA plan. Any calibration failures will be documented with a specific qualifier for the affected results. Calibration records, in accordance with the laboratory QA plan, will be maintained for each piece of measuring and test equipment and each piece of reference equipment. The records will indicate that established calibration procedures have been followed. Records of equipment use will be kept in the laboratory files.

11.9 ANALYTICAL PROCEDURES

11.9.1 Fixed-Base Laboratory Analytical Procedures

When available and appropriate for the sample matrix, SW-846 methods will be used. When not available, other nationally recognized methods such as those of EPA, DOE, and the ASTM will be used. Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) guidance will be used where appropriate. Table 11.6 presents field screening parameters for SOU RI/FS sampling. Note that SW-846 methods will be used to analyze TCL/TAL parameters and typical reporting limits are listed in Table 11.7. Table 11.8 shows analytes with reporting limits greater than the screening levels.

Method detection limits (MDLs) are the extent to which the equipment or analytical processes can provide accurate, minimum data measurements of a reliable quality for specific constituents. MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero. The actual quantification limit for a given analysis will vary depending on instrument sensitivity, matrix effects, and cleanup level requirements. Some MDLs vary based upon individual laboratories, methods, and matrices. Analytical sample volume, holding times, and sample containers are provided in Table 11.9 illustrates typical MDLs. Contracts with laboratories will specify analytes, methods, and reporting limits required to meet requirements detailed within the FSP.

The reporting limits in this RI/FS QAPP (as indicated in Table 11.7) are based on the BGOU project with certain reporting limits being reduced to ensure that the limits are as low as possible. These limits then will be incorporated into the contracting laboratory SOW. Table 11.10 shows the analytical method and sample requirements.

Table 11.6. Field Measurement Parameters

	Analysis
Sample type	**Field measurements or laboratory analysis**
Environmental samples	High purity Ge detector
Waste characterization samples	None [a]

[a] For additional information, refer to the WMP, Chapter 13.

Table 11.7. Reporting Limit for DOECAP Laboratory Analyses of Environmental Samples

Soil (µg/kg)		**TCL volatiles SW-846,[a] 8260**	
10	Benzene	1,1-Dichloroethane	Tetrachloroethene
	Bromodichloromethane	1,2-Dichloroethane	Toluene
	Bromoform	1,1-Dichloroethene	*trans*-1,4-Dichloro-2-butene (100)
	Carbon disulfide	*cis*-1,2-Dichloroethene	1,1,1-Trichloroethane
	Carbon tetrachloride	1,2-Dichloropropane	1,1,2-Trichloroethane
	Chlorobenzene	Ethyl methacrylate	Trichloroethene
	Chloroform	Ethyl benzene	Trichlorofluoromethane
	trans-1,3-Dichloropropene	Iodomethane	1,2,3-Trichloropropane
	cis-1,3-Dichloropropene	Methylene chloride	*trans*-1,2 Dichloroethene
	Dibromochloromethane	Styrene	*m,p*- xylene (20 ug/kg)
	Dibromomethane	Dichlorodifluoromethane	*o*- xylene
	Bromomethane	1,1,2,2-Tetrachloroethane	Chloromethane
	Chloroethane	1,1,1,2-Tetrachloroethane	Vinyl chloride
	4-Methyl-2-pentanone	2-Chloroethyl vinyl ether	Vinyl acetate
	Acetone	2-Butanone	2-Hexanone
		Acrolein	
		Acrylonitrile	

Table 11.7. Reporting Limit for DOECAP Laboratory Analyses of Environmental Samples (Continued)

Soil (µg/kg)		**TCL semivolatiles SW-846, 8270**	
660	Acenaphthene	Dibenz(a,h)anthracene	Isophorone
	Acenaphthylene	Dibenzofuran	2-Methylnaphthalene
	Anthracene	1,2-Dichlorobenzene	2-Methylphenol (o-cresol)
	Benz(a)anthracene	1,3-Dichlorobenzene	4-Methylphenol (p-cresol)
	Benzo(b)fluoranthene	1,4-Dichlorobenzene	Naphthalene
	Benzo(k)fluoranthene	2,4-Dichlorophenol	Nitrobenzene
	Benzo(a)pyrene	Diethylphthalate	2-Nitrophenol
	Benzo(g,h,i)perylene	2,4-Dimethylphenol	N-Nitroso-di-n-dipropylamine
	bis(2-Chloroisopropyl)ether	Dimethylphthalate	N-Nitrosodiphenylamine
	bis(2-Chloroethoxy)methane	2,4-Dinitrotoluene	Phenanthrene
	bis(2-Chloroethyl)ether	2,6-Dinitrotoluene	Phenol
	bis(2-Ethylhexyl)phthalate	Fluoranthene	Pyrene
	4-Bromophenyl-phenylether	Fluorene	1,2,4-Trichlorobenzene
	Butylbenzylphthalate	Hexachlorobenzene	2,4,5-Trichlorophenol
	2-Chloronaphthalene	Hexachlorobutadiene	2,4,6-Trichlorophenol
	2-Chlorophenol	Hexachlorocyclopentadiene	4-Chlorophenyl-phenylether
	di-N-butylphthalate	Hexachloroethane	Chrysene
	di-N-octylphthalate	Indeno(1,2,3-cd)pyrene	
1300	Benzyl alcohol	4-Chloroaniline	3,3’-Dichlorobenzidine
	4-Chloro-3-methylphenol		
Soil (µg/kg)		**TCL semivolatiles SW-846, 8270**	
3300	Benzoic acid	2-Nitroaniline	4-Nitrophenol
	4,6-Dinitro-2-methylphenol	3-Nitroaniline	Pentachlorophenol
	2,4-Dinitrophenol	4-Nitroaniline	
Soil (mg/kg)		**TCL PCBs SW-846, 8082**	
0.1	Aroclor-1016	Aroclor-1242	Aroclor-1254
	Aroclor-1221	Aroclor-1248	Aroclor-1260
	Aroclor-1232		Total PCBs

Table 11.7. Reporting Limit for DOECAP Laboratory Analyses of Environmental Samples (Continued)

Soil (mg/kg)	TAL metals[b]	Method SW-846, 6010, 6020, and 7000 series
20	Aluminum	6010
10	Antimony	6010
0.5	Beryllium	6010
2.5	Chromium	6010
2.5	Copper	6020
20	Iron	6010
20	Lead	6010
2.5	Manganese	6010
5	Molybdenum	6010
5	Nickel	6010
1	Silver	6020
2.5	Vanadium	6010
1	Uranium	6020
20	Zinc	6010
1	Arsenic	6020
0.5	Cadmium	6020
1	Selenium	6020
2	Thallium	6020
0.02	Mercury	7471

Table 11.7. Reporting Limit for DOECAP Laboratory Analyses of Environmental Samples (Continued)

Soil (pCi/g)	Radionuclides	Method
5	Gross alpha	EPA-900
5	Gross beta	EPA-900
3	Uranium-234	Alpha Spec[b]
2	Uranium-235	Alpha Spec[b]
2	Uranium-238	Alpha Spec[b]
8	Technetium-99	Liquid Scintillation[b]
3	Thorium-228	Alpha Spec[b]
4	Thorium-230	Alpha Spec[b]
3	Thorium-232	Alpha Spec[b]
3	Neptunium-237	Alpha Spec[b]
6	Plutonium-238	Alpha Spec[b]
4	Plutonium-239/240	Alpha Spec[b]
3	Americium-241	Alpha Spec[b]
0.5	Cesium-137	Gamma Spec[b]

[a] *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846* (EPA 1994).
[b]This procedure is derived from a variety of sources including, but not limited to, *Environmental Measurement Laboratory Procedures Manual* (HASL-300) (EML 1997. Equivalent laboratory methods may be used for radiological analyses if the laboratory standard operating procedures have been approved by DOE.
TCL = Target Compound List
TAL = Target Analyte List

Table 11.8. Analytes with Reporting Limits Greater than Screening Levels

Method	Analyte	Reporting Limit	Units	Industrial Worker NAL	Teen Recreational User NAL	Surface Soil Background	Subsurface Soil Background
SW-846 8260	Acrylonitrile	0.01	mg/kg	1.52E-01	2.08E-01		
SW-846 8270	Benz(a)anthracene	0.66	mg/kg	1.94E-01	1.79E-01		
	Benzo(b)fluoranthene	0.66	mg/kg	1.94E-01	1.79E-01		
	Dibenz(a,h)anthracene	0.66	mg/kg	1.94E-02	1.79E-02		
	Hexachlorobenzene	0.66	mg/kg	7.59E-02	1/06E-01		
	Indeno(1,2,3-cd)pyrene	0.66	mg/kg	1.94E-01	1.79E-01		
	N-Nitroso-di-n-dipropylamine	0.66	mg/kg	1.96E-02	1.87E-02		
	2-Nitroaniline	3.3	mg/kg	1.96E+00	4.39E+00		
SW-846 6010	Beryllium	0.5	mg/kg	2.82E-03	2.59E-03	0.90	0.92
SW-846 6020	Arsenic	1	mg/kg	4.84E-01	4.64E-01	11	4
	Thallium	2	mg/kg	6.67E-01	4.73E-01	0.21	0.45
	Uranium	1	mg/kg	1.88E+01	1.46E+01	7.6	7.2
Alpha Spec	Uranium-235	2	pCi/g	3.95E-01	9.13E01	0.11	0.11
	Uranium-238	2	pCi/g	1.70E+00	4.02E+00	1.9	1.8
	Thorium-228	3	pCi/g	2.80E-02	6.46E-02	2.3	2.3
	Neptunium-237	3	pCi/g	2.71E-01	6.26E-01	0.028	
	Americium-241	3	pCi/g	5.01E_00	1.28E+01		
Gamma Spec	Cesium-137	0.5	pCi/g	8.58E-02	1.97E-01	0.5	0.074

Table 11.9. Analytical Methods and Sample Requirements for Field Screening Samples

Parameter	Method no.	Matrix	Holding time	Detection limit*	Container	Preservation
High-purity Ge detector	EPA 900	Soil	6 months	5 pCi/g	None	None
Gross alpha and gross beta	EPA 900	Wipe	6 months	5 pCi/g	None	None
Total PCBs	Test Kits – manufacturer's instructions	Soil	7 days	5mg/kg	amber glass jar	None
Total PAHs (as Phenanthrene)	Test Kits – manufacturer's instructions	Soil	14 days	0.2 mg/kg	amber glass jar	None
Metals[b]	X-Ray Fluoroscopy – SW846–6200/ manufacturer's instructions	Soil	6 months	Varies (see Table 11.11)	glass jar	None

*Detection limits of field test kits are approximate. Actual detection limits will be determined based on field instrumentation chosen by DOE Prime Contractor.
[b]Table 11.11 lists metals for analysis by XRF.

Table 11.10. Analytical Methods and Sample Requirements for Environmental Samples

Parameter	Method no.	Matrix	Holding time (from time of collection)	Sample container	Preservative
TCL Volatile Organics	SW-846[a], 8260 Prep 5030	Soil	14 days	4-oz. wide-mouth glass jar with Teflon-lined closure or brass liner	Cool to 4 °C
	SW-846[a], 8260 Prep 5030	Water	14 days	40 mL glass vials with Teflon-lined closure	HCl , pH < 2, Cool to 4 °C
TCL Semivolatile Organics	SW-846[a], 8270 Prep 3550	Soil	7 days extraction/40 days analysis	8-oz. wide-mouth glass jar with Teflon-lined closure or brass liner	Cool to 4 °C
	SW-846[a], 8270 Prep 3550	Water	7 days extraction/40 days analysis	1 L amber Boston Round	Cool to 4 °C
Total PCBs	SW-846, 8082	Soil	14 days extraction/40 days analysis	8-oz. wide-mouth glass jar with Teflon-lined closure or brass liner	Cool to 4 °C
	SW-846, 8082	Water	7 days extraction/40 days analysis	1 L amber Boston Round	Cool to 4 °C
TAL Metals	SW-846, 6010, 6020, and 7000 series*	Soil	180 days (28 days for Mercury)	4-oz. wide-mouth glass jar with Teflon-lined closure or brass liner	Cool to 4 °C
	SW-846, 6010, 6020, and 7000 series*	Water	180 days (28 days for Mercury)	1 L high-density polyethylene	HNO_3, pH < 2, Cool to 4 °C
Gross Alpha and Beta	Lab specific	Soil	6 months	500-ml straight side	Cool to 4 °C
	Lab specific	Water	6 months	1 L straight side	Cool to 4 °C HNO_3 pH<2
Radionuclides	Lab specific	Soil	6 months	500-ml straight side	Cool to 4 °C
	Lab specific	Water	6 months	1 L straight side	Cool to 4 °C HNO_3 pH<2

[a] EPA 1994. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Second Edition, Final Update II, SW-846, September.
°C = degrees Centigrade
HCl = hydrochloric acid
HNO_3 = nitric acid
TAL = Target Analyte List
TCL = Target Compound List

11.9.2 Field Laboratory Analytical Procedures

The analytical procedures for the field screening analysis of radionuclides will be according to the instrument manufacturer's instructions. The specific target compounds to be analyzed by the field laboratory instrumentation with detection limits are shown in Table 11.11.

Table 11.11. Target Compounds and Detection Limits for the Field Laboratory

	Detection limits
Target Compound	**Soil**
High purity Ge detector	5 pCi/g [a]
Total PCBs	1 mg/kg
Total PAHs (as Phenanthrene)	0.2 mg/kg
Antimony	30 mg/kg [a]
Arsenic	11 mg/kg [a]
Cadmium	12 mg/kg [a]
Chromium	85 mg/kg [a]
Copper	35 mg/kg [a]
Iron	100 mg/kg [a]
Lead	13 mg/kg [a]
Manganese	85 mg/kg [a]
Mercury	10 mg/kg [a]
Molybdenum	15 mg/kg [a]
Nickel	65 mg/kg [a]
Selenium	20 mg/kg [a]
Silver	10 mg/kg [a]
Uranium	20 mg/kg [a]
Vanadium	70 mg/kg [a]
Zinc	25 mg/kg [a]

[a] Actual detection limits will be determined based on field instrumentation chosen by DOE Prime Contractor.

11.10 DATA REVIEW AND REPORTING

The data reduction, validation, assessment, and reporting for the investigation will be performed in accordance with PRS-ENM-5003, *Quality Assured Data*. To ensure that data management activities provide an accurate and controlled flow of data generated by the laboratory, it is important that the following data handling and reporting steps be defined and implemented.

11.10.1 Data Reduction

Field program data will be produced by means of visual observation, direct-reading instrumentation, and measuring devices. All field activities, direct-reading instruments, and measuring devices will occur or be used in accordance with the SOPs (Standard Operating Procedures) – all other references are to DOE Prime Contractor-approved procedures and the specifications in the manufacturers' operations and maintenance manuals, as appropriate.

To present field data in a report, the data recorded in field logbooks and forms will need to be summarized and transferred to tables, figures, maps, or logs. To analyze data, some data will need to be entered into computer databases or onto spreadsheets. The Data Management Team and other team members are responsible for data transfer and verification activities pertinent to their roles on the project. The Data Management Team will ensure that electronic data transfers from the laboratory to the Paducah PEMS are performed accurately. Initially, 100% of the transfer activities will be checked. After the first two satisfactory transfers, 20% of the transfer activities will be checked. Data generated by the laboratory will be reduced using the format specified by EPA or other standard methods. The analytical data will be checked for completeness and reasonableness. Laboratory data will be reconciled with field identifiers and will be transferred from the laboratory electronic data deliverable to Paducah PEMS.

It will be the responsibility of the Data Management Team to ensure that all data transferred to tables, spreadsheets, logs, maps, figures, or into Paducah PEMS are transferred correctly. All copies (paper and electronic) of data transferred will be checked at least once for completeness and accuracy. All computer programs used to analyze or reduce data will conform with the requirements of PRS-BFM-0078, *Software Quality Assurance*.

11.10.2 Data Verification, Validation, and Assessment

The data review process consists of the verification, validation, and assessment of environmental measurements, waste management data, field screening data, and analytical data from the fixed-base laboratory. The data verification process determines if results have been returned for all samples, if the proper analytical and field methods have been used, if analyses were performed for the desired parameters, and if the requirements of any laboratory subcontracts have been met. The data validation process determines whether proper QC methods were used and whether the results met established QC criteria. The data assessment process determines whether data are adequate for the intended use. Any problems found during the review process are documented and resolved. Data management information/requirements for data review are discussed in the DMIP, Chapter 12.

11.10.2.1 Data Verification

Verification of analytical data can be broken down into two steps, (1) laboratory contractual screening and (2) electronic Paducah PEMS verification. Laboratory contractual screening is the process of evaluating a set of data against the requirements specified in the analytical SOW to ensure that all requested information is received. The contractual screening includes, but is not limited to, the chain-of-custody, number of samples, analytes requested, total number of analyses, method used, QC samples analyzed, electronic data deliverables (EDDs), units, holding times, and reporting limits achieved. The DOE Prime Contractor Data Management Team primarily is responsible for the screening upon receipt of data from the analytical laboratory. Electronic Paducah PEMS verification is the process for comparing a data set against a set standard or contractual requirement, specific to the project. The Data Management Team performs this electronic verification. Data is flagged, as necessary, and qualifiers are stored in Paducah PEMS for transfer to Paducah OREIS.

Verification of field measurements and field screening data consists of establishing that data are recorded correctly and that field instruments have been calibrated properly, ensuring the accuracy and completeness of all field forms and logbooks (e.g., sample information forms, chain-of-custody forms, requests for samples analysis, etc.). Any problems with the data will be documented, and preventive and possible corrective actions will be taken, if necessary.

11.10.2.2 Data Validation

Data validation is the process of screening data and accepting, rejecting, or qualifying the data on the basis of sound criteria. Data validation will be performed in accordance with PRS-ENM-5003, *Quality Assured Data*, and EPA procedures and shall be validated at a target frequency of a minimum of 10% of the project's total number of samples. DOE Prime Contractor-approved procedures regarding "Data Validation" will be used to validate the data. Data will be validated, as appropriate, based on holding times, initial calibration, continuing calibration, blank results, and other QC sample results. The process includes these steps:

- Reviewing data for compliance with contract provisions;
- Reviewing data collection and analysis methods for conformance with established criteria, such as the FSP, the QAPP, and the latest revision of the analytical methods; and
- Eliminating obvious errors by checking data for proper sample identification, transmittal errors, internal consistency, and temporal and spatial consistency.

11.10.2.3 Data Assessment

The data assessment process will be performed to determine whether the total set of environmental measurements data available to the project satisfies the requirements of the project DQOs. The SOU RI/FS Project Team will perform data assessment. The evaluation is concerned with the set of all data collected during a project or phase of a project that is intended for use in characterization, risk assessment, or remedial action decisions.

Environmental measurements data must have completed the verification and validation phases before being assessed. The verification and validation of any existing data before assessment is required whenever possible, but the validation activity may not be possible for some existing data, given previous deliverable requirements. All QC data from a project or phase of a project are reviewed to evaluate the quality of the data. The total set of data for the project is reviewed for sensitivity and PARCCS parameters.

An integral component of the data assessment process is the comparison of measurement results against the DQOs to determine if the data meet or exceed the "level of certainty" required for decision-making purposes. The field and analytical results are evaluated to see if the requirements determined by the DQO process were met by the sampling and analysis activities. The DOE Prime Contractor RI PM or designee makes a final determination of the usability of the data. Data qualifiers are assigned to indicate the usability of the data for meeting project requirements.

11.10.3 Data Reporting

The fixed-base laboratories are required to report data in accordance with PRS-ENM-5003, *Quality Assured Data*, and consistent with DOE Prime Contractor project requirements for data deliverables. Data deliverables will be reported in a format that fulfills the requirements of these procedures. For this project, all laboratory analyses will include definitive deliverables. For data targeted to support data validation, the laboratory will provide complete data packages that include sample report forms, QC results summaries, and all raw data associated with instrument calibration, sample prep, internal QC, and measurement of QC and field samples.

11.11 FIELD AND LABORATORY QC CHECKS

SOPs are used for all routine sampling operations. Field QC sampling will be conducted to check sampling accuracy and precision and to assess the overall representativeness of field samples. Trip blanks and rinseate blanks are used to evaluate the potential for contamination of samples from field sources of contamination. If contaminants are found in the field blanks, attempts will be made to identify the source of contamination, and corrective action will be initiated in accordance with Section 11.12.4 of this QAPP. The laboratory analyzing the samples also will include internal QC checks and samples in accordance with the specified analytical method or as required by the contracted laboratory SOW. Performance of these samples is discussed in the laboratory's QA plan, which identifies the corrective actions that will be taken when performance criteria are not achieved.

The field and analytical QC field samples and frequencies summarized in this section will be used for this task. The types of field and laboratory, QC samples used in this study are described in the following text.

11.11.1 Field QC Samples

Field QC samples will have sample numbers as described in the FSP. These samples will be analyzed for the parameters of interest; the results will be included in the analytical report. The number of required QC samples is based on specified requirements. To ensure reliability of the analytical data to meet the DQOs for this project, the following QC samples shall be obtained during sample collection.

T**rip blanks** are used to detect VOC cross-contamination from field sources during sample collection, shipping, and handling. A trip blank consists of a sealed container of ASTM Type II water that shall be kept with the investigative samples they represent from the field to the laboratory and shall be left unopened. The trip blank is kept near the sample containers; therefore, it identifies contamination that may potentially contaminate field samples during transport. One trip blank will be placed in each cooler containing samples to be analyzed for VOCs. Trip blanks are analyzed for VOCs only.

Temperature blanks also may be submitted with VOC samples and are used to verify sample preservation at 4°C ± 2. The temperature blank can be potable, deionized, or ASTM Type II water in a sealed volatile organic analyte vial or similar bottle and marked "Temperature Blank." This sample is only used for temperature measurement and is not otherwise preserved.

A **field blank** serves as a check on environmental contamination at the sample site. Distilled, deionized water is transported to the site, opened in the field, transferred into each type of sample bottle, and returned to the laboratory for analysis of all parameters associated with that sampling event. It also is acceptable for field blanks to be filled in the laboratory, transported to the field, and then opened. Field blanks may be used as a reagent blank, as needed. Field blanks will be collected at a frequency of 1 in 20 samples (5%) for each sample matrix.

An **equipment blank or rinseate sample** is a sample of deionized water passed through, or over, decontaminated sampling equipment. Equipment blanks are used as a measure of decontamination process effectiveness and are analyzed for the same parameters as the samples collected with the equipment. Equipment blanks also may be used as reagent blanks, as needed. Equipment blanks are required only when nondisposable equipment is being used. Equipment blanks will be collected at a frequency of 1 in 20 samples (5%).

One **field duplicate** is collected for every 20 samples (5%) per matrix and shall be analyzed for the same set of analytical parameters it is duplicating to determine whether the field sampling technique is reproducible. The field duplicate is a split sample collected from one sampling location, placed in a separate set of containers, and labeled with a different sample number.

A **source water blank** is a sample of the deionized and/or potable water sources used for the project. These samples are collected at the beginning of the project and monthly, if the project will be of long duration. Source water blanks are used to demonstrate that the source water is not contaminated.

11.11.2 Analytical Laboratory QC Samples and Internal QC Checks

Analytical laboratory QC checks and samples will be analyzed as required by the analytical method for the parameters of interest; the results will be included in the analytical report. These include, but are not limited to the following:

Lab preparation and method blanks are samples of the laboratory's ASTM Type II water that are carried through the same sample preparation and analysis procedures as field samples. Laboratory blanks are used assess potential laboratory sources of contamination that could affect the analysis of field samples. Preparation and method blanks are included for each sample matrix and batch.

Instrument and calibration blanks are analyzed according to method requirements to verify instrument zero following calibration, or after samples are analyzed that exceed instrument calibration ranges. These blanks consist of analyte-free water or solvent used to dilute samples to their final volume for analysis. Whenever contamination is observed, the instrument is allowed to equilibrate, or the source of contamination is identified and corrected. Analysis proceeds, or continues, once an acceptable blank is observed. Background measurements are performed for radiological samples and are used in a similar manner to assess the influence of background radiation on sample measurements. When specified by the method, corrective action is used to identify sources of contamination that are above natural backgrounds.

Surrogate spikes and chemical tracers are non-target compounds and analytes that are chemically similar to parameters being measured, and are specified by the individual method. Known quantities of these compounds are added to each field sample and their percent recoveries are determined. When recoveries fall outside acceptable limits for performance, the source of error is investigated and the analysis is reperformed.

Laboratory Control Sample (LCS) are spike samples of target compounds that are analyzed with each sample batch and matrix. For aqueous samples, these are blank-spikes and are often prepared from second-source calibration standards. Solid LCS are prepared by spiking the LCS standards into a sand, or other well-characterized matrix. The LCS is designed to assess method performance and analytical accuracy without the influences of matrix interferences. LCS are often analyzed in pairs (e.g., LCS/LCS Duplicate) to assess analytical precision. When required by the method, LCS and LCS/LCS Duplicate samples are analyzed at a frequency of 1 LCS or LCS/LCS Duplicate per matrix for every 20 samples (5%).

MS/matrix spike duplicate (MSD) samples require the collection of additional sample volume for aqueous samples. The laboratory splits the samples into duplicates and adds predetermined quantities of stock solutions to them before extraction and analysis. Percent recoveries are calculated to assess accuracy. Relative Percent Differences are calculated to assess analytical precision. MS/MSD samples will be analyzed at a frequency of 1 for every 20 samples (5%) for organic parameters. For inorganic parameters, a laboratory duplicate will be analyzed instead of an MSD.

11.12 AUDITS AND SURVEILLANCES

The DOE Prime Contractor QA staff conducts audits and surveillances to accomplish the following, as applicable:

- Establish and implement processes to detect and prevent quality problems
- Check for adherence to the QA/QC requirements specified in the project documents;
- Evaluate the procedures used for data collection, data handling, and project management;
- Verify that the QA program developed for this project is being implemented according to the specified requirements;
- Verify that the laboratory is participating in a Performance Evaluation Program;
- Assess the effectiveness of the QA program; and
- Verify that identified deficiencies are corrected.

The QA Manager is responsible for defining audits and surveillances and will perform or assign them according to a schedule that coincides with appropriate activities on the project schedule and sampling plans. Scheduled audits and surveillances may be supplemented by additional ones for any of the following reasons:

- Significant changes are made in the QAPP,
- It is necessary to verify that corrective action has been taken on a deficiency reported in a previous audit, or
- Appropriate management or project personnel requests additional audits or surveillances.

11.12.1 Audits

Audits are performed in accordance with PRS-QAP-1420, *Final Conduct of Assessments*. No audits are planned for this task, though audits may be conducted at the discretion of the QA Manager. Periodic field surveillances will be conducted.

11.12.2 Surveillances

Surveillances follow the same general format as an audit, but are less detailed and require a less formal report. A surveillance is designed to give project staff rapid feedback concerning QA compliance and facilitate corrective action.

For this project, one field surveillance is planned after field mobilization. Additional field surveillances will be conducted at critical milestones. The following are example activities and documentation that may be subject to surveillance:

- Sampling
- Decontamination
- Chain-of-custody
- Field documentation
- Field training records
- Equipment calibration
- Field QC procedures

QA surveillances will be performed in accordance with PRS-QAP-1420, *Final Conduct of Assessments*. Problems identified during surveillances will be documented, resolved, and closed in accordance with PRS-QAP-1210, *Issues Management*. Nonconformances determined to be significant conditions adverse to quality will be addressed in accordance with PRS-QAP-1440, *Control of Nonconforming Items and Services*. The QA Manager or QA Specialist may schedule other periodic surveillances. The QA Specialist will provide results of the surveillances to the DOE Prime Contractor RI Project Manager.

11.12.3 Nonconformances

Nonconforming items, services, or processes will be identified, controlled, and reported in accordance with PRS-QAP-1440, *Control of Nonconforming Items and Services*. Subcontracting personnel initiate a nonconformance report by completing an NCR. Nonconforming equipment will be labeled or tagged and segregated. If it is not possible to segregate the nonconforming item, due to the item's being part of a larger piece of conforming equipment or due to other field conditions, the nonconforming item will be labeled or tagged and will not be used.

11.12.4 Corrective Action

Each project team member is responsible for notifying the FTM, the RI Project Manager, the QA staff, or other responsible persons if he/she discovers a condition that may affect the quality of the work being performed. The following staff members have specific corrective action responsibilities:

- ER Manager—Overall responsibility for implementing corrective actions.

- QA Manager—Overall responsibility for tracking and accepting corrective actions.

- RI Project Manager—Implementing task-specific corrective actions.

- FTM—Identifying and implementing corrective actions during field activities, and notifying the Project Manager and QA staff of conditions not immediately corrected.

- Sample Manager—Identifying and implementing corrective action during analysis, and notifying the RI Project Manager and QA Specialist when applicable acceptance criteria or DQOs are not satisfied

Immediate corrective actions will be noted in task notebooks. Problems not immediately corrected will require formal corrective action.

11.13 PREVENTIVE MAINTENANCE

Periodic preventive maintenance is required for all sensitive equipment. Specific field equipment preventive maintenance practices and frequencies are described in the factory manual for each instrument. Preventive maintenance procedures for laboratory equipment and instruments are provided in laboratory QA plans. All maintenance activities will be recorded in maintenance logs. Laboratories will be required to maintain an adequate inventory of spare parts and consumables to prevent downtime, as a result of minor problems.

11.14 RECONCILIATION WITH USER REQUIREMENTS

The precision, accuracy, and completeness parameters are quantitative tools by which data sets can be evaluated. These parameters can help ensure that DQOs are met. Procedures for assessing them are provided in the following text.

11.14.1 Precision

To determine the precision of the laboratory analysis, the laboratory performs a routine program of replicate analyses in accordance with the analytical method requirements. The results of replicate analyses are used to calculate the relative percent difference, which is used to assess laboratory precision.

For replicate results C_1 and C_2:

$$Relative\ Percent\ Difference = \frac{|C_1 - C_2|}{|C_1 + C_2|2} \times 100$$

where:

C_1 = original environmental sample

C_2 = replicate sample.

The precision of the total sampling and analytical measurement process will be assessed based on field duplicates. Although a quantitative goal cannot be set due to field variability, the project team will review field duplicate, relative percent difference values to estimate precision.

11.14.2 Accuracy

To determine the accuracy of an analytical method and/or the laboratory analysis, a periodic program of sample spiking is conducted (minimum 1 spike and 1 spike duplicate per 20 samples). The results of sample spiking are used to calculate the QC parameter for accuracy evaluation, the percent recovery (%R).

For surrogate spikes and QC samples:

$$\%R = \frac{C_s}{C_t} \times 100$$

where:

C_s = measured spiked sample concentration (or amount),

C_t = true spiked concentration (or amount).

For matrix spikes:

$$\%R = \frac{|C_s - C_o|}{C_t} \times 100$$

where:

C_s = measured spiked sample concentration,

C_o = sample concentration (not spiked),

C_t = true concentration of the spike.

The accuracy of the total sampling and analytical measurement process will not be determined because such a determination would require the addition of chemical spiking compounds to the samples in the field.

11.14.3 Completeness

To determine the completeness of data, the percentage of valid, viable data obtained from a measurement system is compared with the amount expected under normal conditions. The goal of completeness is to generate a sufficient amount of valid data to satisfy project needs. There also should be an evaluation of the data against the DQOs to determine if goals were met with the data collected.

Completeness (C) is calculated as follows:

$$\%C = \frac{Number\ of\ valid\ measurements}{Number\ of\ total\ measurements} \times 100$$

11.15 QA REPORTS TO MANAGEMENT

All levels of the QA team are responsible for preparing QA reports. The QA Specialist will submit reports to the QA Manager on an as-needed basis. The reports will summarize the following, as applicable:

- Nonconformance Reports (NCRs) issued during the reporting period,
- Status of open NCRs during the reporting period,
- Corrective actions initiated, and
- The status of corrective actions open during the reporting period.

11.16 FIELD CHANGES

Field changes must be governed and documented by control measures in accordance with PRS-WCE-0027, *Field Change Request (FCR), Field Change Notice (FCN), and Design Change Notice (DCN) Process* commensurate with those applied to the documentation of the original design.

- The RI Project Manager must approve each FCR before work proceeds. Approval by the RI Project Manager can be obtained verbally or via telephone, with follow-up sign-off. In no case will a field change be initiated that has not been appropriately approved. The lead engineer must evaluate all FCRs, to determine whether review is needed from other organizations (e.g., Nuclear Safety, QA, Health and Safety, etc.) in accordance with BJC-DE-1008, *Field Change Request (FCR), Field Change Notice (FCN), and Design Change Notice (DCN) Process* (PRS-WCE-0027, *Field Change Request (FCR), Field Change Notice (FCN), and Design Change Notice (DCN) Process*).

- Variances or minor changes to field operating procedures will be allowed and performed in accordance with PRS-WCE-0021, *Work Execution* or PRS-DOC-1107, *Development*, *Approval, and Change Control for PRS Performance Documents.*

- If deemed necessary, relevant project documents will be revised, reviewed, accepted, and reissued with control measures commensurate with the original documents.

- Specific additional requirements for field changes, such as required PGDP approvals, will be addressed in contractual documentation as necessary.

11.17 INSPECTION OF MATERIALS

All project materials (i.e., sampling instruments, etc.) will be inspected prior to acceptance and use and all records generated as a result will be handled in accordance with PRS-DOC-1009, *Documents and Records*. The Site Superintendent or designee will inspect all incoming shipments, as required, for apparent damage, shipping documentation discrepancies, and overages or shortages. For all discrepancies noted, the QA Specialist will initiate an NCR, if necessary, in accordance with PRS-QAP-1440, *Control of Nonconforming Items and Services*.

12. DATA MANAGEMENT IMPLEMENTATION PLAN

The purpose of this DMIP is to identify and document data management requirements and applicable procedures, expected data types and information flow, and roles and responsibilities for all data management activities associated with the Soils OU Project at the PGDP. Data management provides a system for efficiently generating and maintaining technically and legally defensible data that provide the basis for making sound decisions regarding the environmental and waste characterization at PGDP.

Data management for this project is implemented throughout the life cycle for environmental measurements data. This life cycle occurs from the planning of data for environmental and waste characterization, through the collection, review, and actual usage of the data for decision-making purposes, to the long-term storage of data.

Data types to be managed for the project include field data and analytical data. Historical data is downloaded from Paducah OREIS, if available. All historical data available in electronic format are stored in Paducah PEMS. Field data are collected in field logbooks or field data forms and are entered into Paducah PEMS, as appropriate, for storage. Analytical data are planned and managed through Paducah PEMS and transferred to Paducah OREIS for long-term storage and reporting.

To meet current regulatory requirements for DOE environmental management projects, complete documentation of the information flow is established. Each phase of the data management process (planning, collecting, analyzing, managing, verifying, assessing, reporting, consolidating, and archiving) must be appropriately planned and documented. The Soils OU project team is responsible for data collection and data management for this project.

The scope of this DMIP is limited to environmental information generated under the Soils OU project. This information includes electronic and/or hard copy records obtained by the project that describe environmental conditions. Information generated by the project (e.g., laboratory analytical results from samples collected) and obtained from sources outside the project (e.g., historical data) falls within the scope of this DMIP. Certain types of information, such as personnel or financial records, are outside the scope of this DMIP.

12.1 PROJECT MISSION

Requirements and responsibilities described in this plan apply to activities conducted by the project team in support of the Soils OU project. Specific activities involving data include, but are not limited to, sampling of sediment, soil and biota; storing, analyzing, and shipping samples, when applicable; and evaluation, verification, validation, assessment, and reporting of analytical results.

12.2 DATA MANAGEMENT ACTIVITIES

Data management activities for the Soils OU project include the following:

- Acquire existing data
- Plan data collection
- Prepare for sampling activities
- Collect field data

- Collect field samples
- Submit samples for analysis
- Process field measurement and laboratory analytical data
- Laboratory Contractual Screening
- Verify data
- Validate data
- Assess data
- Consolidate, analyze, and use data and records
- Submit data to the Paducah OREIS

Section 12.7 contains a detailed discussion of the activities listed above.

12.3 DATA MANAGEMENT INTERACTIONS

The Data Manager interfaces with the Data Coordinator to oversee the use of Paducah PEMS and to ensure that data deliverables meet DOE's standards. The Data Coordinator enters information into Paducah PEMS related to the fixed-base laboratory data once the samples have been delivered and the Lab Coordinator has verified receipt of the samples. The fixed-base laboratory hard-copy data and the EDDs are loaded into Paducah PEMS by the Data Coordinator. The Data Coordinator will perform electronic data verification. The Soils OU project team is responsible for data assessment. The Data Coordinator is responsible for preparing the data for transfer from Paducah PEMS to Paducah OREIS. The Data Manager is responsible for transferring the data from the RTL files to the Paducah OREIS database.

The Lab Coordinator develops the SOW to be performed by an analytical laboratory in the form of a project-specific laboratory SOW. Analytical method, laboratory QC requirements, and deliverable requirements are specified in this SOW.

The Lab Coordinator receives EDDs, performs contractual screenings, and distributes data packages. The Lab Coordinator interacts with the Data Manager to ensure that hard copy and electronic-deliverable formats are properly specified and interfaces with the contract laboratory to ensure that the requirements are understood and met.

12.3.1 Data Needs and Sources

Multiple data types will be generated and/or assessed during this project. These data types include field data, analytical data (including environmental data), and geographic information system (GIS) data.

12.3.2 Historical Data

Historical data that are available electronically will be downloaded from Paducah OREIS as needed. Historical data available in electronic format will be stored in the project's Paducah PEMS and will be evaluated when necessary.

12.3.3 Field Data

Field data for the project includes sample collection information and field screen measurement results, such as PCB field test kits and ISOCS.

12.3.4 Analytical Data

Analytical data for the project consist of laboratory analyses for environmental and waste characterization.

12.3.5 GIS Coverage

The Paducah GIS network is used for preparing maps used in data analysis and reporting of both historical and newly generated data. Coverage for use during the project is as follows:

- Stations (station coordinates are downloaded from Paducah OREIS)
- Facilities
- Plant roads
- Plant fences
- Streams
- Topographic contours

12.4 DATA FORMS AND LOGBOOKS

Field logbooks, site logbooks, chain-of-custody forms, data packages with associated QA/QC information, and field forms are maintained according to the requirements defined in procedure PRS-DOC-1009, *Records Management, Administrative Records, and Document Control*.

Duplicates of field records are maintained until the completion of the project. Logbooks and field documentation are copied periodically. The originals are forwarded to the Document Control Center (DCC) and copies are maintained in the field office.

12.4.1 Field Forms

Sample information is environmental data describing the sampling event and consists of the following: station (or location), date collected, time collected, and other sampling conditions. This information is recorded in logbooks, chain-of-custody forms, or sample labels. This information is entered directly into Paducah PEMS by the Data Coordinator.

Sample chain-of-custody forms contain sample-specific information recorded during collection of the sample. Any deviations from the sampling plan are noted on the sample chain-of-custody form or logbook. The Sampling Team Leader reviews each sample chain-of-custody form for accuracy and completeness as soon as practical following sample collection.

Sample chain-of-custody forms are generated from Paducah PEMS with the following information:

Information that is preprinted:	Information that is entered manually:
- Lab chain-of-custody number	- Sample date and time
- Project name or number	- Sample comments (optional)
- Sample ID number	
- Sampling location	
- Sample type (e.g., REG = regular sample)	
- Sample matrix (e.g., SO = soil)	
- Analysis (e.g., TCE)	
- Sample container (volume, type)	

Sample identification numbers are identified in Paducah PEMS and are assigned by the Data Coordinator. An example of the sample numbering schemes used for the Soils OU project is provided below.

ssseenMA000

where	sss	Identifies the SWMU/AOC being investigated
	ee	Identifies the exposure unit
	n	Identifies the sequential station number (based on the same numbering scheme, sss-ee-n identifies the location name)
	M	Identifies the media type (W identifies the sample as water, S identifies the sample as soil)
	A	Identifies the sequential sample (usually "A" for a primary sample and "B" for a secondary sample) If additional rounds of sampling are required, the sequential letter designations will continue.
	000	Identifies the planned depth of the sample in ft bgs

12.4.2 Lithologic Description Forms

Lithologic description forms will be used as necessary for this project.

12.4.3 Well Construction Detail Forms

These forms are not necessary for use during this project.

12.4.4 Logbook Sample Collection Sheets

Sample collection sheets are utilized as an aid for recording sampling information in the field. Logbooks are kept in accordance with PRS-ENM-2700, *Logbooks and Data Forms*.

12.5 DATA AND DATA RECORDS TRANSMITTALS

12.5.1 Paducah OREIS Data Transmittals

Data to be stored in Paducah OREIS is submitted to the Data Manager prior to reporting. Official data reporting will be generated from data stored in Paducah OREIS.

12.5.2 Data Records Transmittals

The Soils OU project personnel will make records transfers to the DCC.

12.6 DATA MANAGEMENT SYSTEMS

12.6.1 Paducah PEMS

Paducah PEMS is the data management system that supports the project's sampling and measurement collection activities and generates Paducah OREIS RTL files. The data management staff access Paducah PEMS throughout the life cycle of the project. The project uses Paducah PEMS to support the following functions:

- Initiate the project
- Plan for sampling
- Record sample collection and field measurements
- Record the dates of sample shipments to the laboratory (if applicable)
- Receive and process analytical results
- Verify data
- Access and analyze data
- Transfer project data (in RTL format) to Paducah OREIS

Paducah PEMS is used to generate sample chain-of-custody forms, import laboratory-generated data, update field and laboratory databased on data verification, data validation if applicable, data assessment and transfer data to Paducah OREIS. Requirements for addressing the day-to-day operations of Paducah PEMS include backups, security, and interfacing with the SMO.

The Information Technology group performs system backups daily. The security precautions and procedures implemented by the data management team are designed to minimize the vulnerability of the data to unauthorized access or corruption. Only members of the data management team have access to the project's Paducah PEMS and the hard-copy data files. Members of the data management team have installed password-protected screen savers.

12.6.2 Paducah OREIS

Paducah OREIS is the centralized, standardized, quality assured, and configuration-controlled data management system that is the long-term repository of environmental data (measurements and geographic) for Paducah environmental management projects. Paducah OREIS is comprised of hardware, commercial software, customized integration software, an environmental measurements database, a geographic database, and associated documentation. The Soils OU project will use Paducah OREIS for the following functions:

- Access to existing data
- Spatial analysis
- Report generation
- Long-term storage of project data (as applicable).

12.6.3 Paducah Analytical Project Tracking System

The Paducah Analytical Project Tracking System is the business management information system that manages analytical sample analyses for Paducah environmental projects. The Paducah Analytical Project Tracking System provides cradle-to-grave tracking of sampling and analysis activities. The Paducah Analytical Project Tracking System generates the SOW, tracks collection and receipt of samples by the laboratory, flags availability of the analytical results, and allows invoice reconciliation. The Paducah Analytical Project Tracking System interfaces with Paducah PEMS (output from the Paducah Analytical Project Tracking System is automatically transferred to Paducah PEMS).

12.7 DATA MANAGEMENT TASKS AND ROLES AND RESPONSIBILITIES

12.7.1 Data Management Tasks

The following data management tasks are numbered and grouped according to the activities summarized in Section 12.2. An explanation of the data review process is provided in the following sections.

12.7.1.1 Acquire Existing Data

The primary background data for this project consists of historical analytical data from previous sampling events in the Soils OU SWMUs/AOCs. Paducah OREIS and the Paducah OREIS Data Catalog were queried for the existing information that is provided in Appendix D.

12.7.1.2 Plan Data Collection

Other documents for this project provide additional information for the tasks of project environmental data collection, including sampling and analysis planning, quality assurance, waste management, and health and safety. Also, a laboratory SOW will be developed for this project in accordance with PRS-ENM-5004, *Sample Tracking Lab Coordination, and Sample Handling Guidance*.

12.7.1.3 Prepare for Sampling Activities

The data management tasks involved in sample preparation, as specified in PRS-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*, include identifying all sampling locations, preparing descriptions of these stations, identifying sample containers and preservation, developing field logbooks, preparation of sample kits and chains of custody, and coordinating sample delivery to the laboratory. The Lab Coordinator conducts activities associated with the analytical laboratories. Coordinates for sample locations will be obtained using a global positioning system.

12.7.1.4 Collect Field Data and Samples

Paducah PEMS is used to identify, track, and monitor each sample and associated data from the point of collection through final data reporting. Project documentation includes field logbooks, chain-of-custody records, and hard-copy analytical results.

Data management requirements for field logbooks and field forms specify that (1) sampling documentation must be controlled from initial preparation to completion, (2) sampling documentation generated must be maintained in a project file, and (3) modifications to planned activities and deviations from procedures shall be recorded.

Before the start of sampling, the Lab Coordinator specifies the contents of sample kits, which includes sample containers provided by the laboratories, labels, preservatives, and chain-of-custody records. Sample labels and chains of custody are completed according to PRS-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*.

The Soils OU project field team will collect samples for the project. The field team will record pertinent sampling information on the chain-of-custody and in the field logbook. The Data Coordinator enters the information from the chain-of-custody forms into Paducah PEMS.

12.7.1.5 Submit Samples for Analysis

Before the start of field sampling, the FTM or designee coordinates the delivery of samples with the Lab Coordinator who, in turn, coordinates with the analytical laboratories, according to PRS-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*. The Lab Coordinator presents a general sampling schedule to the analytical laboratories. The Lab Coordinator also coordinates the receipt of samples and containers with the laboratories. The Lab Coordinator ensures that hard-copy deliverables and EDDs from the laboratories contain the appropriate information and are in the correct format.

12.7.1.6 Process Field Measurement and Laboratory Analytical Data

Data packages and EDDs received from the laboratory are tracked, reviewed, and maintained in a secure environment. Paducah PEMS is used for tracking project-generated data. The following information is tracked, as applicable: sample delivery group number, date received, number of samples, sample analyses, receipt of EDD, and comments. The laboratory EDDs are checked as specified in PRS-ENM-5007, *Data Management Coordination*.

The field screen measurement data will be provided by the Soils OU project team to the Data Manager for loading into Paducah PEMS. This data will be provided in a format specified by the Data Manager. Once this data has been loaded to Paducah PEMS, it will be compared to the original files submitted by the project to ensure that it was loaded correctly.

12.7.1.7 Laboratory Contractual Screening

Laboratory contractual screening is the process of evaluating a set of data against the requirements specified in the analytical SOW to ensure that all requested information is received. The contractual screening includes, but is not limited to, the analytes requested, total number of analyses, method used, EDDs, units, holding times, and reporting limits achieved. Contractual screening is performed for 100 percent of the data. The Lab Coordinator is primarily responsible for the contractual screening upon receipt of data from the analytical laboratory according to PRS-ENM-5003, *Quality Assured Data.*

12.7.1.8 Data Verification

Data verification is the process for comparing a data set against a set standard or contractual requirement. Verification is performed by the Data Coordinator electronically, manually, or by a combination of both according to PRS-ENM-5003, *Quality Assured Data*. Verification is performed for 100 percent of data. Data verification includes contractual screening and criteria specific to the Soils OU project. Verification qualifiers may be applied to the databased on holding time exceedance, criteria exceedance, historical exceedance, or background exceedance. Verification qualifiers are stored in Paducah PEMS and transferred with the data to Paducah OREIS.

12.7.1.9 Data Validation

Data validation is the process performed by a third party qualified individual. Third party validation is defined as validation performed by persons independent from sampling, laboratory, and decision making for the program/project (i.e., not the program/project manager). Data validation evaluates the laboratory adherence to analytical-method requirements. Data validation is managed and coordinated with the data management team. The Data Validator performs data validation according to approved procedures. Data validation is documented in a formal deliverable from the data validator. Validation qualifiers are input and stored in Paducah PEMS and transferred to Paducah OREIS.

A minimum of 10 percent of the total number of samples will be validated for this project. Data Validation will only apply to the definitive data. Data packages chosen for data validation will be validated at 100 percent.

12.7.1.10 Data Assessment

Data assessment is the process for assuring that the type, quality, and quantity of data are appropriate for their intended use. It allows for the determination that a decision (or estimate) can be made with the desired level of confidence, given the quality of the data set. Data assessment follows data verification and data validation (if applicable) and must be performed at a rate of 100 percent to ensure data is useable.

The data assessment is conducted by the Soils OU project according to PRS-ENM-5003, *Quality Assured Data* Assessment qualifiers are stored in Paducah PEMS and transferred with the data to Paducah OREIS. Any problems found during the review process are resolved and documented in the data assessment package.

12.7.1.11 Data Consolidation and Usage

The data consolidation process consists of the activities necessary to prepare the evaluated data for the users. The Data Coordinator prepares files of the assessed data from Paducah PEMS to Paducah OREIS for future use in accordance with PRS-ENM-1001, *Transmitting Data to OREIS*. The Data Manager is responsible for transferring the data to Paducah OREIS. Data used in reports distributed to external agencies is obtained from data in Paducah OREIS and has been through the data review process. All data reported has the approval of the Data Manager.

12.7.2 Data Management Roles and Responsibilities

The following project roles are defined, and the responsibilities are summarized for each data management task described in the previous subsection.

12.7.2.1 RI Project Manager

The RI Project Manager is responsible for the day-to-day operation of the Soils OU project. The RI Project Manager ensures the requirements of policies and procedures are met. The RI project manager, or designee assesses data in accordance with PRS-ENM-5003, *Quality Assured Data - Paducah*. The RI Project Manager is responsible to flowdown data management requirements to subcontractors as required.

12.7.2.2 Project Team

The project team consists of the technical staff and support staff (including the data management team) that conducts the various tasks required to successfully complete the project.

12.7.2.3 Data User

Data users are members of the project team who require access to project information to perform reviews, analyses, or ad hoc queries of the data. The data user determines project data usability by comparing the data against predefined acceptance criteria and assessing that the data are sufficient for the intended use.

12.7.2.4 Data Coordinator

The Data Coordinator enters the data into Paducah PEMS, including chain-of-custody information, field data, data assessment and data validation qualifiers, and any pertinent sampling information. After receiving a notification that a fixed base lab EDD is available to download, the Data Coordinator loads the EDD to Paducah PEMS, performs electronic verification of the data, and then compiles the data assessment package. The Data Coordinator also prepares data for transfer from Paducah PEMS to Paducah OREIS.

12.7.2.5 Project Records Coordinator

The Project Records Coordinator is responsible for the long-term storage of project records. The Soils OU project team will interface with the Project Records Coordinator and will transfer documents and records in accordance with DOE requirements.

12.7.2.6 QA Specialist

The QA Specialist is part of the project team and is responsible for reviewing project documentation to determine if the project team followed applicable procedures.

12.7.2.7 Data Manager

The Data Manager is responsible for long-term storage of project data and for transmitting data to external agencies according to the *Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities*, DOE/OR/07-1595&D2, and the Paducah Data Management Policy. The Data Manager ensures compliance to procedures relating to data management with respect to the project and that the requirements of PRS-ENM-5003, *Quality Assured Data - Paducah* are followed.

12.7.2.8 Lab Coordinator

The Lab Coordinator is responsible for contracting any fixed-base laboratory utilized during the sampling activities. The Lab Coordinator also provides coordination for sample shipment to the laboratory, contractual screening of data packages, and transmittal of data packages to the Paducah DCC.

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13. WASTE MANAGEMENT PLAN

13.1 OVERVIEW

This WMP is the primary document for management and final disposition of IDW that will be generated during the Soils OU RI/FS. The RI entails the collection of surface soil samples and installation of soil borings at 79 SWMUs/AOCs located mostly inside the secured area of the PGDP. The soil borings will be executed to a maximum depth of 16 ft bgs. Previous investigations and process knowledge indicate elevated levels of radiological contamination, PCBs, and RCRA hazardous metals may be present at these locations.

This WMP addresses the management of wastes generated during the RI from the point of generation through final disposition. Waste generated will be managed according to contractor-approved procedures and DOE requirements. Additionally, this WMP will comply with all applicable regulatory directives of RCRA, TSCA and PGDP RADCON policies.

A copy of the WMP will be available on-site during execution of the RI. The Waste Management Coordinator will be responsible for daily oversight of waste management activities and for ensuring compliance with the WMP.

The WMP emphasizes the following objectives:

- Management of the waste in a manner that is protective of human health and the environment
- Minimization of waste generation thereby reducing unnecessary costs (analytical, storage, disposal etc.)
- Compliance with federal, state, and DOE requirements
- Selection of storage and/or disposal alternatives for the waste

All waste management activities must comply with this WMP, applicable contractor procedures, *Waste Acceptance Criteria for the Department of Energy Treatment, Storage and Disposal Units at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (BJC/PAD-11/R3, new PRS-WSD-0011, henceforth referred to as the waste acceptance criteria (WAC)) and waste acceptance criteria for on-site treatment, storage and disposal facilities that may be designated to receive Soils OU RI waste.

During the course of the RI, additional contractor and DOE waste management requirements may be identified. If necessary, revisions will be made to the WMP to ensure waste management personnel's compliance with all pertinent requirements.

13.2 WASTE PLANNING AND GENERATION

13.2.1 Waste Planning

A Waste Generation Plan (WGP) is required prior to commencement of all activities that are expected to result in waste generation and should be developed in accordance with Appendix A of the WAC. Items to be identified for each waste stream include waste description, volume (ft^3), container type and an estimate of the number of each type, preliminary waste category, characterization method, analytes, future disposition, schedule and comments. Using information from documents such as the Sampling and

Analysis Plan (SAP) and the PGDP landfill WAC, waste types and volumes are identified. Characterization methods, planned analyses, and suitable containers also can be identified in this manner. The WGP must be signed by the generator and the Waste Operations Manager. A revised WGP must be submitted if the amount of waste to be generated changes significantly during the RI. These are changes that could affect the treatment, storage, and disposal of project IDW. For example, if additional boring are added to the project a new WGP would need to be formulated.

13.2.2 Waste Generation

A variety of IDW is expected to be generated during the RI. All waste generated has the potential to contain contaminants related to known or suspected past operational or disposal practices. IDW generated during sampling activities may include soil, PPE, plastic, sampling residuals and returns, metal sampling equipment, laboratory test solution waste and decontamination water or sludge. Waste will be stored at the C-760 CERCLA waste storage area during the waste characterization period prior to disposal. The C-760 CERCLA storage area complies with the substantive requirements of a RCRA 90-day accumulation area; however, the 90-day storage restriction does not apply to CERCLA storage areas. Brief descriptions of each waste stream are outlined in the following sections.

13.2.2.1 Soil

Soil borings will be executed and samples obtained from 79 SWMUs/AOCs, a majority of which are located inside the secured area of the PGDP. It is expected that Geoprobe™ technology will be used to obtain the samples, per past practice. Though some waste soil is expected to be generated, the use of this method greatly reduces the waste generated by the sampling effort. Each soil boring’s waste material must be segregated exclusive of other waste to facilitate waste characterization at the conclusion of field activities. Soil will be containerized in 55-gal drums. If soil is found to be uncontaminated, it may be used to fill the borehole.

13.2.2.2 Personal Protective Equipment, Plastic

PPE will be worn by project personnel as specified in the HASP and will be characterized concurrently with contacting waste materials. Plastic sheeting and other plastic used during sampling activities can also be included in this waste stream. To facilitate waste characterization, this waste must be segregated and labeled per individual boring number. PPE and plastic will be containerized in 55-gal drums.

13.2.2.3 Sampling Equipment, Sample Residuals

Sampling residuals will be generated from sampling activities. Sample returns and containers will be containerized in 55-gal drums and characterized as per associated analytical results. Disposable sampling equipment may be generated as waste. Sampling equipment will also be characterized as per associated analytical results.

13.2.2.4 Laboratory Test Solution

A small amount of laboratory test solution may be generated if a close-support laboratory is required. Generally, this solution can be characterized using process knowledge [material safety data sheets (MSDS), test method information etc.]. This solution will be stored in an approved container.

13.2.2.5 Decontamination Water and Sludge

Decontamination water and sludge (soil/water) will be generated during drilling/sampling equipment decontamination. The decontamination water will be containerized and stored at a permitted storage facility. The water will be sampled and, if necessary, treated before it is disposed of in accordance with KPDES permit requirements. The sludge will be containerized in 55-gal drums and characterized with soil waste.

13.3 WASTE MANAGEMENT ROLES AND RESPONSIBILITIES

13.3.1 Waste Management Tracking Responsibilities

Waste generated during the RI sampling activities will require the implementation of a comprehensive waste tracking system to maintain waste inventory. The tracking system will document waste container numbers and locations, waste description, generation date, sampling, treatment and disposal date and disposal location. To prevent inappropriate disposal of waste, generation data and information necessary to determine the amount of contamination present will be documented so that proper disposal methods can be implemented. Determination of the ultimate disposal method is the responsibility of the RI Project Manager.

13.3.2 Waste Management Coordinator

The WMC will ensure that all waste management activities comply with contractor requirements and the WMP. Responsibilities of the WMC include coordination of activities with field personnel, oversight of waste management operations and maintenance of the waste management logbook that contains a complete history of generated waste and the current status of individual waste containers.

The WMC will ensure that procurement and inspection of equipment, material or services critical for shipments of waste to off-site treatment, storage and disposal facilities are conducted in accordance with procedure PRS-WSD-3012, *Procurement and Inspection of Items Critical for Paducah Off-Site Waste Shipments.* Additionally, the WMC will ensure that wastes expected to be disposed of at the C-746-U landfill are packaged and managed according to the WAC.

Additional responsibilities of the WMC include:

- Maintaining an adequate supply of labels
- Maintaining drum inventories
- Interfacing with necessary personnel
- Preparing Requests for Disposal (RFDs)
- Tracking generated waste
- Ensuring waste containers are properly labeled
- Coordinating waste disposal or transfers
- Coordinating sampling of waste containers to characterize wastes
- Ensuring that waste storage areas are properly established, maintained, and closed

The WMC or designee will maintain the waste inventory system such that all waste generated during the RI is properly tracked and identified. The waste inventory database shall include the following:

- Generation date
- RFD number

- Origin location
- Waste type
- Description
- Quantity
- Storage location
- Sampling status
- Analytical results
- Resampling status
- Disposal date, location

13.3.3 RI Field Crew

The RI sampling/drill crew must coordinate closely with the WMC concerning daily sampling/drilling locations. The WMC will contact the Waste Operations Manager or his designee and have waste containers delivered to the sampling/drill location.

13.3.4 Waste Operations

When necessary, the WMC will be responsible for interfacing with DOE Prime Contractor Waste Operations personnel to schedule characterization sampling of waste for on-site disposal. Waste Operations Sampling personnel will complete all chain-of-custody forms and are responsible for packaging and delivery of samples to the PGDP on-site laboratory.

13.4 INVESTIGATION-DERIVED WASTE SEGREGATION, CONTAINERIZATION AND STORAGE

13.4.1 IDW Segregation

Soil borings advanced to 16 ft bgs using direct push technology will generate less than 1 ft^3 of soil waste per borehole. To facilitate waste characterization at the conclusion of field activities, each borehole's waste must be segregated until analytical results are obtained. Since it is impractical to use an exclusive 55-gal drum for each borehole's waste, soil waste will be placed in appropriately sized 6-mil plastic bags, labeled with the borehole number and then placed in a 55-gal drum for storage. PPE and plastic also will be placed in a 55-gal drum.

13.4.2 Container Labeling and Identification

Each waste stream (Soil, PPE and Plastic, Sample residuals, etc.) will be tracked and labeled with the RFD (form WSD-F-0014) system. All containers of a single waste stream will be tracked under the same RFD number and each container's contents represented on a Waste Item Container Log (form WSD-F-0015). Containers will be labeled as per the WAC.

13.4.3 IDW Storage

The WMC will establish and maintain an appropriate waste storage area for the RI in accordance with contractor procedure PRS-WSD-3010, *Waste Generator Responsibilities for Temporary On-Site Storage of Regulated Waste Materials at Paducah.* The C-760 CERCLA waste storage area near the NW corner of C-335 will be the storage area for RI waste prior to characterization. The C-760 CERCLA storage area is equipped with secondary containment areas facilitating the temporary storage of liquid waste, if necessary.

13.5 TRANSPORTATION OF INVESTIGATION-DERIVED WASTE

Transportation of waste at PGDP will comply with PRS-WSD-0661, *Transportation Safety Document for On-Site Transportation Within the Paducah Gaseous Diffusion Plant, Paducah, KY*. The WMC will interface with Waste Operations personnel to schedule transportation of waste containers. Waste handling will be carried out by United Steel Workers craft personnel.

13.5.1 Required Equipment

Equipment that will be used to move or handle IDW must be inspected by procedure PRS-ESH-2007, *Industrial Motorized Trucks (Forklifts)*, by the SHR or designee. Equipment that does not pass this inspection will be tagged out of service until corrective actions have been approved and implemented.

Transportation of waste will require the use of forklift trucks, flatbed trailers and flatbed trucks. A drum grabber will be mounted on the forklift to place drums onto pallets for transport.

13.5.2 Containerization and Transportation of Solid IDW

Solid waste must be containerized in U.S. Department of Transportation 1A2/X drums and must contain a 12-mil plastic liner and absorbent clay material prior to transporting waste material to a treatment, storage, or disposal facility in accordance with PRS-WSD-3015, *Waste Packaging*.

13.5.3 Containerization and Transportation of Liquid IDW

Liquid waste must be containerized in U.S. Department of Transportation 1A1 closed-top drums in accordance with PRS-WSD-3015, *Waste Packaging*.

13.6 IDW CHARACTERIZATION, SAMPLING AND ANALYSIS

Sampling and analysis of all RI waste shall comply with the RI SAP and the WAC. Since all waste will be segregated according to boring number, the waste will be characterized according to analytical results of the environmental samples. The contaminants of concern during RI sampling include radionuclides, PCBs, and RCRA metals. PPE will be characterized as contaminated if analytical results of the borehole on which it was used indicate contamination.

For solid waste, the “20 times” rule will be used to determine if the waste is characteristically hazardous. If the total concentration of RCRA constituents is greater than 20 times the Toxicity Characteristic Leaching Procedure (TCLP) limits in 40 *CFR* § 261.24, then the waste will be considered characteristically hazardous and placed into RCRA storage until further TCLP analysis can be performed for complete analysis.

13.7 SAMPLE RESIDUALS AND MISCELLANEOUS WASTE MANAGEMENT

Sample residuals and returns shall be returned to the waste stream prior to final waste disposition. Any hazardous waste returns will be included with waste to be shipped off-site for proper treatment and/or disposal.

13.8 WASTE MINIMIZATION

Waste minimization requirements that will be implemented, as appropriate, include those established by the 1984 Hazardous and Solid Waste Amendments of RCRA; DOE orders 5400.1, 5400.3, and 435.1; and the Contractor. Requirements specified in the Contractors WMP (PRS-CDL-0029), *Waste Management Plan for the Paducah Environmental Remediation Project*, concerning waste generation, tracking and reduction techniques will be followed.

To support the commitment to waste reduction, an effort will be made during all field activities to minimize waste generation, largely through ensuring that potentially contaminated waste material is localized and is not allowed to come into contact with clean material. Such an event could create more contaminated waste. Waste minimization also will be facilitated through waste segregation, selection of PPE, and waste handling practices.

Solid wastes such as Tyvek coveralls and packaging materials will be segregated. An attempt will be made to separate visibly soiled coveralls from clean coveralls. In some instances, partially soiled coveralls can be cut up and segregated. Other solid waste will not be allowed to contact potentially contaminated soil waste. Efforts will be made to keep Tyvek coveralls clean, reuse clean coveralls, and use coveralls only when necessary. Proper waste handling and spill control techniques will help minimize waste, particularly around decontamination areas where water must be containerized.

13.9 HEALTH AND SAFETY ISSUES RELATED TO IDW ACTIVITIES

Waste management activities will be conducted in compliance with health and safety DOE Prime Contractor procedures and general requirements as described in the ES&H plan, included as Chapter 10 of this work plan.

14. COMMUNITY RELATIONS PLAN

SOU RI/FS information will be included in the appropriate stakeholder-related activities as described in the *Community Relations Plan for the Environmental Management and Enrichment Facilities Program, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2007c) and any subsequent updates of the Community Relations Plan.

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APPENDIX A

POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

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ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COE	U.S. Army Corps of Engineers
EDE	effective dos equivalent
EPA	U.S. Environmental Protection Agency
Fed. Reg.	*Federal Register*
FS	feasibility study
KAR	*Kentucky Administrative Record*
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NWP	Nationwide Permit
OSHA	Occupational Safety and Health Association
OU	operable unit
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SWMU	solid waste management unit
T&E	threatened and endangered
TBC	To Be Considered
USC	*United States Code*
USCA	*United States Code Annotated*

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A.1 INTRODUCTION

Congress specified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121(d) (42 *USCA* § 9621) that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site or obtain a waiver [see also 40 *CFR* § 300.430(f) (1) (ii) (B)]. Inherent in the application of applicable or relevant and appropriate requirements (ARARs) is the assumption that protection of human health and the environment is ensured.

This appendix supplies a preliminary discussion of available federal and state chemical-, location-, and action-specific ARARs that may be associated with potential remedial actions at the Soils Operable Unit (Soils OU) at the Paducah Gaseous Diffusion Plant (PGDP). The process of ARAR identification is an iterative one that is continually changing as the remedial investigation/feasibility study (RI/FS) progresses; therefore, the ARARs that are identified represent a compilation of potential ARARs that are subject to change as site-specific contamination at the Soils OU is further characterized and alternatives are further evaluated. Site-specific ARARs will be identified further during the remedial action selection for the FS.

The U.S. Environmental Protection Agency (EPA) differentiates ARARs as either "applicable" or "relevant and appropriate" to a site. The terms and conditions of these categories are as follows:

- *Applicable requirements* are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" (40 *CFR* § 300.5); and

- *Relevant and appropriate requirements* are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 *CFR* § 300.5).

The EPA also categorizes ARARs based on whether they are specific to the chemical(s) present at the site (chemical-specific), the remedial action being evaluated (action-specific), or the location of the site (location-specific). The EPA designated these categories to assist in the identification of ARARs; however, they are not necessarily precise [53 *Fed. Reg*. 51437 (1988)]. Some ARARs may fit into more than one category, while others may not definitively fit into any one category. Terms and conditions relevant to this categorization are included in the list that follows:

- *Chemical-specific ARARs* usually are "health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values" [53 *Fed. Reg*. 51437 (1988)]. These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

- *Action-specific ARARs* usually are "technology- or activity-based requirements or limitations placed on actions taken with respect to hazardous wastes, or requirements to conduct certain actions to address particular circumstances at a site" [53 *Fed. Reg*. 51437 (1988)]. Selection of a particular remedial action at a site will trigger action-specific ARARs that specify appropriate technologies and performance standards.

- *Location-specific ARARs* "generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" [53 *Fed. Reg*. 51437 (1988)]. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Chemical-specific ARARs include concentration limits for contaminants such as maximum contaminant levels. Action-specific ARARs include performance and design standards, such as the Resource Conservation and Recovery Act (RCRA) minimum technology requirements. Location-specific ARARs include regulations covering preservation of historic sites and protection of wetlands and floodplains.

Pursuant to CERCLA § 121(e) [42 *USCA* § 9621(e) (1)], response actions, or portions of response actions entirely on-site, as defined in 40 *CFR* § 300.5, must comply with the substantive portions of ARARs, but not the procedural or administrative requirements. Additionally, CERCLA § 121(d) (4) [42 *USCA* § 9621(d) (4)] provides six ARAR waiver options that may be invoked, provided that human health and the environment are protected.

Published unpromulgated information that does not necessarily meet the definition of an ARAR may be necessary, under certain circumstances, to determine what is protective of human health and the environment. This type of information is known as To Be Considered (TBC) guidance and also may be useful in developing CERCLA remedies. Because ARARs do not exist for every chemical or circumstance that may be found at a CERCLA site, the EPA believes that it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that otherwise would not be considered a potential ARAR. Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. The TBC guidance generally falls within four categories: (1) health effects information; (2) technical information on how to perform or evaluate investigations or response actions; (3) policy; and (4) proposed regulations, if the proposed regulation is noncontroversial and likely to be promulgated as drafted.

The EPA requires compliance with Occupational Safety and Health Association (OSHA) standards through § 300.150 of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), not through the ARARs process. Worker health and safety requirements typically are not addressed as ARARs. The regulations at 29 *CFR* § 1910.120 are designed to protect workers involved in cleanup operations at uncontrolled hazardous waste sites and to provide for worker protection during initial site characterization and analysis, monitoring activities, materials handling activities, training, and emergency response.

The remainder of this appendix will address those requirements that apply to remedial actions through the CERCLA (i.e., ARARs) process. As mentioned above, ARARs identification is an iterative process that continually changes as the RI/FS progresses. Based on the remedial action ultimately selected, ARARs specific to that action will be identified later in the remedial action process.

A.2 CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A.2.1 Radionuclide Contamination

Radionuclides have been detected in soil at some of the Soils OU solid waste management units (SWMUs). While no cleanup standards currently exist for soil contaminated with radionuclides, U.S. Department of Energy (DOE) Order 5400.5, *Radiation Protection of the Public and the Environment* specifies radiation exposure limits for members of the general public. They include an effective dose equivalent (EDE) of 100 mrem/yr. The Order also requires DOE personnel and contractors to strive to ensure that radiation doses to members of the public are as low as reasonably achievable (ALARA) below the appropriate limits. The Order applies to exposure of the public as a result of routine DOE activities, including implementation of remedial actions. While all DOE facilities must comply with this Order, under the NCP, it would be classified as TBC guidance for radionuclide remediation rather than applicable or relevant and appropriate since it has not been promulgated.

A.2.2 Radionuclide Emission Standards

On-site activities involved with the implementation of any remedial action selected may produce airborne pollutants. If radionuclide emissions were to occur, emission standards for DOE facilities would apply. The regulations promulgated pursuant to the Clean Air Act of 1970, as amended by the Clean Air Act of 1990, set emission standards for radionuclides, other than radon, from DOE facilities. This regulation requires that DOE ensure that emissions from its facilities do not exceed those amounts that would cause any member of the public to receive, in any year, an effective dose equivalent in excess of 10 mrem/yr (40 *CFR* § 61.92). These regulations in 40 *CFR* § 61.92 would be applicable to any activity that would result in radionuclide emissions.

A.2.3 Polychlorinated Biphenyls

Soils contaminated with polychlorinated biphenyls (PCBs) are considered “bulk PCB remediation waste” under 40 *CFR* § 761.3. Cleanup and removal of bulk PCB remediation waste will be conducted in accordance with 40 *CFR* § 761.61. These would be applicable requirements.

A.3 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A.3.1 Threatened or Endangered Species

No threatened or endangered (T&E) species or their potential habitats or critical habitats have been identified in the boundaries of the Soils OU SWMUs. Kentucky has no T&E species regulations promulgated at this time. A list of plant and animal species identified for monitoring purposes is maintained by the Kentucky State Nature Preserves Commission. If T&E species later are discovered in the area, potential impacts to the species should be considered for all DOE actions.

A.3.2 Cultural Resources

No cultural resources have been identified in the boundaries of the Soils OU SWMUs.

A.3.3 Floodplains/Wetlands

Eight SWMUs have been identified in a 100-year floodplain, and wetlands have been identified near a few of the SWMUs (CDM 1994). Although all ARARs discussed in this section are applicable, they will be met by avoidance of the resource. If impacts become apparent, however, mitigation measures will be addressed and/or initiated during the remedial design and/or remedial action phase to comply with the ARARs.

Construction activities must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990; 40 *CFR* § 6.302(a); 40 *CFR* § 6, Appendix A; and 10 *CFR* § 1022]. In addition, construction activities must minimize potential harm to the 100-year floodplain [Executive Order 11988 and 10 *CFR* § 1022].

40 *CFR* § 230.10(b) prohibits discharges of dredged or fill material that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 *USC* § 1317), or jeopardize T&E species or their critical habitat under the Endangered Species Act (16 *USC* § 1531, *et seq.*). If it becomes apparent that impacts to wetlands are unavoidable, the substantive requirements of 61 *Fed. Reg.* 65920 Nationwide Permits (NWPs), or 33 *CFR* § 325 (processing of general permits), governing discharges of dredged or fill material into waters of the United States would become applicable.

Specific requirements applicable to all NWPs are defined in 61 *Fed. Reg*. 65920 (December 13, 1996). The substantive requirements of NWP 38 (cleanup of hazardous and toxic waste) are applicable to this action, but the specific requirement of notification is not required for CERCLA actions under this NWP. Consequently, although wetlands should be delineated and avoided, the delineation does not have to be sent to the U.S. Army Corps of Engineers (COE), and the COE does not have to be notified for this action [61 *Fed. Reg*. 65905-65906 (1996)].

As required by 401 *KAR* 4:060, activities or structures exempted by 401 *KAR* 4:020, that includes activities covered by a COE NWP, may be placed within the regulatory floodway limit of a stream only if they are not of such nature as to result in increases in flood elevations.

A.4 ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A.4.1 Site Preparation, Construction, and Excavation Activities

Action-specific ARARs will be developed in the FS.

APPENDIX B
SAMPLING STRATEGY

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B.1 SWMU SAMPLING STRATEGY

The Data Quality Objective (DQO) process has been used to focus the sampling strategy on Solid Waste Management Unit- (SWMU-) specific media, contamination, and migration pathways. This process also has been used to identify the data requirements for the baseline risk assessment and feasibility study. To facilitate this activity, existing data for each SWMU, waste management, releases, and environmental site conditions were gathered and are presented in this document.

Sampling has been planned for the Soils Operable Unit (OU) SWMUs in order to calculate the mean concentration of primary chemicals of potential concern (COPCs)[1]. The mean concentration for each unit investigated will be used to determine if the unit is contaminated (i.e., the mean concentration for each COPC does not exceed the greater of the background value or the risk-based screening level) and requires action. The risk-based screening levels for use in this investigation are the no action levels for the industrial worker for those SWMUs inside the plant boundary and the no action levels for the teen recreator for those SWMUs outside the plant boundary.

The SWMUs have been grouped into the following seven categories to simplify the sampling approach: Former Facility Site, PCBs, Soil/Rubble Piles, Scrap Yards, Underground/Tank, Storage Areas, and Chromium Areas (Table B.1). Each SWMU was divided into approximately 0.5-acre exposure units (EU) (unless noted otherwise), consistent with the approach shown in the Risk Methods Document (DOE 2001), and sampling points were determined within each EU. For each group, historical documents were investigated and existing information was gathered in an effort to identify what the suspected contaminants are, how/why the contamination occurred, and over what time period. Historical sampling was referenced for contaminants, concentrations, and locations.

Initial random sampling locations were determined using Visual Sampling Plan™ (VSP). The sampling pattern was chosen in order to maximize the use of historical samples, which provide adequate data for characterization. Further, a historical sample must have been within 50 ft of an initial sample and within the unit boundary to be utilized [2].

Utilities have been overlaid on maps for reference and planning of sample points.

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[1] Primary COPCs for PGDP are identified in the Risk Methods Document (DOE 2001).

[2] Replacement of a initial sample with a historical sample most recently was used in the *Sampling and Analysis Plan for the Site Investigation and Risk Assessment of the Surface Water Operable Unit (On-Site) at the Paducah Gaseous Diffusion Plant Paducah, Kentucky* (DOE 2005). In the SWOU Sampling and Analysis Plan, historical samples were required to be within 50 ft of a initial sample in order to be considered.

Table B.1. SWMU Groupings

Group	SWMU	Location	Description	Acres
Former Facility Site				
Additional OU or Investigation Listing				
GWOU	1	C-747-C	Oil Landfarm (disposal of waste oil)	2.29492
	99	C-745	Kellogg Building Site (WAG 28)	2.70631
D&DOU	172	C-726	Sandblasting Facility	0.07533
D&DOU	194	DUF Facility	McGraw Construction Facilities	41.6967
	196	C-746-A	Septic System, WAG 27 proposed NFA	0.4156
GWOU	211	C-720	Technetium Spill Site Northwest, WAG 27	0.06181
	483	C-603	Was C-603 Nitrogen Facility, now concrete slab	0.26757
	489	C-710 North	Septic Tank	0.02082
	531	C-746-A south	Aluminum Slag Reacting Area	0.21037
			Total Acres:	**47.7494**
PCBs				
Additional OU or Investigation Listing				
	56	C-540-A	PCB Staging Area	0.00115
	57	C-541-A	PCB Waste Staging Area	0.00115
	74	C-340	Transformer Spill Site	0.06436
	75	C-633	PCB Spill Site	0.11008
	78	C-420	PCB Spill Site	0.08263
	79	C-611	PCB Spill Site	0.02592
	80	C-540	PCB Spill Site	0.34455
	81	C-541	PCB Spill Site	0.26154
	135	C-333	PCB Soil Contamination	0.33652
	137	C-746-A	Inactive PCB Area	0.00063
	153	C-331	PCB Soil Contamination (west)	0.60248
	154	C-331	PCB Soil Contamination (southeast)	1.03029
	155	C-333	PCB Soil Contamination (west)	0.71102
	156	C-310	PCB Soil Contamination (west)	0.46277
	160	C-745	Cylinder Yard (PCB soils) Spoils	0.11479
	163	C-304	HVAC Piping System (soil backfill from C-611)	0.08222
	219	C-728	DMSA OS-08, empty fiberglass tank	0.03797
	488	C-410 Trailers	PCB Contamination Area	0.00106
			Total Acres :	**4.27113**

Table B.1. SWMU Groupings (Continued)

Group	SWMU	Location	Description	Acres
Soil/Rubble Pile				
Additional OU or Investigation Listing				
Soils OU Inactive Facility	19	C-410-B	HF Emergency Lagoon	0.04419
	20	C-410-E	Emergency Holding Pond	0.04316
	180	WKWMA	Outdoor Firing Range WKWMA	2.2076
Soils OU Inactive Facility	181	West Side	Outdoor Firing Range PGDP	0.50891
	204	Dyke Road	Historical Staging Area, WAG 28	11.2968
Soils OU Soil Pile Investigation	492	Outfall 011	Contaminated Soil Area	0.04664
Soils OU Soil Pile Investigation	541	Outfall 011	Contaminated Soil Area	1.99904
Soils OU Soil Pile Investigation	561		Soil Pile I	9.446
	138	C-100	Southside Berm	0.91754
	195	SW PGDP	Curlee Road Contaminated Soil Mounds	9.70968
	493	Outfall 001	Concrete Rubble Piles	0.12949
	517	West of PGDP	Rubble and debris, erosion control fill area	0.01475
			Total Acres:	**36.3638**
Scrap yard				
Additional OU or Investigation Listing				
	12	C-747-A	UF_4 Drum Yard (Drum Mountain)	0.71333
SWOU	13	C-746-P&P1	P&P1 Scrapyards	6.83063
SWOU	14	C-746-E	E Scrap yard	5.75068
SWOU	15	C-746-C	C Scrap yard	5.28672
SWOU	16	C-746-D	D Scrap yard	2.01491
	518	C-746-P1	Field south of P1 scrap yard	0.81476
	520	C-746-A	Scrap Material	2.89439
			Total Acres:	**24.3054**
Underground/Tank				
Additional OU or Investigation Listing				
GWOU	11	C-400 (SE)	C-400 Technetium Leak Site, SE of C-400 building	0.0203
	26	C-400 to C-404	4" Underground Transfer Line, 1500' long	0.0409
	27	C-722	Acid Neutralization Tank	0.00273
	31	C-720	Compressor Pit Water Storage Tank	0.00236
	32	C-720	2 (C-728) Clean Waste Oil Tanks (removed)	0.0376
Soils OU Inactive Facility	40	C-403	Neutralization Tank	0.02057
	76	C-632-B	Sulfuric Acid Storage Tank	0.01947
	77	C-634-B	Sulfuric Acid Storage Tank	0.01704
	165	C-616-L	Pipeline and Vault Soil Contamination	0.48722
	170	C-729	Acetylene Building Drain Pits	0.00293
			Total Acres:	**0.65112**
Storage Area				
Additional OU or Investigation Listing				
	47	C-400	Technetium Storage Tank Area	0.02276
	200	Central PGDP	TSCA Waste Storage Facility	0.81408

Table B.1. SWMU Groupings (Continued)

Group	SWMU	Location	Description	Acres
	212	C-745-A	Radiological Contamination Area	0.09263
	213	C-745-A	DMSA OS-02	0.16258
	214	C-611	DMSA OS-03, RCRA NFA pending	0.01355
	215	C-743	DMSA OS-04, rail tank car	0.01279
	216	C-206	DMSA OS-05, RCRA NFA pending	0.02663
	217	C-740	DMSA OS-06, RCRA NFA pending	0.97704
	218	C-741	DMSA OS-07, RCRA NFA pending	0.09501
	220	C-409	DMSA OS-09, RCRA NFA pending	0.2219
	221	C-635	DMSA OS-10	0.20831
	222	C-410	DMSA OS-11, RCRA NFA pending	0.05279
	223	C-301	DMSA OS-12, RCRA NFA pending	0.76268
	224	C-340	DMSA OS-13, empty drum storage	0.14879
	225	C-533-1	DMSA OS-14, rail cars	0.09296
	226	C-745-B	DMSA OS-15	0.31757
	227	C-746-B	DMSA OS-16, RCRA NFA pending	1.27855
	228	C-747-B	DMSA OS-17	0.23234
	229	C-746-F	DMSA OS-18	0.84898
			Total Acres:	**6.38194**
Chromium Areas				
Additional OU or Investigation Listing				
	158	C-720	Chilled-Water System Leak Site	0.05785
	169	C-410-E	HF Vent Surge Protection Tank	0.00231
	176	C-331	Recirculating Water (RCW) Leak NW Side	0.13764
	177	C-331	Leak East Side	0.15853
			Total Acres:	**0.35633**

Former Facility Site Group

The units and areas comprising the former facility sites grouping are listed below. As necessary, SWMUs greater than 0.5 acre (SWMUs 1, 99, and 194) were divided into EUs, as shown below. For practicality, some EUs were created greater than or less than 0.5 acre; however, the average of the EUs over the former facility sites grouping remained reasonably close to 0.5 acre. A large portion of SWMU 194 was not included in the EU division because the Depleted Uranium Hexafluoride Facility is being constructed at this location.

No samples will be collected from SWMUs 172, 196, or 483.

SWMU	Acres	SWMU	Acres	SWMU	Acres
1		EU194-09	0.546	EU194-28	0.517
EU001-01	0.52	EU194-10	0.517	EU194-29	0.604
EU001-02	0.525	EU194-11	0.517	EU194-30	0.517
EU001-03	0.606	EU194-12	0.776	EU194-31	0.517
EU001-04	0.644	EU194-13	0.517	EU194-32	0.517
99		EU194-14	0.517	EU194-33	0.623
EU099-01	0.771	EU194-15	0.517	EU194-34	0.517
EU099-02	0.785	EU194-16	0.517	EU194-35	0.517
EU099-03	0.768	EU194-17	0.565	EU194-36	0.517
EU099-04	0.382	EU194-18	0.517	EU194-37	0.200
194		EU194-19	0.517	EU194-38	0.307
EU194-01	0.576	EU194-20	0.776	EU194-39	0.437
EU194-02	0.560	EU194-21	0.517	EU194-40	0.566
EU194-03	0.554	EU194-22	0.517	**211**	0.06181
EU194-04	0.821	EU194-23	0.517	**489**	0.02082
EU194-05	0.538	EU194-24	0.517	**531**	0.21037
EU194-06	0.532	EU194-25	0.584	**Total Acres**	**26.8**
EU194-07	0.526	EU194-26	0.517	**Average Acres/EU**	**0.52**
EU194-08	0.520	EU194-27	0.517		

SWMUs 172 and 483 both have a concrete surface, therefore; a radiation evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected at each SWMU.

SWMU 196 has been evaluated under another investigation and has enough data to proceed to a FS.

The locations were randomly chosen by VSP and are displayed below in Figures B.1 through B.6. A list of sample coordinates is provided in Table B.2. Section 9.3 provides information on sampling depths. Where applicable, historical samples providing adequate data for characterization will replace new sample locations/data.

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 1							
001-01-1	1	-6,875.61	-1,740.56				
001-01-2	1	-6,985.61	-1,749.56				
001-01-3	1	-6,926.61	-1,810.56				
001-01-4	1	-6,867.61	-1,830.56				
001-02-1	2	-6,792.47	-1,684.42				
001-02-2	2	-6,855.47	-1,721.42				
001-02-3	2	-6,764.00	-1,804.00				
001-02-4	2	-6,819.47	-1,793.42				
001-03-1	3	-6,642.47	-1,714.42	001-103	-6,625.08	-1,699.5	0-0, 2-6, 6-10 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
001-03-2	3	-6,582.47	-1,702.42	001-102	-6,575.2	-1,699.67	0-0, 2-6, 6-10 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
001-03-3	3	-6,677.47	-1,729.42	001-104	-6,675.05	-1,699.72	0-0, 2-6, 6-10 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
001-03-4	3	-6,579.47	-1,810.42				
001-04-1	4	-6,925.00	-1,880.00				
001-04-2	4	-6,971.56	-1,838.56	001-170	-6,967.57	-1,865.29	1-1.75 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
001-04-3	4	-6,806.56	-1,911.56	OF08B-07-02	-6,776.99	-1,913.02	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
001-04-4	4	-6,701.56	-1,879.56	001-146	-6,689.73	-1,901.02	0-1 ft bgs/Metals, Radionuclides, SVOA, VOA, (OF08A-216 for PCBs)
SWMU 99							
099-01-1	1	-1,742.36	-1,416.13				
099-01-2	1	-1,548.36	-1,423.13	099-014	-1,548.35	-1,423.12	Metals, PCB, Radionuclides, SVOA
099-01-3	1	-1,782.36	-1,452.13				
099-01-4	1	-1,586.36	-1,512.13				
099-02-1	2	-1,655.97	-1,537.78				
099-02-2	2	-1,545.97	-1,548.78				
099-02-3	2	-1,544.97	-1,635.78	099-012	-1,544.96	-1,635.77	Metals, PCB, Radionuclides, SVOA
099-02-4	2	-1,687.97	-1,639.78				
099-03-1	3	-1,629.46	-1,673.25	099-009	-1,629.46	-1,673.25	Metals, PCB, Radionuclides, SVOA
099-03-2	3	-1,582.46	-1,689.25	099-011	-1,582.46	-1,689.25	Metals, PCB, Radionuclides, SVOA
099-03-3	3	-1,547.46	-1,775.25	099-010	-1,547.46	-1,775.25	Metals, PCB, Radionuclides, SVOA
099-03-4	3	-1,586.46	-1,781.25				

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
099-04-1	4	-1,524.55	-1,812.91				
099-04-2	4	-1,199.55	-1,827.91				
099-04-3	4	-1,121.55	-1,864.91	OF10B-03-02	-1,121.54	-1,864.90	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
099-04-4	4	-1,236.55	-1,882.91				
SWMU 172 (no samples to be collected)							
SWMU 194							
194-01-1	1	-5,415.34	-4,150.04				
194-01-2	1	-5,404.34	-4,232.04				
194-01-3	1	-5,361.34	-4,239.04				
194-01-4	1	-5,303.34	-4,141.04				
194-02-1	2	-5,289.73	-4,099.86				
194-02-2	2	-5,214.73	-4,228.86				
194-02-3	2	-5,208.73	-4,098.86				
194-02-4	2	-5,165.73	-4,193.86				
194-03-1	3	-5,123.73	-4,209.68				
194-03-2	3	-5,104.73	-4,200.68				
194-03-3	3	-5,098.73	-4,168.68				
194-03-4	3	-5,025.73	-4,101.68				
194-04-1	4	-4,990.73	-4,133.50				
194-04-2	4	-4,878.73	-4,192.50				
194-04-3	4	-4,853.73	-4,106.50				
194-04-4	4	-4,794.73	-4,242.50				
194-05-1	5	-4,761.46	-4,182.24				
194-05-2	5	-4,722.46	-4,148.24				
194-05-3	5	-4,716.46	-4,235.24				
194-05-4	5	-4,638.46	-4,120.24				
194-06-1	6	-4,609.46	-4,194.06				
194-06-2	6	-4,570.46	-4,118.06				
194-06-3	6	-4,539.46	-4,198.06	H015	-4,532.86	-4,224.61	0-2, 2-4, 4-6 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
194-06-4	6	-4,478.46	-4,213.06				
194-07-1	7	-4,465.46	-4,115.88				
194-07-2	7	-4,406.46	-4,112.88				
194-07-3	7	-4,394.46	-4,204.88				
194-07-4	7	-4,352.46	-4,244.88				
194-08-1	8	-4,313.46	-4,127.71				
194-08-2	8	-4238.46	-4195.71				
194-08-3	8	-4,229.46	-4,243.71				
194-08-4	8	-4,205.46	-4,164.71				
194-09-1	9	-5,434.95	-4,339.53				
194-09-2	9	-5,393.95	-4,311.53				
194-09-3	9	-5,345.95	-4,354.53				

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
194-09-4	9	-5,323.95	-4,381.53				
194-10-1	10	-5,265.73	-4,367.53				
194-10-2	10	-5,250.73	-4,397.53				
194-10-3	10	-5,239.73	-4,273.53				
194-10-4	10	-5,213.73	-4,308.53				
194-11-1	11	-5,123.73	-4,284.53				
194-11-2	11	-5,112.73	-4,304.53				
194-11-3	11	-5,092.73	-4,284.53				
194-11-4	11	-5,047.73	-4,273.53				
194-12-1	12	-4,925.73	-4,269.53				
194-12-2	12	-4,893.73	-4,395.53				
194-12-3	12	-4,806.73	-4,375.53				
194-12-4	12	-4,773.73	-4,298.53				
194-13-1	13	-4,747.46	-4,270.53				
194-13-2	13	-4,707.46	-4,266.53				
194-13-3	13	-4,694.46	-4,277.53				
194-13-4	13	-4,634.46	-4,398.53				
194-14-1	14	-4,559.46	-4,343.53				
194-14-2	14	-4,551.46	-4,253.53				
194-14-3	14	-4,483.46	-4,261.53				
194-14-4	14	-4,475.46	-4,378.53				
194-15-1	15	-4,447.46	-4,268.53				
194-15-2	15	-4,425.46	-4,260.53				
194-15-3	15	-4,408.46	-4,388.53				
194-15-4	15	-4,322.46	-4,321.53				
194-16-1	16	-4267.46	-4270.53				
194-16-2	16	-4,251.46	-4,374.53				
194-16-3	16	-4,244.46	-4,286.53				
194-16-4	16	-4,193.46	-4,335.53				
194-17-1	17	-5,454.57	-4,482.53				
194-17-2	17	-5,422.57	-4,526.53				
194-17-3	17	-5,338.57	-4,479.53				
194-17-4	17	-5,301.57	-4,451.53				
194-18-1	18	-5,224.73	-4,409.53				
194-18-2	18	-5,221.73	-4,520.53				
194-18-3	18	-5,193.73	-4,492.53				
194-18-4	18	-5,179.73	-4,421.53				
194-19-1	19	-5,092.73	-4,435.53				
194-19-2	19	-5,083.73	-4,477.53				
194-19-3	19	-5,050.73	-4,462.53				
194-19-4	19	-4,993.73	-4,539.53				
194-20-1	20	-4,990.73	-4,491.53				
194-20-2	20	-4,923.73	-4,525.53				

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
194-20-3	20	-4,824.73	-4,447.53				
194-20-4	20	-4,791.73	-4,504.53				
194-21-1	21	-4,743.46	-4,405.53				
194-21-2	21	-4,729.46	-4,543.53				
194-21-3	21	-4,676.46	-4,463.53				
194-21-4	21	-4,635.46	-4,493.53	UFSB-01	-4,675.8	-4,516.09	0-1, 3-5, 6-10, 11-13 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
194-22-1	22	-4,610.46	-4,478.53				
194-22-2	22	-4,572.46	-4,413.53				
194-22-3	22	-4,545.46	-4,531.53				
194-22-4	22	-4,481.46	-4,504.53				
194-23-1	23	-4,420.46	-4,435.53				
194-23-2	23	-4,416.46	-4,532.53	UFSB-02	-4,327.49	-4,514.77	0-1, 1-5, 6-10, 11-15 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
194-23-3	23	-4,385.46	-4,417.53				
194-23-4	23	-4,324.46	-4,450.53				
194-24-1	24	-4,300.46	-4,547.53				
194-24-2	24	-4,293.46	-4,482.53				
194-24-3	24	-4,279.46	-4,412.53				
194-24-4	24	-4,222.46	-4,501.53				
194-25-1	25	-5,456.18	-4,651.53				
194-25-2	25	-5,441.18	-4,688.53				
194-25-3	25	-5,370.18	-4,623.53				
194-25-4	25	-5,306.18	-4,568.53				
194-26-1	26	-5,225.73	-4,573.53				
194-26-2	26	-5,283.73	-4,630.53				
194-26-3	26	-5,199.73	-4,661.53				
194-26-4	26	-5,244.73	-4,692.53				
194-27-1	27	-5,116.73	-4,696.53				
194-27-2	27	-5,096.73	-4,629.53				
194-27-3	27	-5,027.73	-4,665.53				
194-27-4	27	-5,017.73	-4,619.53				
194-28-1	28	-4,982.73	-4,651.53				
194-28-2	28	-4,981.73	-4,700.53				
194-28-3	28	-4,894.73	-4,651.53				
194-28-4	28	-4,874.73	-4,604.53				
194-29-1	29	-5,463.79	-4,799.53				
194-29-2	29	-5,384.79	-4,838.53				
194-29-3	29	-5,378.79	-4,725.53				
194-29-4	29	-5,345.79	-4,805.53				
194-30-1	30	-5,272.73	-4,773.53				
194-30-2	30	-5,265.73	-4,795.53				

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
194-30-3	30	-5,154.73	-4,792.53				
194-30-4	30	-5,147.73	-4,840.53				
194-31-1	31	-5,119.73	-4,728.53				
194-31-2	31	-5,111.73	-4,822.53				
194-31-3	31	-5,032.73	-4,815.53				
194-31-4	31	-5,024.73	-4,766.53				
194-32-1	32	-4,970.73	-4,806.53				
194-32-2	32	-4,967.73	-4,744.53				
194-32-3	32	-4,917.73	-4,782.53				
194-32-4	32	-4,846.73	-4,814.53				
194-33-1	33	-5,445.40	-4,861.53				
194-33-2	33	-5,393.40	-4,878.53				
194-33-3	33	-5,372.40	-4,935.53				
194-33-4	33	-5,331.40	-4,964.53				
194-34-1	34	-5,288.73	-4,975.53				
194-34-2	34	-5,260.73	-4,907.53				
194-34-3	34	-5,220.73	-4,972.53				
194-34-4	34	-5,186.73	-4,861.53				
194-35-1	35	-5,105.73	-4,954.53				
194-35-2	35	-5,105.73	-4,984.53				
194-35-3	35	-5,075.73	-4,865.53				
194-35-4	35	-5,030.73	-4,869.53				
194-36-1	36	-4,990.73	-4,883.53				
194-36-2	36	-4,948.73	-4,969.53				
194-36-3	36	-4,945.73	-4,904.53				
194-36-4	36	-4,875.73	-4,996.53				
194-37-1	37	-5,415.31	-5,016.53				
194-37-2	37	-5,350.31	-5,023.53				
194-37-3	37	-5,323.31	-5,021.53				
194-37-4	37	-5,313.31	-5,022.53				
194-38-1	38	-5,281.73	-5,045.53				
194-38-2	38	-5,234.73	-5,006.53				
194-38-3	38	-5,157.73	-5,063.53				
194-38-4	38	-5,152.73	-5,085.53				
194-39-1	39	-5,087.73	-5,011.53				
194-39-2	39	-5,072.73	-5,070.53				
194-39-3	39	-5,044.73	-5,093.53				
194-39-4	39	-5,014.73	-5,099.53				
194-40-1	40	-4,953.73	-5,069.53				
194-40-2	40	-4,950.73	-5,137.53				
194-40-3	40	-4,865.73	-5,082.53				
194-40-4	40	-4,853.73	-5,031.53				
SWMU 196 (no samples to be collected)							

Table B.2. RI Sample Location Coordinates for the Former Facility Site Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 211							
211-01-1	1	-5,072.63	-2,025.44				
211-01-2	1	-5,021.63	-2,027.44				
211-01-3	1	-5,042.63	-2,044.44				
211-01-4	1	-5,030.63	-2,053.44				
SWMU 483 (no samples to be collected)							
SWMU 489							
489-01-1	1	-4,238.93	-2,153.90				
489-01-2	1	-4,241.93	-2,159.90				
489-01-3	1	-4,226.93	-2,168.90				
489-01-4	1	-4,245.93	-2,171.90				
SWMU 531							
531-01-1	1	-5,437.66	207.36				
531-01-2	1	-5,585.66	205.36				
531-01-3	1	-5,352.66	201.36				
531-01-4	1	-5,461.66	186.36				

* These samples are RI samples to be collected during sampling for SWMU 520.

Blue shading indicates sample provides definitive data from a historical investigation.

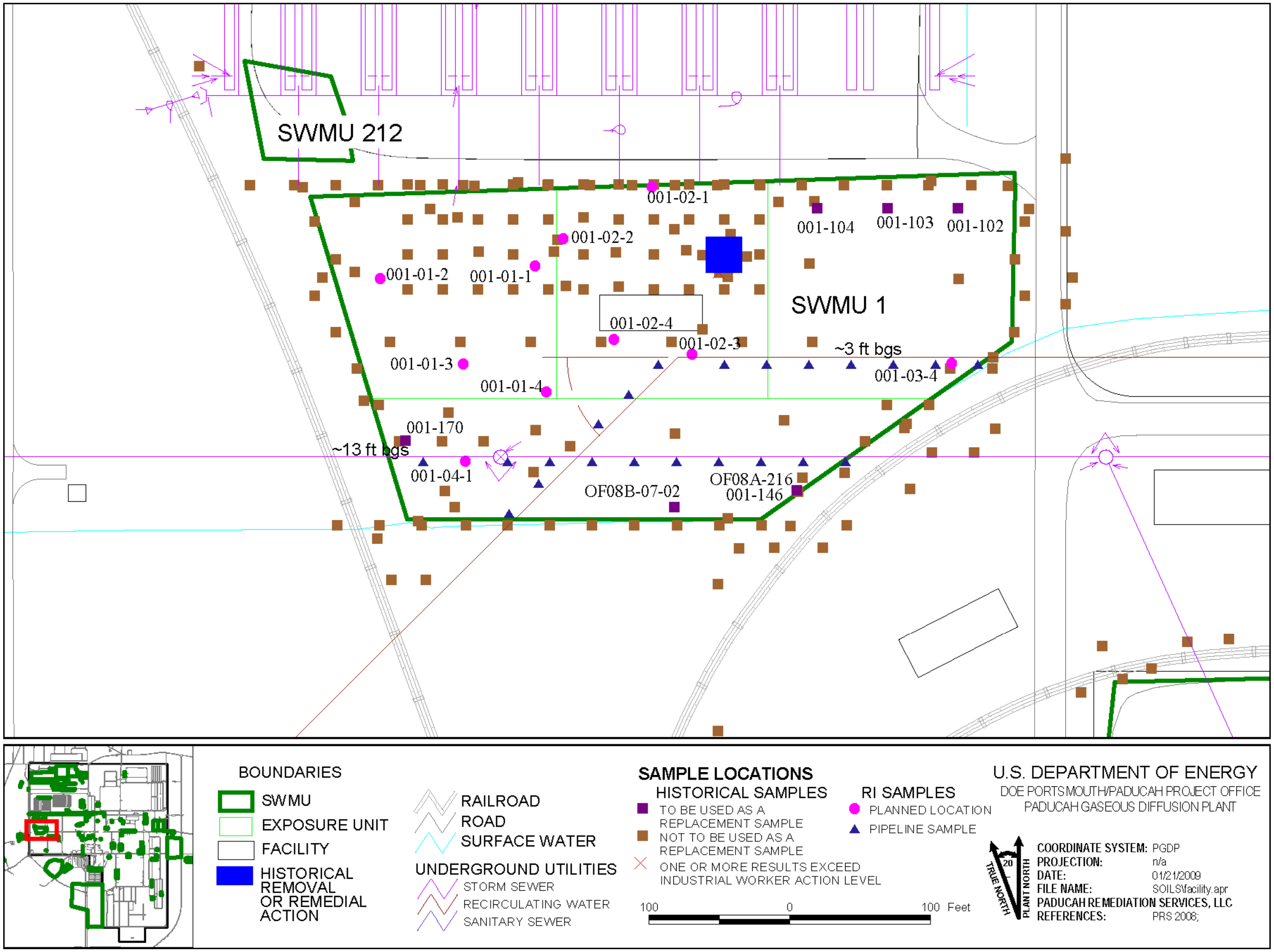

Figure B.1. Soils OU RI Samples for SWMU 1

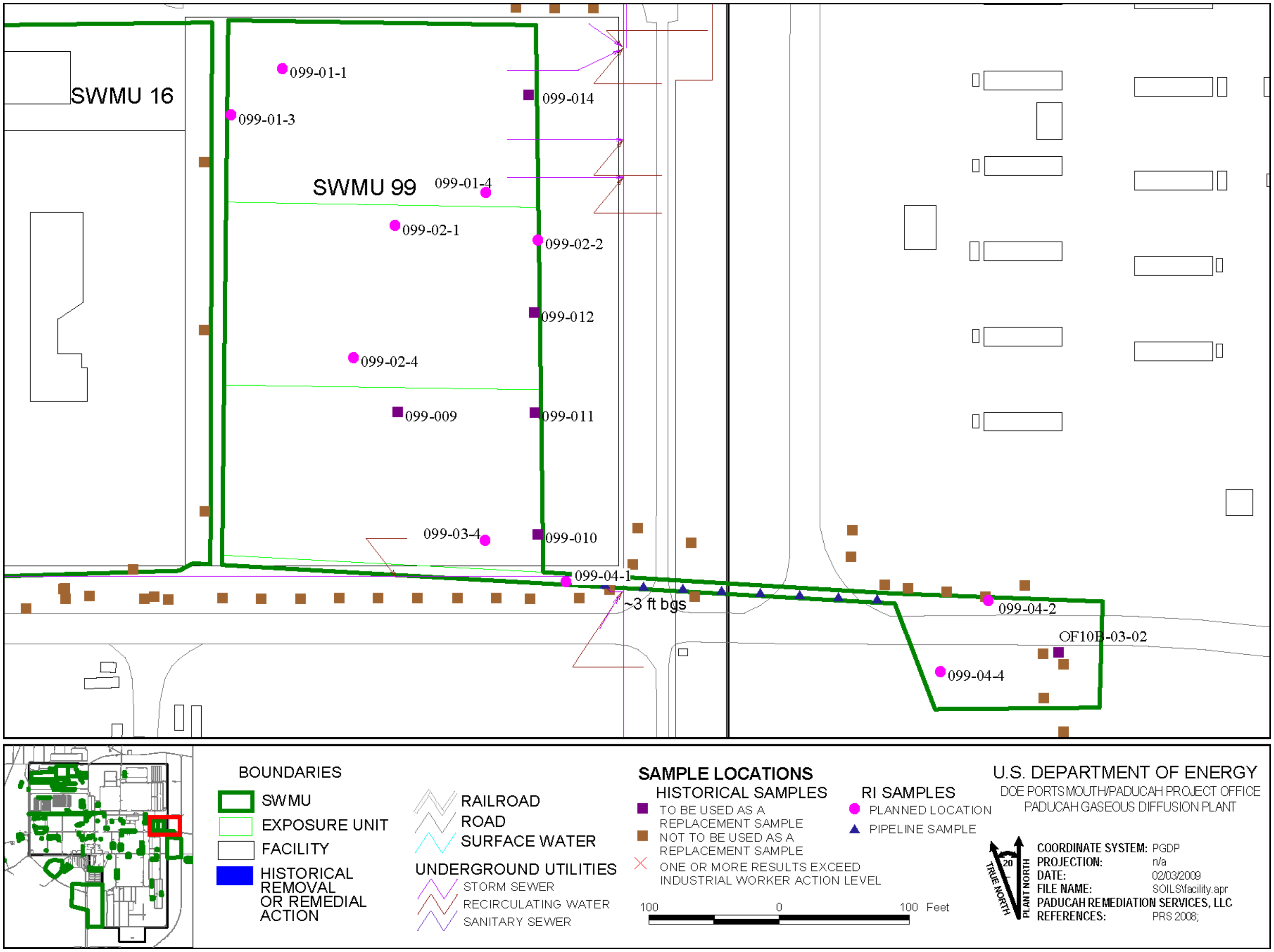

Figure B.2. Soils OU RI Samples for SWMU 99

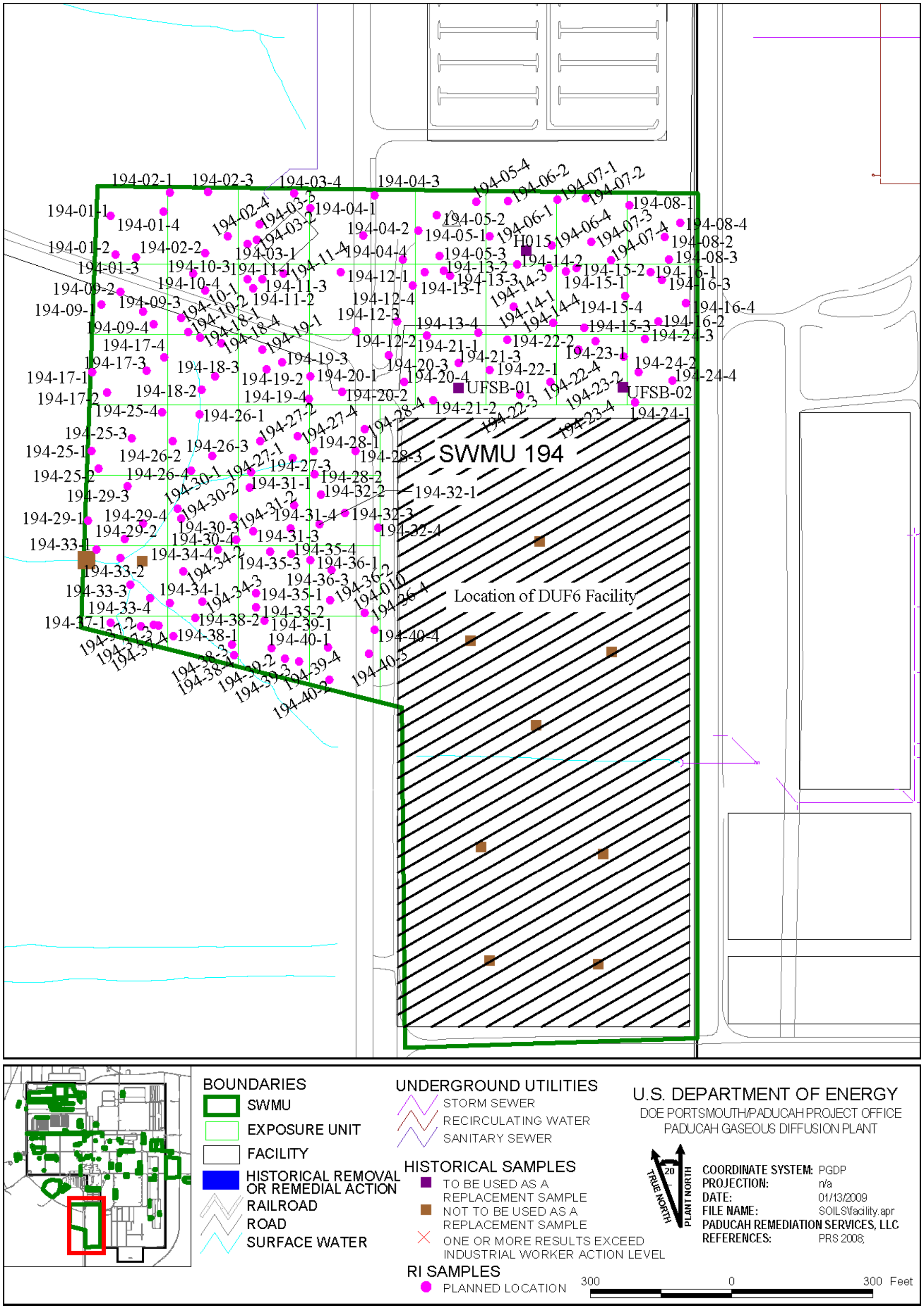

Figure B.3. Soils OU RI Samples for SWMU 194

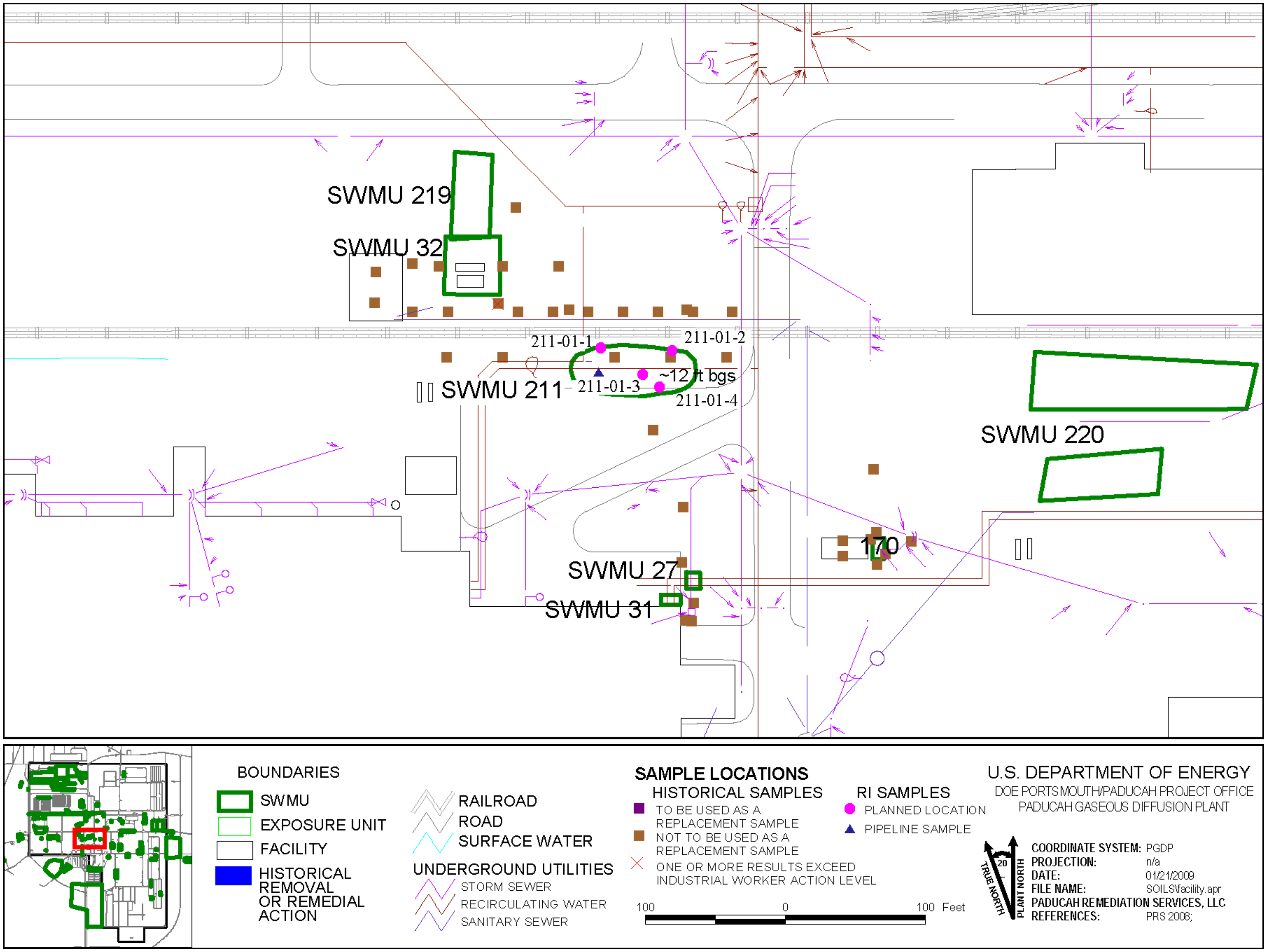

Figure B.4. Soils OU RI Samples for SWMU 211

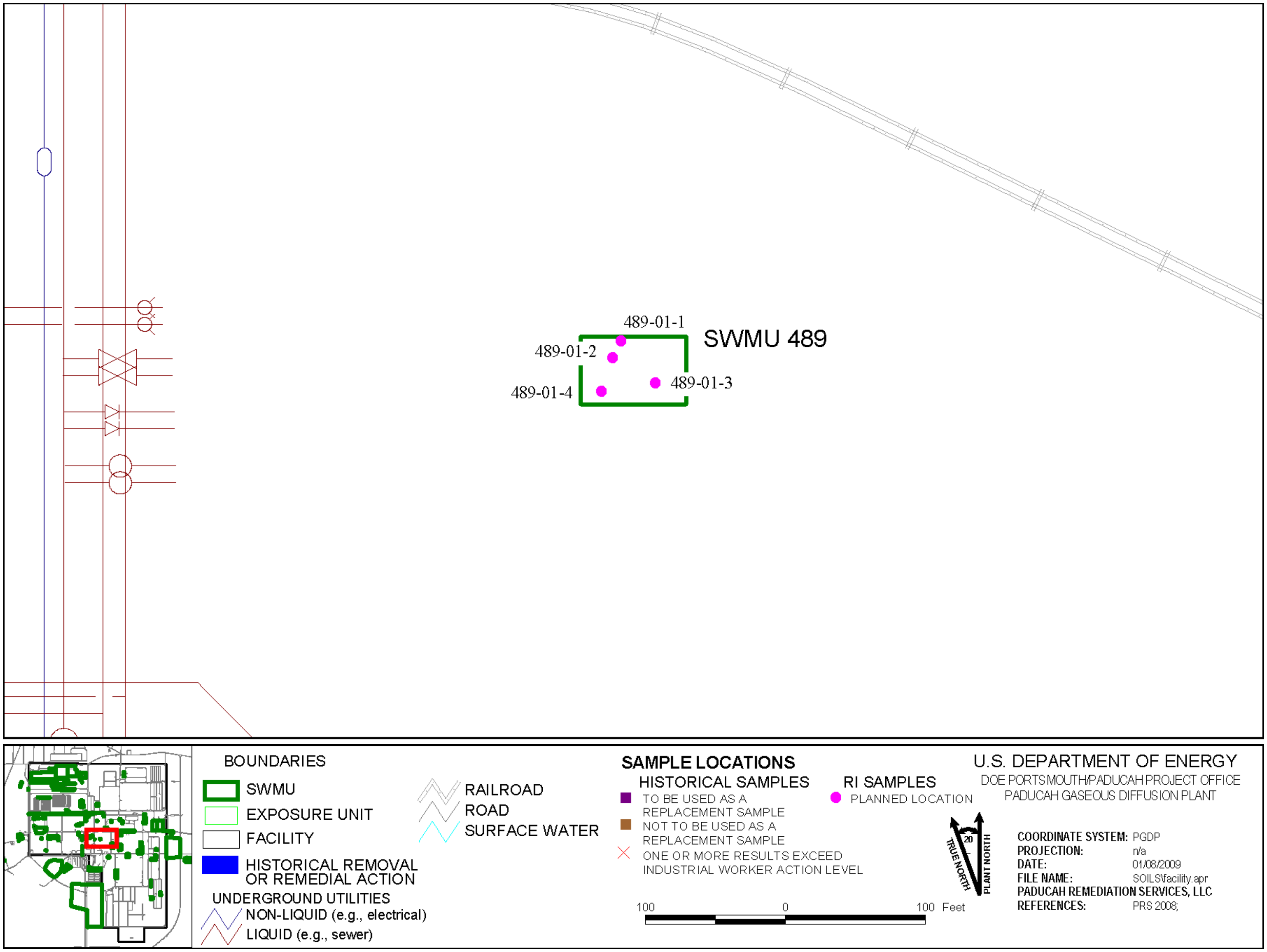

Figure B.5. Soils OU RI Samples for SWMU 489

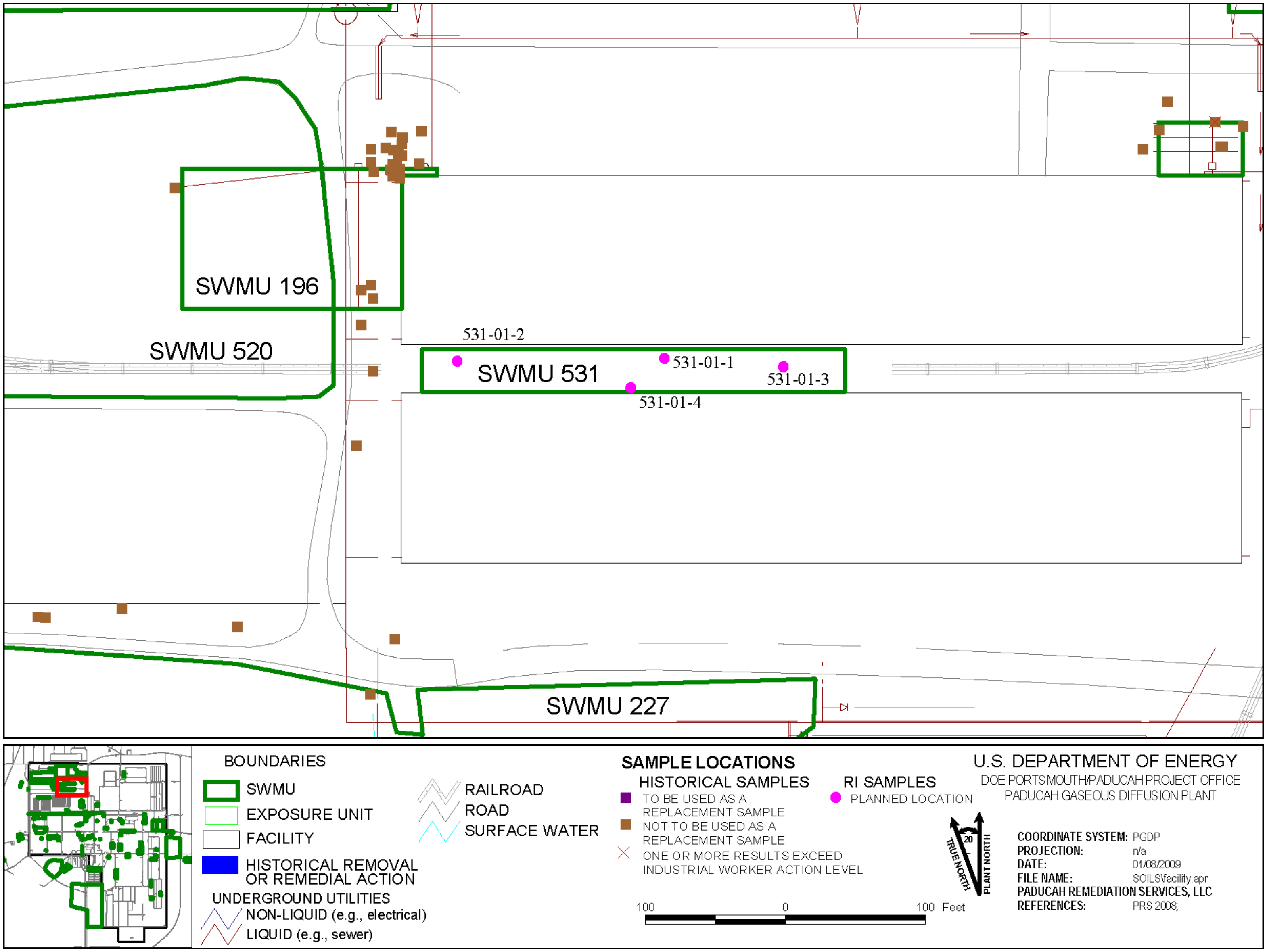

Figure B.6. Soils OU RI Samples for SWMU 531

PCBs Group

The units and areas comprising the PCBs grouping are listed below. As necessary, SWMUs greater than 0.5 acre (SWMU 154) were divided into EUs. Some SWMUs greater than 0.5 acre (SWMUs 153 and 155) were not divided due to practicality. Although some of the individual EUs were greater than 0.5 acre, the average of the exposure units over the PCB areas remained reasonably close to 0.5 acre.

SWMUs 56, 57, 74, 79, 80, 81, 135, and 160 will not be sampled.

SWMU	Acres
75	0.11
78	0.083
137	0.00063
153	0.602
154	
EU 154-01	0.469
EU 154-02	0.561
155	0.71
156	0.46
163	0.082
219	0.038
488	0.00106
Total Acres	**3.1**
Average Acres/EU	**0.28**

SWMU 135 has a concrete surface; therefore, a RAD evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected at each SWMU.

SWMUs 56, 57, 74, 79, 80, 81, and 160 have been previously investigated and have enough data to proceed to a FS.

The locations were randomly chosen by VSP and are displayed below in Figures B.7 through B.16. A list of sample coordinates is provided in Table B.3. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.3. RI Sample Location Coordinates for the PCBs Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 56 (no samples to be collected)							
SWMU 57 (no samples to be collected)							
SWMU 74 (no samples to be collected)							
SWMU 75							
075-01-1	1	-1,658.48	-4,439.08				
075-01-2	1	-1,665.48	-4,482.08				
075-01-3	1	-1,641.48	-4,526.08				
075-01-4	1	-1,661.48	-4,539.08				
SWMU 78							
078-01-1	1	-3,977.35	-1,689.62				
078-01-2	1	-3,936.35	-1,708.62				
078-01-3	1	-3,970.35	-1,716.62	H257	-3,986.2	-1,711.2	0-1, 2-4, 4-6 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
078-01-4	1	-3,950.35	-1,719.62				
SWMU 79 (no samples to be collected)							
SWMU 80 (no samples to be collected)							
SWMU 81 (no samples to be collected)							
SWMU 135 (no samples to be collected)							
SWMU 137							
137-01-1	1	-5,001.70	253.80				
137-01-2	1	-4,999.70	252.80				
137-01-3	1	-5,007.70	251.80				
137-01-4	1	-5,004.70	251.80				
SWMU 153							
153-01-1	1	-3,377.50	-2,418.50				
153-01-2	1	-3,409.50	-2,509.50				
153-01-3	1	-3,330.50	-2,539.50				
153-01-4	1	-3,427.50	-2,598.00				
SWMU 154							
154-01-1	1	-2,619.30	-2,667.22				
154-01-2	1	-2,523.30	-2,702.22				
154-01-3	1	-2,555.30	-2,754.22				
154-01-4	1	-2,516.30	-2,771.22				
154-02-1	2	-2,513.78	-2,499.55				
154-02-2	2	-2,442.78	-2,503.55				
154-02-3	2	-2,474.78	-2,631.55				
154-02-4	2	-2,430.78	-2,681.55				
SWMU 155							
155-01-1	1	-3,575.10	-3,498.50				
155-01-2	1	-3,551.10	-3,626.50				
155-01-3	1	-3,510.10	-3,706.50				
155-01-4	1	-3,497.10	-3,816.50				

Table B.3. RI Sample Location Coordinates for the PCBs Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 156							
156-01-1	1	-3,727.14	-2,360.68				
156-01-2	1	-3,724.14	-2,436.68				
156-01-3	1	-3,677.14	-2,485.68				
156-01-4	1	-3,699.14	-2,524.68				
SWMU 160 (no samples to be collected)							
SWMU 163							
163-01-1	1	-3,876.90	-2,917.50				
163-01-2	1	-3,897.90	-2,918.50				
163-01-3	1	-3,890.90	-2,939.50				
163-01-4	1	-3,839.90	-2,951.50				
SWMU 219							
219-01-1	1	-5,164.17	-1,895.60				
219-01-2	1	-5,155.17	-1,901.60				
219-01-3	1	-5,154.17	-1,912.60				
219-01-4	1	-5,160.17	-1,936.60				
SWMU 488							
488-01-1	1	-4,471.58	-2,173.02				
488-01-2	1	-4,467.58	-2,176.02				
488-01-3	1	-4,465.58	-2,176.02				
488-01-4	1	-4,469.58	-2,179.02				

Blue shading indicates sample provides definitive data from a historical investigation.

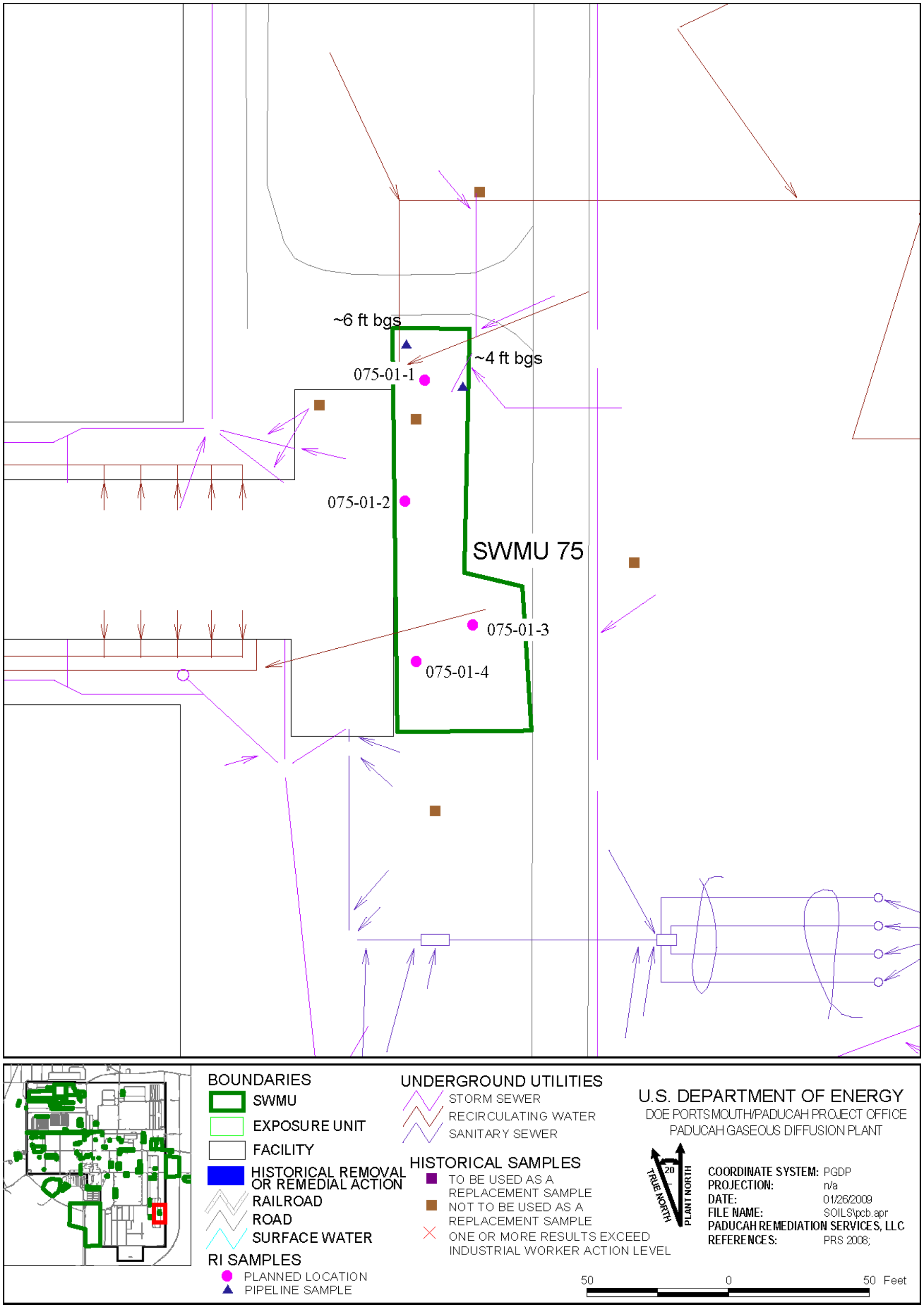

Figure B.7. Soils OU RI Samples for SWMU 75

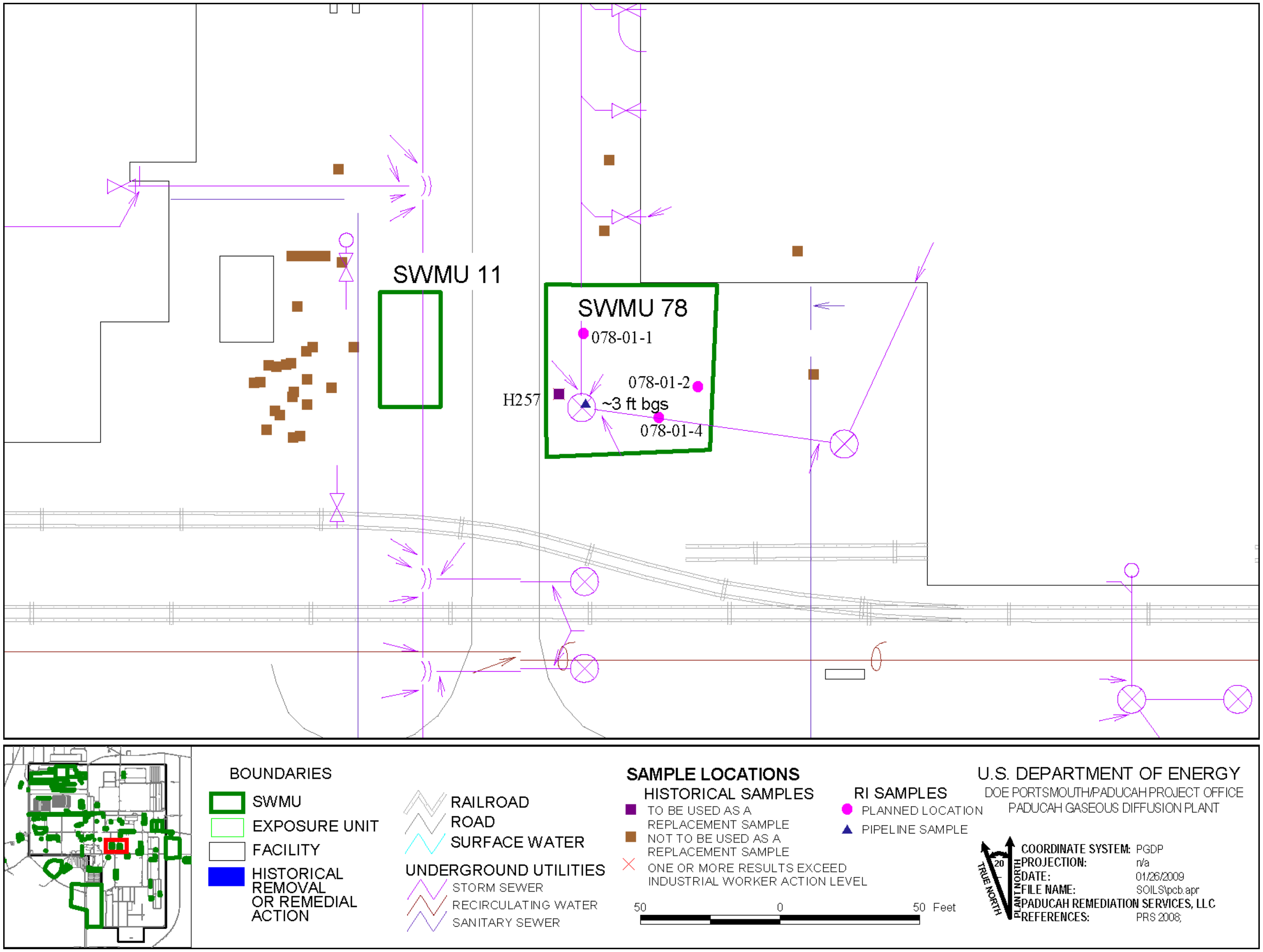

Figure B.8. Soils OU RI Samples for SWMU 78

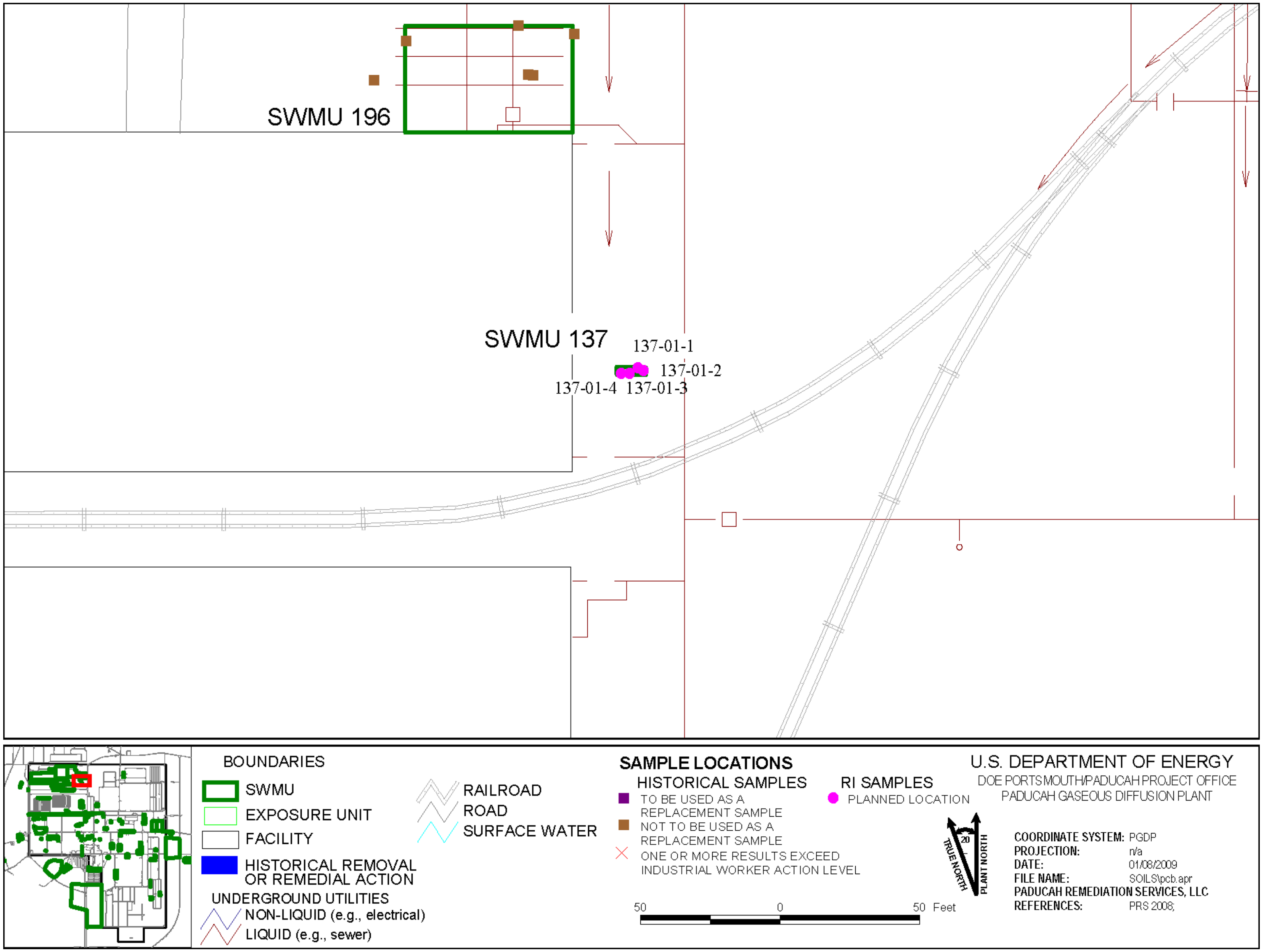

Figure B.9. Soils OU RI Samples for SWMU 137

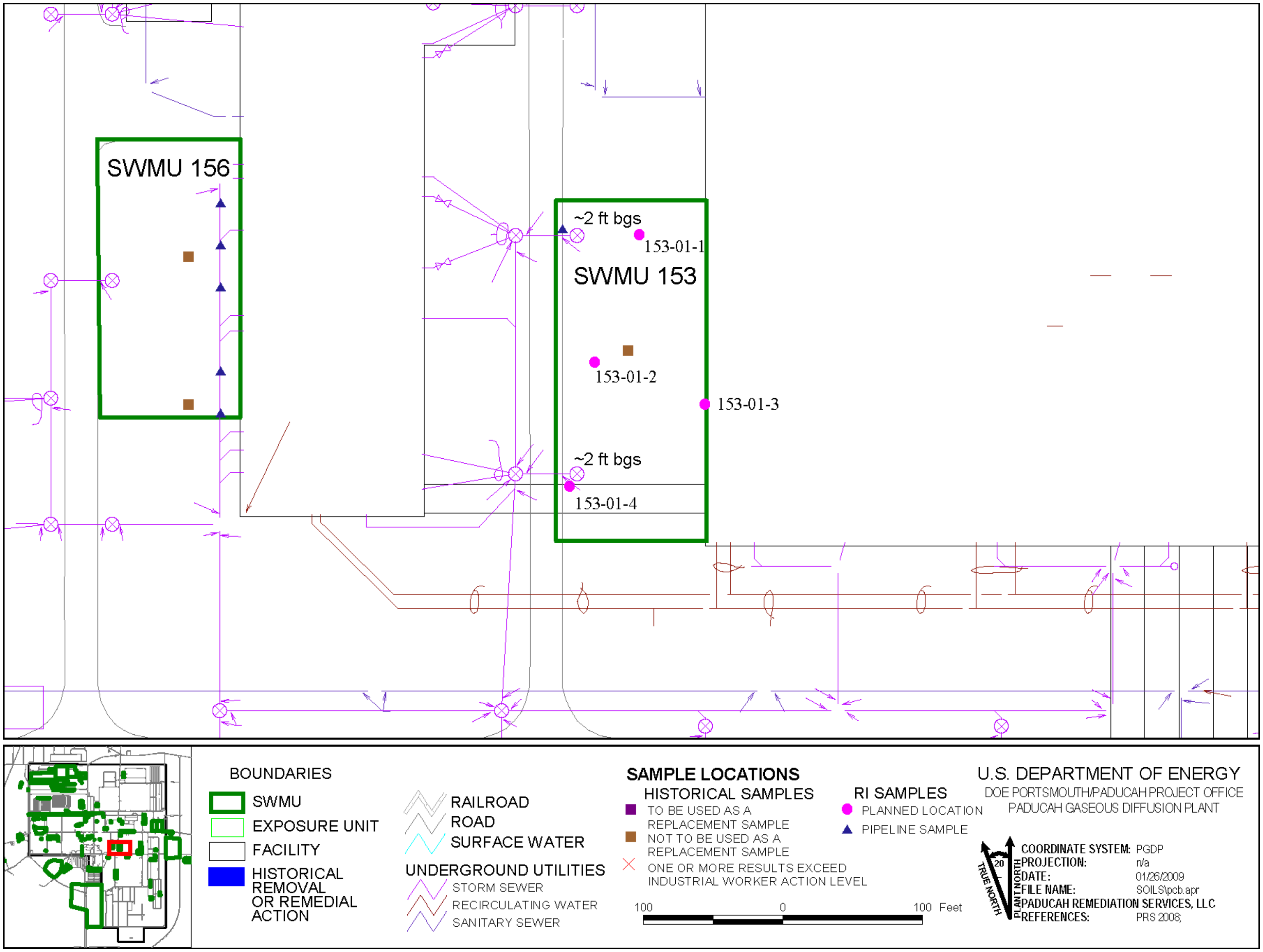

Figure B.10. Soils OU RI Samples for SWMU 153

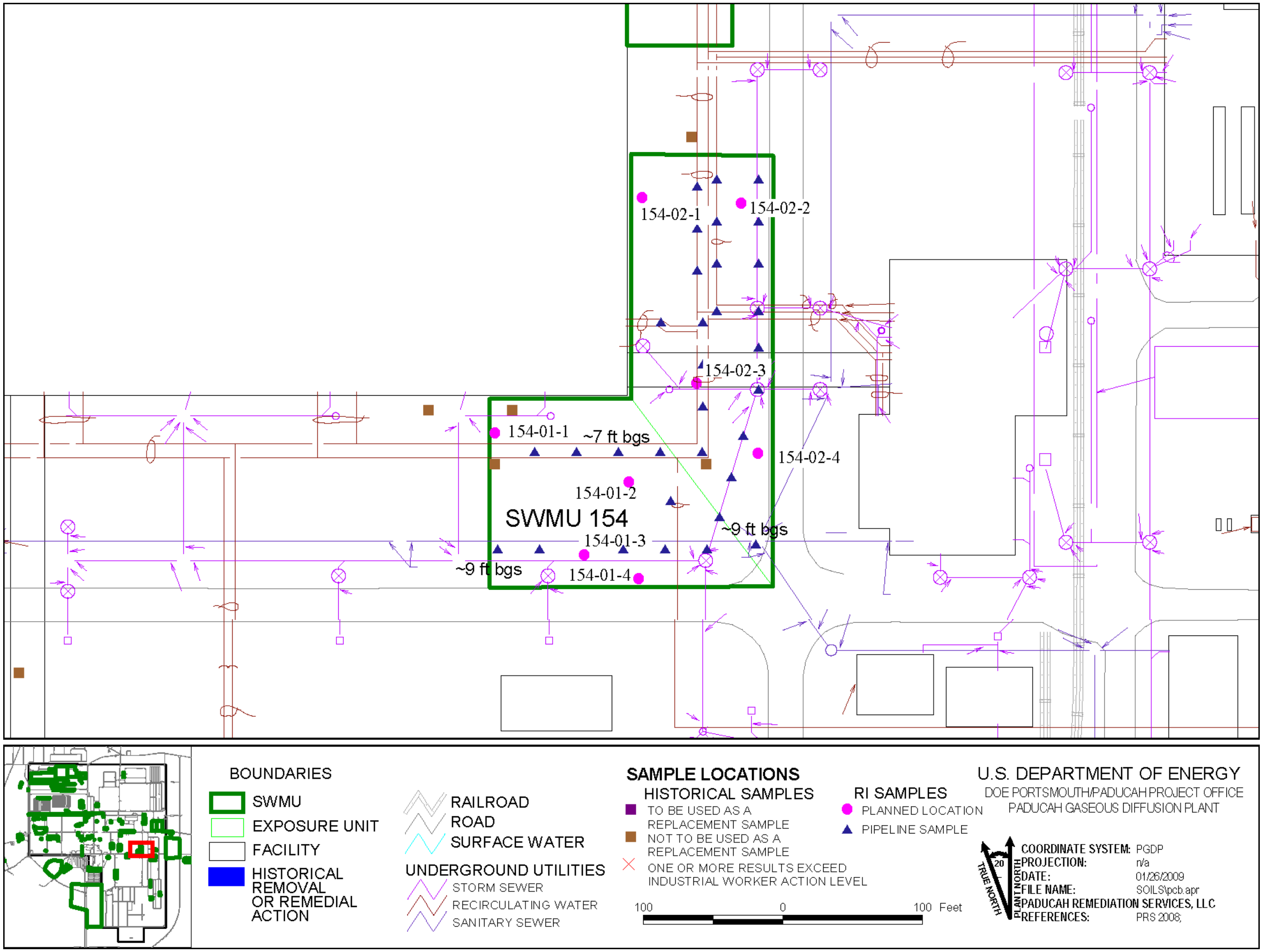

Figure B.11. Soils OU RI Samples for SWMU 154

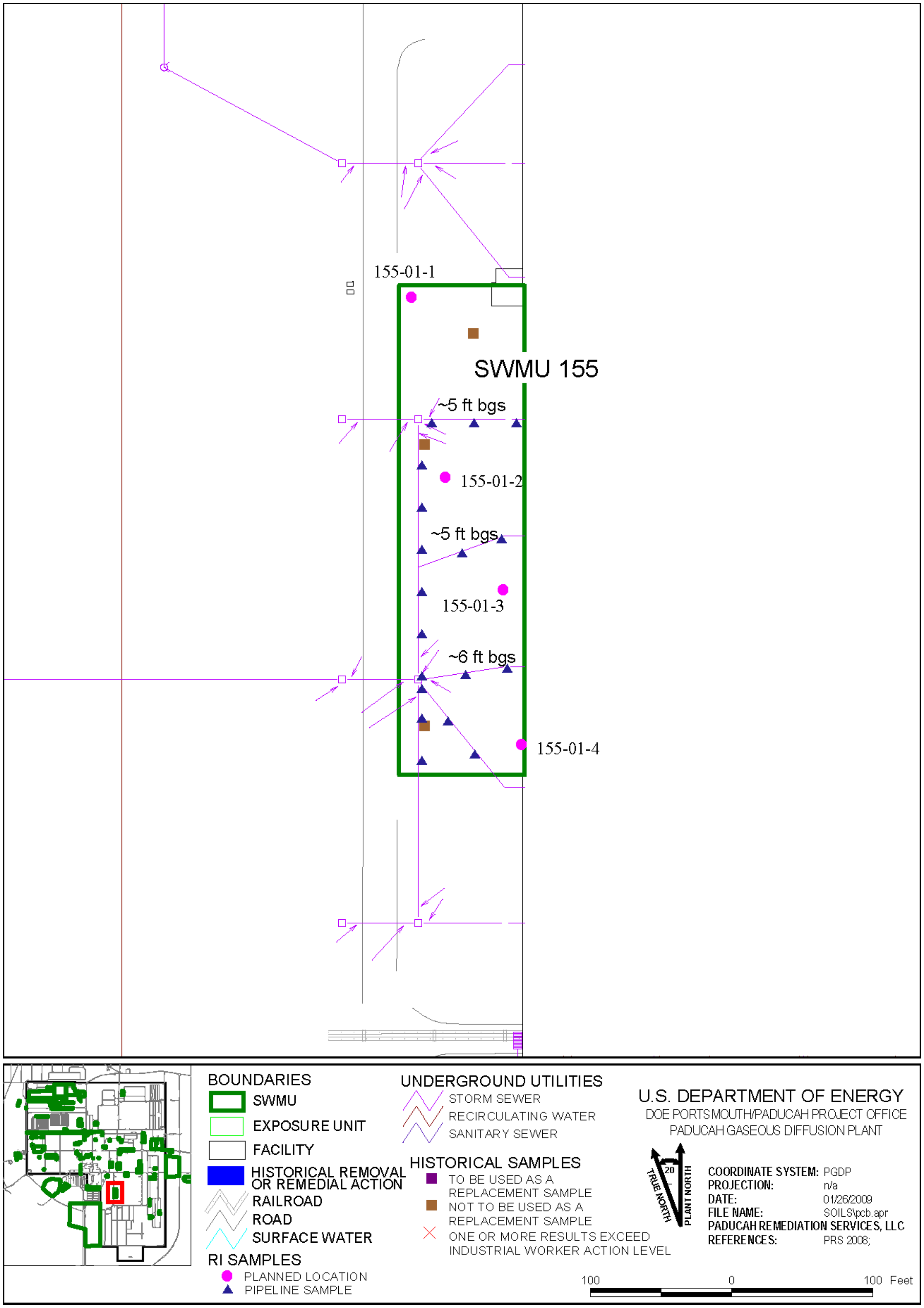

Figure B.12. Soils OU RI Samples for SWMU 155

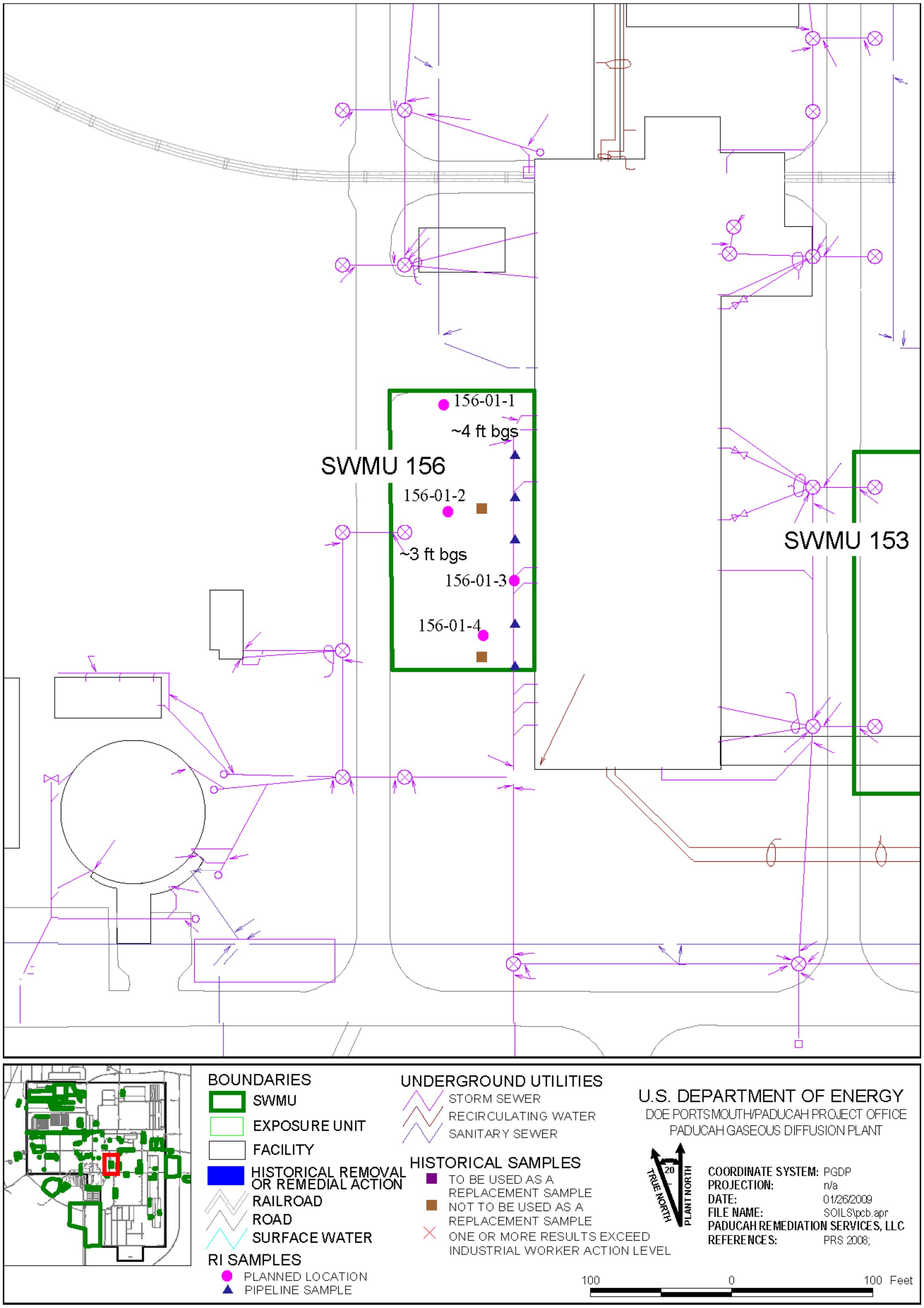

Figure B.13. Soils OU RI Samples for SWMU 156

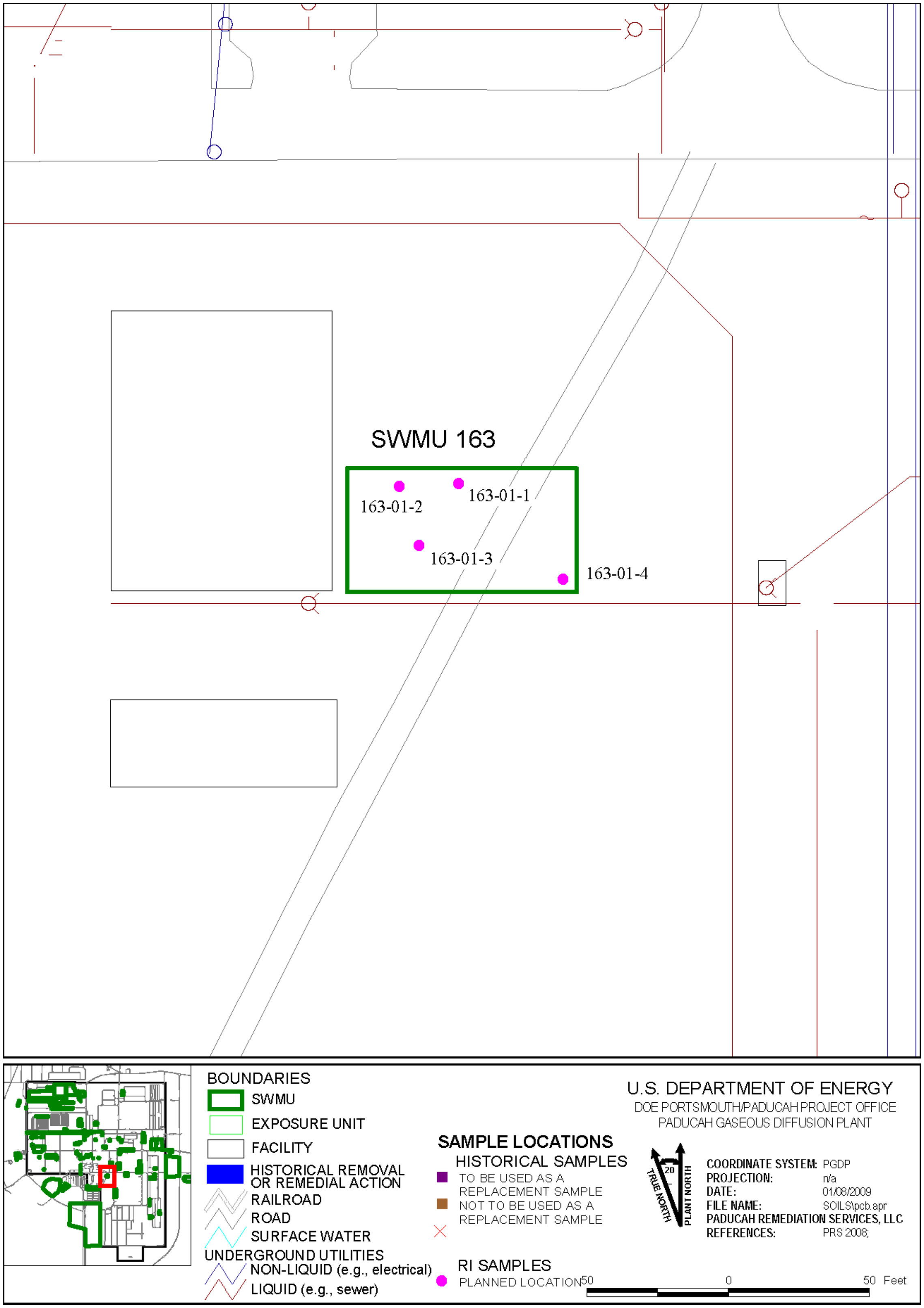

Figure B.14. Soils OU RI Samples for SWMU 163

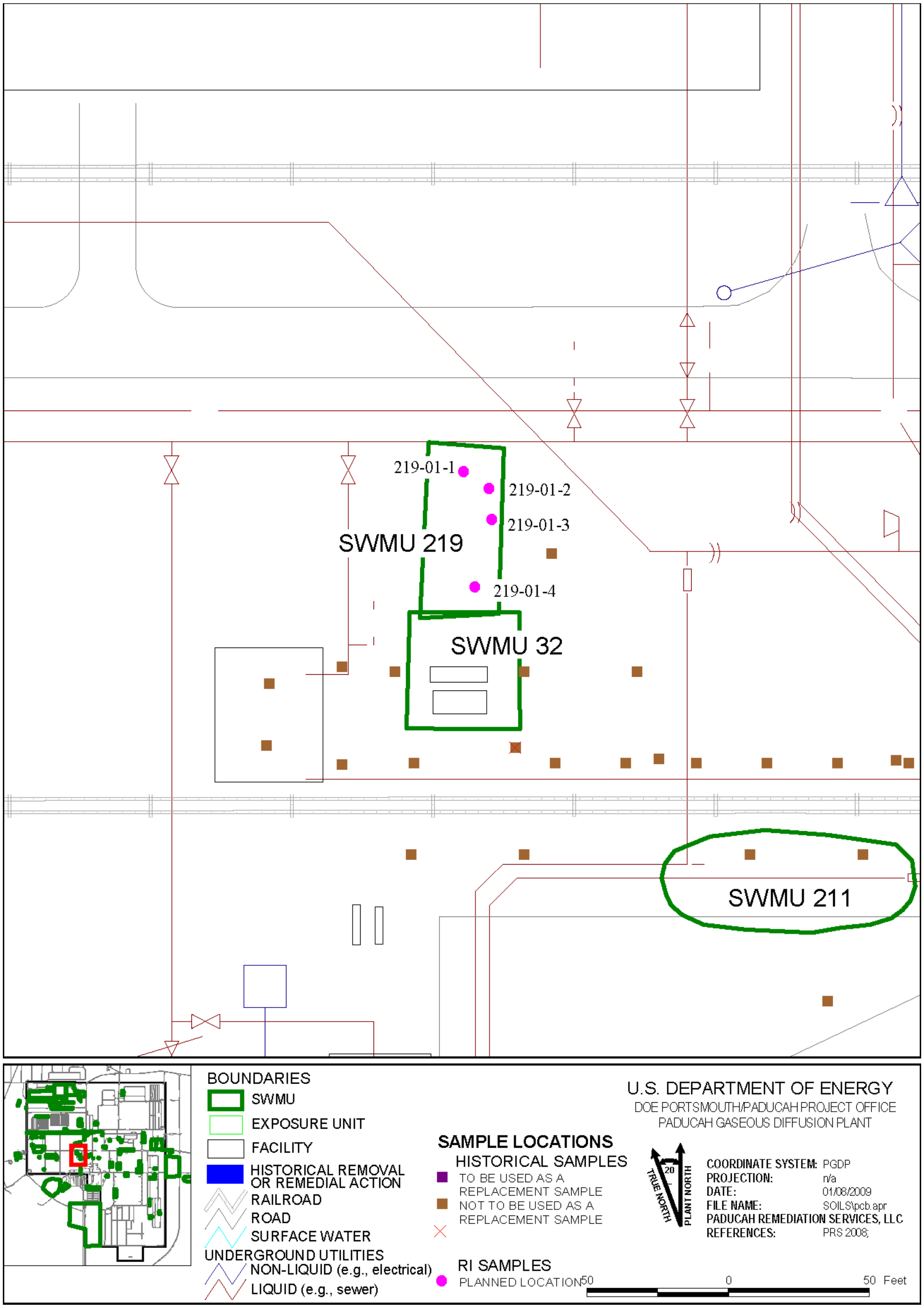

Figure B.15. Soils OU RI Samples for SWMU 219

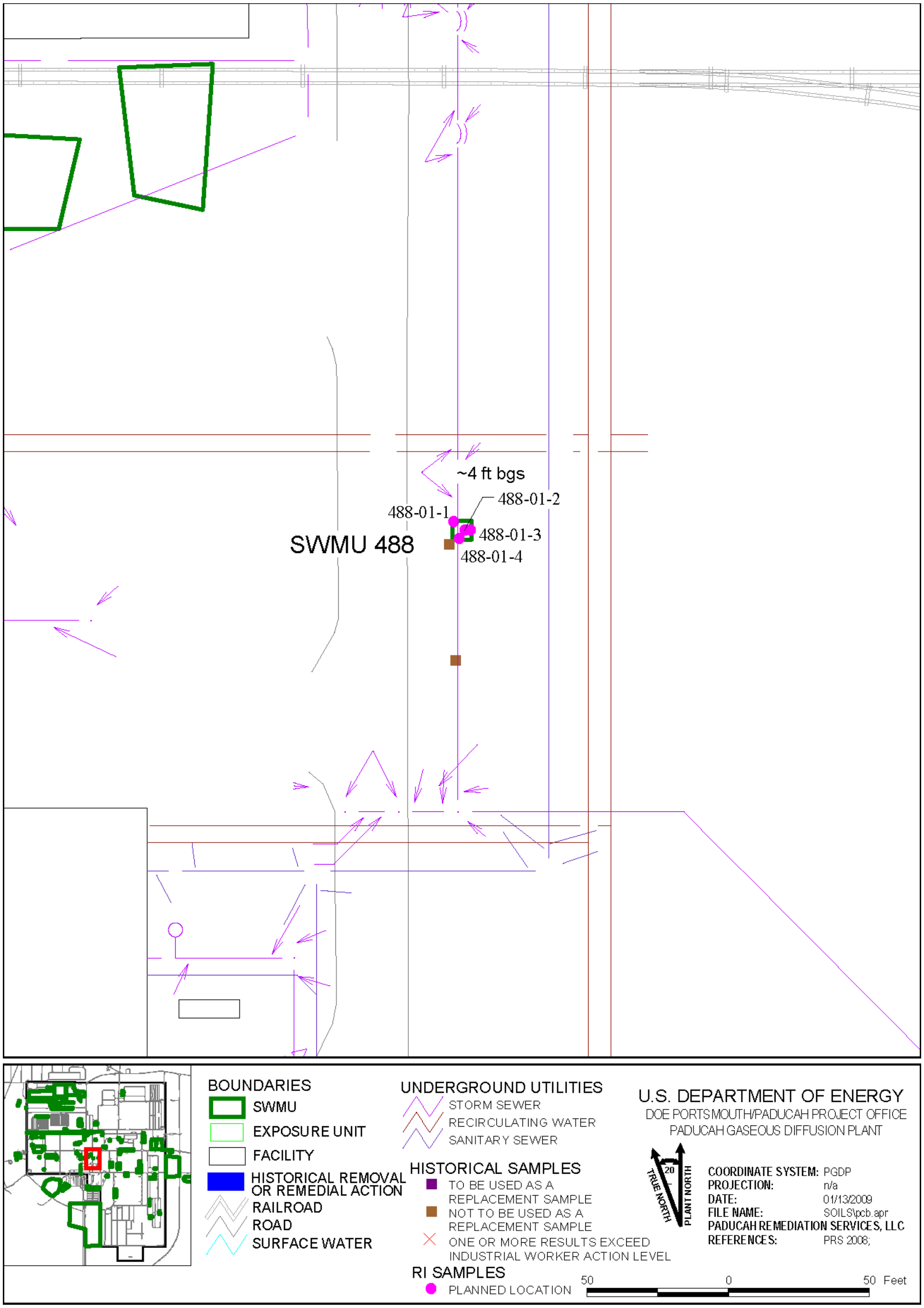

Figure B.16. Soils OU RI Samples for SWMU 488

Soil/Rubble Pile Group

The units and areas comprising the soil and rubble piles grouping are listed below. As necessary, SWMUs greater than 0.5 acre (SWMUs 180, and 195, and AOC 204) were divided into exposure units, consistent with guidance in the Risk Methods Document. Although some of the individual exposure units were greater than 0.5 acre, the average of the exposure units over the soil and rubble piles grouping remained reasonably close to 0.5 acre.

SWMUs 19, 20, 181, 492, 541, and 561 will not be sampled.

SWMU	Acres
138	
EU 138-01	0.46
EU 138-02	0.45
180	
EU 180-01	0.393
EU 180-02	0.356
EU 180-03	0.386
EU 180-04	0.389
EU 180-05	0.683
195	
EU 195-01	0.319
EU 195-02	0.484
EU 195-03	0.373
EU 195-04	0.517
EU 195-05	0.517
EU 195-06	0.327
EU 195-07	0.624
EU 195-08	0.517
EU 195-09	0.517
EU 195-10	0.574
EU 195-11	0.627

SWMU	Acres
EU 195-12	0.517
EU 195-13	0.517
EU 195-14	0.579
EU 195-15	0.437
EU 195-16	0.516
EU 195-17	0.512
EU 195-18	0.430
EU 195-19	0.427
EU 195-20	0.382
204	
EU 204-01	0.486
EU 204-02	0.428
EU 204-03	0.369
EU 204-04	0.270
EU 204-05	0.515
EU 204-06	0.517
EU 204-07	0.517
EU 204-08	0.448
EU 204-09	0.513
EU 204-10	0.517
EU 204-11	0.517

SWMU	Acres
EU 204-12	0.453
EU 204-13	0.512
EU 204-14	0.517
EU 204-15	0.517
EU 204-16	0.459
EU 204-17	0.511
EU 204-18	0.517
EU 204-19	0.517
EU 204-20	0.464
EU 204-21	0.506
EU 204-22	0.467
EU 204-23	0.421
EU 204-24	0.342
493	
EU 493-01	0.051
EU 493-02	0.79
517	0.15
Total Acres	**25.12**
Average Acres/EU	**0.47**

SWMU 20 has a concrete surface and is holding water; therefore, a water sample will be taken and characterized for disposal followed by removal of the water. Then a RAD evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected.

SWMUs 19 and 181 are part of the SOU Inactive Facilities and are listed for a removal action.

SWMUs 20, 492, 541, and 561 have been previously investigated and have enough data to proceed to a FS.

The locations were randomly chosen by VSP and are displayed below in Figures B.18 through B.22. A list of sample coordinates is provided in Table B.4. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 19 (no samples to be collected)							
SWMU 20 (no samples to be collected)							

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 138							
138-01-1	1	-4,719.44	-3,424.99				
138-01-2	1	-4,563.44	-3,445.99				
138-01-3	1	-4,643.44	-3,454.99				
138-01-4	1	-4,612.44	-3,464.99				
138-02-1	2	-4,306.03	-3,463.55				
138-02-2	2	-4,426.03	-3,464.55				
138-02-3	2	-4,440.03	-3,474.55				
138-02-4	2	-4,223.03	-3,479.55				
SWMU 180							
180-01-1	1	-12,976.19	-5,324.19				
180-01-2	1	-12,920.19	-5,273.19				
180-01-3	1	-12,915.19	-5,223.19				
180-01-4	1	-12,910.19	-5,325.19				
180-02-1	2	-12,859.71	-5,218.85				
180-02-2	2	-12,841.71	-5,177.85				
180-02-3	2	-12,826.71	-5,199.85				
180-02-4	2	-12,826.71	-5,266.85				
180-03-1	3	-12,928.39	-5,400.90				
180-03-2	3	-12,851.39	-5,359.90				
180-03-3	3	-12,849.39	-5,429.90				
180-03-4	3	-12,847.39	-5,455.90				
180-04-1	4	-12,812.08	-5,375.48				
180-04-2	4	-12,773.08	-5,307.48				
180-04-3	4	-12,770.08	-5,392.48				
180-04-4	4	-12,764.08	-5,292.48				
180-05-1	5	-12,833.39	-5,484.11				
180-05-2	5	-12,822.39	-5,533.11				
180-05-3	5	-12,701.39	-5,492.11				
180-05-4	5	-12,692.39	-5,549.11				
SWMU 181 (no samples to be collected)							
SWMU 195							
195-01-1	1	-6,028.68	-3,154.58				
195-01-2	1	-6,016.68	-3,113.58				
195-01-3	1	-5,989.68	-3,082.58				
195-01-4	1	-5,964.68	-3,103.58				
195-02-1	2	-5,951.32	-3,156.52				

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
195-02-2	2	-5,904.32	-3,161.52				
195-02-3	2	-5,894.32	-3,097.52				
195-02-4	2	-5,893.32	-3,267.52				
195-03-1	3	-6,246.19	-3,129.47				
195-03-2	3	-6,245.19	-3,099.47				
195-03-3	3	-6,210.19	-3,156.47				
195-03-4	3	-6,185.19	-3,082.47				
195-04-1	4	-6,192.38	-3,218.50				
195-04-2	4	-6,167.38	-3,250.50				
195-04-3	4	-6,109.38	-3,170.50				
195-04-4	4	-6,091.38	-3,239.50				
195-05-1	5	-6,033.52	-3,254.70				
195-05-2	5	-6,014.52	-3,370.70				
195-05-3	5	-6,012.52	-3,240.70				
195-05-4	5	-5,947.52	-3,295.70				
195-06-1	6	-5,968.66	-3,438.89				
195-06-2	6	-5,928.66	-3,412.89				
195-06-3	6	-5,922.66	-3,355.89				
195-06-4	6	-5,909.66	-3,329.89				
195-07-1	7	-6,369.35	-3,118.30				
195-07-2	7	-6,354.35	-3,166.30				
195-07-3	7	-6,351.35	-3,275.30				
195-07-4	7	-6,322.35	-3,213.30				
195-08-1	8	-6,292.57	-3,332.35				
195-08-2	8	-6,254.57	-3,296.35				
195-08-3	8	-6,180.57	-3,280.35				
195-08-4	8	-6,177.57	-3,251.35				
195-09-1	9	-6,170.72	-3,390.55				
195-09-2	9	-6,154.72	-3,448.55				
195-09-3	9	-6,080.72	-3,389.55				
195-09-4	9	-6,033.72	-3,401.55				
195-10-1	10	-6,038.86	-3,512.75				
195-10-2	10	-6,027.86	-3,545.75				
195-10-3	10	-6,007.86	-3,445.75				
195-10-4	10	-5,997.86	-3,604.75				
195-11-1	11	-6,488.46	-3,256.07				
195-11-2	11	-6,437.46	-3,333.07				
195-11-3	11	-6,426.46	-3,404.07				
195-11-4	11	-6,407.46	-3,265.07				
195-12-1	12	-6,412.77	-3,405.21				
195-12-2	12	-6,306.77	-3,390.21				
195-12-3	12	-6,299.77	-3,463.21				
195-12-4	12	-6,283.77	-3,433.21				
195-13-1	13	-6,251.92	-3,442.41				
195-13-2	13	-6,250.92	-3,541.41				
195-13-3	13	-6,210.92	-3,568.41				
195-13-4	13	-6,176.92	-3,491.41				
195-14-1	14	-6,163.06	-3,638.61				

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
195-14-2	14	-6,123.06	-3,581.61				
195-14-3	14	-6,069.06	-3,705.61				
195-14-4	14	-6,055.06	-3,625.61				
195-15-1	15	-6,580.45	-3,458.29				
195-15-2	15	-6,551.45	-3,475.29				
195-15-3	15	-6,537.45	-3,385.29				
195-15-4	15	-6,499.45	-3,394.29				
195-16-1	16	-6,476.41	-3,558.07				
195-16-2	16	-6,440.41	-3,554.07				
195-16-3	16	-6,422.41	-3,484.07				
195-16-4	16	-6,345.41	-3,518.07				
195-17-1	17	-6,338.67	-3,669.27				
195-17-2	17	-6,329.67	-3,615.27				
195-17-3	17	-6,314.67	-3,550.27				
195-17-4	17	-6,264.67	-3,653.27				
195-18-1	18	-6,234.91	-3,744.47				
195-18-2	18	-6,206.91	-3,736.47				
195-18-3	18	-6,203.91	-3,642.47				
195-18-4	18	-6,166.91	-3,688.47				
195-19-1	19	-5,705.14	-3,376.12				
195-19-2	19	-5,674.14	-3,335.12				
195-19-3	19	-5,664.14	-3,367.12				
195-19-4	19	-5,583.14	-3,300.12				
195-20-1	20	-5,674.14	-3,480.78				
195-20-2	20	-5,663.14	-3,429.78				
195-20-3	20	-5,596.14	-3,416.78				
195-20-4	20	-5,534.14	-3,339.78				
SWMU 204							
204-01-1	1	-1,370.55	-2,163.75				
204-01-2	1	-1,325.55	-2,127.75				
204-01-3	1	-1,320.55	-2,180.75	OF10B-02-02	-1,342.94	-2,218.15	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-01-4	1	-1,264.55	-2,198.75				
204-02-1	2	-1,196.55	-2,137.87	OF10B-02-03	-1,212.91	-2,137.91	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-02-2	2	-1,191.55	-2,110.87				
204-02-3	2	-1,137.55	-2,173.87	OF10B-02-04	-1,141.87	-2,156.18	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-02-4	2	-1,102.55	-2,133.87				
204-03-1	3	-1,049.55	-2,121.00	OF10B-01-03	-1,040.02	-2,142.15	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-03-2	3	-9,84.55	-2,166.00	OF10B-01-01	-975.96	-2,174.23	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-03-3	3	-1,085.55	-2,188.00				
204-03-4	3	-9,67.55	-2,201.00				
204-04-1	4	-925.55	-2,165.12				
204-04-2	4	-890.55	-2,218.12				
204-04-3	4	-846.55	-2,186.12	OUTFALL10-2	-827.05	-2,193.02	0-1 ft bgs/Metals, PCB,

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
							Radionuclides, VOA
204-04-4	4	-829.55	-2,156.12				
204-05-1	5	-1,363.18	-2,284.75				
204-05-2	5	-1,344.18	-2,239.75				
204-05-3	5	-1,312.18	-2,307.75				
204-05-4	5	-1,265.18	-2,276.75				
204-06-1	6	-1,228.55	-2,302.75				
204-06-2	6	-1,150.55	-2,364.75				
204-06-3	6	-1,135.55	-2,251.75				
204-06-4	6	-1,131.55	-2,356.75				
204-07-1	7	-1,063.55	-2,269.75				
204-07-2	7	-1,005.55	-2,251.75				
204-07-3	7	-999.55	-2,364.75				
204-07-4	7	-955.55	-2,295.75				
204-08-1	8	-931.55	-2,260.75				
204-08-2	8	-909.55	-2,287.75				
204-08-3	8	-868.55	-2,250.75				
204-08-4	8	-849.55	-2,346.75				
204-09-1	9	-1,360.81	-2,462.75				
204-09-2	9	-1,294.81	-2,505.75				
204-09-3	9	-1,293.81	-2,386.75				
204-09-4	9	-1,279.81	-2,396.75				
204-10-1	10	-1,243.55	-2,449.75				
204-10-2	10	-1,209.55	-2,524.75				
204-10-3	10	-1,192.55	-2,413.75				
204-10-4	10	-1,137.55	-2,485.75				
204-11-1	11	-1,066.55	-2,415.75				
204-11-2	11	-1,034.55	-2,476.75				
204-11-3	11	-983.55	-2,473.75				
204-11-4	11	-956.55	-2,414.75				
204-12-1	12	-893.55	-2,401.75				
204-12-2	12	-882.55	-2,521.75				
204-12-3	12	-869.55	-2,452.75				
204-12-4	12	-835.55	-2,472.75				
204-13-1	13	-1,360.44	-2,633.75				
204-13-2	13	-1,353.44	-2,557.75				
204-13-3	13	-1,271.44	-2,567.75				
204-13-4	13	-1,251.44	-2,602.75				
204-14-1	14	-1,219.55	-2,627.75				
204-14-2	14	-1,210.55	-2,565.75				
204-14-3	14	-1,113.55	-2,664.75				
204-14-4	14	-1,101.55	-2,645.75				
204-15-1	15	-1,077.55	-2,593.75				
204-15-2	15	-1,065.55	-2,548.75				
204-15-3	15	-1,038.55	-2,676.75				
204-15-4	15	-998.55	-2,590.75				
204-16-1	16	-922.55	-2,529.75				
204-16-2	16	-911.55	-2,587.75				

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
204-16-3	16	-849.55	-2,583.75				
204-16-4	16	-822.55	-2,619.75				
204-17-1	17	-1,360.07	-2,737.75				
204-17-2	17	-1,339.07	-2,697.75				
204-17-3	17	-1,278.07	-2,725.75				
204-17-4	17	-1,264.07	-2,810.75				
204-18-1	18	-1,234.55	-2,725.75				
204-18-2	18	-1,211.55	-2,797.75				
204-18-3	18	-1,169.55	-2,774.75				
204-18-4	18	-1,113.55	-2,706.75				
204-19-1	19	-1,085.55	-2,711.75				
204-19-2	19	-1,068.55	-2,773.75				
204-19-3	19	-1,020.55	-2,791.75				
204-19-4	19	-960.55	-2,681.75				
204-20-1	20	-913.55	-2,721.75				
204-20-2	20	-866.55	-2,804.75				
204-20-3	20	-851.55	-2,711.75				
204-20-4	20	-819.55	-2,821.75				
204-21-1	21	-1,376.69	-2,871.75				
204-21-2	21	-1,372.69	-2,830.75				
204-21-3	21	-1,317.69	-2,915.75				
204-21-4	21	-1,276.69	-2,865.75				
204-22-1	22	-1,243.55	-2,862.75				
204-22-2	22	-1,212.55	-2,839.75				
204-22-3	22	-1,181.55	-2,889.75				
204-22-4	22	-1,150.55	-2,956.75	OF11B-01-01	-1,167.93	-2,947.01	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-23-1	23	-1,054.55	-2,911.75	OF11B-01-04	-1,031.02	-2,950.91	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
204-23-2	23	-1,052.55	-2,831.75				
204-23-3	23	-982.55	-2,830.75				
204-23-4	23	-978.55	-2,857.75				
204-24-1	24	-904.55	-2,912.75				
204-24-2	24	-896.55	-2,856.75				
204-24-3	24	-836.55	-2,880.75				
204-24-4	24	-828.55	-2,852.75				
SWMU 492 (no samples to be collected)							
SWMU 493							
493-01-1	1	-7,598.90	254.37	SYB003	-7,597.65	259.49	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
493-01-2	1	-7,599.90	222.37				
493-01-3	1	-7,612.90	212.37				
493-01-4	1	-7,630.90	195.37				
493-02-1	2	-7,636.74	97.93				
493-02-2	2	-7,662.74	94.93				
493-02-3	2	-7,670.74	84.93				
493-02-4	2	-7,658.74	58.93				
SWMU 517							

Table B.4. RI Sample Location Coordinates for the Soil/Rubble Pile Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
517-01-1	1	-7,320.84	-9.23				
517-01-2	1	-7,312.84	-23.23				
517-01-3	1	-7,318.84	-42.23				
517-01-4	1	-7,314.84	-63.23				
SWMU 541 (no samples to be collected)							
SWMU 561 (no samples to be collected)							

Blue shading indicates sample provides definitive data from a historical investigation.

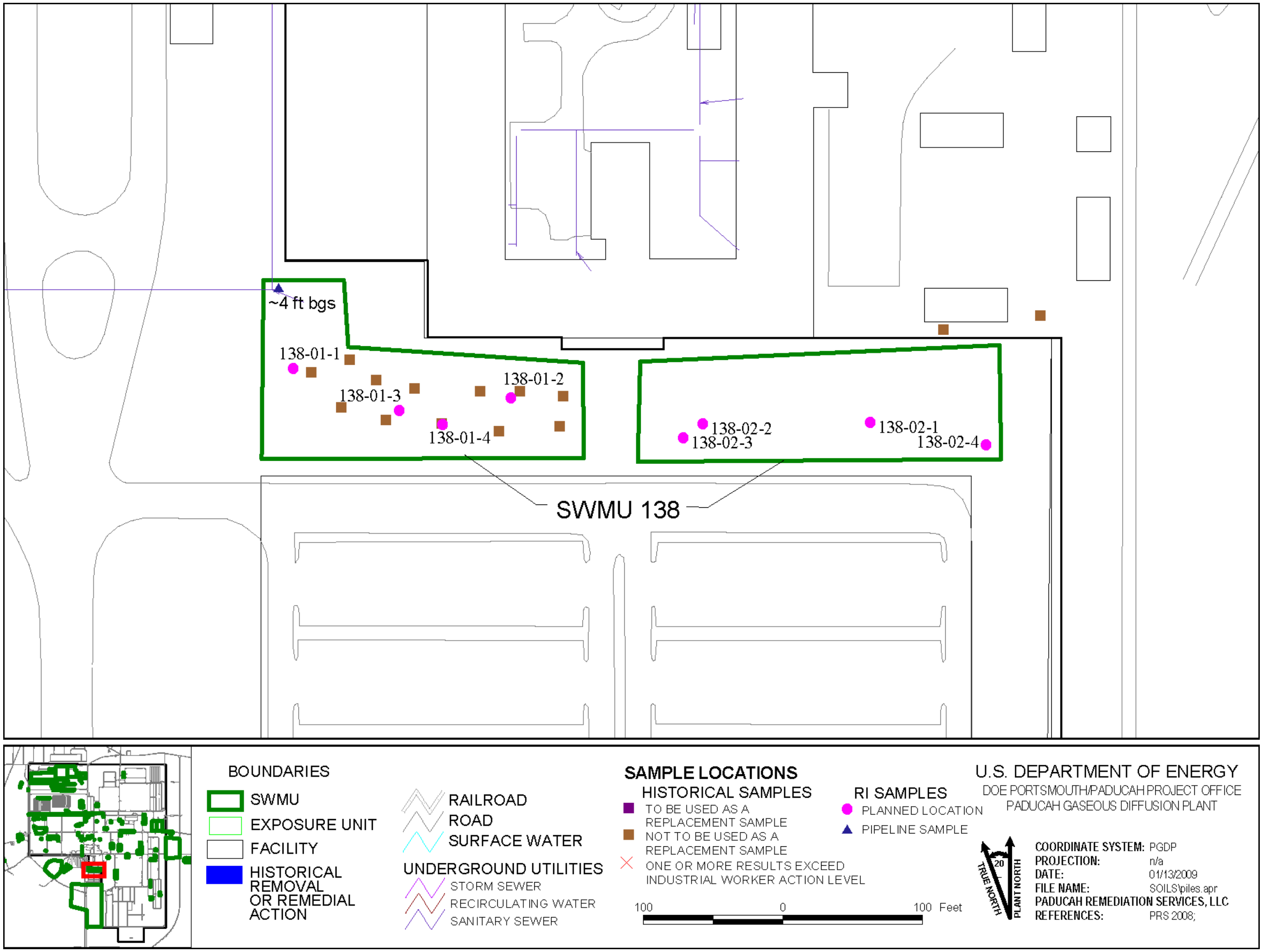

Figure B.17. Soils OU RI Samples for SWMU 138

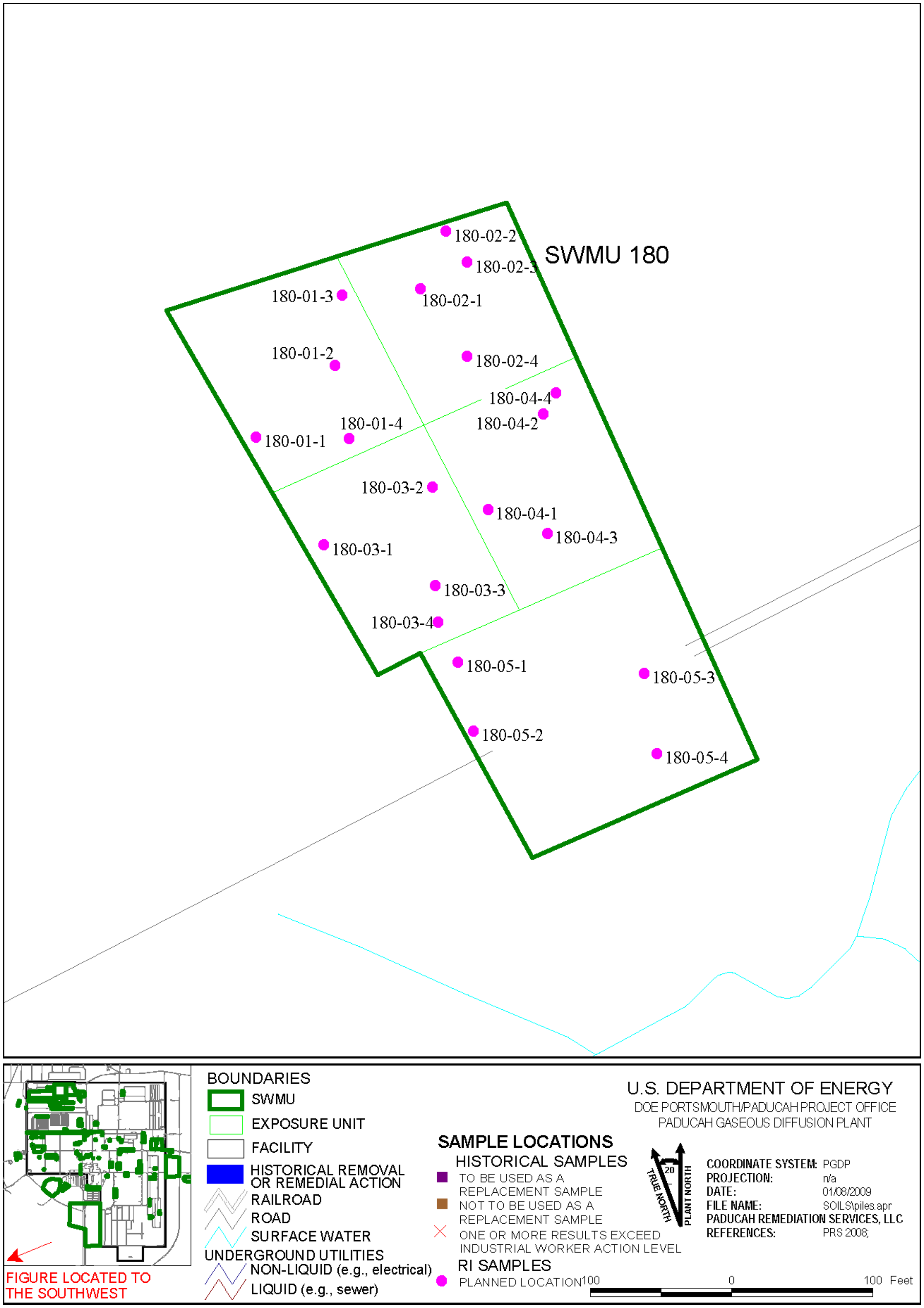

Figure B.18. Soils OU RI Samples for SWMU 180

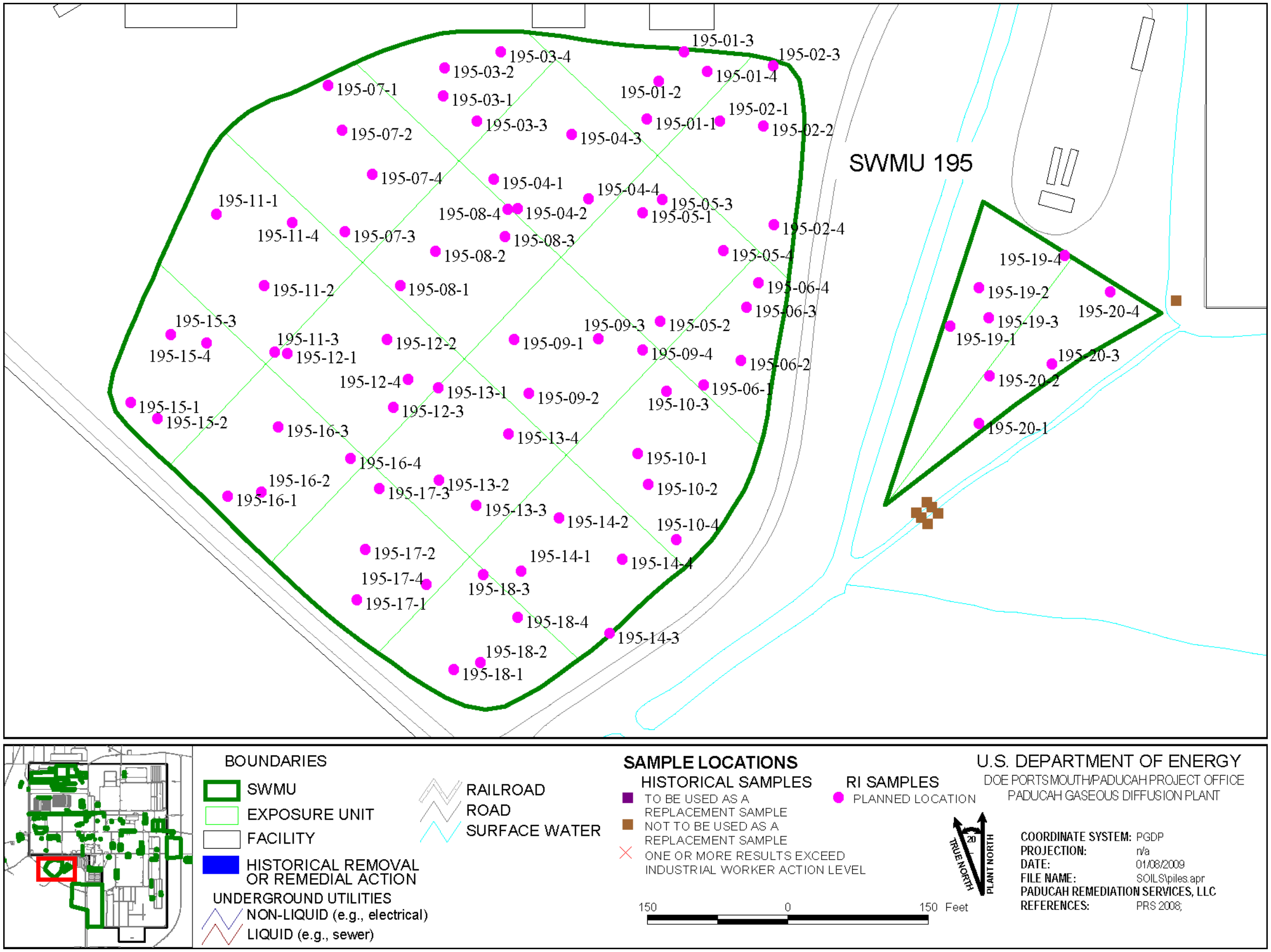

Figure B.19. Soils OU RI Samples for SWMU 195

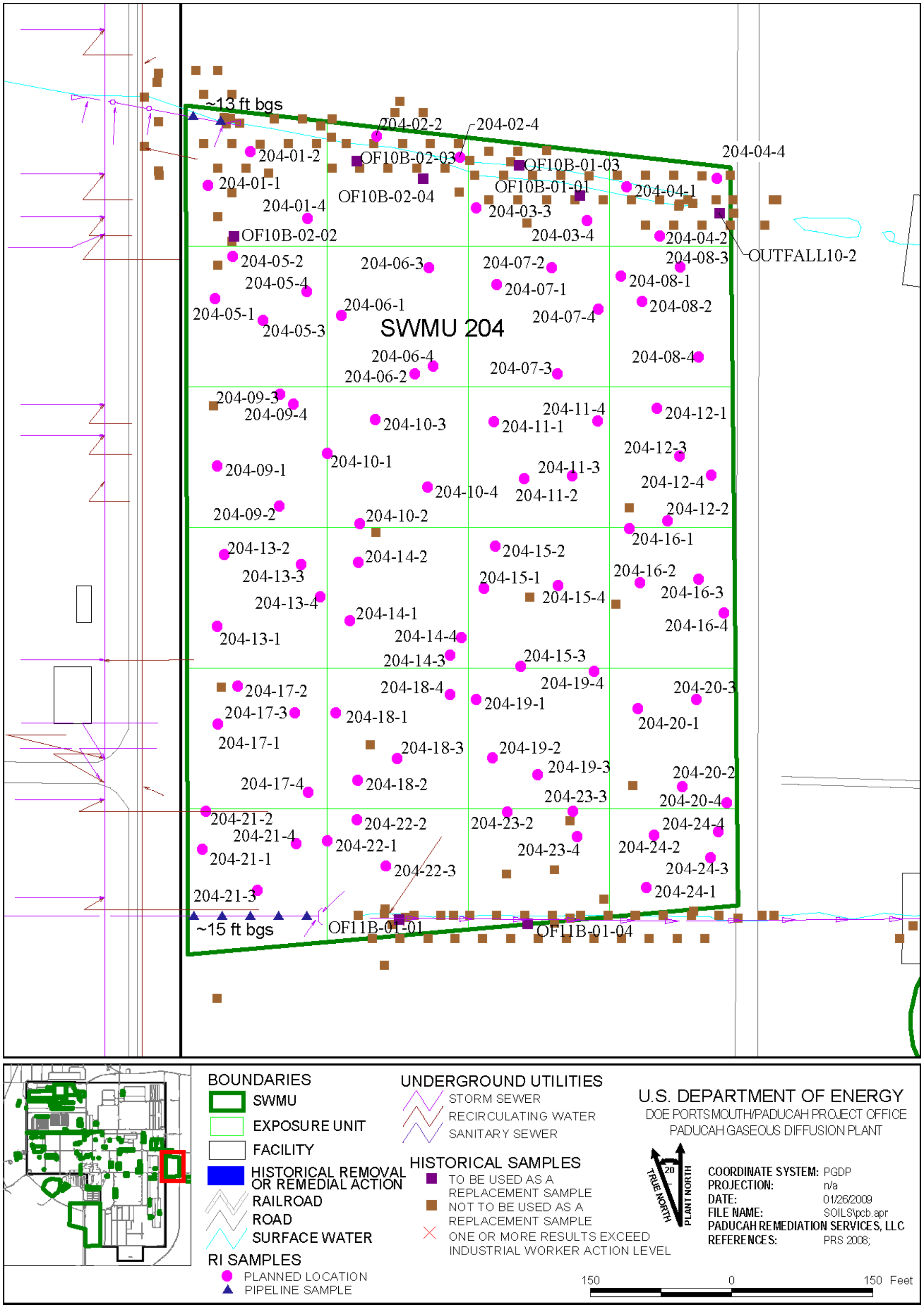

Figure B.20. Soils OU RI Samples for SWMU 204

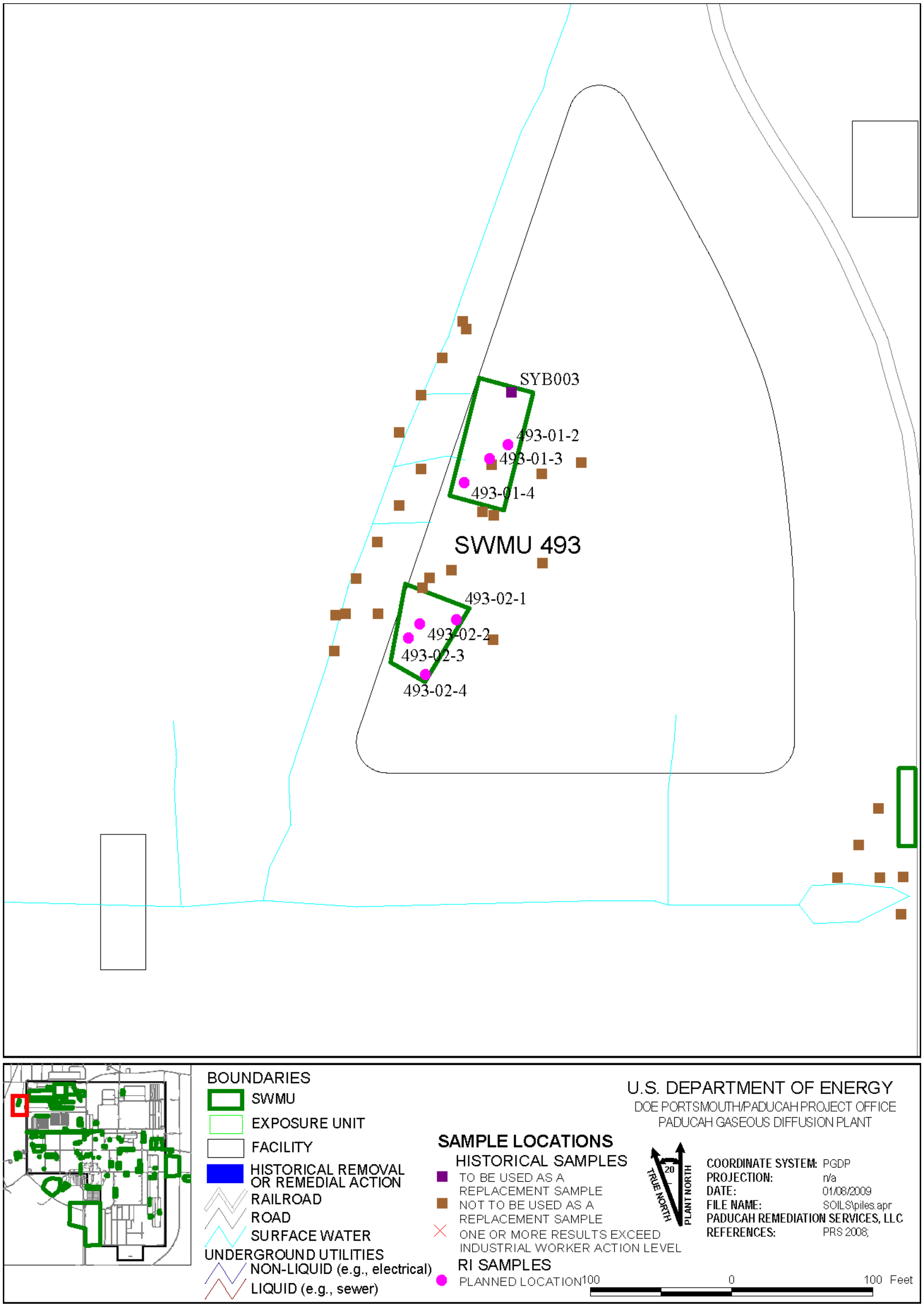

Figure B.21. Soils OU RI Samples for SWMU 493

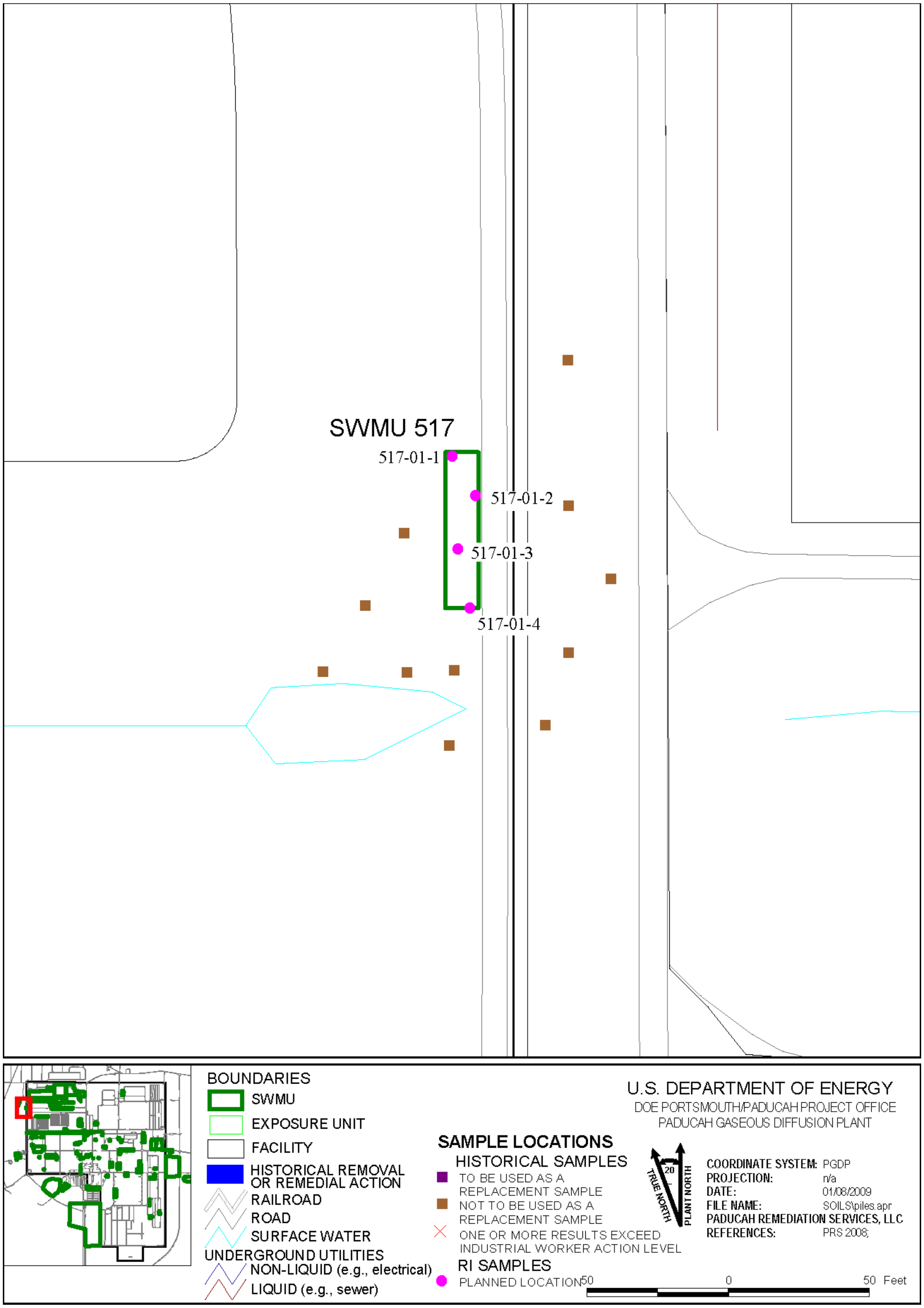

Figure B.22. Soils OU RI Samples for SWMU 517

Scrap Yards Group

The units and areas comprising the scrap yards grouping are listed below. As necessary, SWMUs greater than 0.5 acre were divided into exposure units, consistent with guidance in the Risk Methods Document. For practicality, some SWMUs greater than 0.5 acre were not divided (such as SWMU 12 at 0.7 acre); however, the average of the exposure units over the scrap yard grouping remained reasonably close to 0.5 acre.

SWMU	**Acres**
12	0.7
13	
EU 13-01	0.429
EU 13-02	0.432
EU 13-03	0.429
EU 13-04	0.431
EU 13-05	0.374
EU 13-06	0.517
EU 13-07	0.517
EU 13-08	0.517
EU 13-09	0.508
EU 13-10	0.517
EU 13-11	0.496
EU 13-12	0.517
EU 13-13	0.571
EU 13-14	0.586
14	
EU 14-01	0.471
EU 14-02	0.536

SWMU	**Acres**
EU 14-03	0.500
EU 14-04	0.484
EU 14-05	0.483
EU 14-06	0.471
EU 14-07	0.476
EU 14-08	0.487
EU 14-09	0.480
EU 14-10	0.480
EU 14-11	0.430
EU 14-12	0.450
15	
EU 15-01	0.515
EU 15-02	0.591
EU 15-03	0.517
EU 15-04	0.517
EU 15-05	0.289
EU 15-06	0.487
EU 15-07	0.489
EU 15-08	0.491

SWMU	**Acres**
EU 15-09	0.502
EU 15-10	0.631
EU 15-11	0.258
16	
EU 16-01	0.482
EU 16-02	0.507
EU 16-03	0.499
EU 16-04	0.528
518	0.8
520	
EU 520-01	0.468
EU 520-02	0.465
EU 520-03	0.494
EU 520-04	0.496
EU 520-05	0.503
EU 520-06	0.467
Total Acres	**24.3**
Average Acres/EU	**0.49**

The locations were randomly chosen by VSP and are displayed below in Figures B.23 through B.29. A list of sample coordinates is provided in Table B.5. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 12							
012-01-1	1	-6,374.23	822.93				
012-01-2	1	-6,253.23	784.93				
012-01-3	1	-6,392.23	748.93				
012-01-4	1	-6,345.23	724.93				
SWMU 13							
013-01-1	1	-7,180.16	616.72	C746P1GR41	-7,172.3	594.3	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-01-2	1	-7,098.16	609.72				
013-01-3	1	-7,066.16	578.72	C746P1GR33	-7,094.7	551.5	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-01-4	1	-7,146.16	549.72	C746P1GR31	-7,182.7	551.7	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-02-1	2	-7,065.11	497.6	C746P1GR13	-7,088.4	463.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-02-2	2	-7,058.11	489.6	C746P1GR14	-7,047.7	465.3	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-02-3	2	-7,185.11	466.6				
013-02-4	2	-7,153.11	416.6				
013-03-1	3	-6,982.16	608.43				
013-03-2	3	-7,025.16	607.43	C746P1GR45	-7,037	591.9	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-03-3	3	-6,929.16	602.43	C746P1GR58	-6,922.8	633.5	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-03-4	3	-6,985.16	589.43	C746P1GR37	-6,972.2	570.3	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-04-1	4	-7,018.16	489.61				
013-04-2	4	-7,022.16	466.61	C746P1GR15	-7,009.5	459.8	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-04-3	4	-6,901.16	447.61	C746P1GR18	-6,905.8	458.9	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-04-4	4	-6,994.16	399.61	C746P1GR5	-7,012.4	439.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-05-1	5	-6,829.16	624.48	C746P1GR60	-6,790	623.8	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-05-2	5	-6,891.16	616.48				
013-05-3	5	-6,762.16	605.48				
013-05-4	5	-6,866.16	566.48				
013-06-1	6	-6,754.16	535.61				
013-06-2	6	-6,807.16	518.61				
013-06-3	6	-6,814.16	492.61	C746P1GR20	-6,804.1	463.7	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-06-4	6	-6,820.16	415.61				
013-07-1	7	-6,678.16	688.61				
013-07-2	7	-6,647.16	604.61	C746PGR83	-6,675.8	594.3	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-07-3	7	-6,714.16	572.61				
013-07-4	7	-6,619.16	562.61				

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
013-08-1	8	-6,698.16	549.62	C746PGR65	-6,740.6	544.9	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-08-2	8	-6,618.16	476.62				
013-08-3	8	-6,694.16	414.62	SYP004	-6,685.7	448.7	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-08-4	8	-6,693.16	407.62	C746PGR1	-6,728.5	426.6	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-09-1	9	-6,472.16	675.62	DD-07	-6,469.1	681.2	0-0 ft bgs/Metals, PCB, Radionuclides, SVOA
013-09-2	9	-6,455.16	674.62	C746PGR104	-6,477.5	660.2	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-09-3	9	-6,574.16	593.62	SYP007	-6,551.9	601.8	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-09-4	9	-6,481.16	559.62	SYP001	-6,490.7	561.7	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-10-1	10	-6,518.16	534.61	C746PGR38	-6,506.9	513.8	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-10-2	10	-6,498.16	488.61	SYP006	-6,486.2	452.5	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-10-3	10	-6,487.16	428.61	C746PGR7	-6,498.5	420	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-10-4	10	-6,587.16	410.61	SYP005	-6,583.6	452.5	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-11-1	11	-6,367.16	677.88	C746PGR106	-6,365.4	636.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-11-2	11	-6,305.16	617.88	C746PGR91	-6,314.7	596.8	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-11-3	11	-6,419.16	603.88	SYP002	-6,388.2	566.8	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-11-4	11	-6,360.16	561.88	C746PGR58	-6,365.3	565.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-12-1	12	-6,356.16	542.61				
013-12-2	12	-6,426.16	540.61	C746PGR41	-6,423.4	511.9	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-12-3	12	-6,339.16	508.61				
013-12-4	12	-6,373.16	413.61	C746PGR27	-6,350.8	454.5	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-13-1	13	-6,219.16	685.31				
013-13-2	13	-6,137.16	683.31				
013-13-3	13	-6,220.16	595.31	C746PGR78	-6,193.1	589.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-13-4	13	-6,128.16	585.31				
013-14-1	14	-6,251.16	540.61				
013-14-2	14	-6,247.16	491.61	C746PGR29	-6,253.6	457.6	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
013-14-3	14	-6,151.16	420.61	C746PGR31	-6,186	456.4	3-3.5 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
013-14-4	14	-6,260.16	403.61				
SWMU 14							
014-01-1	1	-6,061.77	945.21	DOESS-3	-6,060	946	0-0 ft bgs/PCB, Radionuclides
014-01-2	1	-6,113.77	911.21				
014-01-3	1	-5,986.77	883.21				
014-01-4	1	-5,989.77	846.21				
014-02-1	2	-5,640.33	593.5				
014-02-2	2	-5,786.33	578.5				
014-02-3	2	-5,629.33	570.5				
014-02-4	2	-5,737.33	476.5				
014-03-1	3	-5,853.66	560.02				
014-03-2	3	-5,953.66	547.02				
014-03-3	3	-5,885.66	509.02				
014-03-4	3	-5,853.66	494.02				
014-04-1	4	-5,991.99	570.21				
014-04-2	4	-6,052.99	529.21				
014-04-3	4	-6,082.99	497.21				
014-04-4	4	-5,984.99	493.21				
014-05-1	5	-5,720.82	699.2				
014-05-2	5	-5,778.82	665.2				
014-05-3	5	-5,633.82	634.2				
014-05-4	5	-5,645.82	615.2				
014-06-1	6	-5,951.89	701.42				
014-06-2	6	-5,811.89	664.42				
014-06-3	6	-5,902.89	662.42				
014-06-4	6	-5,829.89	620.42				
014-07-1	7	-5,984.92	699.71				
014-07-2	7	-6,061.92	692.71				
014-07-3	7	-6,004.92	627.71				
014-07-4	7	-6,027.92	586.71				
014-08-1	8	-5,711.42	811.8				
014-08-2	8	-5,764.42	804.8				
014-08-3	8	-5,630.42	772.8				
014-08-4	8	-5,731.42	726.8				
014-09-1	9	-5,894.16	806.05				
014-09-2	9	-5,827.16	778.05				
014-09-3	9	-5,846.16	763.05				
014-09-4	9	-5,927.16	741.05				
014-10-1	10	-5,964.85	794.33				
014-10-2	10	-6,055.85	792.33				
014-10-3	10	-5,977.85	759.33				
014-10-4	10	-6,093.85	722.33				
014-11-1	11	-5,643.01	934.69				
014-11-2	11	-5,722.01	931.69				
014-11-3	11	-5,655.01	898.69				
014-11-4	11	-5,684.01	892.69				
014-12-1	12	-5,864.42	947.45				

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
014-12-2	12	-5,835.42	913.45				
014-12-3	12	-5,924.42	910.45				
014-12-4	12	-5,802.42	846.45				
,SWMU 15							
015-01-1	1	-5,485.51	936.62				
015-01-2	1	-5,513.51	902.62				
015-01-3	1	-5,612.51	893.62				
015-01-4	1	-5,612.51	847.62				
015-02-1	2	-5,394.51	945.74				
015-02-2	2	-5,454.51	907.74				
015-02-3	2	-5,382.51	858.74				
015-02-4	2	-5,462.51	810.74				
015-03-1	3	-5,584.51	784.62	C746CGR13	-5,609.9	763.2	3-3 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
015-03-2	3	-5,501.51	754.62				
015-03-3	3	-5,589.51	714.62				
015-03-4	3	-5,493.51	676.62				
015-04-1	4	-5,359.51	790.62				
015-04-2	4	-5,350.51	777.62				
015-04-3	4	-5,422.51	711.62				
015-04-4	4	-5,397.51	671.62				
015-05-1	5	-5,299.51	798.62				
015-05-2	5	-5,295.51	708.62				
015-05-3	5	-5,309.51	682.62				
015-05-4	5	-5,198.51	670.62				
015-06-1	6	-5,555.51	650.62				
015-06-2	6	-5,539.51	589.62				
015-06-3	6	-5,613.51	541.62				
015-06-4	6	-5,584.51	526.62				
015-07-1	7	-5,332.51	633.62				
015-07-2	7	-5,436.51	614.62				
015-07-3	7	-5,447.51	562.62				
015-07-4	7	-5,384.51	517.62				
015-08-1	8	-5,318.51	654.62				
015-08-2	8	-5,285.51	603.62				
015-08-3	8	-5,193.51	586.62				
015-08-4	8	-5,226.51	514.62				
015-09-1	9	-5,090.51	652.49				
015-09-2	9	-5,164.51	594.49				
015-09-3	9	-5,111.51	582.49				
015-09-4	9	-5,052.51	581.49				
015-10-1	10	-4,944.89	602.46				
015-10-2	10	-5,006.89	600.46				
015-10-3	10	-4,855.89	567.46				
015-10-4	10	-4,925.89	534.46				
015-11-1	11	-5,013.47	508.19				
015-11-2	11	-4,888.47	496.19				
015-11-3	11	-4,960.47	480.19				

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
015-11-4	11	-5,002.47	466.19				
SWMU 16							
016-01-1	1	-1,889.90	-1,389.82				
016-01-2	1	-1,978.90	-1,399.82				
016-01-3	1	-1,853.90	-1,454.82				
016-01-4	1	-1,808.90	-1,460.82				
016-02-1	2	-1,804.99	-1,521.51	099-008	-1,803.1	-1,488	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
016-02-2	2	-1,935.99	-1,530.51				
016-02-3	2	-1,857.99	-1,557.51				
016-02-4	2	-1,958.99	-1,572.51				
016-03-1	3	-1,849.90	-1,628.21	099-006	-1,802.9	-1,618	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
016-03-2	3	-1,950.90	-1,635.21				
016-03-3	3	-1,892.90	-1,645.21				
016-03-4	3	-1,860.90	-1,677.21				
016-04-1	4	-1,805.21	-1,719.91				
016-04-2	4	-1,802.21	-1,734.91	099-005	-1,802.6	-1,759	0-3 ft bgs/Metals, PCB, Radionuclides, SVOA
016-04-3	4	-1,963.21	-1,746.91				
016-04-4	4	-1,870.21	-1,784.91				
SWMU 518							
518-01-1	1	-7,216.33	257.88	SYP1-001	-7,169.6	274.5	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
518-01-2	1	-7,113.33	294.88	SYP1-002	-7,067.2	277.4	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
518-01-3	1	-7,012.33	283.88	SYP1-003	-6,971.1	283.3	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
518-01-4	1	-6,871.33	244.88	SYP1-004	-6,874.42	283	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA, VOA
SWMU 520							
520-01-1	1	-6,232.16	347.77				
520-01-2	1	-6,205.16	307.77				
520-01-3	1	-6,253.16	215.77				
520-01-4	1	-6,284.16	203.77				
520-02-1	2	-6,105.53	318.57				
520-02-2	2	-6,181.53	303.57				
520-02-3	2	-6,146.53	256.57				
520-02-4	2	-6,126.53	207.57				
520-03-1	3	-6,002.25	357.35				
520-03-2	3	-5,978.25	289.35				
520-03-3	3	-6,050.25	238.35				
520-03-4	3	-6,065.25	220.35				
520-04-1	4	-5,942.16	310.51				
520-04-2	4	-5,967.16	283.51				
520-04-3	4	-5,962.16	239.51				
520-04-4	4	-5,975.16	203.51				

Table B.5. RI Sample Location Coordinates for the Scrap Yard Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
520-05-1	5	-5,802.88	373.23				
520-05-2	5	-5,804.88	339.23				
520-05-3	5	-5,845.88	258.23				
520-05-4	5	-5,789.88	211.23				
520-06-1	6	-5,749.76	299.95				
520-06-2	6	-5,684.76	274.95				
520-06-3	6	-5,700.76	247.95				
520-06-4	6	-5,721.76	205.95				

Blue shading indicates sample provides definitive data from a historical investigation.

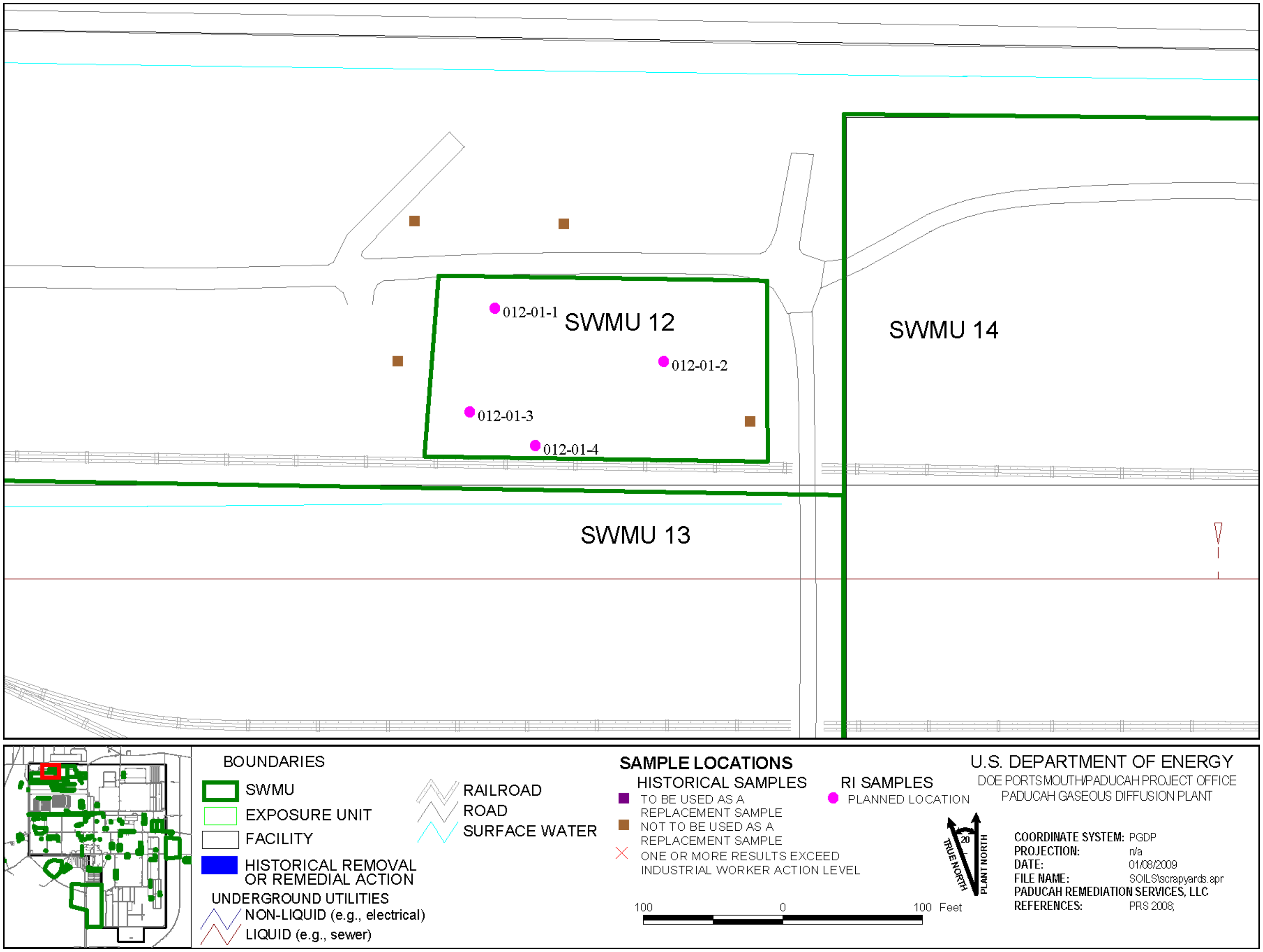

Figure B.23. Soils OU RI Samples for SWMU 12

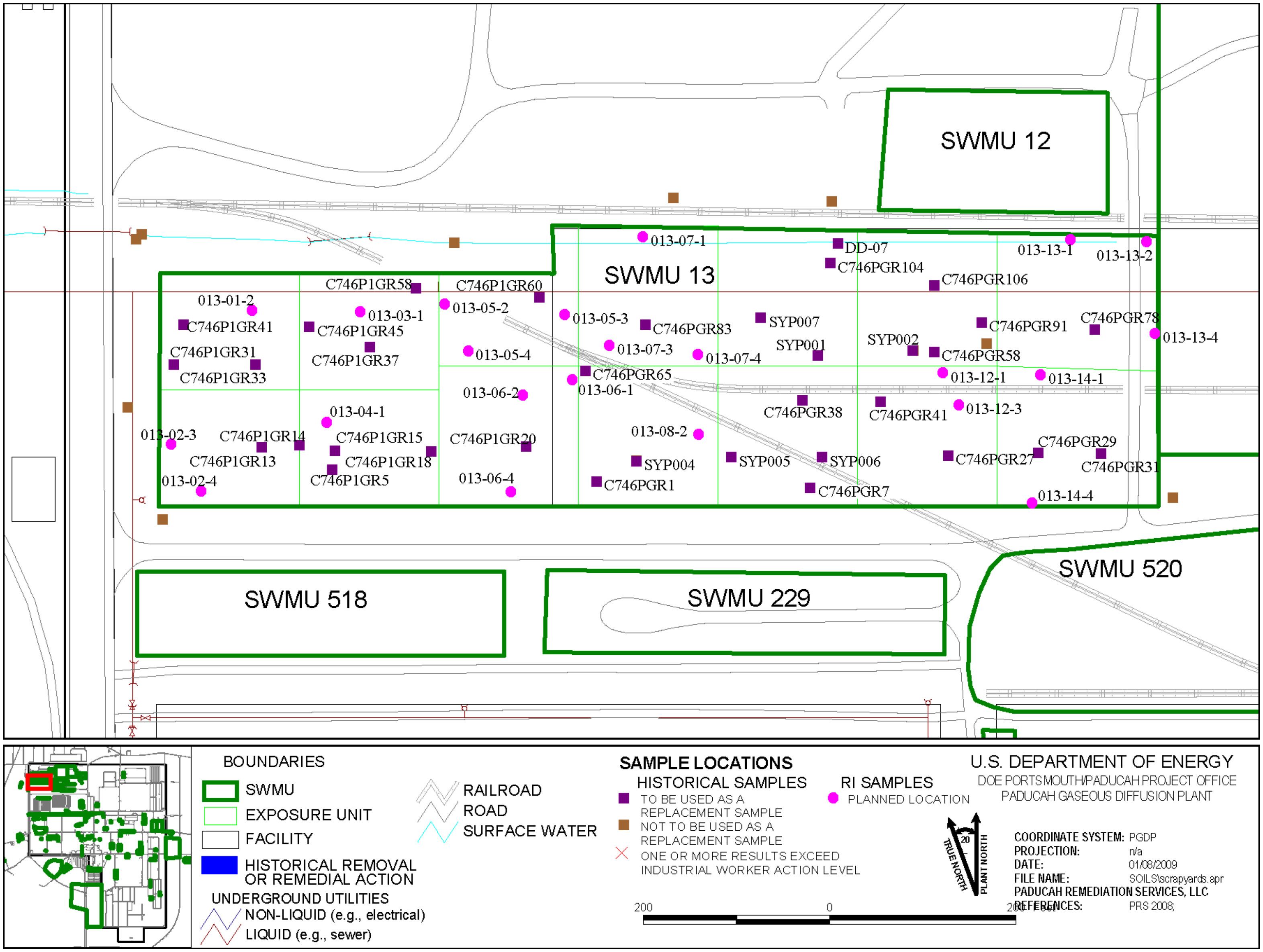

Figure B.24. Soils OU RI Samples for SWMU 13

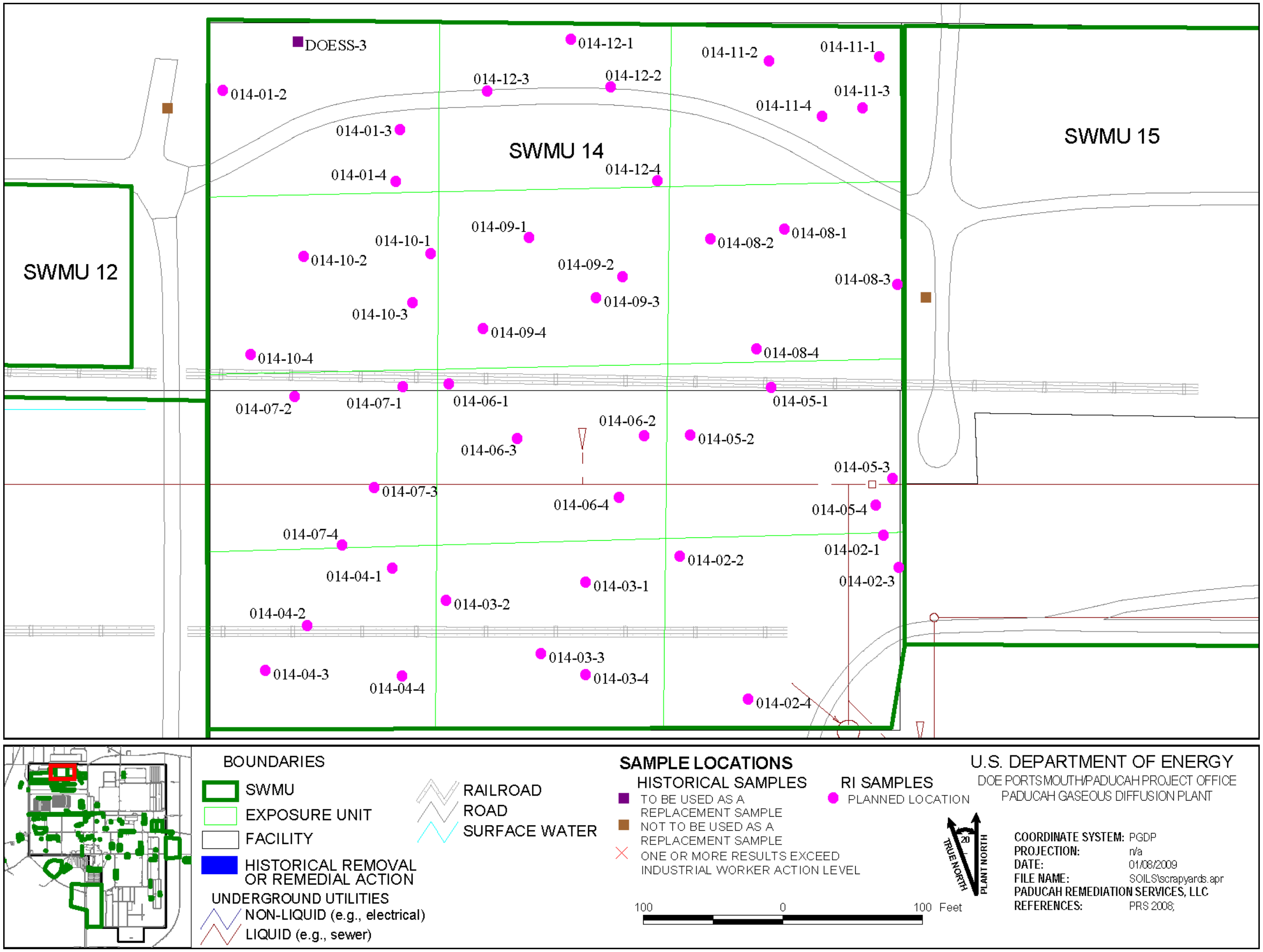

Figure B.25. Soils OU RI Samples for SWMU 14

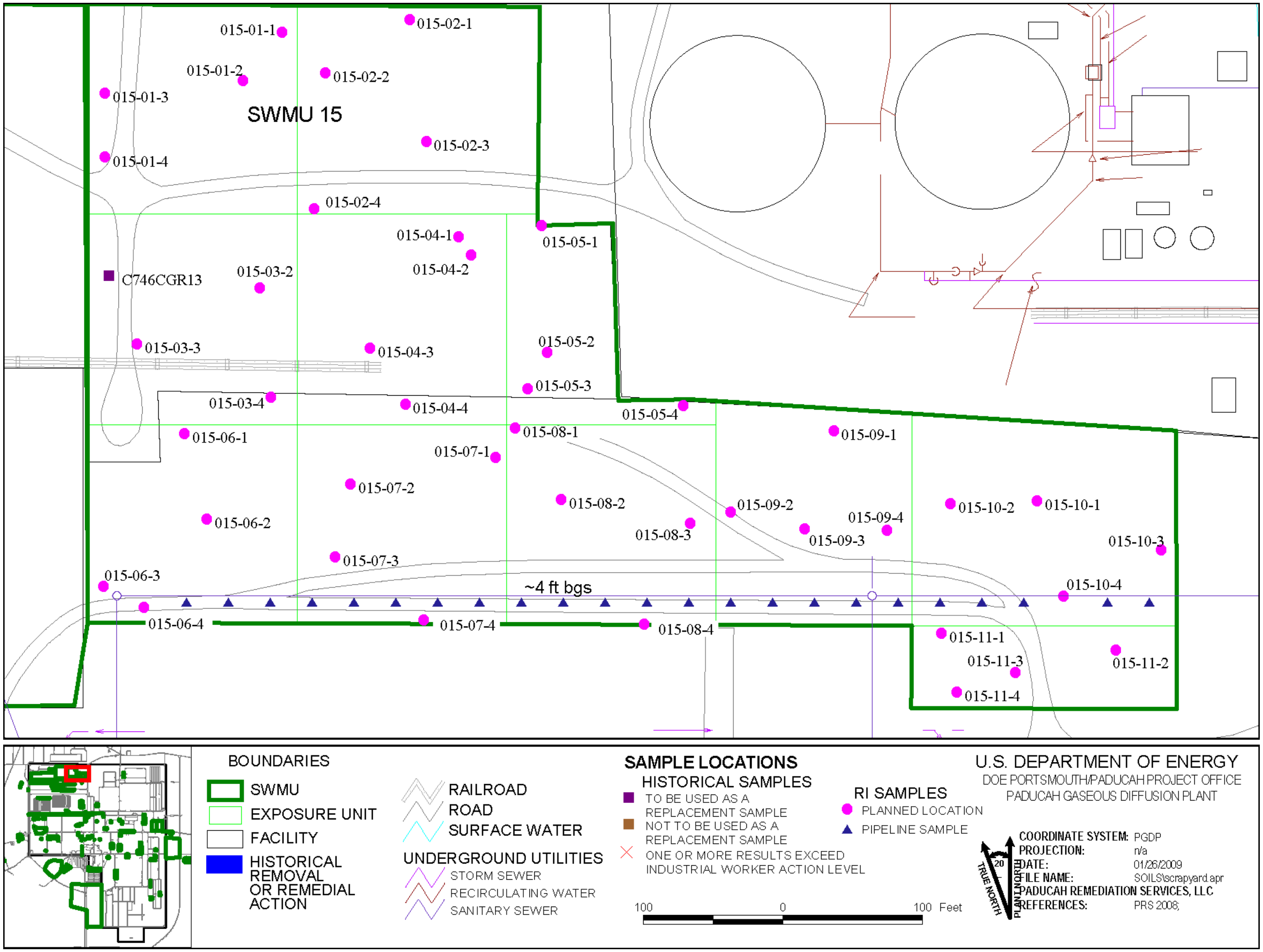

Figure B.26. Soils OU RI Samples for SWMU 15

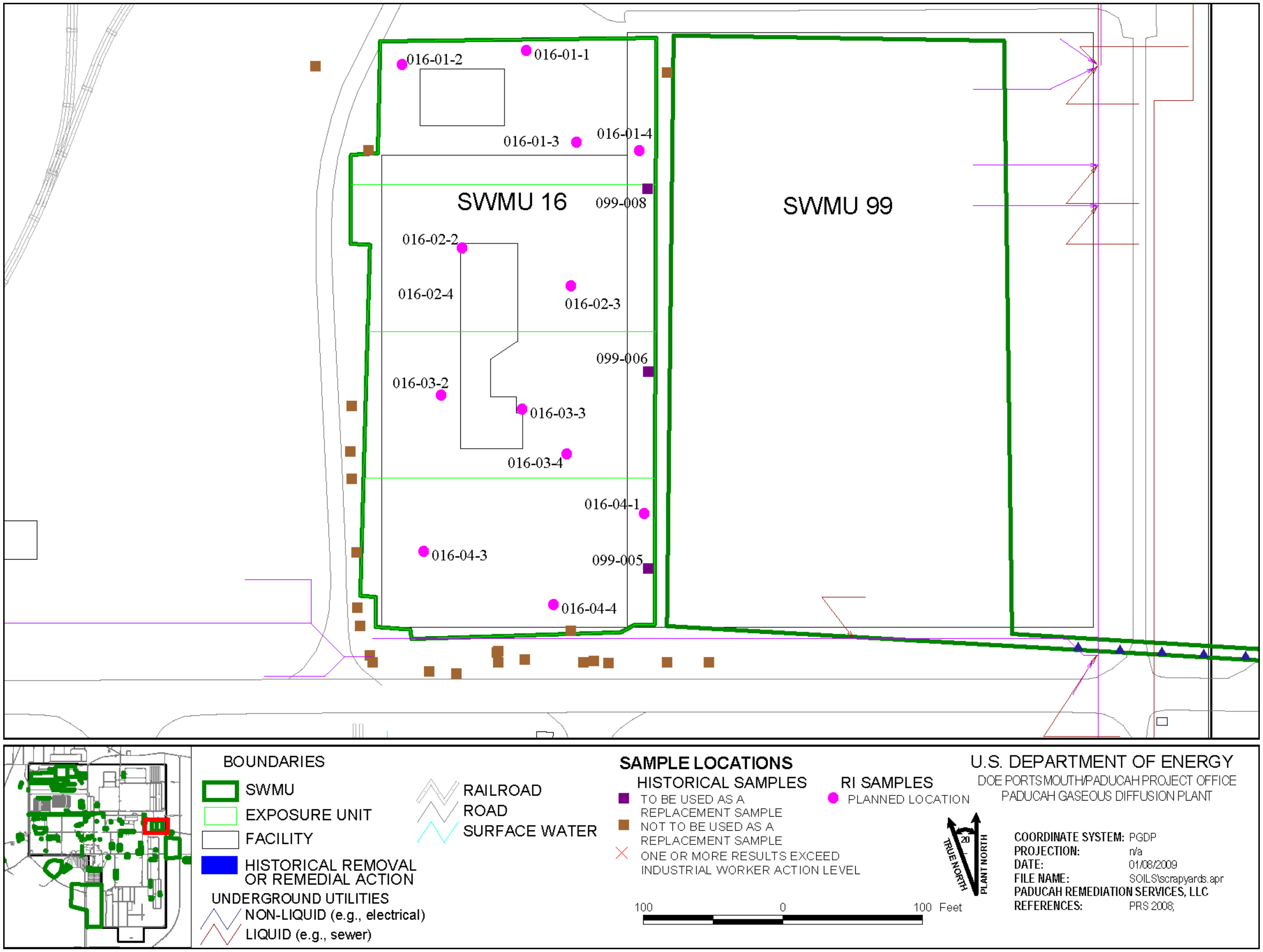

Figure B.27. Soils OU RI Samples for SWMU 16

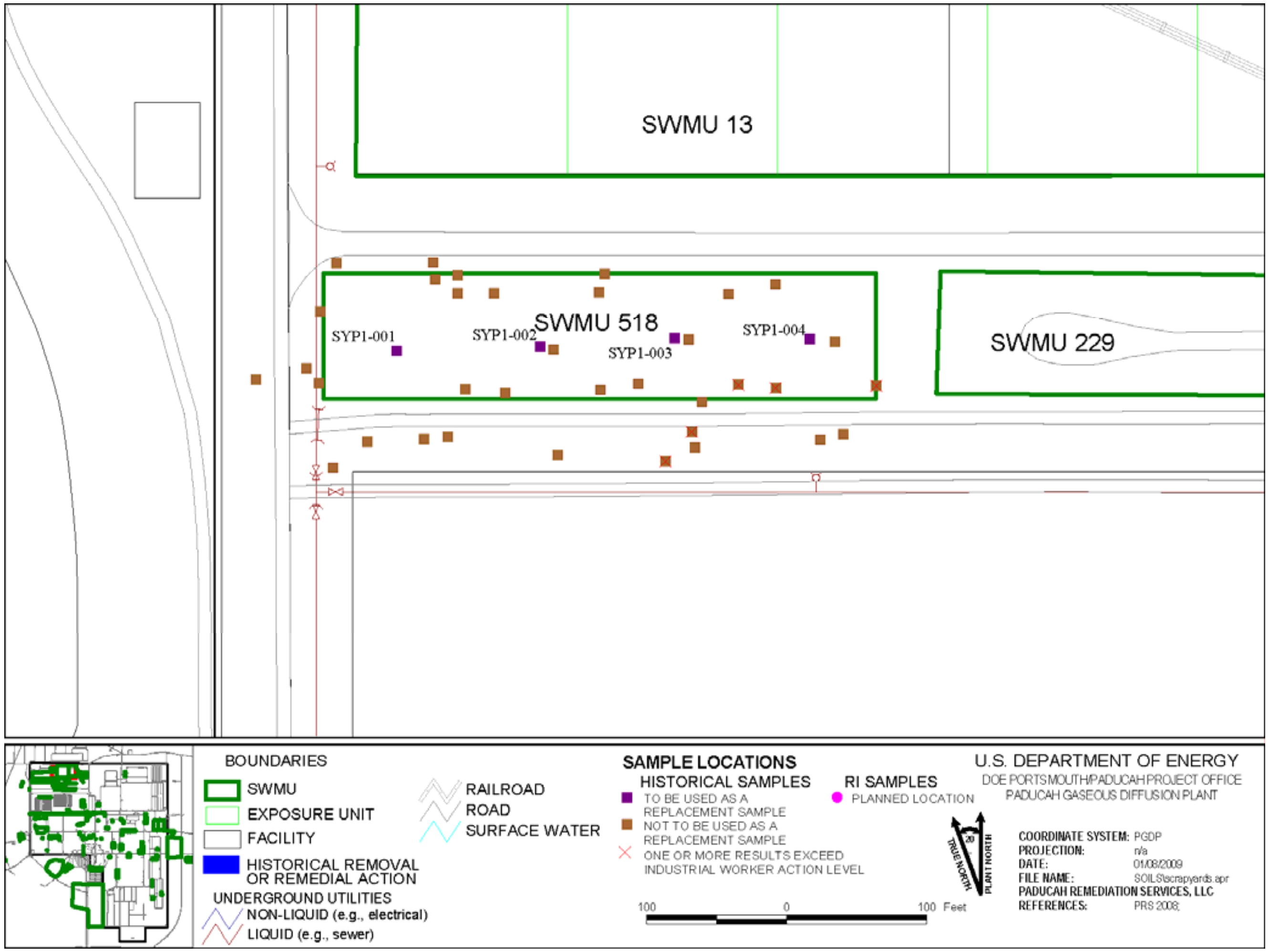

Figure B.28. Soils OU RI Samples for SWMU 518

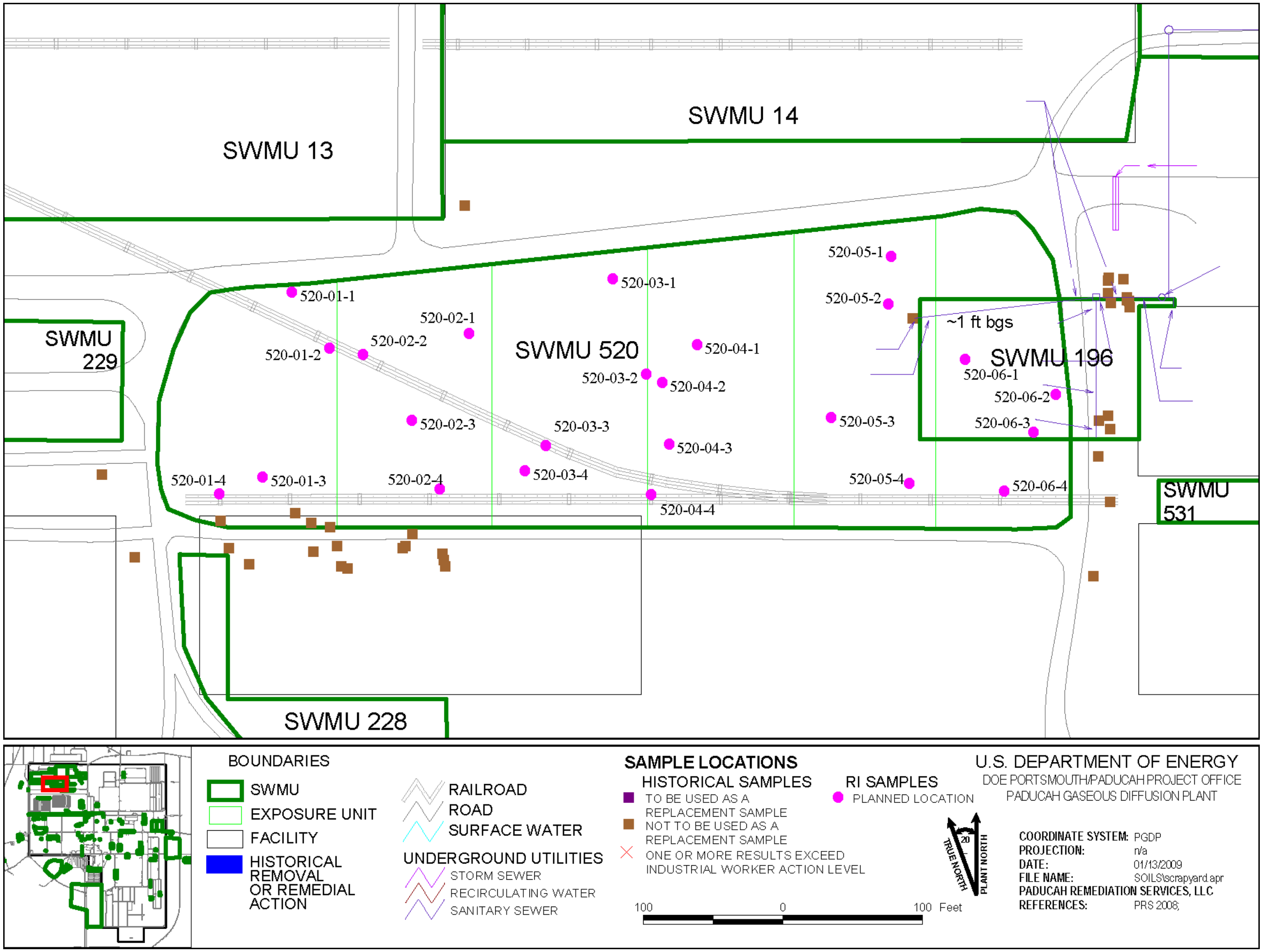

Figure B.29. Soils OU RI Samples for SWMU 520

Underground/Tank Group

The units and areas comprising the Underground/Tank grouping are listed below. No SWMUs within this grouping were greater than 0.5 acre, so division into EUs was not necessary.

SWMUs 27, 31, 32, 40, 77, 165, and 170 will not be sampled.

SWMU	**Acres**
11	0.020
26	0.041
76	0.019
Total Acres	**0.08**
Average Acres/EU	**0.03**

SWMUs 31 and 32 both have a concrete surface; therefore, a RAD evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected at each SWMU.

SWMU 77 has a concrete surface and may be holding water; therefore a water sample will be taken and characterized for disposal. Then the water removed. Then a rad evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected.

SWMUs 27, 165, and 170 have been previously investigated and have enough data to proceed to a FS.

SWMU 40 is part of the SOU Inactive Facilities and is listed for a removal action.

The locations were randomly chosen by VSP and are displayed below in Figures B.30 through B.32. A list of sample coordinates is provided in Table B.6. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.6. RI Sample Location Coordinates for the Underground/Tank Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 11							
011-01-1	1	-4,039.69	-1,681.30				
011-01-2	1	-4,041.69	-1,695.30				
011-01-3	1	-4,045.69	-1,707.30				
011-01-4	1	-4,032.69	-1,709.30				
SWMU 26							
026-01-1	1	-5,479.66	-1,058.00				
026-01-2	1	-5,138.66	-1,058.00				
026-01-3	1	-4,269.66	-1,058.00				
026-01-4	1	-4,085.66	-1,133.00				
SWMU 27 (no samples to be collected)							
SWMU 31 (no samples to be collected)							
SWMU 32 (no samples to be collected)							
SWMU 40 (no samples to be collected)							
SWMU 76							
076-01-1	1	-3,287.22	-1,466.63				
076-01-2	1	-3,282.22	-1,468.63				
076-01-3	1	-3,276.22	-1,484.63				
076-01-4	1	-3,279.22	-1,491.63				
SWMU 77 (no samples to be collected)							
SWMU 165 (no samples to be collected)							
SWMU 170 (no samples to be collected)							

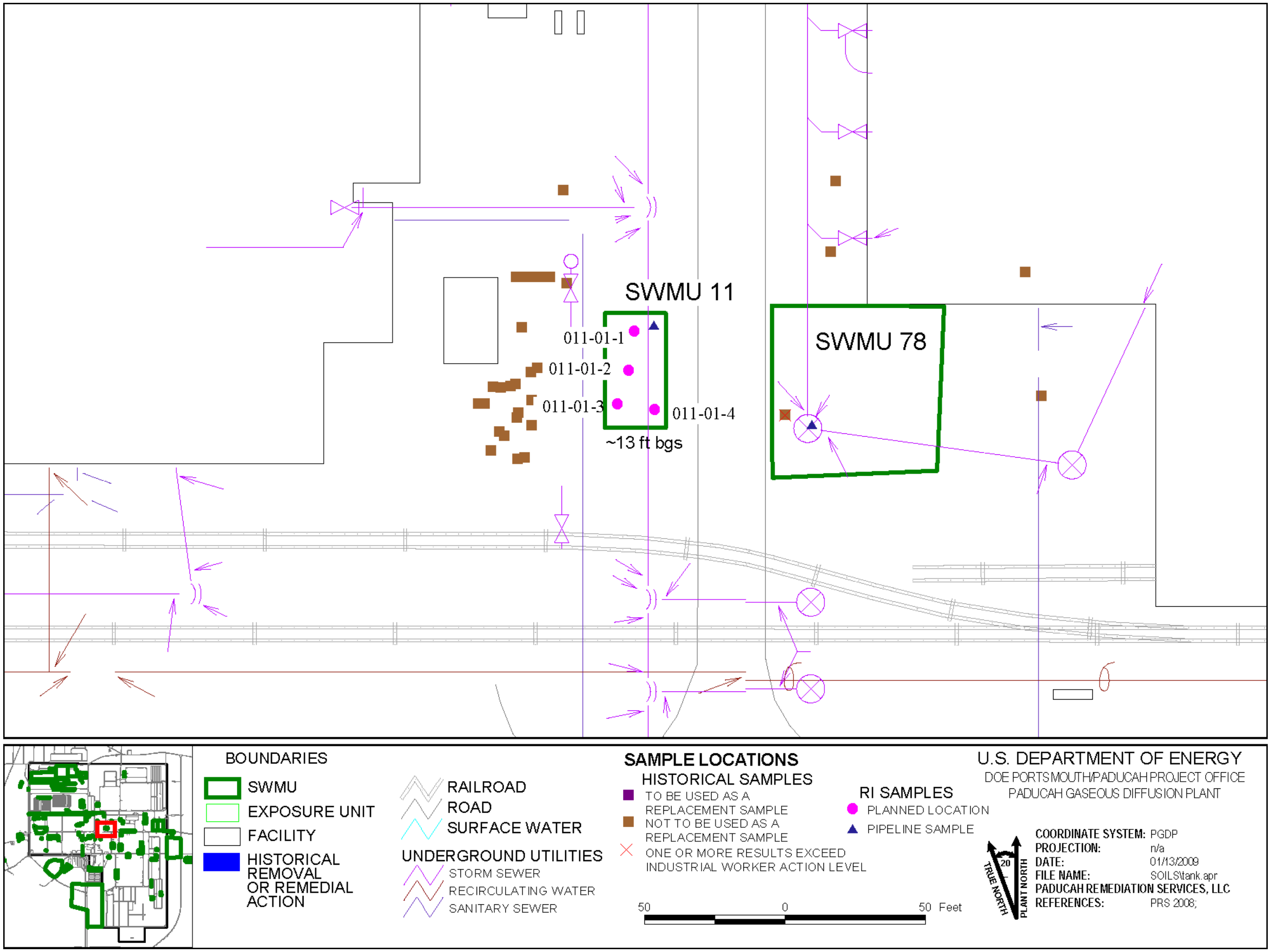

Figure B.30. Soils OU RI Samples for SWMU 11

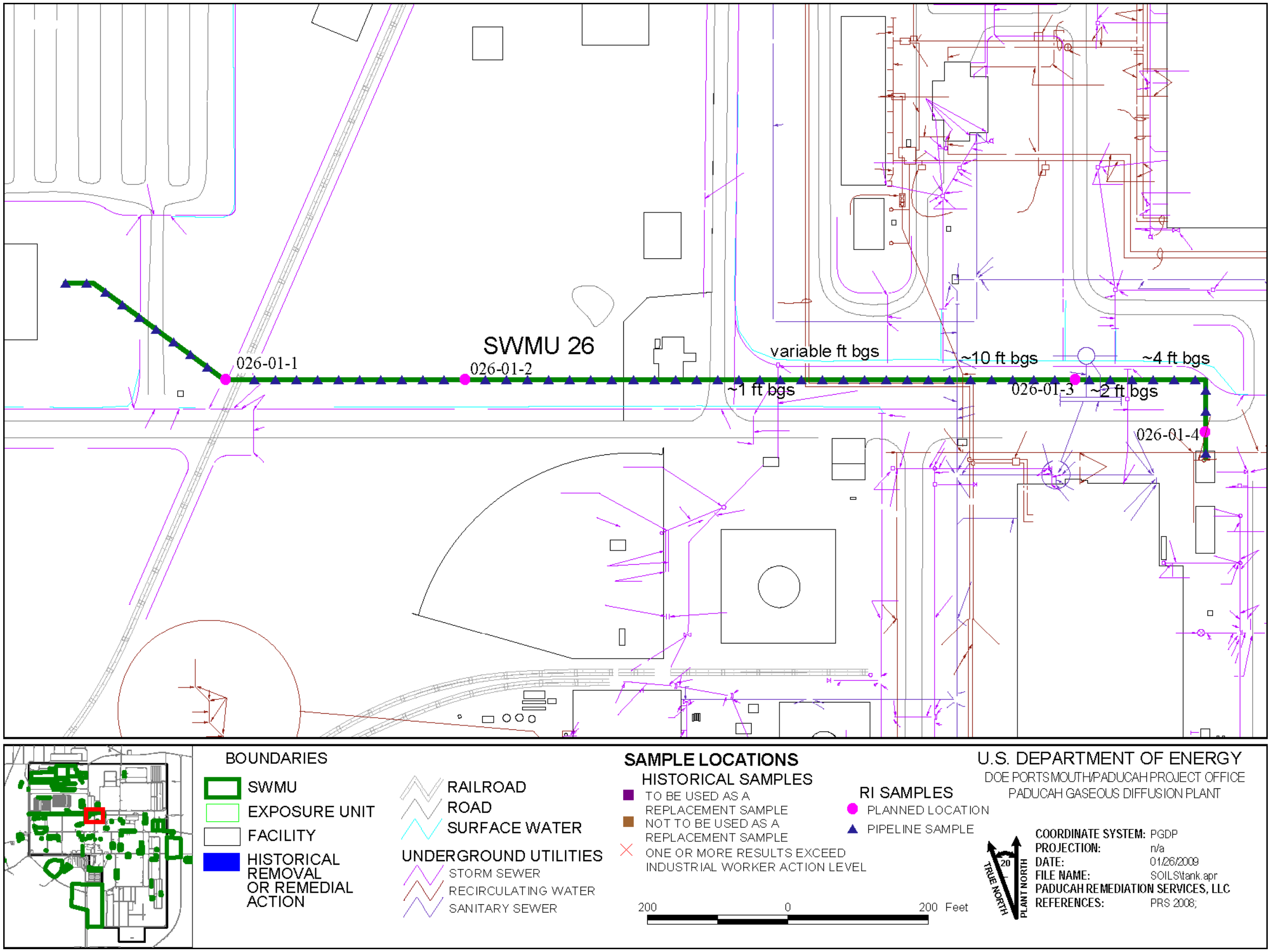

Figure B.31. Soils OU RI Samples for SWMU 26

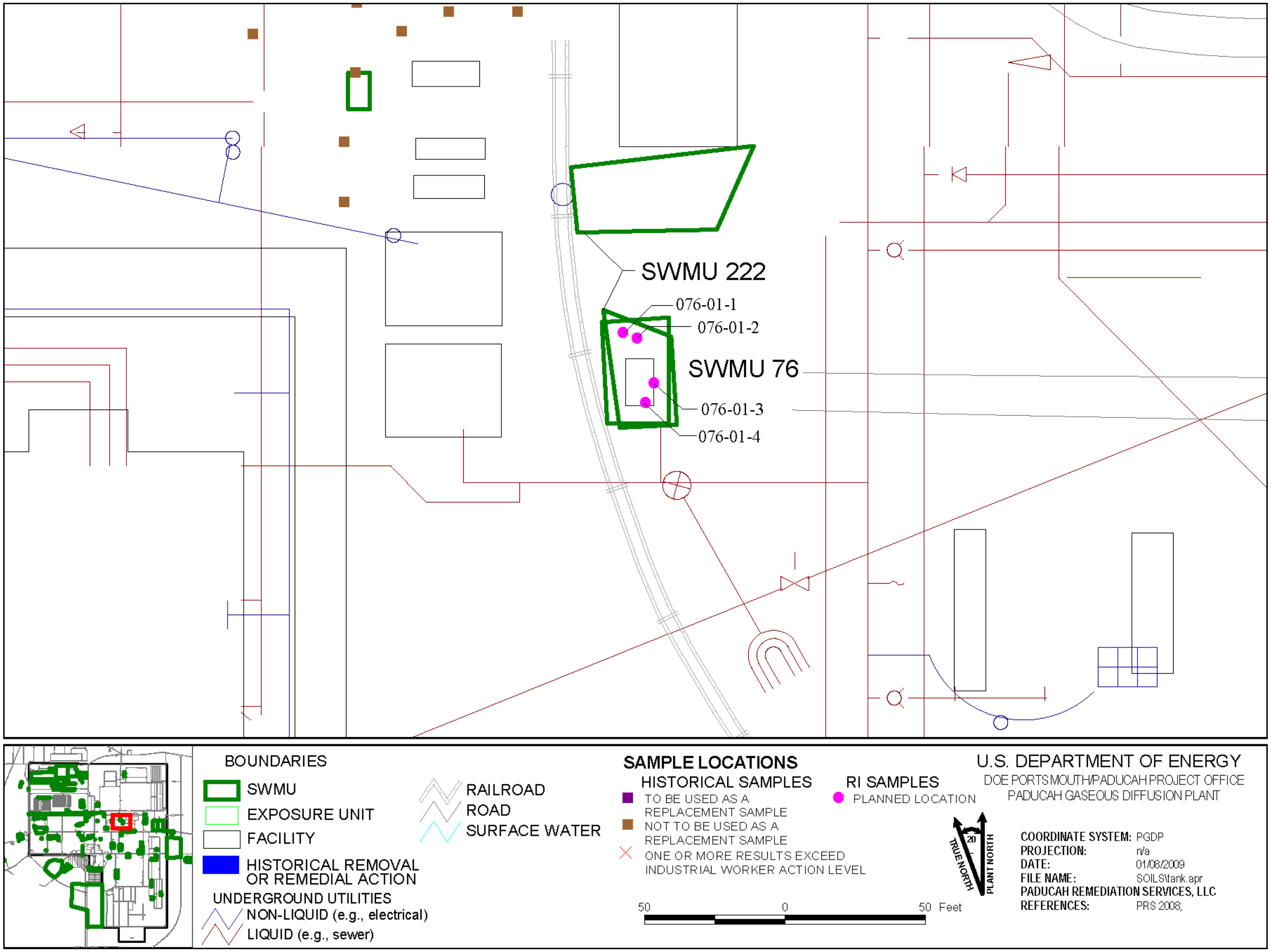

Figure B.32. Soils OU RI Samples for SWMU 76

Storage Area Group

The units and areas comprising the storage area grouping are listed below.

As necessary, SWMUs greater than 0.5 acre (SWMUs 217 and 227) were divided into exposure units, consistent with guidance in the Risk Methods Document. For practicality, some SWMUs greater than 0.5 acre were not divided (such as SWMUs 200 and 229 at 0.8 acre); however, the average of the exposure units over the Storage Area grouping remained reasonably close to 0.5 acre.

SWMUs 218, 220, and 223 will not be sampled.

SWMU	Acres
47	0.02
200	0.81
212	0.09
213	
EU 213-01	0.04
EU 213-02	0.13
214	0.014
215	0.013
216	0.027
217	
EU 217-01	0.487
EU 217-02	0.490
221	0.21
222	
EU 222-01	0.034
EU 222-02	0.018
224	0.15
225	0.093
226	0.32
227	
EU 227-01	0.718
EU 227-02	0.561
228	0.23
229	0.85
Total Acres	**5.31**
Average Acres/EU	**0.27**

SWMUs 218, 220 and 223 have a concrete surface; therefore, a RAD evaluation and a visual inspection for oil staining will occur. If staining is present, then a wipe sample will be collected at each SWMU.

There are 8 DMSAs (SWMUs 214, 216, 217, 218, 220, 222, 223, 227) that are pending a RCRA NFA; if approved, this work plan may be affected. The SWMUs historically have no documented spills and no staining or other indications of contamination have been identified at these locations. Of these locations, those that require sampling will be sampled from 0 to 1 ft bgs at the locations determined by VSP.

The locations were randomly chosen by VSP and are displayed below in Figures B.33 through B.48. A list of sample coordinates is provided in Table B.7. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.7. RI Sample Location Coordinates for the Storage Area Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
				SWMU 47			
047-01-1	1	-4,377.20	-1,390.92	047-005	-4,375.33	-1,391.43	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
047-01-2	1	-4,374.20	-1,404.92	047-009	-4,375.02	-1,402.83	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
047-01-3	1	-4,368.20	-1,382.92	047-008	-4,375.12	-1,379.32	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
047-01-4	1	-4,354.20	-1,377.92	047-007	-4,352.62	-1,380.76	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
				SWMU 200			
200-01-1	1	-5,076.00	-692.16				
200-01-2	1	-5,076.00	-783.16				
200-01-3	1	-5,043.00	-526.16				
200-01-4	1	-5,019.00	-747.16				
				SWMU 212			
212-01-1	1	-7,060.28	-1,644.72				
212-01-2	1	-7,027.28	-1,609.72				
212-01-3	1	-7,018.28	-1,647.72				
212-01-4	1	-7,017.28	-1,627.72				
				SWMU 213			
213-01-1	1	-7,056.08	-1,297.43				
213-01-2	1	-7,049.08	-1,281.43				
213-01-3	1	-6,981.08	-1,278.43				
213-01-4	1	-6,882.08	-1,282.43				
213-02-1	2	-6,669.12	-1,277.39				
213-02-2	2	-6,644.12	-1,283.39				
213-02-3	2	-6,608.12	-1,284.39				
213-02-4	2	-6,588.12	-1,283.39				
				SWMU 214			
214-01-1	1	-8,334.26	-3,086.28				
214-01-2	1	-8,325.26	-3,076.28				
214-01-3	1	-8,325.26	-3,097.28				
214-01-4	1	-8,324.26	-3,069.28				
				SWMU 215			
215-01-1	1	-6,581.44	-2,659.93				
215-01-2	1	-6,567.44	-2,649.93				
215-01-3	1	-6,550.44	-2,645.93				
215-01-4	1	-6,547.44	-2,649.93				

Table B.7. RI Sample Location Coordinates for the Storage Area Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 216							
216-01-1	1	-6,767.25	-2,149.92				
216-01-2	1	-6,756.25	-2,130.92				
216-01-3	1	-6,748.25	-2,114.92				
216-01-4	1	-6,744.25	-2,140.92				
SWMU 217							
217-01-1	1	-6,414.65	-2,098.39				
217-01-2	1	-6,413.65	-2,051.39				
217-01-3	1	-6,372.65	-2,136.39				
217-01-4	1	-6,340.65	-2,097.39				
217-02-1	2	-6,250.20	-2,097.41				
217-02-2	2	-6,167.20	-2,122.41				
217-02-3	2	-6,117.20	-2,042.41				
217-02-4	2	-6,085.20	-2,082.41	36-SB-003	-6,111.67	-2,120.39	1-4, 4-9, 9-14 ft bgs/ Metals, PCB, Radionuclides, SVOA, VOA
SWMU 218 (no samples to be collected)							
SWMU 220 (no samples to be collected)							
SWMU 221							
221-01-1	1	-4,379.68	-711.21				
221-01-2	1	-4,359.68	-679.21				
221-01-3	1	-4,320.68	-674.21				
221-01-4	1	-4,304.68	-720.21				
SWMU 222							
222-01-1	1	-3,296.20	-1,427.35				
222-01-2	1	-3,276.20	-1,421.35				
222-01-3	1	-3,266.20	-1,414.35				
222-01-4	1	-3,256.20	-1,410.35				
222-02-1	2	-3,287.22	-1,466.63	076-01-1*	-3,287.22	-1,466.63	
222-02-2	2	-3,282.22	-1,468.63	076-01-2*	-3,282.22	-1,468.63	
222-02-3	2	-3,276.22	-1,484.63	076-01-3*	-3,276.22	-1,484.63	
222-02-4	2	-3,279.22	-1,491.63	076-01-4*	-3,279.22	-1,491.63	
SWMU 223 (no samples to be collected)							
SWMU 224							
224-01-1	1	-1,882.72	-2,885.56				
224-01-2	1	-1,877.72	-2,929.56				
224-01-3	1	-1,856.72	-2,866.56				
224-01-4	1	-1,838.72	-2,920.56				
SWMU 225							
225-01-1	1	-2,075.40	-4,191.11				
225-01-2	1	-2,071.40	-3,976.11				
225-01-3	1	-2,070.40	-4,047.11				
225-01-4	1	-2,062.40	-4,160.11				
SWMU 226							
226-01-1	1	-6,885.62	-397.00				
226-01-2	1	-6,678.62	-390.00				
226-01-3	1	-6,454.62	-395.00				

Table B.7. RI Sample Location Coordinates for the Storage Area Group (Continued)

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
226-01-4	1	-6,431.62	-395.00				
SWMU 227							
227-01-1	1	-6,236.09	-60.72				
227-01-2	1	-6,157.09	-10.72	006-003	-6,110.28	-6.51	0-1 ft bgs/Metals, PCB, Radionuclides, SVOA
227-01-3	1	-6,027.09	-63.72				
227-01-4	1	-5,920.09	-45.72				
227-02-1	2	-5,802.09	-38.01				
227-02-2	2	-5,688.09	-65.01				
227-02-3	2	-5,568.09	-64.01				
227-02-4	2	-5,420.09	-71.01				
SWMU 228							
228-01-1	1	-6,288.34	77.40				
228-01-2	1	-6,222.34	56.40				
228-01-3	1	-6,157.34	25.40				
228-01-4	1	-6,122.34	40.40				
SWMU 229							
229-01-1	1	-6,731.63	316.58				
229-01-2	1	-6,637.63	305.58				
229-01-3	1	-6,512.63	317.58				
229-01-4	1	-6,391.63	316.58				

* These samples are RI samples to be collected during sampling for SWMU 76.

Blue shading indicates sample provides definitive data from a historical investigation.

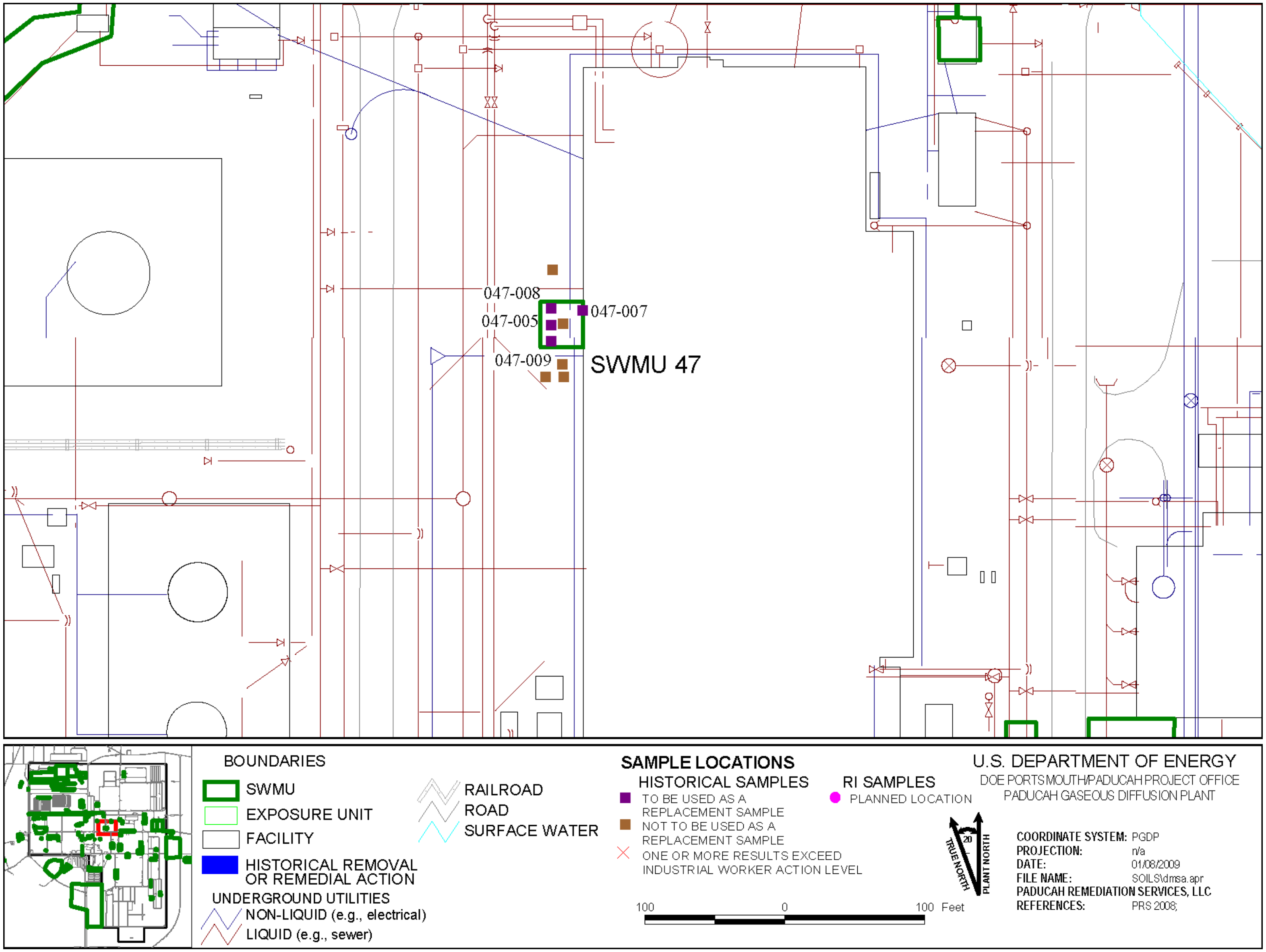

Figure B.33. Soils OU RI Samples for SWMU 47

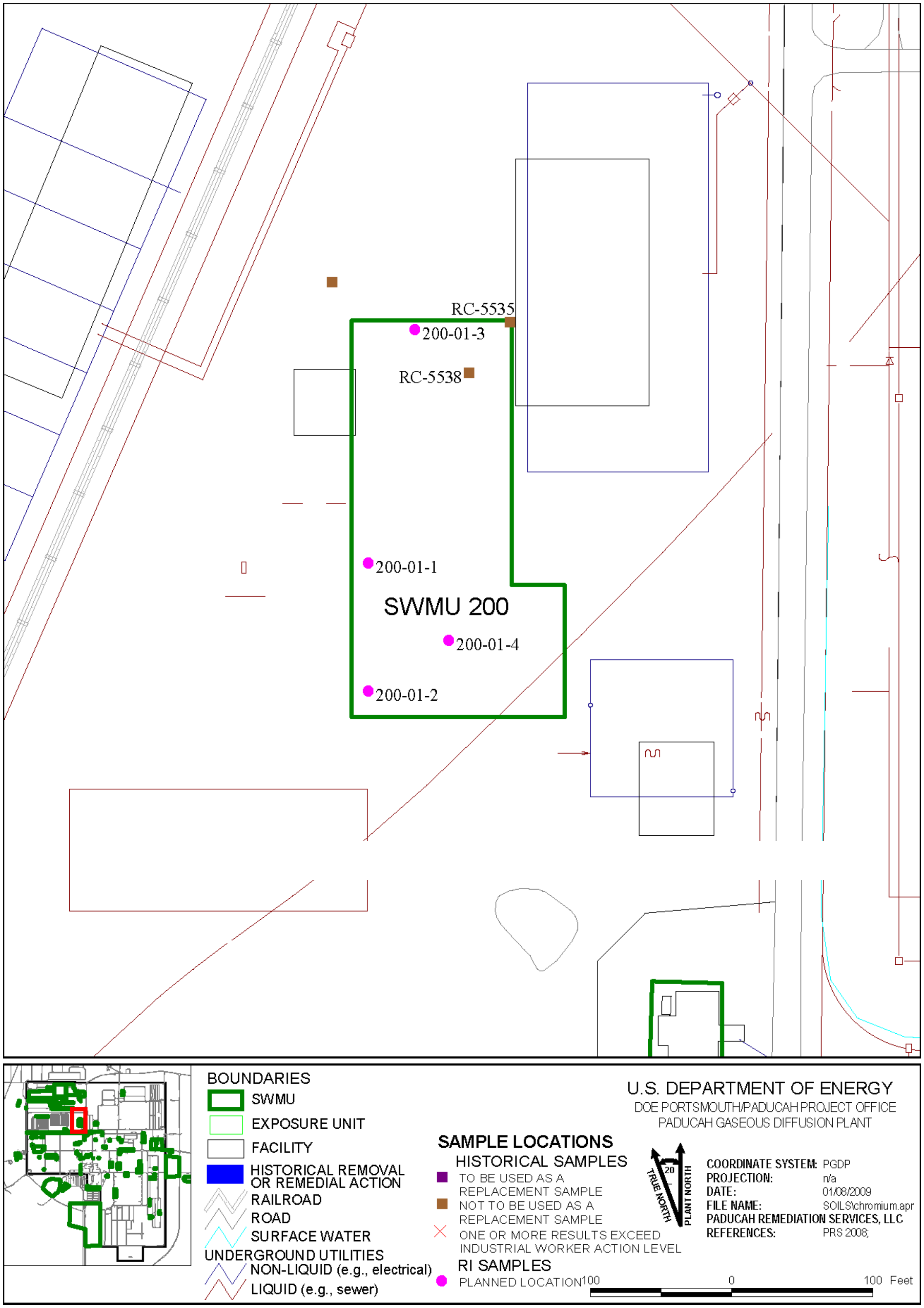

Figure B.34. Soils OU RI Samples for SWMU 200

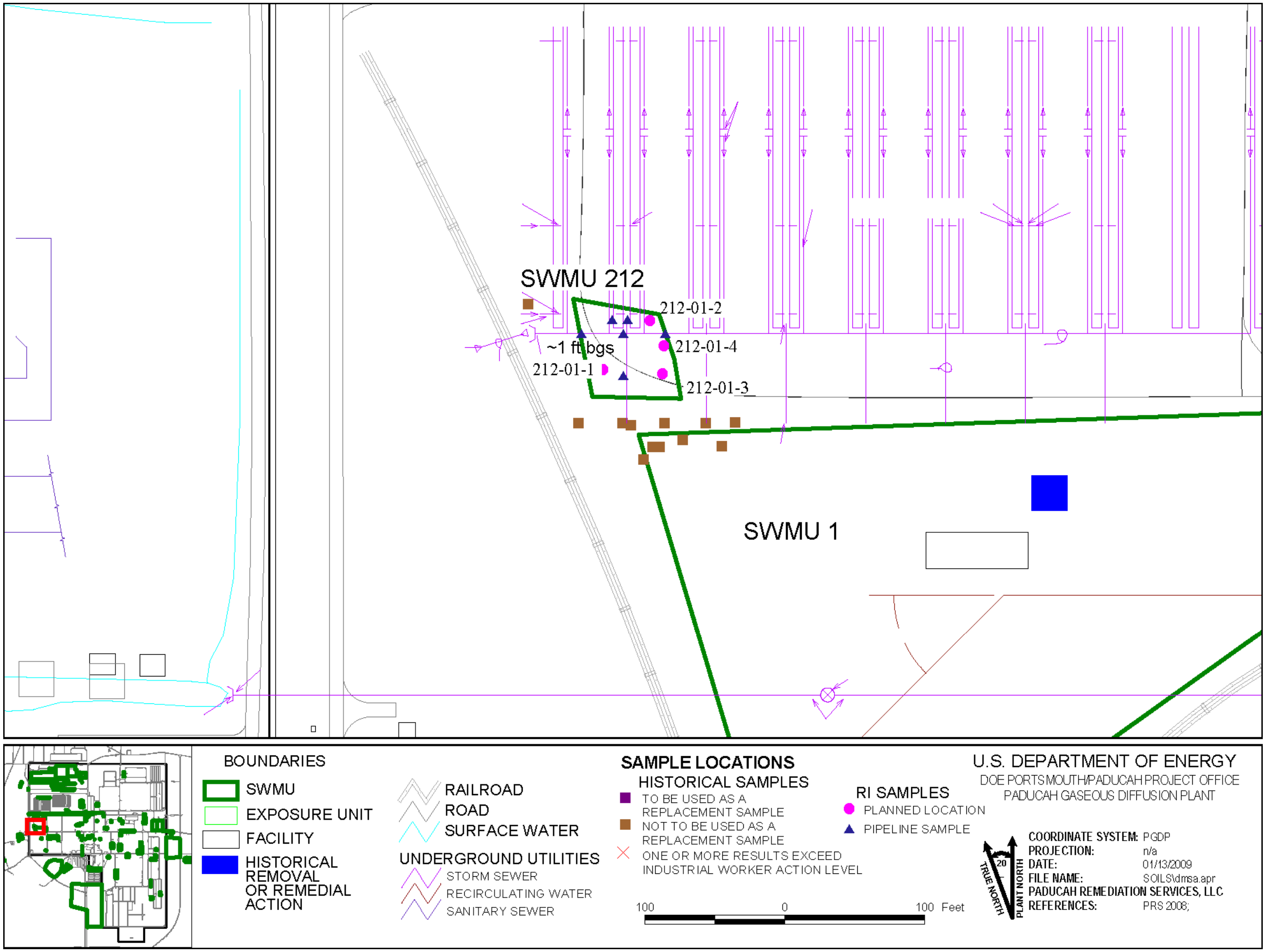

Figure B.35. Soils OU RI Samples for SWMU 212

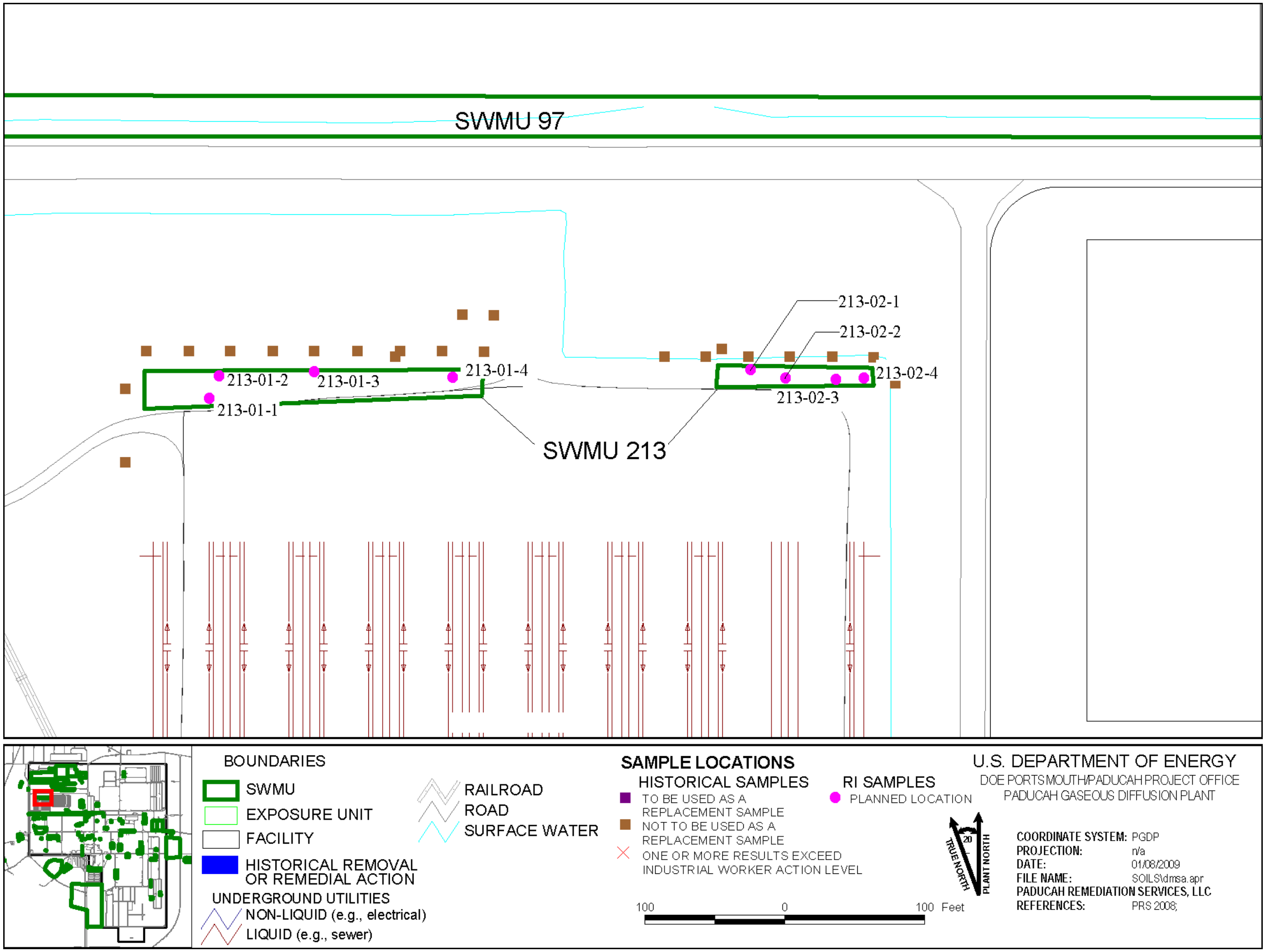

Figure B.36. Soils OU RI Samples for SWMU 213

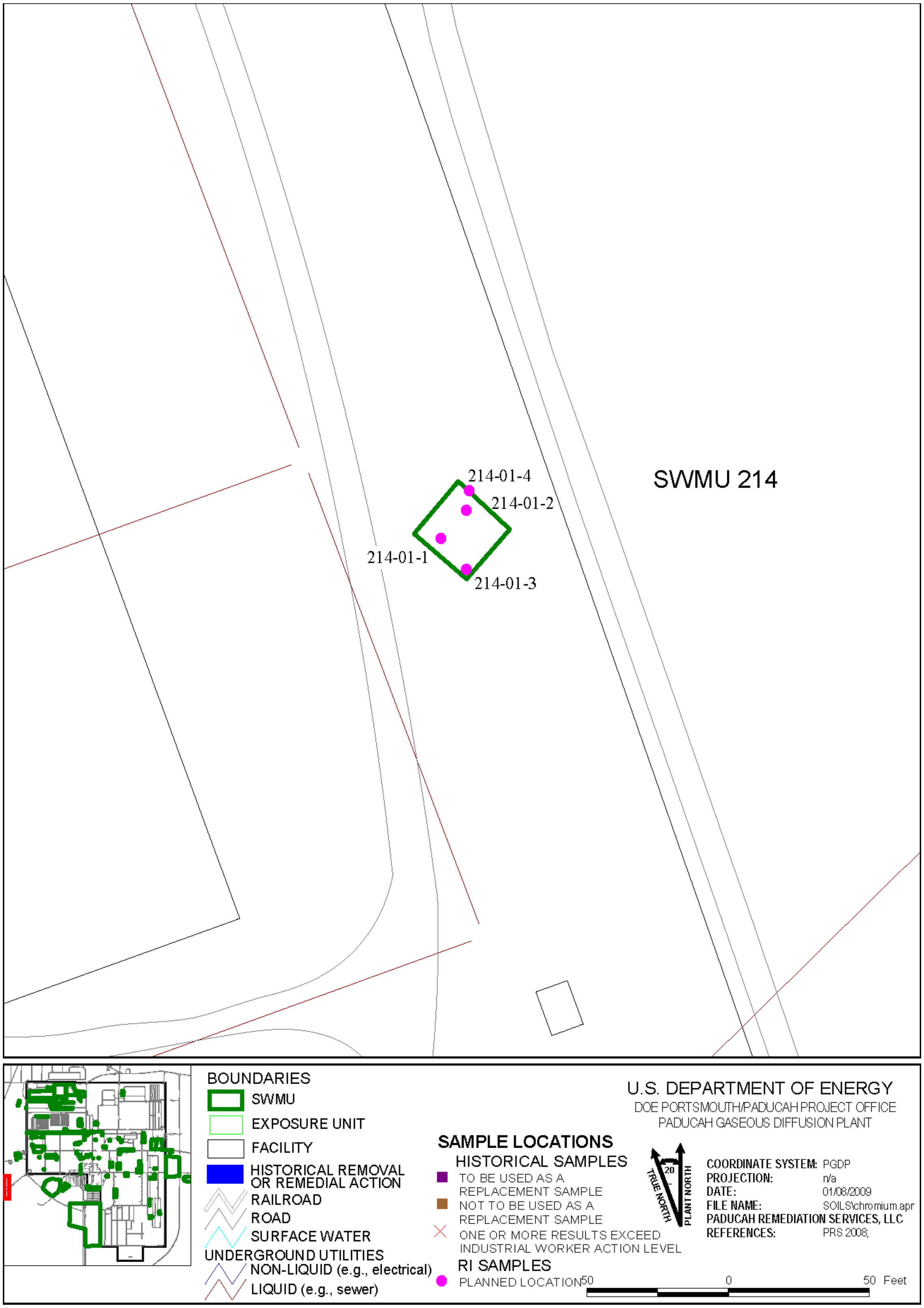

Figure B.37. Soils OU RI Samples for SWMU 214

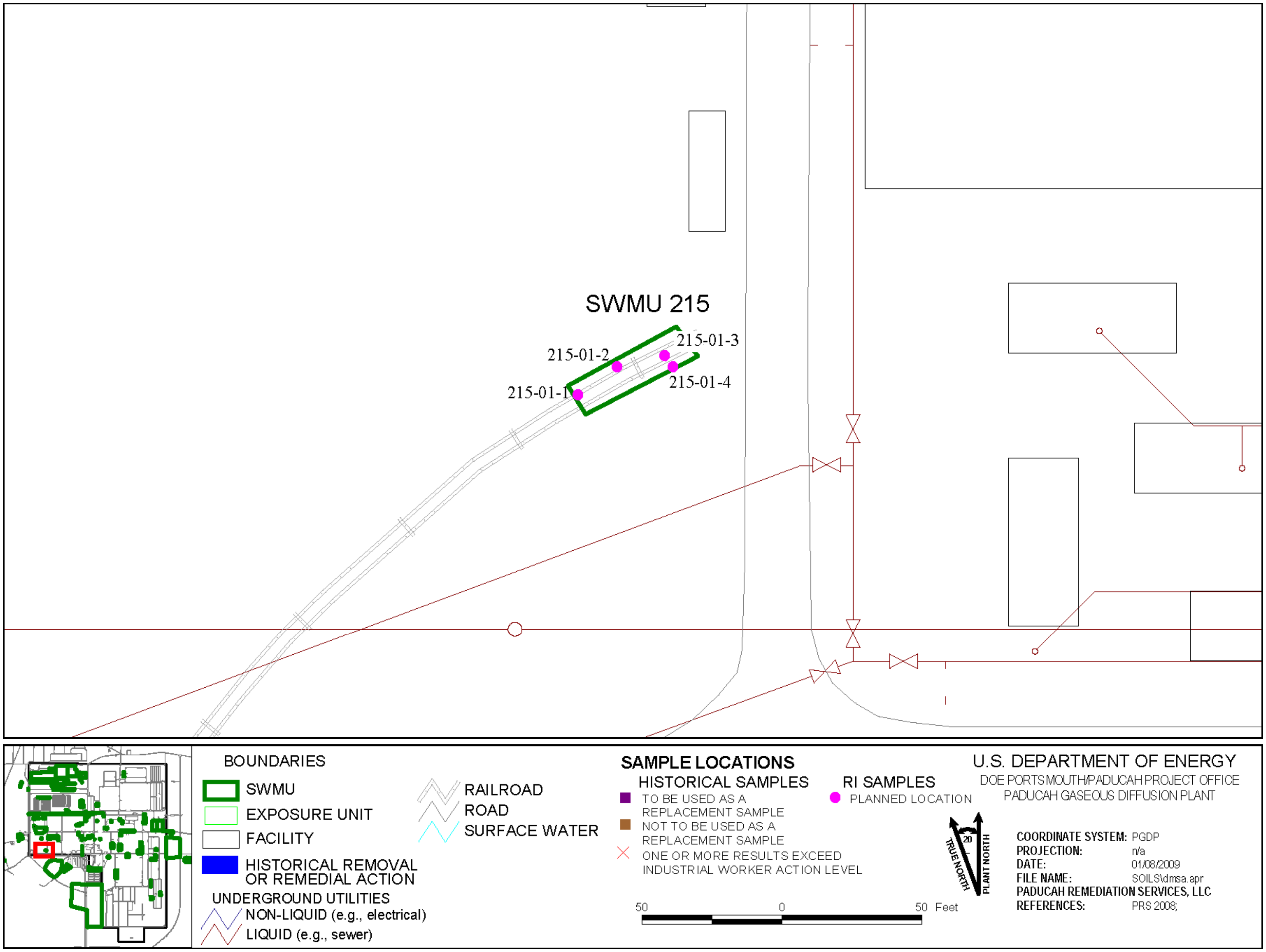

Figure B.38. Soils OU RI Samples for SWMU 215

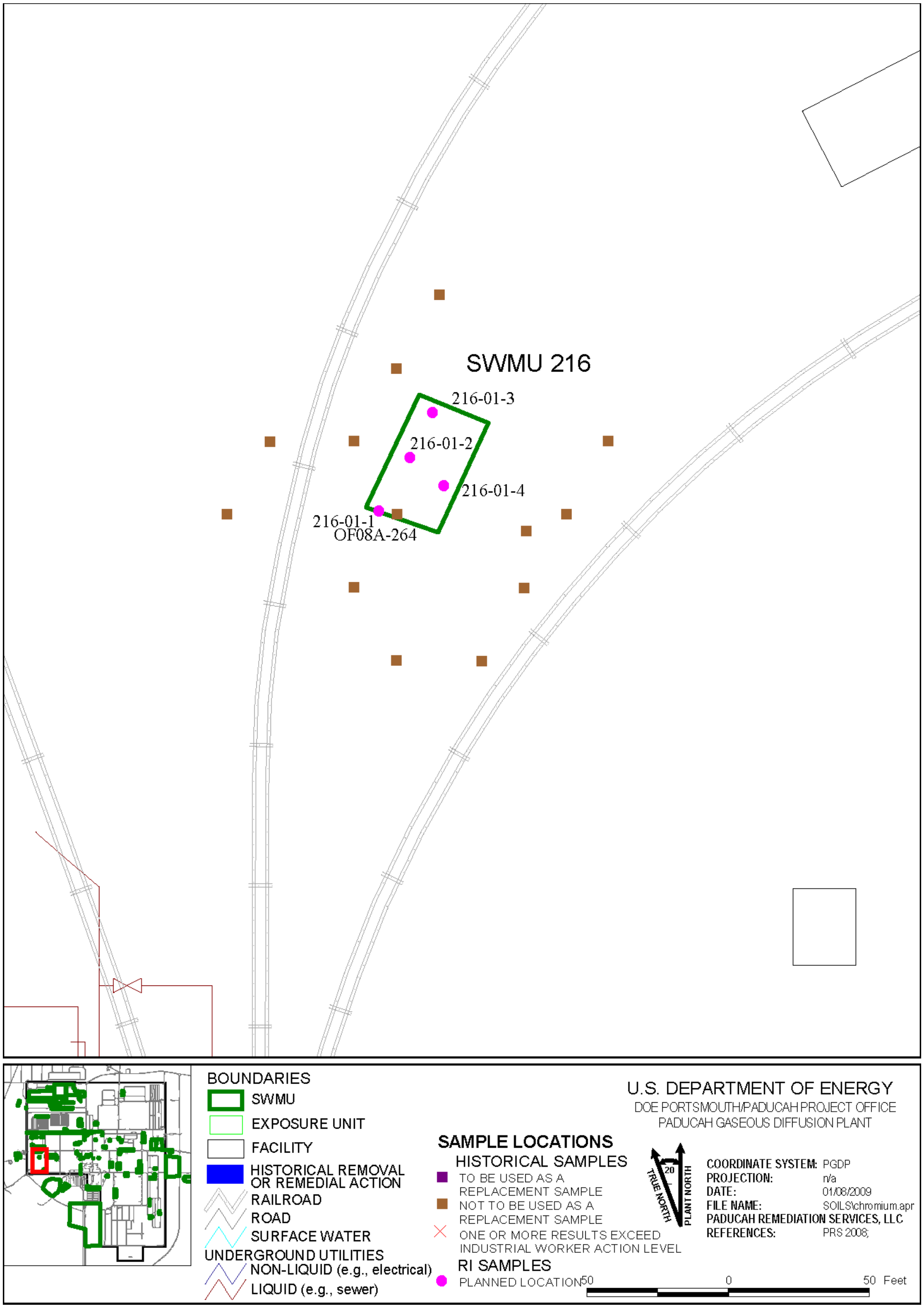

Figure B.39. Soils OU RI Samples for SWMU 216

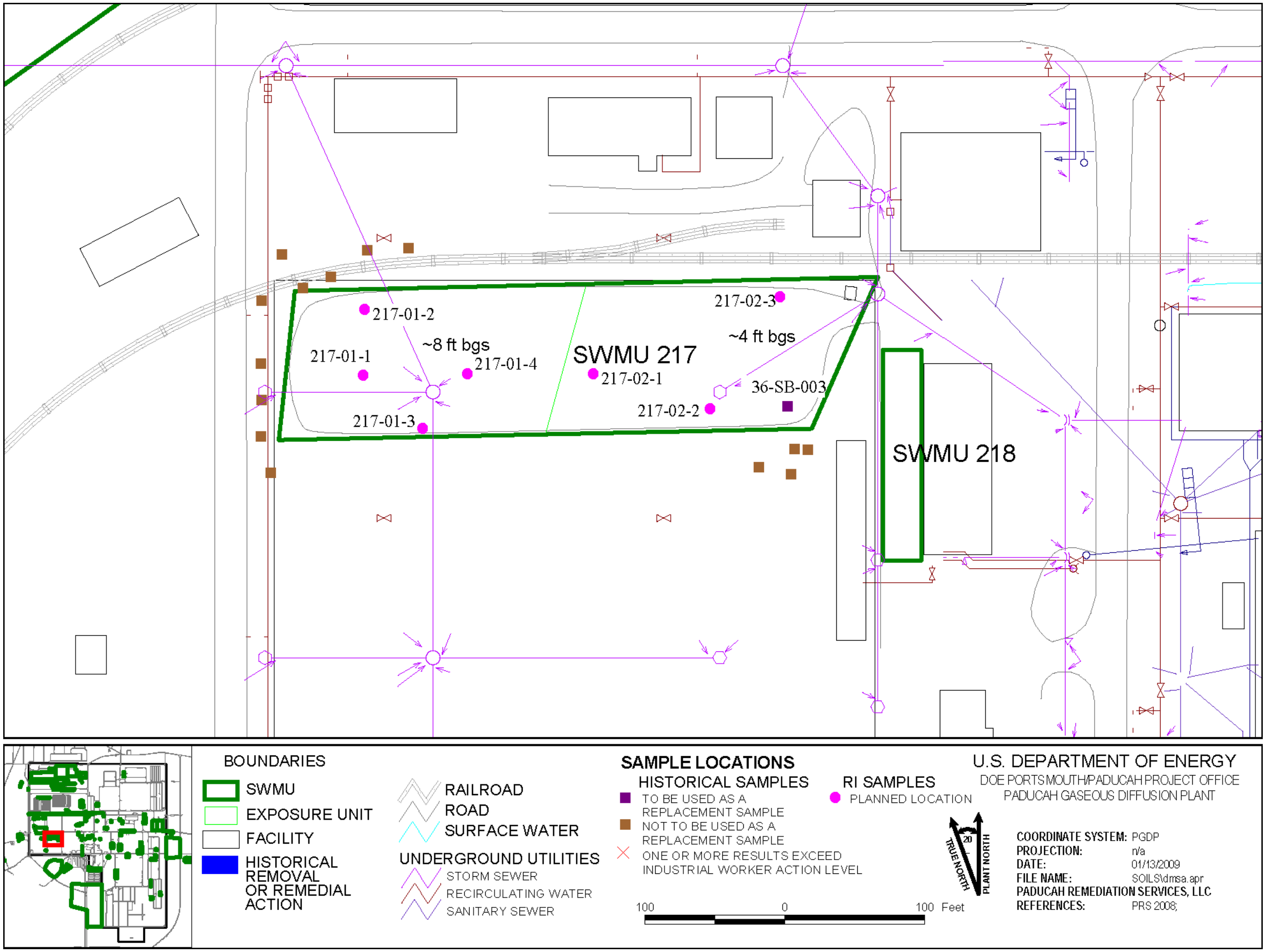

Figure B.40. Soils OU RI Samples for SWMU 217

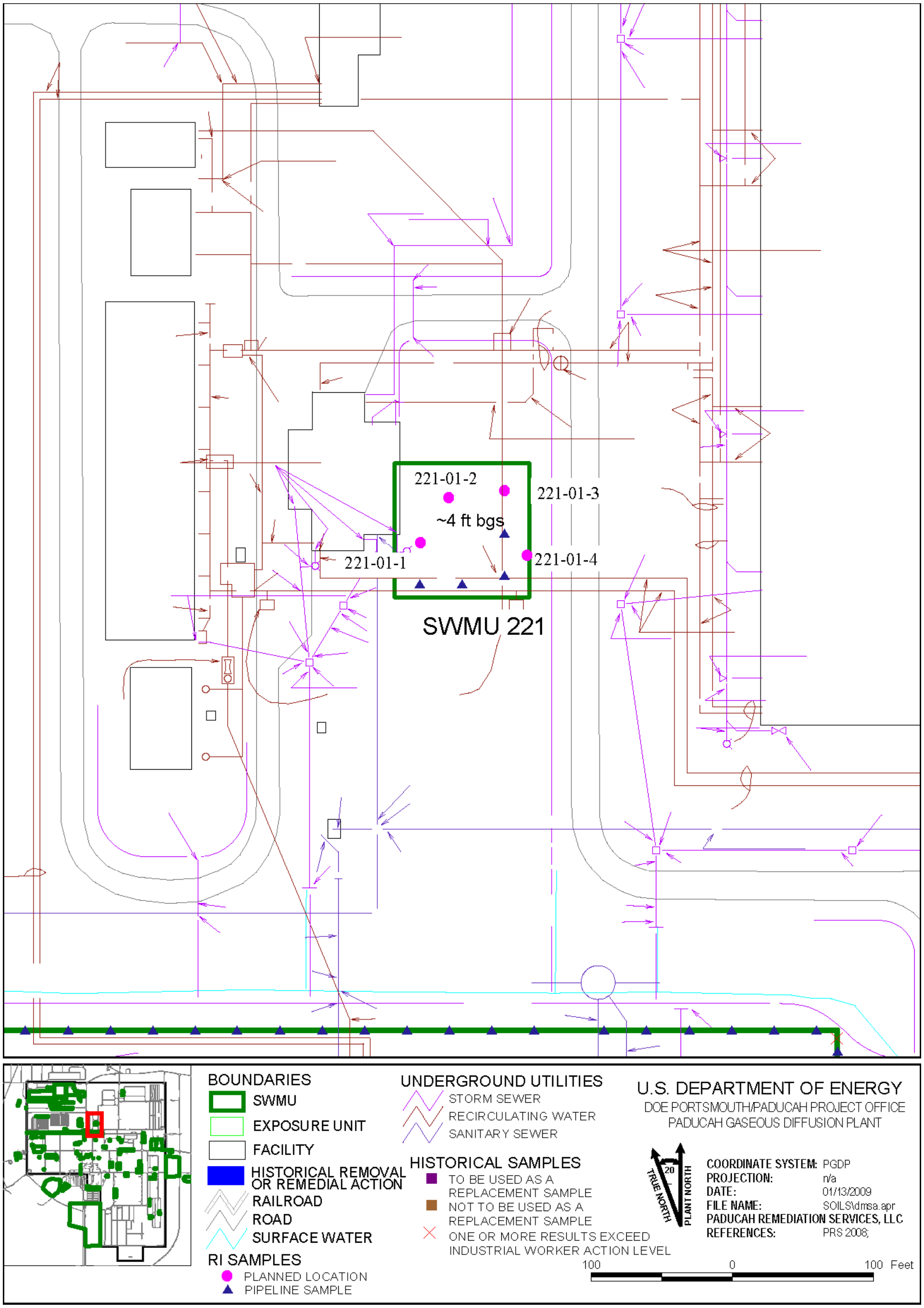

Figure B.41. Soils OU RI Samples for SWMU 221

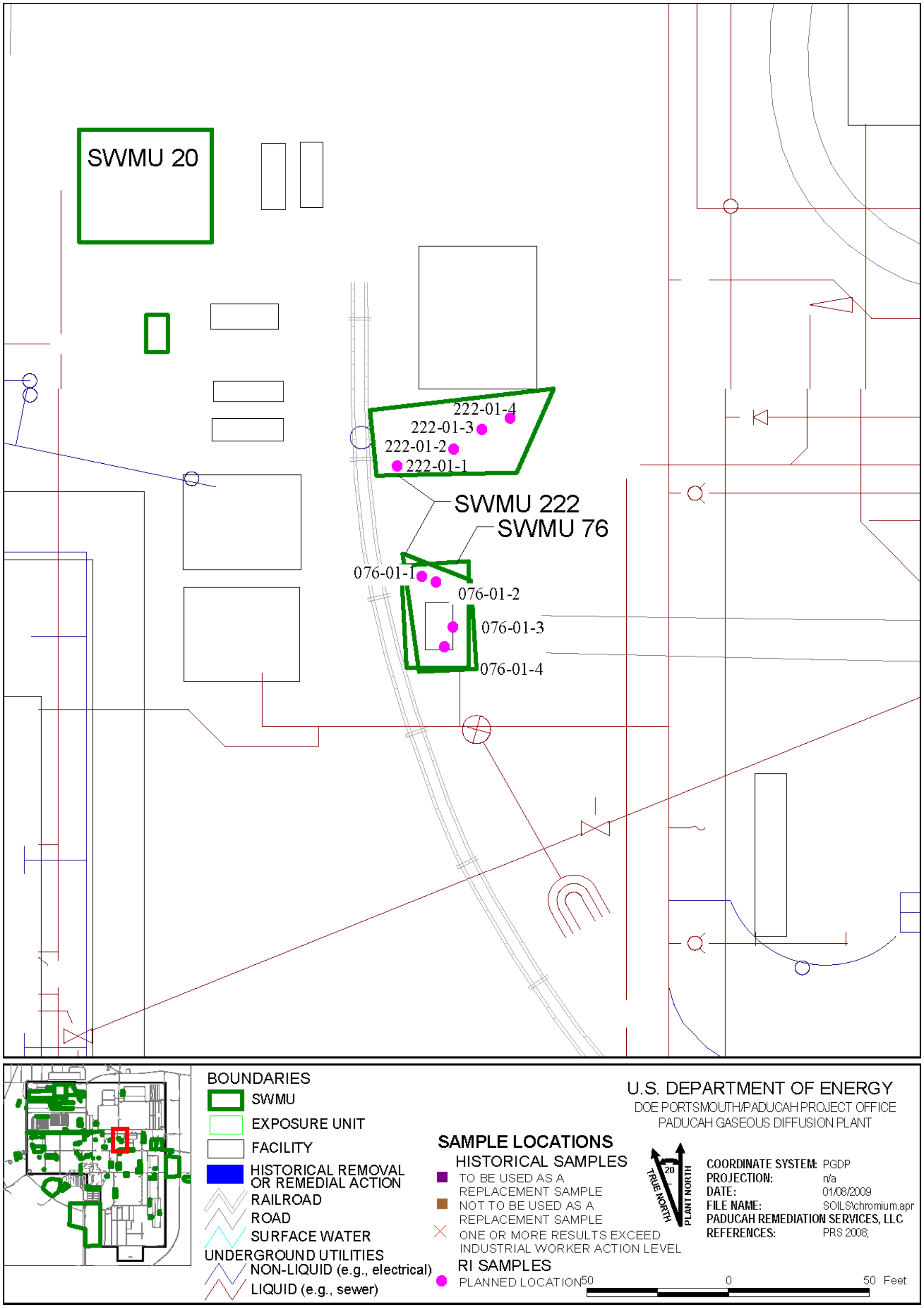

Figure B.42. Soils OU RI Samples for SWMU 222

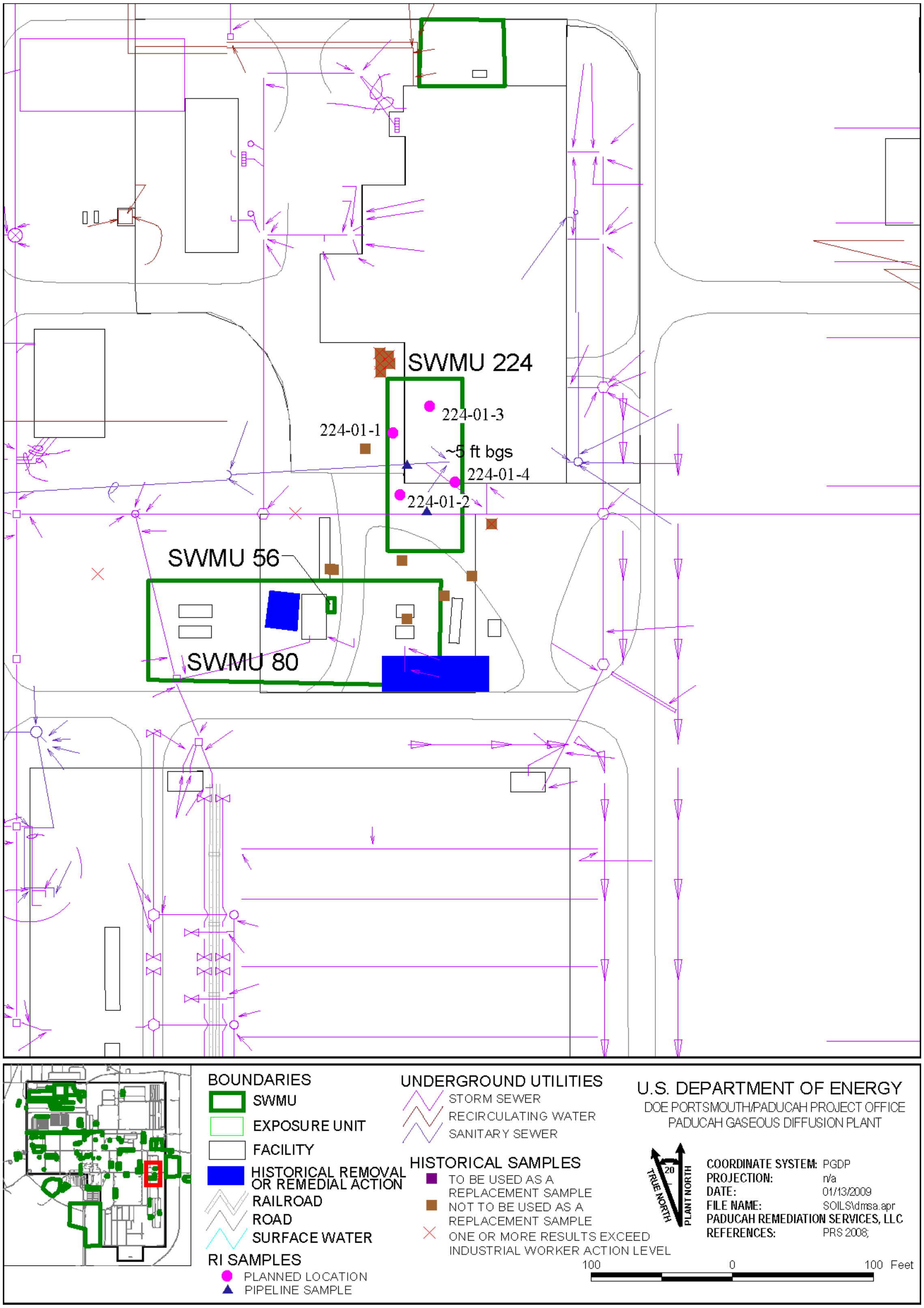

Figure B.43. Soils OU RI Samples for SWMU 224

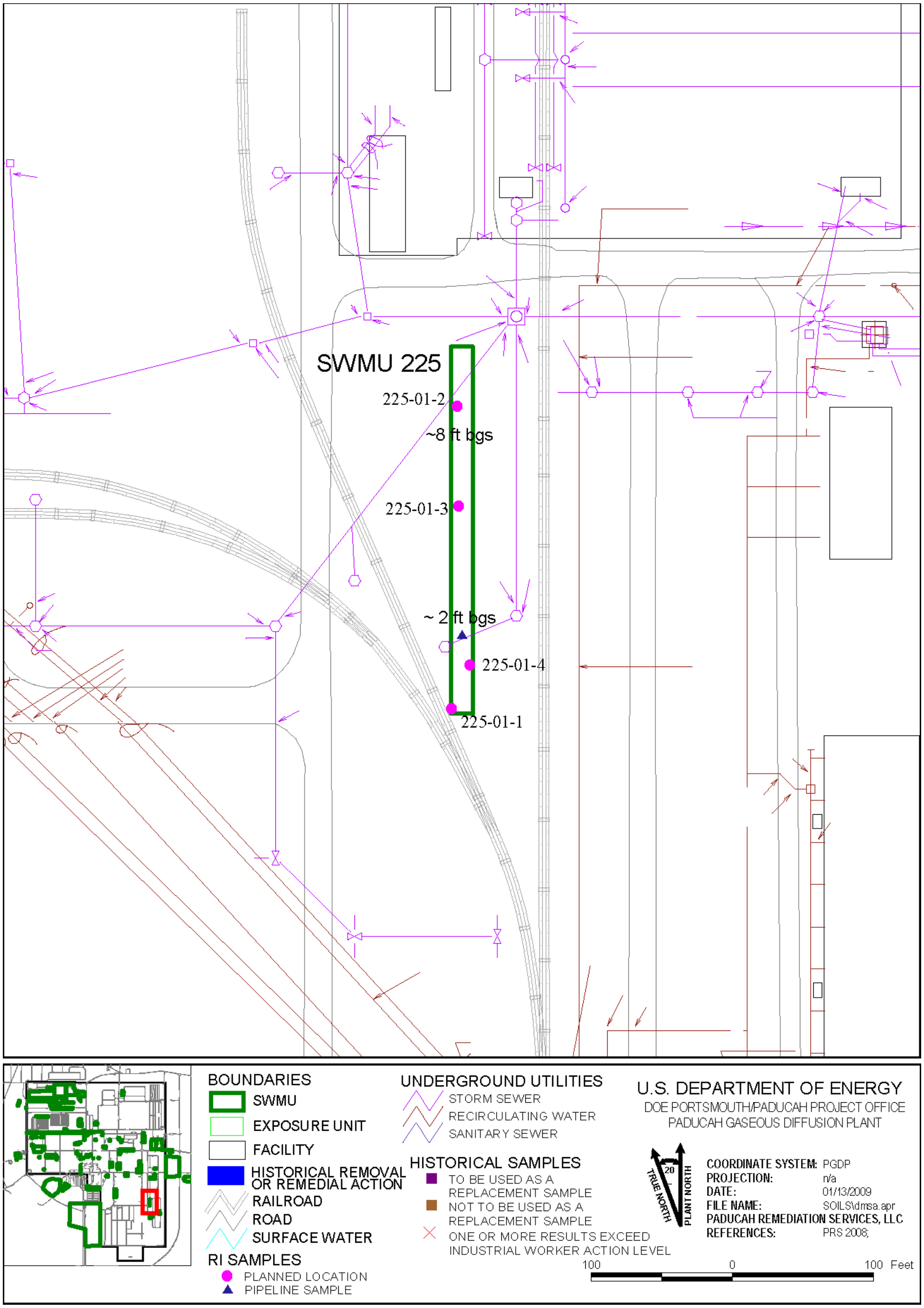

Figure B.44. Soils OU RI Samples for SWMU 225

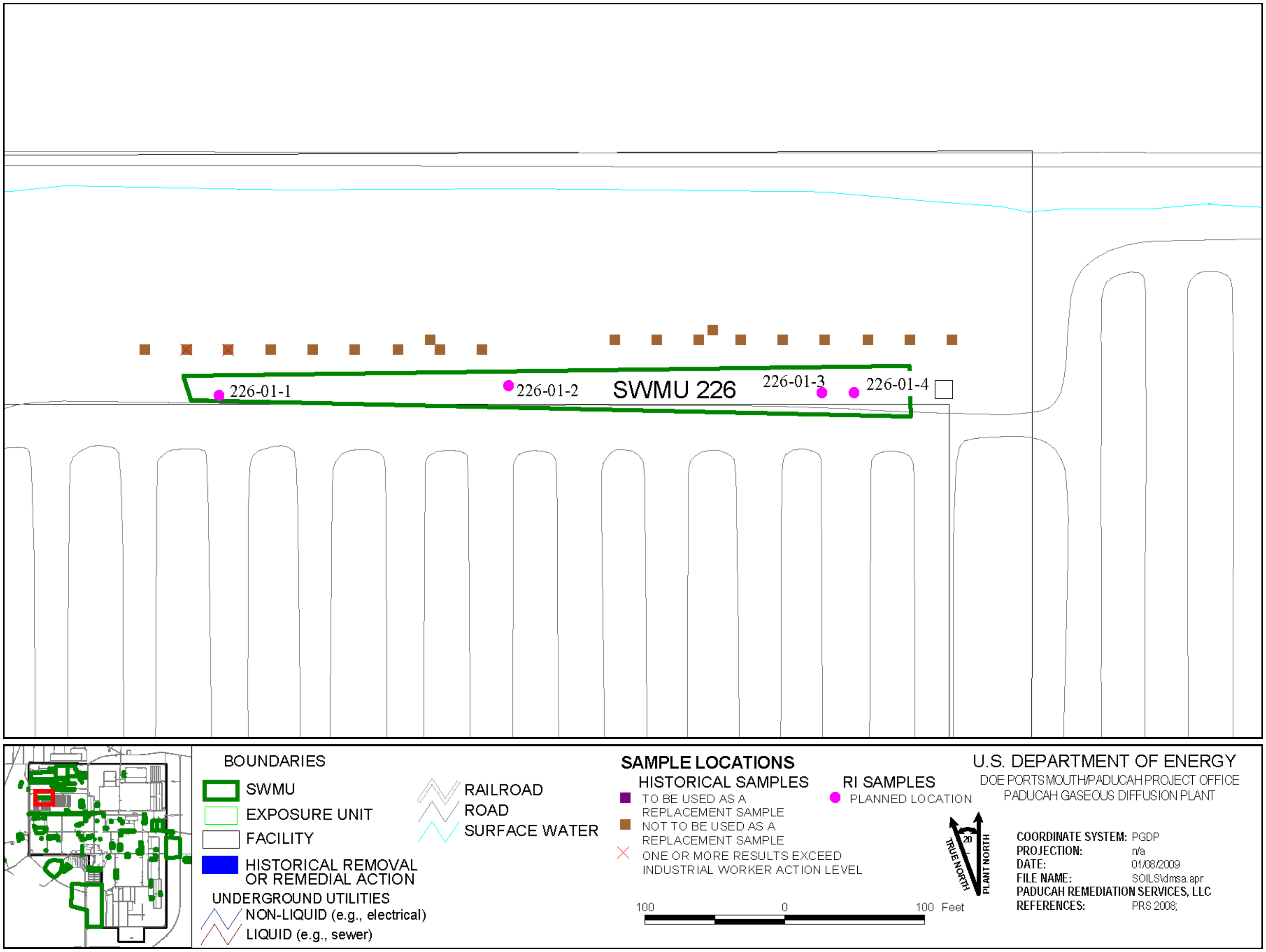

Figure B.45. Soils OU RI Samples for SWMU 226

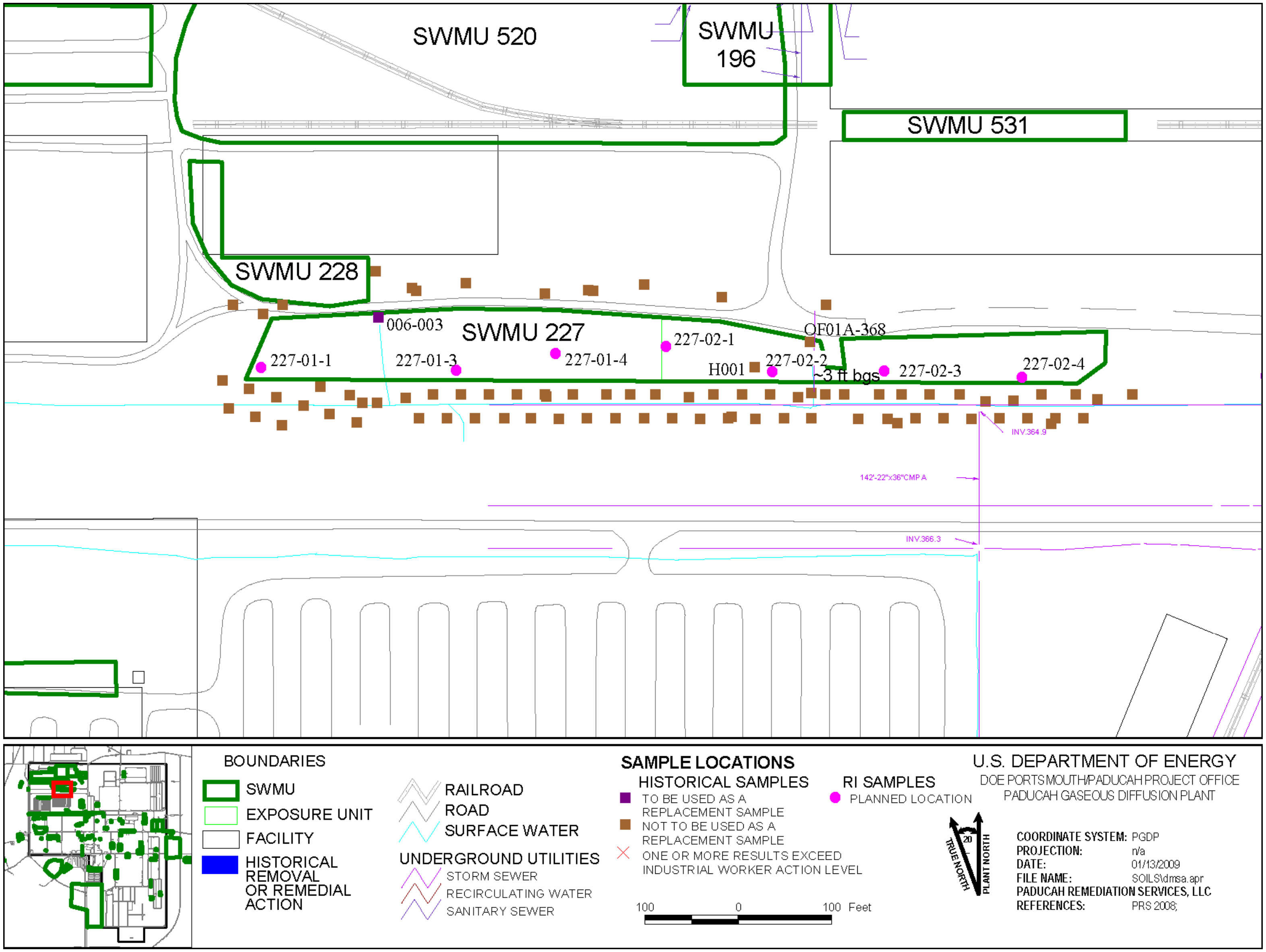

Figure B.46. Soils OU RI Samples for SWMU 227

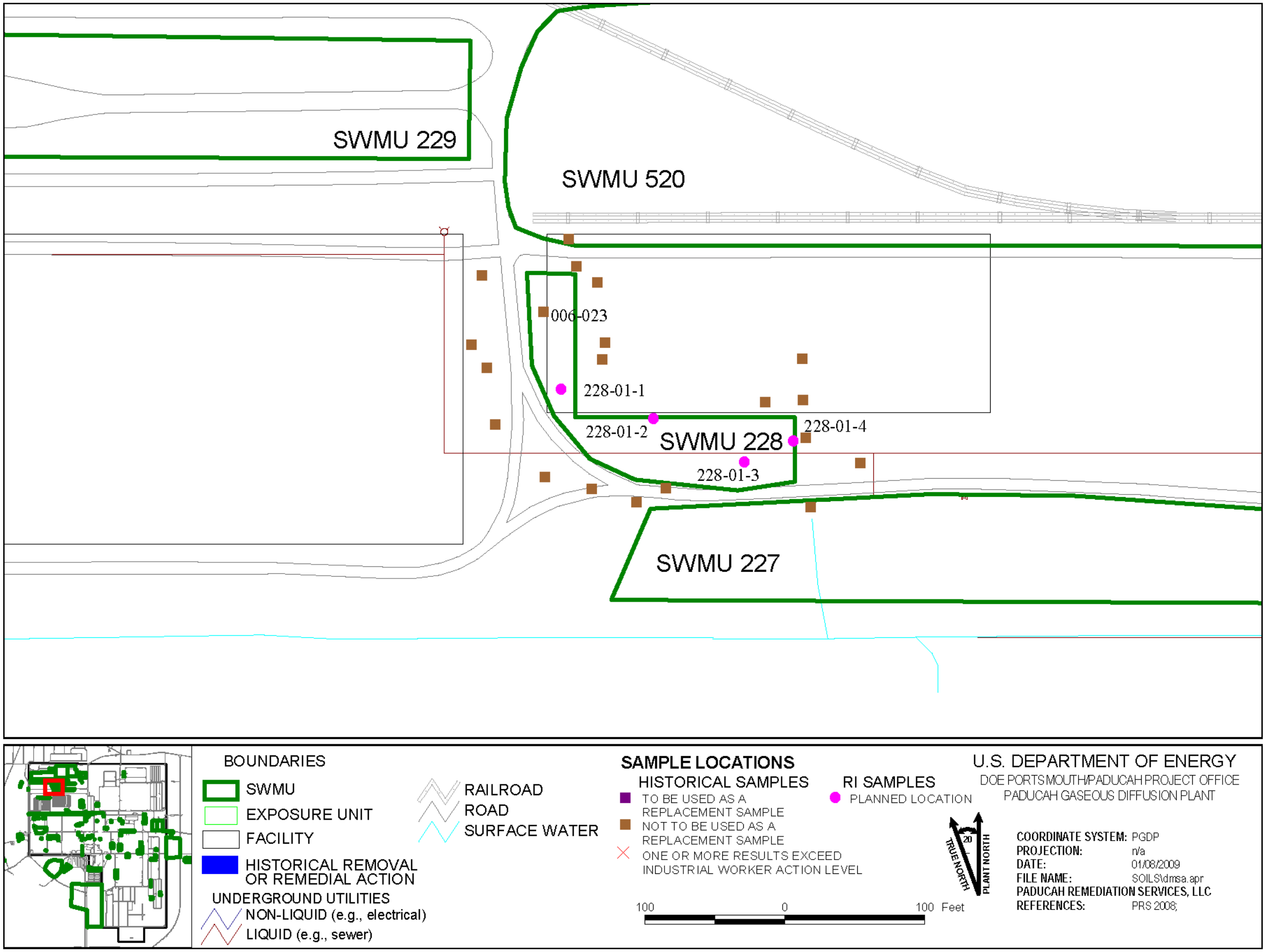

Figure B.47. Soils OU RI Samples for SWMU 228

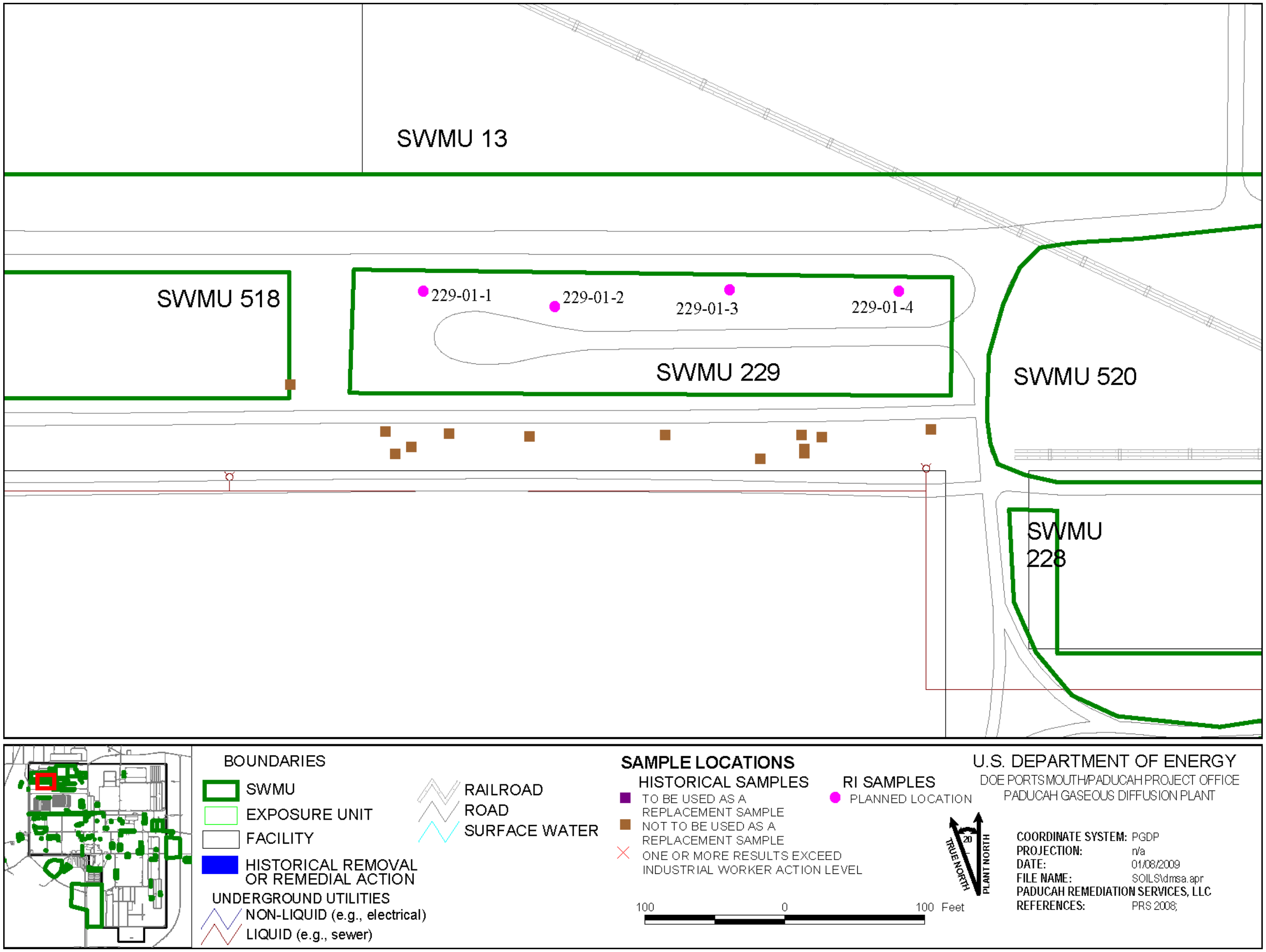

Figure B.48. Soils OU RI Samples for SWMU 229

Chromium Area Group

The units and areas comprising the chromium spill grouping are listed below. No SWMUs within this grouping were greater than 0.5 acre, so division into EUs was not necessary.

SWMU	Acres
158	0.055
169	0.002
176	0.137
177	0.158
Total Acres	**0.35**
Average Acres/EU	**0.09**

The locations were randomly chosen by VSP and are displayed below in Figures B.49 through B.52. A list of sample coordinates is provided in Table B.8. Section 9.3 provides information on sampling depths. Where applicable, historical samples will replace new sample locations/data.

Table B.8. RI Sample Location Coordinates for Chromium Group

Station Name	EU	X	Y	Replaced by Historical Sample	X	Y	Sampling Interval(s)/ Data Available
SWMU 158							
158-01-1	1	-5,002.05	-2,469.51				
158-01-2	1	-5,000.05	-2,483.51				
158-01-3	1	-4,999.05	-2,627.51				
158-01-4	1	-5,002.05	-2,727.51				
SWMU 169							
169-01-1	1	-3,382.44	-1,374.08				
169-01-2	1	-3,383.44	-1,379.08				
169-01-3	1	-3,384.44	-1,383.08				
169-01-4	1	-3,380.44	-1,385.08				
SWMU 176							
176-01-1	1	-3,377.40	-1,923.11				
176-01-2	1	-3,360.40	-1,956.11				
176-01-3	1	-3,325.40	-1,975.11				
176-01-4	1	-3,385.40	-1,976.11				
SWMU 177							
177-01-1	1	-2,522.75	-2,314.60				
177-01-2	1	-2,467.75	-2,314.60				
177-01-3	1	-2,500.75	-2,367.60				
177-01-4	1	-2,500.75	-2,387.60				

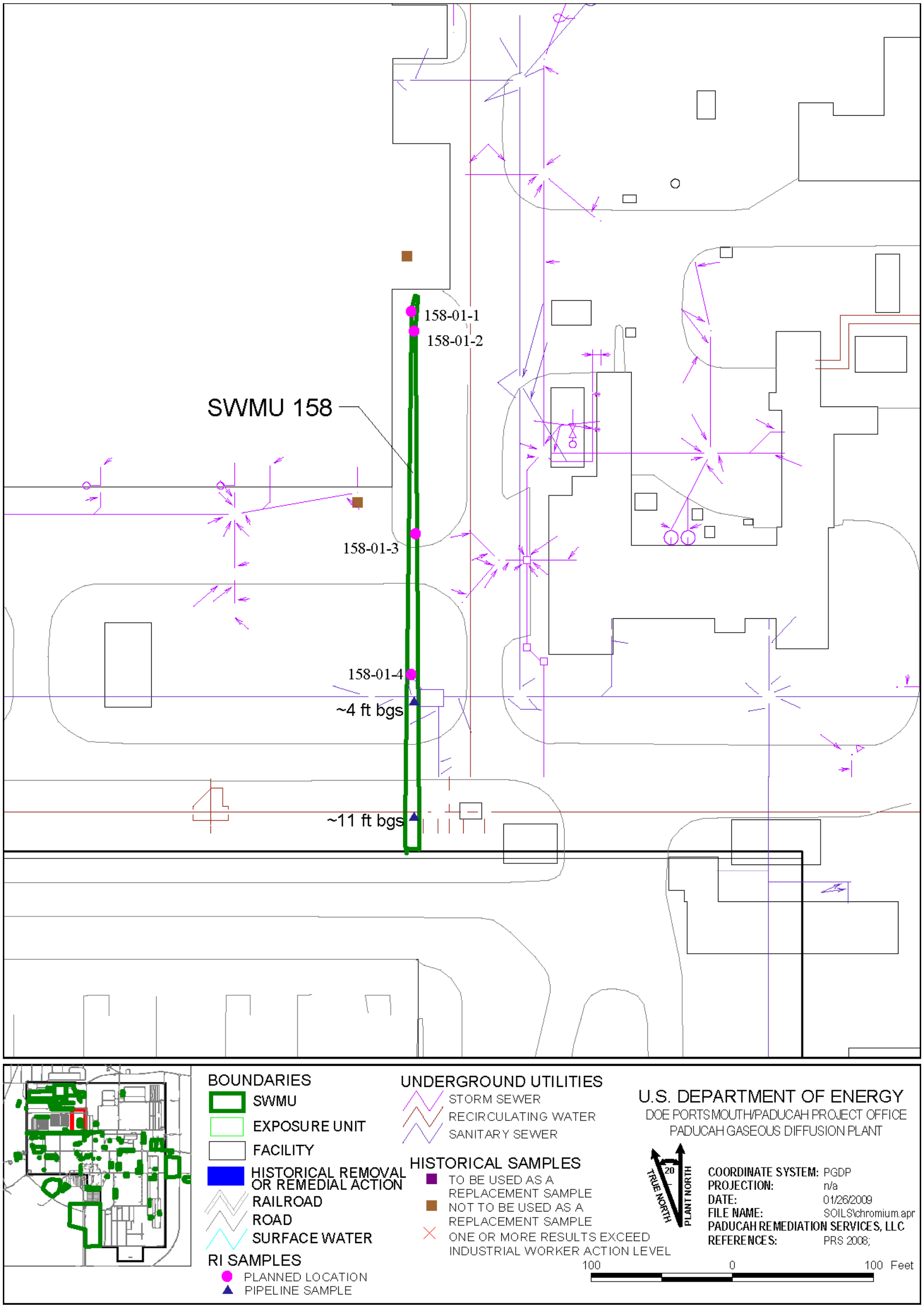

Figure B.49. Soils OU RI Samples for SWMU 158

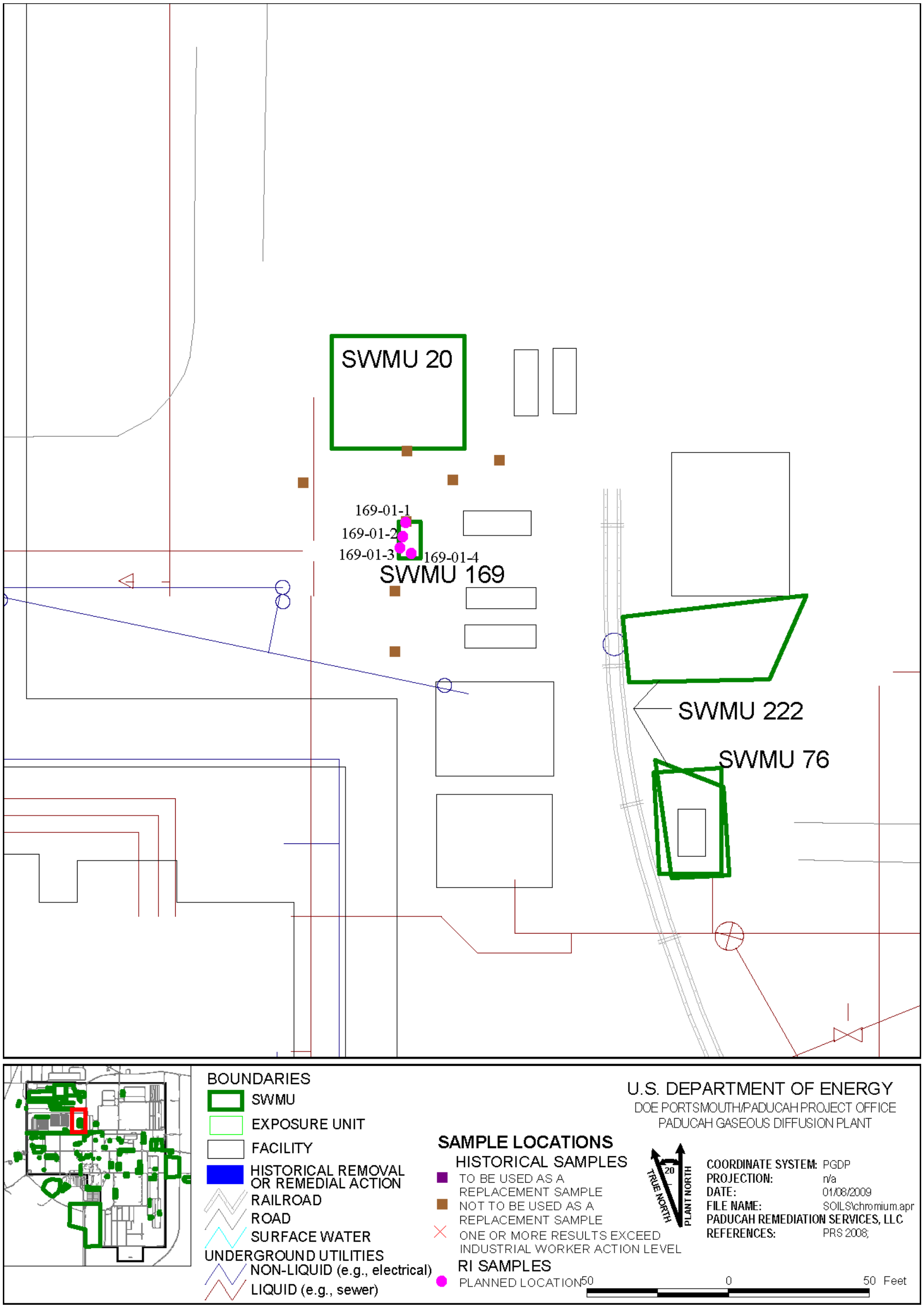

Figure B.50. Soils OU RI Samples for SWMU 169

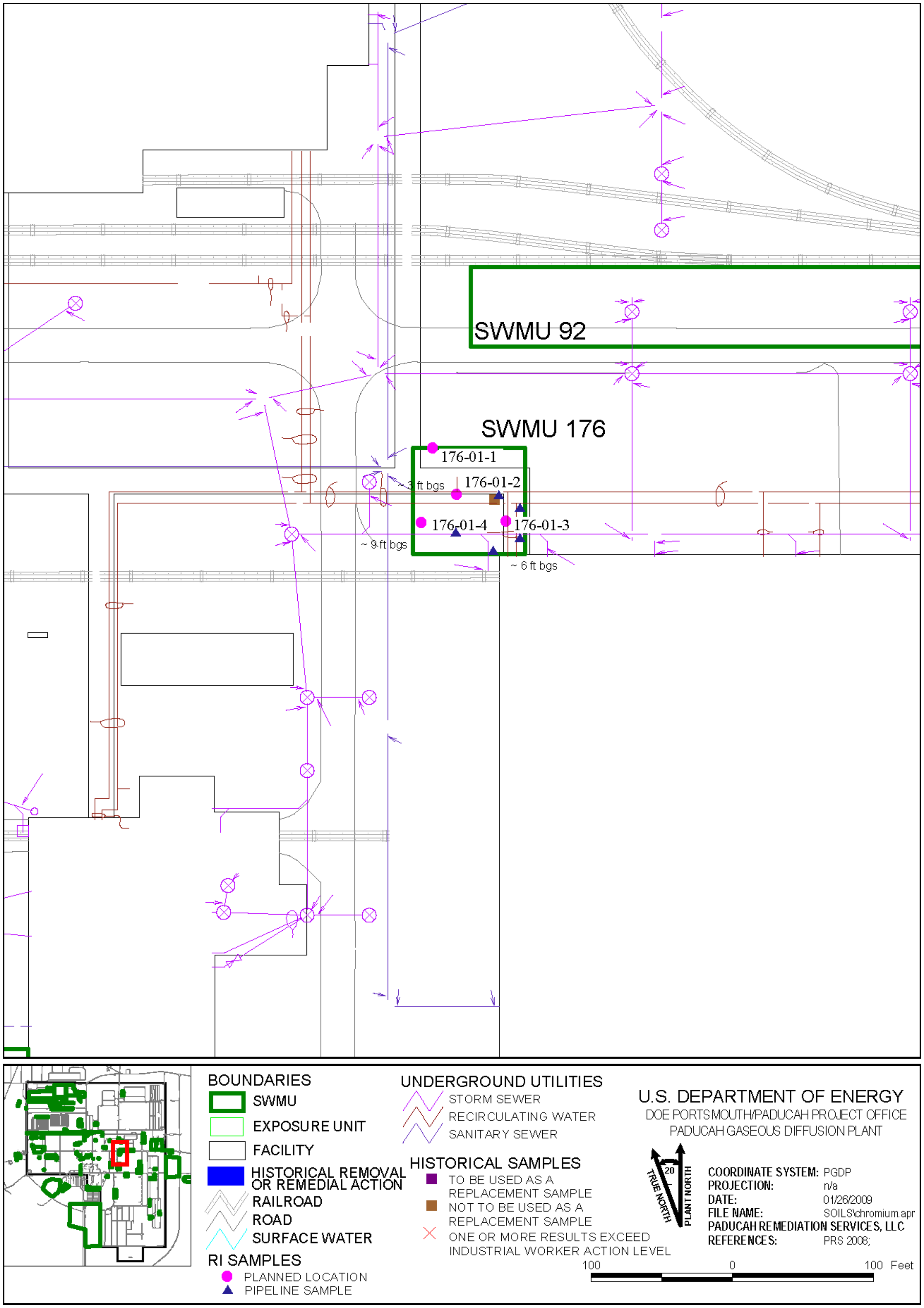

Figure B.51. Soils OU RI Samples for SWMU 176

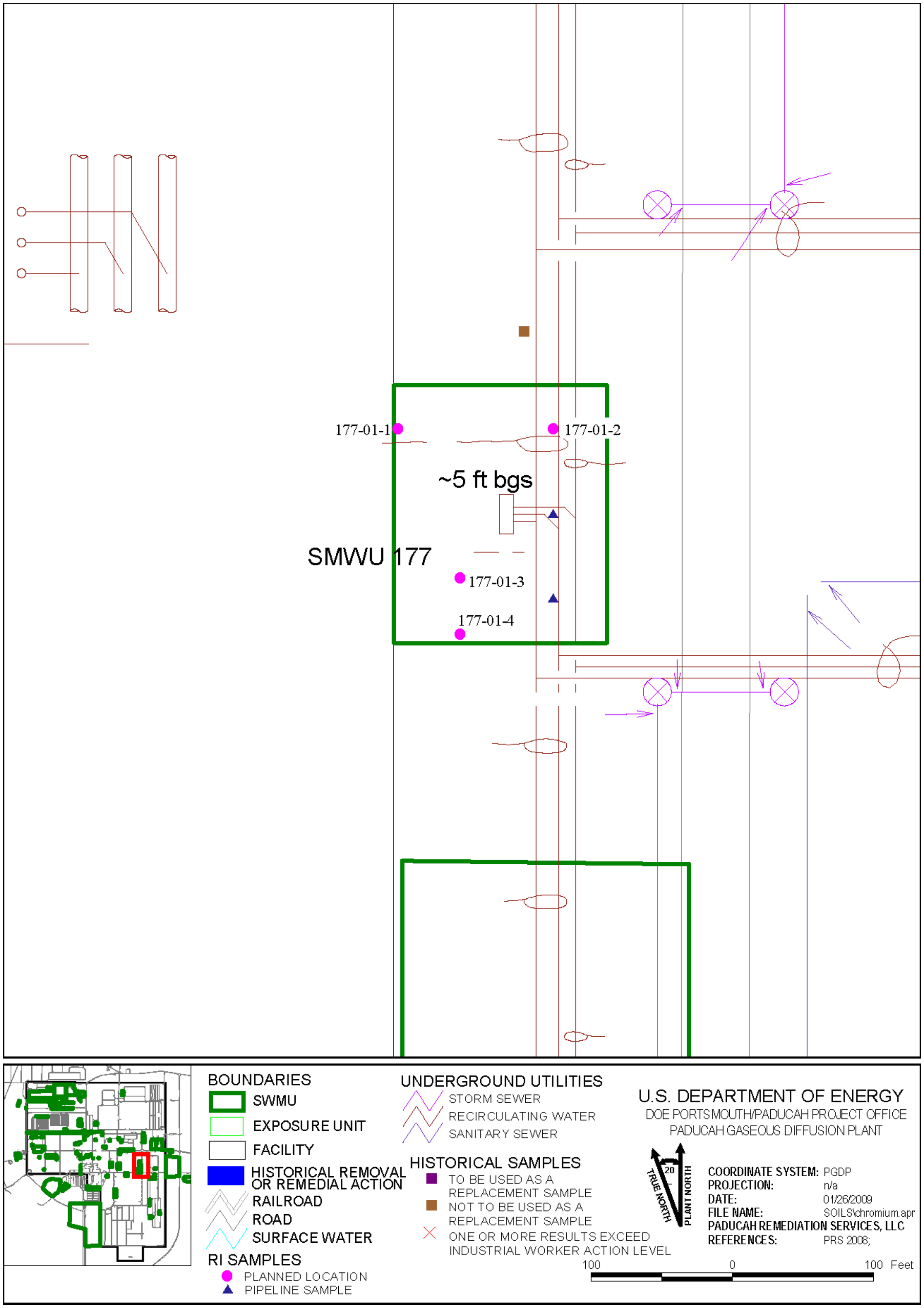

Figure B.52. Soils OU RI Samples for SWMU 177

B.2 PCB SAMPLING STRATEGY

The PCB evaluation will include the sampling and analysis of locations to a depth of 1 ft bgs. There has been identified 6,192 linear ft of ditches that capture runoff from switchyards. For the ditches, samples will be collected along a centerline every 10 ft.

PCB field screening will be performed on each of the five discrete subsamples and one composite in accordance with the *HACH Pocket Colormeter™ II Test Kit Instruction Manual* along with 10% confirmatory fixed-based laboratory sampling. To ensure PCB data can be fully evaluated, the HACH system will be calibrated daily. The PCB measurements are colorimetric in nature, and acquire semiquantitative results by employing a field grade photometer. As a result, calibration standards and calibration verification standards and blanks will be prepared weekly and stored in accordance with the PRS-QAP-1020, ***Control and Calibration of Measuring and Test Equipment.*** Calibration standards and blanks will be analyzed daily or at the end of a sample group – whichever is more frequent to monitor instrument drift during analysis. They will be analyzed sequentially: (1) calibration verification and (2) blank and will follow the 20th natural sample analyzed or at the end of a group of samples, whichever is more frequent.

B.3 LIMITED AREA RAD SAMPLING STRATEGY

Survey Preparations

A reference grid system, encompassing DOE-owned property, has been developed to facilitate survey planning, implementation, and documentation. This system, illustrated on Figure B.53, is based on 1,000 m x 1,000 m (3,280 ft x 3,280 ft) survey units, and referenced to the Kentucky state plane coordinate system.

There are 26 units, each denoted as A–Z; however, only those within the fenced area will be included within this survey. The grid system is oriented along true north to simplify the layout and use of the grids in field situations. Each of the survey units is divided into 100 m x 100 m (1 hectare or 2.47 acres) survey blocks or subunits. There are 2,600 total subunits. Of these subunits, there are 1495 [both full (1 ha) and partial (< 1 ha) blocks], which fall within DOE fenced area in this survey. These are denoted by a numeric reference system, using numbers 0 through 9 for both latitudinal and longitudinal axes. A specific 1 acre area is referenced first by the survey unit letter designation, followed by the latitudinal axis number (x-axis), then by the longitudinal axis number (y-axis). The area included in the scope for this work plan, consists of grassy or dirt areas that do not have roads, gravel pads, buildings, or other infrastructure, and has not been addressed under other investigations (i.e., Surface Water On-site Investigation). Slabs, subsurface structures, and underlying soils left after completing D&D of the operating GDP, will be addressed in subsequent Soils OU projects.

Survey packages will be prepared for each survey unit. The survey package is a collection of information that controls the survey process and provides a consistent framework for documenting the results and planning further investigations. The package will include a map or drawing of the area, indicating major site features, ground cover, and delineating classifications of all surfaces and directions for implementing survey activities. Additional information will be added to the package as the survey progresses. Examples of such additional information include survey data, a summary and evaluation of results, and recommendations for further activities, if appropriate.

Before initiating ground walk-over survey activities, a walk down of the survey unit will be conducted and anomalies noted on the area map or drawing. In addition, needs for ground clearance (mowing, bushhogging, etc.) or other actions to facilitate access to surfaces of interest will be identified and initiated. Ground clearance will be coordinated with the government furnished services and infrastructure prime contractor.

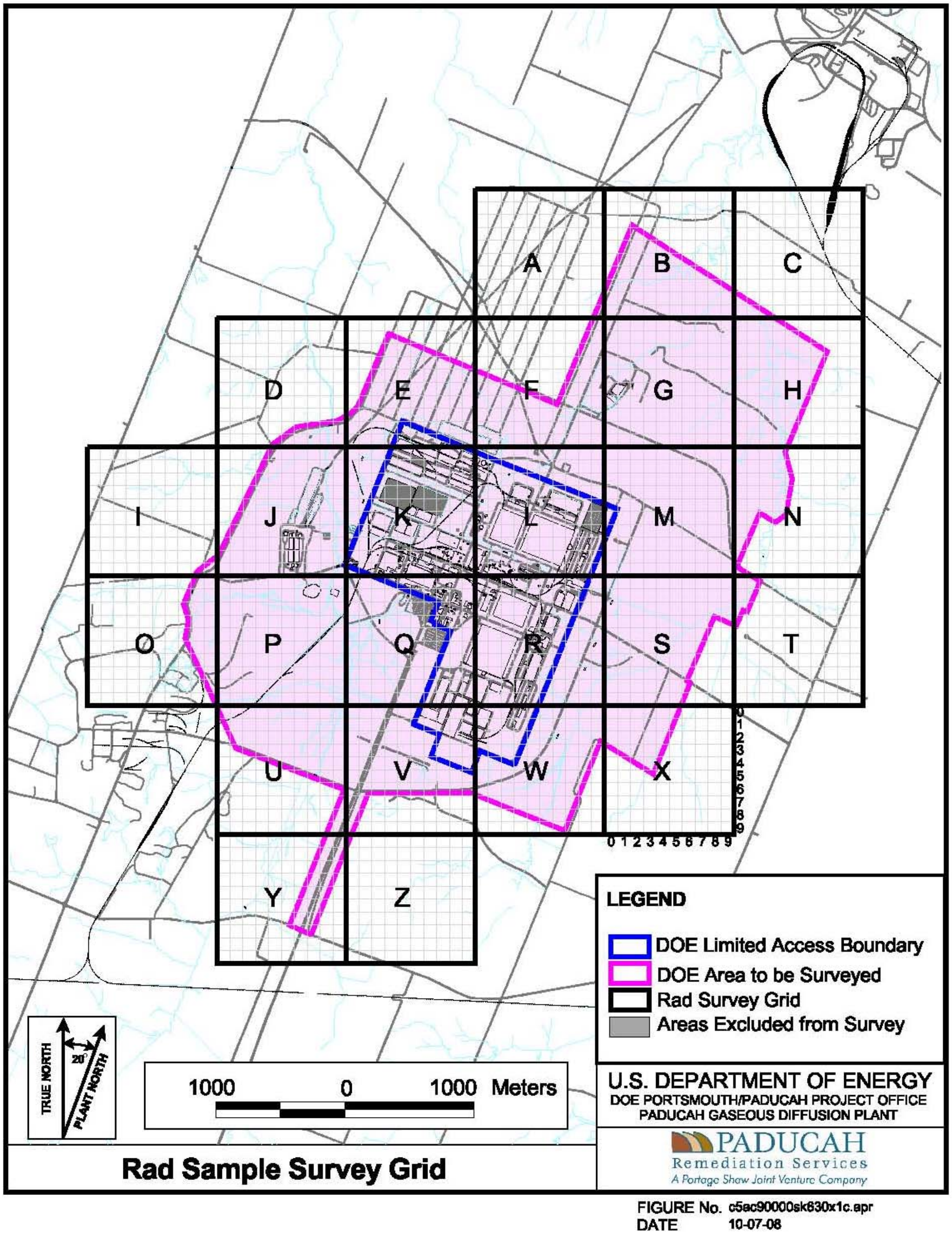

Figure B.53. Illustration of Survey Reference System, Indicating Survey Units (A-Z) and 1 Hectare Subunits

Instrumentation

Gamma scans will be performed with NaI detectors, coupled with scaler/ratemeters. The goal of the gamma scans is to identify deposits of 1 m^2 or greater having uranium-238 surface contamination levels ≥ 528 pCi/g. The specific detector design has yet to be determined, but is expected to be a Ludlum model 44-10, with a 2 inch x 2 inch scintillation crystal or functional equivalent. The detector may be outfitted with a shield in areas of high backgrounds, such as near UF_6 cylinder yards, to improve ability to distinguish changes in instrument response. The expected scaler/ratemeter is a Ludlum model 2221 or functional equivalent. The scaler/ratemeter will be coupled with a global positioning system (GPS) to automatically determine the state planer coordinates of the measurement location. The GPS instrument will record both the geographical location and associated count-rate data. The GPS system will have subfoot accuracy. The audible signal provided by the scaler/ratemeter will be monitored by the technician for increases in count rate, which could be indicative of the presence of nearby contamination. Instruments will be calibrated by a DOE prime contractor-approved vendor in accordance with ANSI-N323A-1997 and PRS procedure PRS-RAD-1111, *Workplace Monitoring*. Detection sensitivities for a 2 inch x 2 inch NaI detector, assuming a contaminated area 3.8-ft diameter and a detector movement of 0.5 m/sec, have been estimated in accordance with NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*. These sensitivities for audible recognition and 1- and 2-second integrated data are listed in Table B.16.

Table B.16. Detection Sensitivity for ^{238}U

Detector Model	Type	Nominal Background (c/m)	Detection Sensitivity (pCi/g)		
			audible	1 sec integrate	2 sec integrate
Ludlum 44-10	2 inch x 2 inch NaI	7,000	40	260	190

For comparison, the average uranium-238 concentration of 528 pCi/g has been determined to be associated with an annual dose of 15 mrem to an industrial worker. Scanning will be capable of identifying small areas containing uranium-238 concentrations of 528 pCi/g by audible signal changes. Scanning, using logged count integration with GPS coordinates also will be capable of identifying surface soil, ≤ 1 m^2 in area, with such uranium-238 concentrations.

Daily instrument performance checks of background and source response will be conducted per PRS procedure PRS-RAD-1319, *Setup for Operability Tests of Portable Field Instruments*.

Scanning Methodology

Scanning is performed by moving the detector in a serpentine pattern approximately 1-m wide, while advancing at a rate of approximately 0.5 m/sec. The sensitive area of the detector is maintained as close to the surface as practical, considering the surface conditions; 2–10 cm is a reasonable distance. Use of GPS-based data logging may be restricted and/or unreliable in locations where satellite signals are blocked intermittently by vegetation, tree canopy, or structures. For this reason, the audible signal is monitored continuously by the surveyor for indication of increases in instrument response that may indicate the presence of contamination in the immediate area.

Audible clicks on survey instrumentation represent instantaneous detection of radiation. Meter face or digital readouts responses are integrated over time so are therefore not an instant response. Because of this, any detectable increase in audible instrument response will be noted. Further scanning in the immediate vicinity will be conducted to confirm the increased response. Observations of anomalous areas or materials that may contain contaminated materials will be noted and then scans of these areas will be conducted. Finding will be recorded and sketches prepared of areas of confirmed elevated direct radiation, including dimensions and associated radiation levels. The area or material will be marked and photographed. The radiological control technician (RCT) supervisor will be notified of the findings and forwarded the results, dimensions, location, and photograph(s).

Any area or material noted to exhibit an associated direct gross gamma radiation level (in counts per minute) on the scanning instrument in excess of twice the ambient background will be evaluated for posting in accordance with 10 *CFR* § 835 and PRS-RAD-1108, *Posting and Labeling*. Areas will be posted as Controlled Areas and Contamination Areas if contamination levels exceed 10 *CFR* § 835 values.

Survey Schedule

On-site field experience with similar instrumentation and survey techniques has demonstrated that, on average, a two person survey team can visually assess and scan approximately 0.5 to 1.0 hectare (1.2 to 2.5 acres) per day. This includes planning, preparation, documentation, and evaluation of results. The DOE prime contractor will establish a goal of 0.75 acres per day progression.

Survey progress will be charted and reviewed daily to ensure that established interim goals are met. Progress will be depicted graphically using a series of maps and overlays that show the coverage and relative radiation levels for the surveyed area. Additionally, due to the inherent hazards associated with this activity, a specific work package and activity hazard analysis will be prepared to analyze and control the work activity.

Survey Report

Following completion of the field survey activities, a report will be prepared to be included in the RI and FS Reports. This report will describe the survey techniques, methods, and the survey findings. Evaluation of the survey findings will be discussed, along with recommendations for future actions. The DOE prime contractor will archive data electronically following guidance in PRS-ENM-1003, *Developing, Implementing, and Maintaining Data Management Implementation Plans*. Records will be kept in accordance with PRS-DOC-1009, *Records Management, Administrative Records, and Document Control*.

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APPENDIX C
DOCUMENT OUTLINE

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INTEGRATED RFI/RI REPORT

Executive Summary
1. Introduction
    1.1 Purpose of Report
    1.2 Site Background
        1.2.1 Site Description
        1.2.2 Site History
        1.2.3 Previous Investigations
    1.3 Report Organization
2. Study Area Investigation
    2.1 Includes all field activities associated with site characterization. These may include physical and chemical monitoring of some of the following:
        2.1.1 Surface Features
        2.1.2 Contaminant Source Investigations
        2.1.3 Meteorological Investigations
        2.1.4 Surface Water and Sediment Investigations
        2.1.5 Geological Investigations
        2.1.6 Soil and Vadose Zone Investigations
        2.1.7 Groundwater Investigations
        2.1.8 Human Population Surveys
        2.1.9 Ecological Investigations
    2.2 If technical memoranda documenting field activities were prepared, they may be included in an appendix and summarized in this report section.
3. Physical Characteristics of the Study Area
    3.1 Includes results of the field activities to determine physical characteristics. These may include some of the following:
        3.1.1 Surface Features
        3.1.2 Meteorology
        3.1.3 Surface Water Hydrology
        3.1.4 Geology
        3.1.5 Soils
        3.1.6 Hydrogeology
        3.1.7 Demography and Land Use
        3.1.8 Ecology
4. Nature and Extent of Contamination
    4.1 Presents the results of site characterization, both natural chemical components and contaminants of the following media:
        4.1.1 Sources (Lagoons, Sludges, Tanks, etc.)
        4.1.2 Soils and Vadose Zone
        4.1.3 Groundwater
        4.1.4 Surface Water and Sediments
        4.1.5 Air
5. Fate and Transport
    5.1 Potential Routes of Migration (i.e., Air, Groundwater, etc.)
    5.2 Contaminant Persistence
        5.2.1 Describe estimated persistence in the study area environment and physical, chemical, and/or biological factors of importance for the media of interest.

    5.3 Contaminant Migration

5.3.1 Describe factors affecting contaminant migration for the media of importance (e.g., sorption onto soils, solubility in water, movement of groundwater, etc.).
5.3.2 Describe modeling methods and results, if applicable.

6. BRA
    6.1 Human Health Evaluation
        6.1.1 Exposure Assessment
        6.1.2 Toxicity Assessment
        6.1.3 Risk Characterization
    6.2 Environmental Evaluation
7. Summary and Conclusions
    7.1 Summary
        7.1.1 Nature and Extent of Contamination
        7.1.2 Fate and Transport
        7.1.3 Risk Assessment
    7.2 Conclusions
        7.2.1 Data Limitations and Recommendations for Future Work
        7.2.2 Recommended RA Objectives

Appendices
    A Technical Memoranda on Field Activities
    B Analytical Data and QA/QC Evaluation Results C
    Risk Assessment Methods

NOTE: Elements included in this outline shall be considered and incorporated, as appropriate, when developing the above-referenced document.

INTEGRATED FS/CMS REPORT

Executive Summary
1. Introduction
    1.1 Purpose and Organization of Report
    1.2 Background Information (Summarized from RI/RFI Report)
        1.2.1 Site Description
        1.2.2 Site History
        1.2.3 Nature and Extent of Contamination 1.2.4 Contaminant Fate and Transport 1.2.5 BRA
2. Identification and Screening of Technologies
    2.1 Introduction
    2.2 RA Objectives -
        Presents the development of RA objectives for each medium of interest. For each medium, the following should be discussed:
        2.2.1 Contaminants of Interest
        2.2.2 Allowable Exposure Based upon Risk Assessment (including ARARs)
        2.2.3 Development of Remediation Goals
    2.3 General Response Actions -
        For each medium of interest, describe the estimation of areas or volumes to which treatment, containment, or exposure technologies may be applied.
    2.4 Identification and Screening of Technology Types and Process Options - For each medium of interest, describe:
        2.4.1 Identification and Screening of Technologies
        2.4.2 Evaluation of Technologies and Selection of Representative Technologies
3. Development and Screening of Alternatives
    3.1 Development of Alternatives -
        Describes rationale for combination of technologies/media into alternatives.
    3.2 Screening of Alternatives (if conducted)
        3.2.1 Introduction
        3.2.2 Alternative 1
        3.2.2.1 Description
        3.2.2.2 Evaluation
        3.2.3 Alternative 2 (etc.)
        3.2.4 Alternative 3 (etc.)
4. Detailed Analysis of Alternatives
    4.1 Introduction
    4.2 Individual Analysis of Alternatives
        4.2.1 Alternative 1
            4.2.1.1 Description
            4.2.1.2 Assessment
        4.2.2 Alternative 2 (etc.)
        4.2.3 Alternative 3 (etc.)
    4.3 Comparative Analysis
Bibliography
Appendices

NOTE: Elements included in this outline shall be considered and incorporated, as appropriate, when developing the above-referenced document.

Baseline Risk Assessment Outline

Baseline Human Health Risk Assessment

1. Results of Previous Studies
2. Identification of Chemicals of Potential Concern
    - 2.1 Sources of Data
    - 2.2 General Data Evaluation Considerations
    - 2.3 Risk Assessment Specific Data Evaluation
    - 2.4 Evaluation of Data from Other Sources
    - 2.5 Summary of Chemicals of Potential Concern
3. Exposure Assessment
    - 3.1 Characterization of Exposure Setting
    - 3.2 Identification of Exposure Pathways
    - 3.3 Quantification of Exposure
    - 3.4 Summary of Exposure Assessment
4. Toxicity Assessment
    - 4.1 Inorganics
    - 4.2 Organics
    - 4.3 Radionuclides
    - 4.4 Chemicals for Which No EPA Toxicity Values Are Available
    - 4.5 Uncertainties Related to Toxicity Assessment
    - 4.6 Summary
5. Risk Characterization
    - 5.1 Determination of Noncancer Effects
    - 5.2 Determination of Excess Cancer Risk
    - 5.3 Risk Characterization for Current Use Scenario(s)
    - 5.4 Risk Characterization for Future Use Scenario(s)
    - 5.5 Risk Characterization for Lead (if needed)
    - 5.6 Identification of Use Scenarios, Contaminants, Pathways, and Media of Concern
    - 5.7 Summary of Risk Characterization
6. Uncertainty in the Risk Assessment
    - 6.1 Uncertainties Associated with Data
    - 6.2 Uncertainties Associated with Exposure Assessment
    - 6.3 Uncertainties Associated with Toxicity Assessment
    - 6.4 Uncertainties Associated with Risk Characterization
    - 6.5 Summary of Uncertainties
7. Conclusions and Summary
    - 7.1 Chemicals of Potential Concern
    - 7.2 Exposure Assessment
    - 7.3 Toxicity Assessment
    - 7.4 Risk Characterization
    - 7.5 Observations

Screening-Level Ecological Risk Assessment

(The outline of the SERA will be consistent with the completion of Steps 1, 2, and 3 of the EPA ecological risk assessment process as outlined in Volume 2 of the PGDP Risk Methods Document (DOE 2001c). This outline for the ecological risk assessment is dependent on the amount of information available after completion of field activities; therefore, the outline will be determined at that time.)

APPENDIX D

HISTORICAL DATA SUMMARY

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APPENDIX D
HISTORICAL DATA SUMMARY

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