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

PPPO-02-1362034-12B

Ms. Jennifer Tufts
Remedial Project Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Mullins and Ms. Tufts:

TRANSMITTAL OF THE REMEDIAL DESIGN SUPPORT INVESTIGATION CHARACTERIZATION PLAN FOR THE C-747-C OIL LANDFARM AND C-720 NORTHEAST AND SOUTHEAST SITES AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/LX/07-0350&D1)

Please find enclosed the *Remedial Design Support Investigation Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Sites at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/LX/07-0350&D1). This secondary document corresponds to the Remedial Design Work Plan, which is in the process of review and approval by the Federal Facility Agreement parties. This document identifies the strategy for the collection of data necessary for the design and implementation of remedial technologies at the C-747-C Oil Landfarm and C-720 Northeast and Southeast sites.

Section XX.6.2 of the Federal Facility Agreement allows for a 90-day review cycle for a secondary document. In order to accommodate the current project schedule, the U.S. Department of Energy is requesting a 30-day review cycle and respectfully requests comments by March 9, 2012.

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

Enclosure:
Remedial Design Support Investigation Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Sites DOE/LX/07-0350&D1

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DOE/LX/07-0350&D1
Secondary Document

Remedial Design Support Investigation Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Sites at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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DOE/LX/07-0350&D1
Secondary Document

Remedial Design Support Investigation Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Sites at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—February 2012

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

Prepared by
LATA ENVIRONMENTAL SERVICES OF KENTUCKY, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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TABLES

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ACRONYMS

AHA	Activity Hazard Assessment
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	chain-of-custody
DMIP	data management implementation plan
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DPT	direct push technology
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FFS	focused feasibility study
HASP	health and safety plan
HU	hydrogeologic unit
LUC	land use control
MCL	maximum contaminant level
MIP	membrane interface probe
NCP	National Contingency Plan
OU	operable unit
OREIS	Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
PID	photoionization detector
PSQ	principal study question
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	remedial action objective
RDSI	Remedial Design Support Investigation
RFD	request for disposal
RG	remediation goal
RGA	Regional Gravel Aquifer
RI	remedial investigation
SI	site investigation
SWMU	solid waste management unit
UCRS	Upper Continental Recharge System
VOC	volatile organic compound
WAG	waste area grouping

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1. PROJECT DESCRIPTION

This Remedial Design Site Investigation (RDSI) Characterization Plan supports implementation of the selected alternatives for remediation of contaminant source areas for the Southwest Plume at the Paducah Gaseous Diffusion Plant (PGDP), near Paducah, Kentucky. The Southwest Plume refers to an area of groundwater contamination in the Regional Gravel Aquifer (RGA) south of the Northwest Groundwater Plume and west of the C-400 Building. The plume was identified during the Waste Area Grouping (WAG) 27 Remedial Investigation (RI) in 1998 (DOE 1999). Additional work to characterize the plume [Solid Waste Management Unit (SWMU) 210] was performed as part of the WAG 3 RI and Source Areas to Off-Site Groundwater Contamination Investigation, both in 1999 (DOE 2000a; DOE 2000b). As discussed in these reports, the primary groundwater contaminant of concern for the Southwest Plume is trichloroethene (TCE). Other potential contaminants found in the plume include additional volatile organic compounds (VOCs), metals, and the radionuclide technetium-99.

The U.S. Department of Energy (DOE) conducted a site investigation (SI) in 2004 to address uncertainties regarding potential source areas to the Southwest Plume that remained after previous investigations. The SI further profiled the current level and distribution of VOCs in the dissolved-phase plume along the west plant boundary. Results of the SI were reported in the *Site Investigation Report for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2007). The potential presence of dense nonaqueous-phase liquid (DNAPL) TCE at the Southwest Plume source areas was noted in the SI report and in the previous WAG 27 RI report, based on contaminant trends observed in soil and groundwater samples.

The potential source areas investigated in the SI (DOE 2007) included the C-747-C Oil Landfarm (Oil Landfarm, SWMU 1); the C-720 Building Area near the northeast and southeast corners of the building (C-720 Northeast Site, SWMU 211-A, and C-720 Southeast Site, SWMU 211-B); and the storm sewer system between the south side of the C-400 Building and Outfall 008 (storm sewer, SWMU 102). As a result of the Southwest Plume SI, the storm sewer was excluded as a potential VOC source to the Southwest Plume. Respective SWMU numbers and locations for the Southwest Plume source areas to be addressed by the remedial action are provided in Table 1 and Figure 1, respectively.

Table 1. Summary of Southwest Plume Potential Source Areas

Potential Source Area	SWMU No.
C-747-C Oil Landfarm	1
C-720 TCE Spill Sites Northeast and Southeast	211-A, 211-B

A revised focused feasibility study (FFS) (DOE 2011a) was prepared to evaluate remedial alternatives for potential application at the Southwest Plume source areas. The revised FFS defined these remedial action objectives (RAOs):

(1) Treat and/or remove the principal threat waste consistent with the National Contingency Plan (NCP).

(2a) Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (< 10 ft).

(2b) Prevent exposure to non-VOC contamination and residual VOC contamination through interim land use controls (LUCs) within the Southwest Plume source areas (i.e., SWMU 1, SWMU 211-A, and SWMU 211-B) pending remedy selection as part of the Soils Operable Unit (OU) and the Groundwater OU.

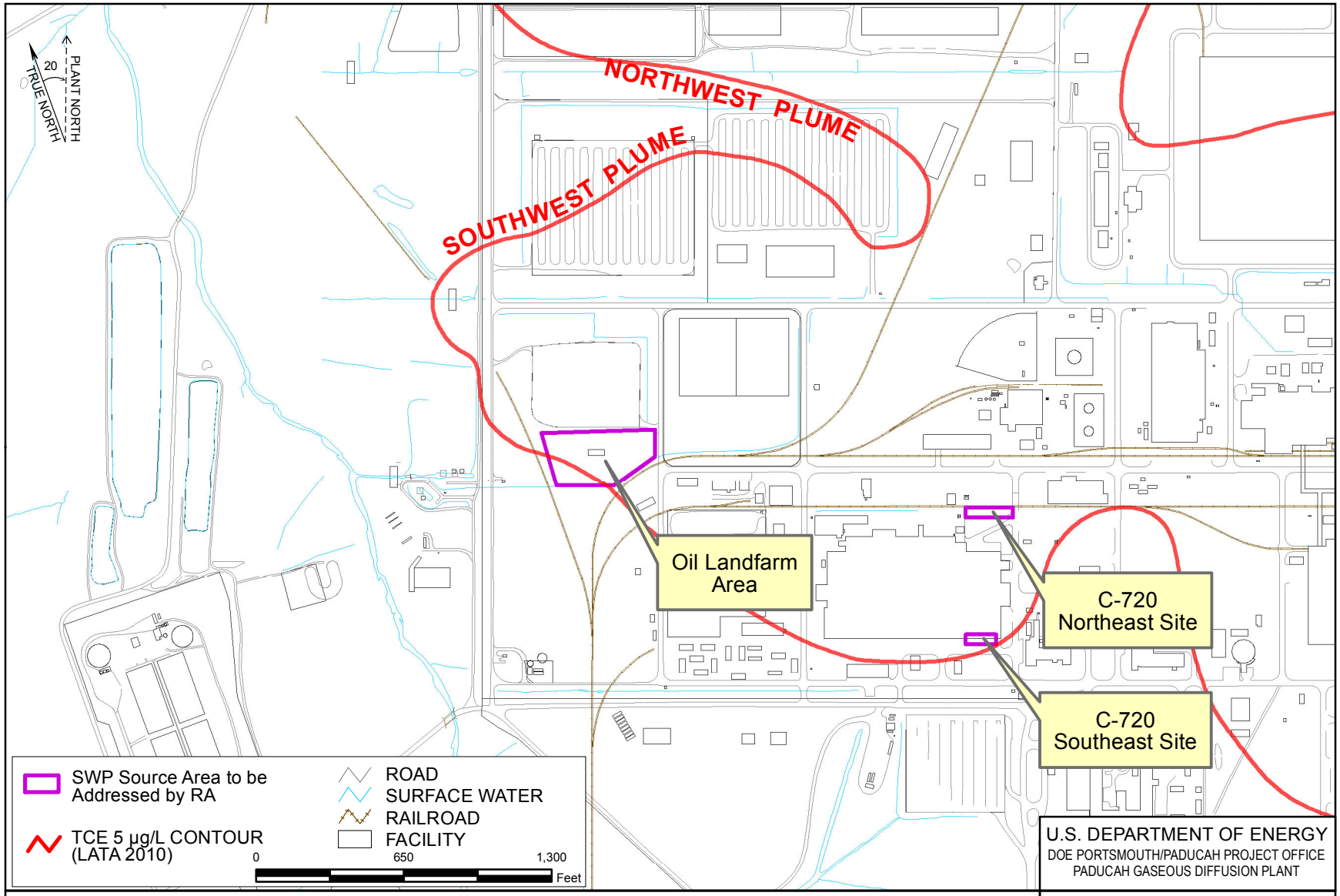

Figure 1. Southwest Plume Source Areas Addressed by the Remedial Design

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(3) Reduce VOC migration from contaminated subsurface soils in the treatment areas at the Oil Landfarm and C-720 Northeast and Southeast Sites so that contaminants migrating from the treatment areas do not result in the exceedance of maximum contaminant levels (MCLs) in underlying RGA groundwater.

TCE concentrations in Upper Continental Recharge System (UCRS) soil that would meet RAO #3 in the absence of any controls (cleanup levels) were calculated and presented in the revised FFS as follows:

- C-747-C Oil Landfarm: 7.3E-02 mg/kg
- C-720 Northeast and Southeast Sites: 7.5E-02 mg/kg

The Preferred Alternatives identified in the revised proposed plan (DOE 2011b) and the record of decision (DOE 2011c) are as follows:

- SWMU 1—Oil Landfarm—*In Situ* Source Treatment Using Deep Soil Mixing with Interim LUCs (Alternative 3),

- SWMU 211-A—C-720 Building TCE Northeast Spill Site—Final Characterization of source extent and magnitude followed by either *In Situ* Source Treatment Using Enhanced *In Situ* Bioremediation with Interim LUCs (Alternative 8) or Long-term Monitoring with Interim LUCs (Alternative 2), and

- SWMU 211-B—C-720 Building Southeast Spill Site—Final Characterization of source extent and magnitude followed by either *In Situ* Source Treatment Using Enhanced *In Situ* Bioremediation with Interim LUCs (Alternative 8) or Long-Term Monitoring with Interim LUCs (Alternative 2).

The objective of this RDSI is to resolve data needs in support of the treatment system design. The primary data need identified in the revised FFS (DOE 2011a) requiring resolution is the identification of the areal and vertical extents of VOC contamination above cleanup levels at the C-747-C Oil Landfarm and the C-720 Northeast and Southeast Sites.

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2. SITE BACKGROUND

PGDP [site U.S. Environmental Protection Agency (EPA) ID KY8-890-008-982] is located in McCracken County in western Kentucky, about 3.5 miles south of the Ohio River and approximately 10 miles west of the city of Paducah. PGDP has produced enriched uranium since 1952. Most industrial activities are sited in a security area and buffer zones (approximately 650 acres) that are restricted from access by the public. This secured area is located on 3,556 acres controlled by DOE.

2.1 SITE DESCRIPTION

PGDP lies in the Jackson Purchase Region of western Kentucky between the Tennessee and Mississippi Rivers, bounded on the north by the Ohio River. Local elevations range from 290 ft above mean sea level (amsl) along the Ohio River to 450 ft amsl in the southwestern portion of PGDP near Bethel Church Road. Generally, the topography in the PGDP area slopes toward the Ohio River at an approximate 27 ft per mile gradient (CH2M HILL 1992). The terrain in the vicinity of the plant is slightly modified by the dendritic drainage systems associated with the two principal streams in the area, Bayou Creek and Little Bayou Creek.

The C-747-C Oil Landfarm is a relatively flat, open, grass-covered area located in the west-central part of PGDP. It was active from 1973 to 1979. Waste oils were spread on the surface every three to four months, and then the area was limed and fertilized. Within the boundary of the landfarm were two roughly parallel disposal plots; however, the precise locations of the two plots have not been fully defined. TCE was detected in the SI at concentrations above the cleanup level at the maximum depth of investigation at 59.5 ft below ground surface (bgs).

The C-720 Building is located in the west-central area of PGDP, to the southwest of the C-400 Building, and consists of several repair and machine shops as well as other support operations. The building was constructed in 1953. TCE was detected at concentrations above the cleanup level at the Northeast and Southeast Sites at the maximum depth of investigation at 56.5 ft bgs during the 2004 SI (DOE 2007).

Contamination at the C-720 Northeast Site is believed to have been released during routine equipment cleaning and rinsing performed in the area (DOE 2011a). Solvents were used to clean parts, and the excess solvent may have been discharged on the ground. Spills and leaks from the cleaning process also may have contaminated surface soils in the area. Solvents may have migrated as dissolved contamination, in rainfall percolating through the soils and migrating to deeper soils and the shallow groundwater; or as DNAPL migrating to adjacent and underlying soils.

The source of VOC contamination at the C-720 Southeast Site is not certain (DOE 2011a). The VOCs may have originated from spills that occurred within the building, with subsequent discharge to storm drains leading to the southeast corner of the building, or from spills or leaks on the loading dock or parking lot located to the southeast of the building. The area of concern discovered during the WAG 27 RI (DOE 1999) is near the outlet to one of the storm drains for the east end of the building. A storm sewer inlet for the southeast parking lot also is located in the vicinity. The north edge of the parking lot, where the contamination occurs, is the location of one of the loading docks for the C-720 Building, an area where chemicals, including solvents, may have been loaded or unloaded.

The estimated C-720 Northeast and Southeast Site boundaries shown in the Southwest Plume Revised FFS (DOE 2011a) were based on the fate and transport model grid for the C-720 area used in the WAG

27 RI and the Southwest Plume SI (DOE 2007). The Groundwater OU Feasibility Study (DOE 2001) also provided estimates of source area locations and dimensions.

2.2 REGIONAL GEOLOGY

The stratigraphic sequence in the PGDP region consists of Cretaceous, Tertiary, and Quaternary sediments uncomformably overlying Paleozoic bedrock. Exposed strata in the Jackson Purchase region range in age from Devonian to Holocene.

Coastal Plain deposits unconformably overlie Mississippian carbonate bedrock in the Jackson Purchase and consist of the following (from oldest to youngest): the Tuscaloosa Formation; sands and clays of the Clayton/McNairy Formations; the Porters Creek Clay; and the Eocene sand and clay deposits of the undivided Jackson, Claiborne, and Wilcox Formations. Continental deposits unconformably overlie the Coastal Plain deposits, which are, in turn, covered by loess and/or alluvium. The Porters Creek Clay Terrace Slope, a buried terrace slope that trends approximately east to west across the southern portion of PGDP, represents the southern limit of erosion of the ancestral Tennessee River (Figure 2). All three source areas to the Southwest Plume that are part of this remedial action overlie sedimentary fill of the ancestral Tennessee River channel.

2.3 SITE GEOLOGY

The sediments above the limestone bedrock beneath most of PGDP are grouped into three major stratigraphic units (loess, Continental Deposits, and McNairy Formation), based on how the sediments were deposited, and three locally significant groundwater systems (the UCRS, the RGA, and the McNairy Flow System), based on how water moves within the sediments.

The first (shallowest) stratigraphic unit consists of fill and a layer of wind-deposited, silty clay (known as loess) extending from the surface to a depth of approximately 20 ft beneath PGDP. This loess overlies the Continental Deposits. In the Jackson Purchase, the Continental Deposits are divisible into an upper fine-grained member and a lower coarse-grained member. Together, the two members constitute an upper-fining sequence of sediments left by a large, low-gradient, alluvial fan that covered much of the region and eventually buried the erosional topography.

The buried river valley of the ancestral Tennessee River, which underlies most of the PGDP plant area and the land to the north, contains reworked Continental Deposits. These sediments consist of an upper sequence of silts and clays units with interbedded sand (and some gravel) lenses to a depth of approximately 55 ft beneath PGDP. Sand and gravel typically constitute a significant proportion of the Upper Continental Deposits close to the Porters Creek Clay Terrace Slope and form a horizon of common sand and gravel lenses immediately beneath the loess under most of the plant area.

A lower sequence of highly permeable gravelly sand or chert gravel, typically occurring between 55 and 92 ft bgs at PGDP, forms the Lower Continental Deposits. The Lower Continental Deposits average 30-ft thick. Under most of PGDP and the land to the north, the Continental Deposits rest upon an unconformity cut into the top of the McNairy Formation.

The McNairy Formation is a sequence of marine silts, clays, and fine sands that extends from approximately 92 to 350 ft bgs beneath PGDP. Sand accounts for 40–50% of the total formation.

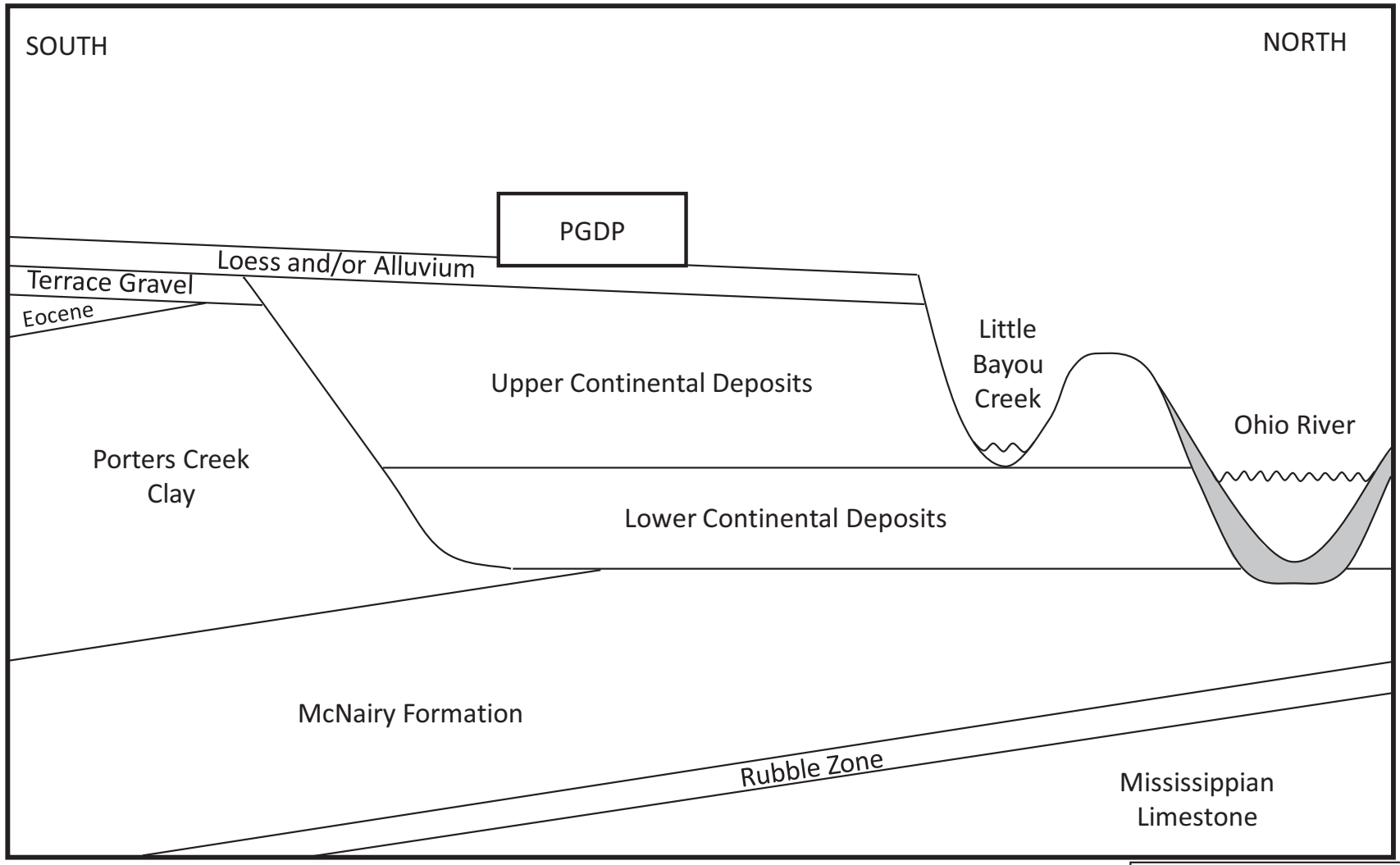

Figure 2. Geologic relationships underlying the PGDP area

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DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

LATA Environmental Services of Kentucky, LLC

2.4 HYDROGEOLOGY

The UCRS is the shallow groundwater system underlying most of PGDP and the three source areas of the Southwest Plume that are the focus of this investigation. Three primary hydrogeologic units (HUs) make up the UCRS: a shallow loess unit to approximately 20 ft depth (HU1); an interval of common sand and gravel lenses in a sandy silt unit (HU2), of variable thickness; and an underlying silty or sandy clay interval (HU3) that extends to a depth of approximately 60 ft. (Both HU2 and HU3 are members of the Upper Continental Deposits.) Groundwater flows downward through the UCRS, providing recharge to the underlying RGA.

The depth of the water table varies considerably across the PGDP, primarily in response to the texture of the HU3 and the presence of enhanced recharge. In the areas of this investigation, the water table is anticipated to be relatively shallow (approximately 10 to 30 ft bgs).

The RGA is the uppermost aquifer at PGDP. It typically consists of an upper thin sand unit (HU4), which is the basal unit of the Upper Continental Deposits, and a 30-ft thick sandy gravel unit (HU5), which comprises the Lower Continental Deposits beneath most of PGDP. Groundwater flow in the RGA is primarily northward, eventually to discharge into the Ohio River or gaining streams near the river.

Silts, clays, and sands of the McNairy Formation underlie the Lower Continental Deposits (at approximately 90 ft depth). These sediments have significantly lower hydraulic conductivity than the RGA and form a lower semiconfining unit to the RGA flow system.

3. DATA QUALITY OBJECTIVES

This RDSI Characterization Plan implements the seven-step data quality objectives (DQO) process (EPA 2006) to ensure that sufficient data of the appropriate type and quality are collected to resolve the data needs identified previously. The DQO process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. The DQO process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study.

The DQO process includes systematic planning for environmental data collection. This step is based on the widely accepted "scientific method" and includes concepts such as objectivity of approach and acceptability of results (EPA 2006). The DQO process consists of seven iterative steps. Since it is an iterative process, one or more of these steps may be revisited as more information is obtained. The first five steps are focused on identifying qualitative criteria such as the nature of the problem, conceptual model, decisions that need to be made, type of data needed, and the analytic approach or decision rule that describes how the data will be used to draw conclusions. The sixth step establishes acceptable quantitative criteria (acceptance criteria) on the quality and quantity of the data to be collected. The seventh step involves a data collection design to generate data that will meet the quantitative and qualitative criteria specified in step 6. The data collection design specifies the type, number, location, and physical quantity of samples and data as well as quality assurance (QA)/quality control (QC) measures.

The DQO process as applied to data collection in support of decision making is summarized below:

(1) **State the Problem**, wherein the problem to be resolved by the data collection activity is sufficiently defined that the focus of the study will be unambiguous.

(2) **Identify the Decision**, wherein the principal study question (PSQ) is defined that the study will try to resolve. An output of this step is a decision statement that links the PSQ to possible actions that will solve the problem.

(3) **Identify Inputs to the Decision**, which identifies informational inputs required to resolve the decision statement and determine which inputs require environmental measurements.

(4) **Define the Study Boundaries**, which defines the spatial and temporal boundaries of the problem.

(5) **Develop a Decision Rule**, wherein the environmental measurement parameter of interest, the action level, and inputs from previous steps are formulated in a single statement that describes a logical basis for choosing among alternative actions. An output of this step is an "If…then…" statement that defines conditions that would cause the decision maker to choose among alternative actions.

(6) **Specify Limits on Decision Errors**, wherein the decision makers' tolerable limits on decision errors are used to establish performance goals for the data collection design.

(7) **Optimize the Design for Obtaining Data**, wherein an efficient strategy for obtaining data that satisfy the DQOs is identified.

These steps in the DQO process, as they apply to SWMU 1 and C-720 Northeast and Southeast Sites, are shown in Table 2. The resulting sampling and analysis plan is described in Section 6.

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Table 2. Summary of the DQO Process for the Southwest Plume Source Areas RDSI

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries	5: Develop a Decision Rule	6: Specify Limits on Decision Errors	7: Optimize the Design for Obtaining Data
	Principal Study Questions	**Alternative Actions**	**Decision Statement**					
Problem statement: The PGDP's Southwest Plume consists of groundwater in the RGA contaminated primarily with TCE. The C-747-C Oil Landfarm (SWMU 1) and the C-720 Building Northeast and Southeast Sites (SWMUs 211-A and 211-B, respectively) are sources of contamination to the Southwest Plume. A revised FFS (DOE 2011a) was performed for the three Southwest Plume source areas. RAOs defined in the Southwest Plume FFS include: (1) Treat and/or remove principal threat waste consistent with CERCLA, the NCP. (2a) Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (< 10 ft depth bgs). (2b) Prevent exposure to non-VOC contamination and residual VOC contamination through interim LUCs within the Southwest Plume source areas (i.e., SWMU 1, SWMU 211 A, and SWMU 211 B), pending remedy selection as part of the Soils OU and the Groundwater OU. (3) Reduce VOC migration from contaminated subsurface soils in the treatment areas at the Oil Landfarm and C-720 Northeast and Southeast sites so that contaminants migrating from the treatment areas do not result in an exceedance of MCLs in underlying RGA groundwater. Soil cleanup levels, volume-averaged TCE UCRS soil concentrations that would meet RAO #3, calculated in the Southwest Plume Revised FFS Appendix C are listed below: · Oil Landfarm source area: 7.3E-02 mg/kg · C-720 northeast and southeast source areas: 7.5E-02 mg/kg. Previous investigations documented in the WAG 27 RI (DOE 1999) and the SI Report (DOE 2007) did not completely define the areal and vertical extent of soil contaminated above cleanup levels in the source areas. This was identified in the Southwest Plume FFS (DOE 2011a) as a data gap to be resolved in the RDSI. The Southwest Plume Proposed Plan (DOE 2011b) identified *In Situ* Source Treatment Using Deep Soil Mixing with Interim Land Use Controls (LUCs) (Alternative 3) as the preferred alternative for the C-747-C Oil Landfarm and Final Characterization of source extent and magnitude followed by either *In Situ* Source Treatment Using Enhanced *In Situ* Bioremediation with Interim LUCs	PSQ-1: What is the areal extent of TCE and TCE degradation products present at volume-averaged concentrations higher than cleanup levels at the Southwest Plume source areas? PSQ-2: What additional information (beyond contaminant extent) is required for design of the remedial actions?	AA-1a: Remediation is required where the volume-averaged concentrations of TCE and TCE degradation products in soils of the UCRS exceed cleanup levels. AA-1b: Remediation is not required where the volume-averaged concentrations of TCE and TCE degradation products in soils of the UCRS do not exceed cleanup levels.	DS-1: Determine where volume-averaged concentrations of TCE and TCE degradation products in soils of the UCRS in the Southwest Plume source areas exceed cleanup levels, requiring remediation. DS-2: Determine where additional design-type information is required for the preferred alternatives.	1) Process knowledge of releases (DOE 2011a) 2) Previous investigation results (DOE 2011a) 3) Description of C-720 source areas in Appendix C of the GWOU FS (DOE 1999) 4) Site conceptual model (DOE 2011a) 5) Southwest Plume FFS Alternatives 2, 3, and 8 descriptions (DOE 2011a) 6) Minimum TCE cleanup levels: 7.3E-02 mg/kg for the C-747-C Oil Landfarm and 7.5E-02 mg/kg for the C-720 Northeast and Southeast Sites (DOE 2011a) 7) TCE DLs by USEC = 5E-03 mg/kg (Watson 2010). 8) Current estimates of source area dimensions shown in Southwest Plume FFS (DOE 2011a) 9) Information requirements for design of the preferred alternatives (EPA and vendor guidance documents).	*Spatial boundaries:* The vertical boundary of the study is the base of the UCRS (base of HU3 interval) at all sites. TCE concentrations above cleanup levels are present at the maximum depths sampled in previous investigations. The approximate areal boundaries of the study for the Oil Landfarm (SWMU 1) are defined by the extent of soil shown in Southwest Plume FFS Figure 1.17 (DOE 2011a). The areal extents for the C-720 Northeast and Southeast Sites are undefined. Surface and subsurface infrastructure is present in the C-720 source areas. The C-720 building bounds the north side of the southeast source area. *Schedule boundaries*: The focused investigation results must be available by the start of development of the 90% remedial design. Fieldwork and lab analysis turnaround is anticipated to require approximately 120 days. *Operational boundaries:* Field investigations and remedial design are constrained by surface and subsurface infrastructure at the C-720 Building. No significant interferences exist at the Oil Landfarm. None of the areas are posted as radiological contamination areas; however, VOCs, metals, and SVOCs are present in soils. An underground storage tank near northeast corner of C-720 may present problems both as subsurface infrastructure and source of petroleum in soils. *Administrative boundaries*:	DR-1: If depth-averaged concentrations of TCE and TCE degradation products in soil of the UCRS exceed volume-averaged cleanup levels for a given soil boring, then include the location in the treatment area. If the depth-averaged soil concentrations do not exceed volume-averaged cleanup levels, then the area need not be included in the treatment area. DR-2: If additional design-type information is required to implement the preferred alternatives, then collect the information during the RDSI.	Definitive data quality is assumed for fixed-base laboratory analysis. Screening level data quality is assumed for field analyses. The depth-averaged contaminant concentration will be derived from a combination of laboratory analysis from each 5-ft depth interval and extrapolated soil concentration at 0.5 ft intervals, extrapolated based on field PID measurements at 0.5-ft depth intervals. The derived depth-averaged contaminant concentration will be used as a definitive criterion for comparison with the RG, with no consideration for false rejection rate or false acceptance rate. The sampling plan minimizes decision error by intentionally biasing the location of the sample for laboratory analysis to the location of highest field PID measurement.	The selected treatment technologies are able to address the range of small, discrete areas to broad areas. There effectively is no minimum or maximum decision area. A combination of field screening instruments, field laboratory analysis, and fixed-base laboratory confirmation analysis will be used to define the outer extent of the area contaminated above the RGs. The contaminants of interest are TCE and degradation products: 1,1-dichloroethene; *cis*-1,2-dichloroethene; *trans*-1,2-dichloroethene; and vinyl chloride. The targeted depth of investigation is 60 ft bgs, which penetrates through the average depth of the base of the HU3 at SWMU 1 and at the C-720 sites. Sample borings that reach a minimum of 50 ft bgs depth may be considered completed if the average contaminant concentrations (averaged from analyses and extrapolated concentrations) at the bottom 10 ft of the boring are below the site RGs. Where one or more depth-averaged contaminant concentrations in a soil boring exceed an RG for a site, contingency borings will be sampled, as necessary (up to the contingency allotment for each site), to bound the

Table 2. Summary of the DQO Process for the Southwest Plume Source Areas RDSI (Continued)

1: State the Problem	2: Identify the Decision			3: Identify Inputs to the Decision	4: Define the Study Boundaries	5: Develop a Decision Rule	6: Specify Limits on Decision Errors	7: Optimize the Design for Obtaining Data
	Principal Study Questions	Alternative Actions	Decision Statement					
(Alternative 8) or Long-term Monitoring with Interim LUCs (Alternative 2) as the preferred alternatives for the C-720 Northeast and Southeast Sites. An RDSI is proposed to resolve data gaps including areal and vertical extent of soil contaminated above cleanup levels in the source areas. The RDSI must produce data of sufficient quality and quantity to resolve the data gaps.					Establishment of a field laboratory facility will require development of additional work control.			remediation area. At SWMU 1, contingency boring step outs can be no greater than 75 ft. At the C-720 sites, contingency boring step outs must be consistent with the sampling grid except where prevented by the presence of utilities or other obstructions. Parameters as established in quality assurance project plan for precision, accuracy, representativeness, completeness, and comparability. A combination of field measurements and fixed-base laboratory analysis will be used to quantify key design criteria for the preferred alternatives.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; DL = detection limit; EPA = U.S. Environmental Protection Agency; FFS = focused feasibility study; FS = feasibility study; GWOU = Groundwater Operable Unit; MCL = maximum contaminant level; NCP = National Contingency Plan; OU = operable unit; PGDP = Paducah Gaseous Diffusion Plant; RAO = remedial action objective; RDSI = Remedial Design Support Investigation; RG = remediation goal; RGA = Regional Gravel Aquifer; SVOC = semivolatile organic compound; SWMU = solid waste management unit; TCE = trichloroethene; UCRS = Upper Continental Recharge System; USEC = United States Enrichment Corporation; VOC = volatile organic compound

4. RDSI PLANNING

RDSI planning includes evaluation of existing data, DQO scoping, and a site visit. Each activity is discussed below.

4.1 EVALUATION OF EXISTING DATA

Evaluation of existing data used to develop the sampling strategy is described in Appendix A.

4.2 DQO SCOPING MEETING

A DQO scoping meeting, attended by subject matter experts, was held February 4, 2010, to gather input to DQO development for the RDSI characterization plan. Subsequently, additional meetings have been held from which data needs specific to selected remedies were identified. Results were incorporated in the DQO development discussion in Section 3.

4.3 SITE WALKDOWNS

The three source areas will be visited by the project team prior to commencement of the RDSI characterization plan implementation. The sampling design will be revised, as needed, based on the outcome of the walkdowns.

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5. TECHNICAL APPROACH FOR THE RDSI

The primary focus of this field investigation is the collection of soil samples for VOCs analysis for each 5 ft depth interval (e.g., 0-5 ft, 5-10 ft, 10-15 ft) to 60 ft depth (approximate depth of the UCRS) in each of three investigation areas. Field measurements of VOCs in soils at 0.5 ft depth intervals [using a field photoionization detector (PID)] will be used to interpolate and extrapolate the laboratory analytical results. The average (using both laboratory analytical result and interpolated/extrapolated concentrations) contaminant level in each soil boring will be compared to the site-specific remediation goals (RGs). The extent of depth-average soil contamination that exceeds the RGs will define the remediation area.

Additional soil and groundwater sampling and field measurement and testing are being performed to support the remedial design.

5.1 HEALTH AND SAFETY

A project-specific health and safety plan (HASP) will be developed for this RDSI and approved by the DOE prime contractor prior to field implementation. The HASP will establish the specific applicable standards and practices to be used during execution of the RDSI characterization plan to protect the safety and health of workers, the public, and the environment. It will incorporate directly, or by reference, applicable federal and state standards, consensus standards, and contract requirements. The HASP will be implemented in accordance with 29 *CFR* § 1926.65, *Hazardous Waste Operations and Emergency Response*. Additional specific health and safety requirements will be incorporated into the Activity Hazard Assessment (AHA) for the various field activities that comprise the RDSI.

The HASP will evolve as “lessons learned” are incorporated to continuously improve the work processes, while maintaining focus on the functions and guiding principles of the Integrated Safety Management System and the zero-accident performance philosophy.

5.2 SURFACE GEOPHYSICAL SURVEY

Underground utilities are present in the investigation area, and avoiding penetration of these utilities during intrusive sampling activities is a primary concern; therefore, an extensive excavation/penetration permit process, including a geophysical survey, will be conducted in each sampling area prior to intrusive sampling. This geophysical survey will verify that sample locations are free of interfering utilities. Locations of known utilities will be checked against the sampling location. The geophysical survey will assist in identifying any previously unknown utilities that may exist. This survey will be used in conjunction with utility drawings and field measurements to help locate these utilities before invasive drilling activities begin.

Sampling locations may require relocation based upon results of the geophysical survey to avoid penetrating any utilities.

5.3 SAMPLING STRATEGY

Soil will be the primary media for characterization of the extent of TCE. To provide timely access to the TCE characterization data, the investigation will use a mobile field laboratory for VOC analyses,

following protocols to provide quality assured data or quick-turnaround analyses from a fixed-base laboratory under the DOE Consolidated Audit Program (DOECAP). The sampling strategy design, detailed in Appendix A, is based upon site background information, the cleanup levels, DQOs, and geospatial analysis of historical data. Proposed RDSI sampling locations are listed in Appendix A. The sampling strategy to meet the RDSI objectives is described in the following subsections.

5.3.1 C-720 Building Source Areas

The initial site characterization will consist of field screening and sampling of soil borings that are located on a rectangular grid of 30 ft by 30 ft (or smaller interval). Where previous soil borings with detections of TCE above the cleanup level are adjacent to the sampling grids, the sampling grids have been extended beyond the boundaries of each SWMU to include the area of the previous soil borings. Each soil boring will provide continuous core for field screening at 0.5 ft depth intervals, and the collection of a soil sample for laboratory analysis from each 5 ft depth interval, to the bottom of the UCRS, a depth of approximately 60 ft bgs.

The following is the overall sampling sequence for the C-720 northeast and southeast source areas.

(1) Perform initial site visit and geophysical surveys, excavation/penetration permit program requirements, and AHA for both sites.

(2) Mobilize to the first site (northeast or southeast).

(3) Core and sample location 1 to the bottom of the UCRS, approximately 60 ft bgs.

(4) Perform field scan of continuous core at 0.5 ft depth intervals using a field PID.[1]

(5) Subsample the core in the field using En Core® samplers[2] or equivalent. Soil samples will be collected for laboratory analysis at an approximate rate of one sample per 5 ft interval (approximately 12 soil samples per soil core). The soil samples will be collected from the interval with highest field PID results.[3] Label, document, package, and preserve the soil samples as described in Section 8.

(6) Repeat steps 3 through 5 for each of the remaining sample locations at the site. (There are 26 defined sample locations at the C-720 Northeast Site and 18 defined sample locations at the C-720 Southeast Site.)

(7) Deliver soil samples to the mobile field laboratory for quick-turn VOC analysis. Deliver/ship soil samples to a fixed-base laboratory for other investigation analyses.

(8) Obtain and evaluate VOC quick-turn analytical results and calculate the depth-averaged TCE concentration for each soil boring.

[1] The primary field PID instrument for assessing VOC trends in the soil core will be a ppbRAE PID or equivalent. The measurement range of the ppbRAE PID is 1 ppb to 10,000 ppm.

[2] Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof or its contractors or subcontractors.

[3] The field crew may elect to collect additional soil samples for VOC analysis from above and below the elevated PID response interval(s) to strategically document the vertical distribution of TCE.

(9) For the single soil boring location at each site with the highest depth-averaged TCE concentration, sample four additional soil borings located in the center point of the grid surrounding the target soil boring. The screening and sampling process will be focused in the vertical depth interval(s) identified in the single soil boring which indicated the highest concentrations.

(10) Deliver soil samples to the mobile field laboratory for quick-turn VOC analysis. Deliver/ship soil samples analyses to a fixed-base laboratory for other investigation.

(11) Contour the depth-averaged TCE concentrations to confirm delineation and/or select additional sample locations(s) and depth intervals to bound the area of soil exceeding the cleanup level. Up to 10 additional soil borings will be sampled for field screening and laboratory analysis at the C-720 Northeast area and up to 6 additional soil borings will be sampled for field screening and lab analysis at the southeast source area.

(12) Mobilize to the second site at C-720 (northeast or southeast).

(13) Repeat steps 3–11 for the second site.

(14) Demobilize from the C-720 area.

5.3.2 C-747-C Oil Landfarm Source Area

The sampling sequence for the C-747-C Oil Landfarm source area will be similar to that of the C-720 Building source areas. Sampling will consist of the following steps.

(1) Perform initial site visit and geophysical surveys, excavation penetration permit program requirements, and AHA.

(2) Mobilize to the first sample location.

(3) Core and sample location 1 (of 15) to the bottom of the UCRS, approximately 60 ft bgs.

(4) Perform field scan of continuous core at 0.5 ft depth intervals using a field PID (ppbRAE PID or equivalent).

(5) Subsample the core in the field using En Core® samplers or equivalent. Soil samples will be collected for laboratory analysis at an approximate rate of one sample per 5-ft interval (approximately 12 soil samples per soil core). The soil samples will be collected from the interval with highest field PID results.[4] Label, document, package, and preserve the soil samples, as described in Section 8.

(6) Repeat steps 3 through 5 for each of the remaining sample locations at the site. (There are 15 defined sample locations.)

(7) Deliver soil samples to the mobile field laboratory for quick-turn VOC analysis. Deliver/ship soil samples analyses to a fixed-base laboratory for other investigation.

[4] The field crew may elect to collect additional soil samples for VOC analysis from above and below the elevated PID response interval(s) to document strategically the vertical distribution of TCE.

(8) Obtain and evaluate VOC quick-turn analytical results and calculate the depth-averaged TCE concentration for each soil boring.

(9) Contour the depth-averaged TCE concentrations to confirm delineation and/or select additional sample locations(s) and depth intervals to bound the area of soil exceeding the cleanup level. Up to eight additional soil borings will be sampled for field screening and laboratory analysis.

(10) Perform additional shallow DPT probing, as needed, to identify the extent of any buried concrete debris which may impact design of the deep soil mixing remedy.

(11) Demobilize from the C-747-C Oil Landfarm.

5.4 GEOLOGIST'S LOGS OF SELECT SOIL CORES

A geologist will develop a continuous log of the soil core, consistent with PAD-ENM-2303, *Borehole Logging*, at select locations in each of the source areas distributed across the source areas to aid in design of the preferred remedies. These detailed logs will be used to identify the lithologic sequence and HUs at each source area and facilitate the development of abbreviated logs of the remaining soil cores. (Anomalous soil units will be fully described.) A minimum of 10 soil cores will be logged in detail at the C-720 northeast source area, a minimum of 8 soil cores will be logged in detail at the C-720 southeast source area, and a minimum of 5 soil cores will be logged in detail at the C-747-A Oil Landfarm source area.

5.5 GEODETIC SURVEY OF ALL SAMPLING LOCATIONS

All sampling locations shall be surveyed by a registered and licensed surveyor of the Commonwealth of Kentucky. Locations shall be surveyed on the Kentucky State Plane Coordinate System and the PGDP Plane Coordinate System. Horizontal and vertical accuracy for this work must be at least plus or minus 0.1 ft and must be sufficient to support the design of the follow-on remedial action. All coordinates and elevations shall be tied to the U.S. Geological Survey National Geodetic Vertical Datum of 1929 or the North American Datum of 1983. Survey results will be reported in both hard copy and electronic files.

5.6 BORING ABANDONMENT

Each borehole will be plugged and abandoned as soon as practicable on the day sampling is completed. Boring abandonment will be consistent with Commonwealth of Kentucky requirements and approved site procedures.

The driller will be required to abandon all borings, created by direct push technology (DPT) and by conventional drilling method(s), if required, by placing the grout in the borehole with a tremie pipe, proceeding from the base of the open borehole to be abandoned to near ground surface. Once the DPT or drill rig is moved off the hole, the driller will rope off the area around the boring for safety. After 24 hours, the driller will check the grout level and add grout, if necessary. When the grout level has stabilized, the driller will fill the remaining 18 inches of the hole, using soil or pavement similar to the area ground surface.

5.7 DECONTAMINATION PROCEDURES

Decontamination of all drilling-related equipment and other down-hole equipment will be completed in accordance with DOE prime contractor-approved procedures before moving between each of the investigation areas and at the completion of the RDSI. The purpose of the RDSI is to characterize the extent of soils with significant VOC contamination. As such, the DPT rig or drill rig will require decontamination between boreholes at the contractor's discretion should the drill rig become dirty. Drill rods will be decontaminated after each boring. Decontamination activities will need to be completed on-site.

Personal protective equipment, clothing, and personnel decontamination procedures for the implementation of the RDSI will be addressed in the HASP.

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6. SAMPLING AND ANALYSIS PLAN

6.1 SOIL SAMPLING

Table 3 summarizes measurements and sample collection activities for this investigation. DPT will be used for soil sampling through the UCRS for VOCs at the C-747-C Oil Landfarm and the C-720 Northeast and Southeast Sites. Soil samples will be collected using DPT equipment that advances a sampling tool by pushing, driving, or vibrating it to the desired sampling depth, consistent with PAD-ENR-0020, *Collection of Soil Samples With Direct Push Technology Sampling*. For this field characterization effort, the DPT rig will use a dual tube sampling system. A common sampler in use is the Dual Tube 22 sampler of Geoprobe®. The Dual Tube 22 sampler is a direct push system for collecting continuous core sample of unconsolidated materials from within a sealed casing of 2.25-inch probe rods. Samples are collected and retrieved within a liner that is threaded onto the leading end of a string of center rods. The center rods hold the liner in place as the outer casing is driven to fill the liner with soil. The inner rods are then retracted to retrieve the full liner. This system eliminates the generation of side slough in the sample and prevents cross-contamination. Thin-walled polyvinyl chloride (PVC) sample tubes, with a 1.375-inch outside diameter, will be used to contain and retrieve the core samples.[5]

If DPT cannot advance to the approximate targeted sampling depth or collect a representative sample because of the large size of the soil matrix relative to the diameter of the DPT sampler, a rotary sonic or hollow-stem auger boring may also be utilized.

The process for sample collection for this field investigation is summarized as follows:

(1) Cut open the liner and perform a brief radiological and field PID scan of the soil core to ensure the safety of the field samplers.

(2) Immediately cover the exposed core with clean aluminum foil once the radiological and field PID scans are completed.

(3) Measure and determine field PID scanning points to represent 0.5 ft depth increments of the soil core.[6]

(4) As the field PID is available at each field PID scanning location, prepare the soil core by inserting a clean awl through the aluminum foil cover and through the soil core to expose soil for the field PID scan. Insert the field PID sample tube (equipped with a water separator) over the hole in the aluminum foil/soil core and measure the VOC level. Record each reading in a field logbook. The field PID measurements will be used to identify sections of the soil core containing high VOC levels for subsampling with an En Core® sampler.

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[5] PVC generally is considered an inferior material for use in collection of VOC samples. PVC is being used because it is superior material for liner durability and can be cut open with a knife for PID and radiological scanning of the soil core and for sampling. The PVC liner will be in contact only with the outside of the core (not the sampled portion for lab analysis) for the brief time between driving the soil sampler and subsampling, immediately following retrieval and field scans of the soil core.

[6] Although the soil core will be collected in 5 ft depth increments, the retrieved core may be longer or shorter than 5.0 ft depending upon swelling, compaction, or loss of the soil. Where swelling or compaction accounts for a discrepancy in the core length, the sample points will be adjusted to represent 0.5 ft depth intervals in the subsurface. Where it is apparent that soil has been lost in the sampling process, the samplers will note the lost core interval in the field logbooks and identify the sample locations to represent 0.5 ft depth intervals in the subsurface.

Table 3. Measurement and Sample Collection Activities for the Southwest Plume RDSI

SAMPLE ACTIVITY	SOUTHWEST PLUME SOURCE AREAS		
	C-747-C OIL LANDFARM	C-720 NORTHEAST SITE	C-720 SOUTHEAST SITE
SOIL			
DUAL TUBE SAMPLER	**Number of Soil Borings (DPT)**		
• Field VOC measurements with PID (120 measurements per boring, each 0.5 ft) • Laboratory VOC analysis (12 samples per boring, 1 per 5 ft interval)			
— Initial sampling locations	15	26	18
— Vicinity of highest average VOCs	not in scope	4	4
— Contingency sampling locations	8	10	6
• Permeameter testing (3 samples per boring, 1 per HU)	not in scope	3	3
• Fraction organic carbon • Grain size analysis (3 samples per boring, 1 per HU)	3	3	3
• Archive soil core (continuous, 0–60 ft bgs)	2	2	2
THIN-WALLED SAMPLER	**Number of Soil Borings (DPT or HSA)**		
• *In situ* water content • pH • Unconfined compressive strength • Compressibility • Index properties (9 samples per boring, 3 per HU)	1	not in scope	not in scope
GROUNDWATER			
EXISTING MONITORING WELLS	**Number of Wells**		
— Water level measurements (weekly)	2	2	2
• Field water quality parameters • VOCs • Alkalinity • Total and dissolved metals • Ferrous iron • Major anions • Dissolved gasses (3 samples per well)	2	2	2
INVESTIGATION NESTED WELLS	**Number of Nested Wells**		
• Water level measurements (3 measurements per well)	3	3	3

Table 3. Measurement and Sample Collection Activities for the Southwest Plume RDSI (Continued)

SAMPLE ACTIVITY	SOUTHWEST PLUME SOURCE AREAS		
	C-747-C OIL LANDFARM	C-720 NORTHEAST SITE	C-720 SOUTHEAST SITE
• Analyses as for existing monitor wells • Microbial population (dehalococcoides) (1 sample per well)	3	3	3
• Injection testing (1 test per well)	not in scope	3	3

DPT = direct push technology
HSA = hollow stem auger
HU = hydrogeologic unit

(5) If elevated PID responses are detected, collect a soil sample(s) using an En Core® sampler or equivalent in proximity to the location of the elevated response. As warranted, additional soil samples may be collected to bracket the interval of elevated PID response.

(6) If no elevated PID responses are measured, collect soil samples based on observations of higher permeability zones and/or depths corresponding to adjacent core locations where soil samples were collected for laboratory analysis. (It can be representatively sampled best.)

To provide timely access to the soil (and groundwater) TCE analyses, the investigation will use a mobile field laboratory, following protocols to provide quality assured data, or quick-turnaround analyses from a fixed-base laboratory under the DOECAP.

The membrane interface probe (MIP) technology was considered for its capabilities and application to this investigation. According to several vendors (Columbia Technologies 2010; Stone Environmental 2010; Vironex 2010), the VOC detection limit of the MIP is significantly higher than the cleanup levels required for this remediation. The MIP total VOC concentration typically is measured in parts per million, but can be as low as 200–250 parts per billion (ppb). The cleanup levels for TCE for this project are 73 ppb for the C-747-C Oil Landfarm and 75 ppb for the C-720 Northeast and Southeast Sites; the detection limit for the MIP is too high to delineate extent of the TCE contamination.

Additional soil sampling will be performed to support the analysis and design of remedial technologies (i.e., deep soil mixing at the C-747-C Oil Landfarm source area, enhanced *in situ* bioremediation at the C-720 northeast and southeast source areas, and subsequent monitoring to assess the attenuation of residual contamination). For each of the three investigation areas, representative soil samples will be collected for grain size analysis [consistent with American Society for Testing and Materials (ASTM) D6913-04] and fraction of organic carbon[7] (consistent with SW9060 as modified for soil samples) from all HUs in three DPT soil borings. In addition, field personnel temporarily will archive DPT soil cores from two additional borings at all three investigation areas for any otherwise unanticipated remediation contractor design testing. All of the archived cores will be sealed in the DPT core liners; clearly labeled to identify the soil boring, depth interval, and top and bottom; and preserved in a sample refrigerator. Any unused core will be disposed of with soil waste generated during the construction of the remedial measures.

[7] Samples for fraction of organic carbon will be collected to represent soils with both high VOCs and low VOCs content as measured by the field PID.

At the C-747-C Oil Landfarm area, three soil samples will be collected from each of the HUs in one soil boring with a thin-walled sampler using DPT or a hollow stem auger-equipped drill rig to assess the following parameters:

- *In situ* water content (using procedure ASTM D2216-10 or equivalent),
- pH (using ASTM D4972-01 or equivalent),
- Unconfined compressive strength (using ASTM D2166-06 or equivalent),
- Compressibility (using ASTM D2850-03a or equivalent), and
- Index properties (using ASTM D4318-10 or equivalent).

At each of the C-720 sites, soil samples will be collected from each of the HUs in three of the DPT borings to provide for laboratory permeameter testing of hydraulic conductivity (using ASTM D5084-10 or equivalent).

6.2 GROUNDWATER SAMPLING/WATER LEVEL MEASUREMENTS

Water level measurements will be performed in each of the vicinity UCRS and RGA wells each week during the period of the field investigation. Table 4 identifies the associated wells.

Table 4. Existing Monitoring Wells Associated with Each Investigation Area

Associated Existing Monitoring Wells	Investigation Areas		
	C-747-C Oil Landfarm	C-720 Northeast Site	C-720 Southeast Site
UCRS Wells	MW162	MW204	MW217 MW218
RGA Wells	MW161	MW203	None Available

The investigation will install nested wells with a well in each of the three UCRS hydrogeologic units at each of the three investigation areas using hollow stem augers. Weekly measurements in these wells over three consecutive weeks will be used to establish the local vertical gradients in the UCRS. In addition, the nested wells of the C-720 sites will be used for constant head injection testing (ASTM D4360-96 or equivalent) to assess the potential for injection of water-soluble amendments.

Groundwater samples will be collected on three consecutive weeks from each of the UCRS and RGA wells in the vicinity of the C-747-C Oil Landfarm and the C-720 sites (see Table 4) for the following field measurements and analyses:

- Dissolved oxygen, oxidation reduction potential, pH, and specific conductance (using procedure *Groundwater Sampling*, PAD-ENM-2101);

- Alkalinity (using HACH® Alkalinity Test Kit, Model AL-DT or equivalent);

- Total and dissolved aluminum, chromium, iron, and manganese (using EPA SW-846, Method 6020 or equivalent);

- $Iron^{2+}$ (ferrous iron) [using HACH® Iron (Ferrous) Color Disc Test Kit, Model IR-18C, 0.2-10 mg/L or equivalent];

- Dissolved methane, ethane, and ethene (using modified R. S. Kerr SOP-175);[9]

- Chloride, nitrate, and sulfate (using EPA SW-846, Method 9056 or equivalent); and

- VOCs [using EPA SW-846, Method 8260B (EPA 2008) or equivalent].

At the C-747-C Oil Landfarm and each of the C-720 source areas, upon completion of sampling in all planned soil borings but before the constant head injection testing at the C-720 sites, the investigation will attempt to collect a grab water sample from each of the investigation-installed wells. These samples, if they can be collected,[10] will be analyzed for the above parameters and for microbial population analysis (using nucleic acid base methods, specifically the quantitative polymerase chain reaction method to quantify the dehalococcoides bacteria and vinyl chloride reductase genes). Table 3 presents all groundwater measurements and sample collection activities required for this investigation.

Upon completion of the groundwater sampling and injection testing at each investigation area, the investigation team will evaluate the future utility of the wells installed during the investigation. If the investigation-installed wells have no anticipated future use, the wells will be abandoned as part of the investigation activities, in accordance with 401 *KAR* 6:350, *Monitoring well construction practices and standards*.

6.3 WASTE CHARACTERIZATION SAMPLING

Wastes generated during this project will be characterized and disposed of as soon as practicable. Waste sampling will be performed from containerized waste. All samples will be sent to a Sample Management Office-approved, fixed-base laboratory for analysis. Details of the sampling and analytical requirements for waste characterization are described in the waste management plan for the RDSI (Appendix B).

6.4 ANALYTICAL REQUIREMENTS

The primary data derived from the RDSI will include the following:

- Quantitative results for VOCs in soil and groundwater using EPA SW-846, Method 8260B (EPA 2008) or equivalent;[11]

- Qualitative results for VOCs in soil as measured by field PID; the field PID results will be recorded in field logbooks as described in Section 8;

- Quantitative geotechnical properties measurements of soil cores as specified in Section 6.1;

- Quantitative microbial population counts in groundwater;

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[9] A modified R.S. Kerr SOP-175 is stipulated to provide low reporting limits. The target laboratory reporting limits for this investigation are 0.10 µg/L methane, 0.025 µg/L ethane, and 0.025 µg/L ethane.

[10] It is unknown if HU1 is saturated in the C-720 source areas.

[11] The investigation will use a mobile field laboratory, following protocols to provide quality assured data or quick-turnaround analyses from a fixed-base laboratory under the DOECAP.

- Quantitative results for groundwater analyses as specified in Section 6.2; and
- Geodetic surveys of all sampling locations.

The secondary data derived from the field project will consist of the following:

- Groundwater level measurements in existing vicinity UCRS and RGA wells and UCRS wells installed for this investigation;
- Field measurements of groundwater quality parameters (pH, oxidation reduction potential, and dissolved oxygen) in UCRS wells in the vicinity of the C-720 sites;
- Geologist's logs of selected soil cores; and
- Injection tests from UCRS wells installed at the C-720 sites.

7. DATA MANAGEMENT

The data management implementation plan (DMIP) is provided in Appendix C of this RDSI Characterization Plan. The DMIP identifies and documents data management requirements and applicable procedures, expected data types and flow, and roles and responsibilities for all data management activities associated with the RDSI.

All historical data used in this assessment were downloaded from Paducah's Oak Ridge Environmental Information System (OREIS), which is the centralized, standardized, quality-assured, and configuration-controlled data management system that is the long-term repository for environmental data (measurements and geographic) for all environmental management projects.

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8. DOCUMENTATION

Field documentation will be maintained throughout the RDSI in various types of documents and formats, including field logbooks and field data sheets. The following general guidelines for maintaining field documentation will be implemented. Additional information is contained in the QA program plan (Appendix D) and the DMIP (Appendix C). All entries will be written clearly and legibly using indelible ink.

- Corrections will be made by striking through the error with a single line that does not obliterate the original entry. Corrections will be dated and initialed.
- Dates and times will be recorded using the format “mm/dd/yy” for the date and the military (i.e., 24-hour) clock to record the time.
- Zeroes will be recorded with a slash (/) to distinguish them from letter Os.
- Blank lines are prohibited. Information should be recorded on each line or the line should be lined out, initialed, and dated.
- No documents will be altered, destroyed, or discarded even if they are illegible or contain inaccuracies that require correction.
- All information blocks on field data forms will be completed or a line will be drawn through the unused section, and the area will be dated and initialed.
- Unused logbook pages will be marked with a diagonal line drawn from corner to corner and a signature and date must be placed on the line.
- Security of all logbooks will be maintained by storing them in a secured (e.g., locked) area when not in use.
- Photocopies of all logbooks, field data sheets, and chain-of-custody (COC) forms will be made weekly and sent to the project file.

8.1 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 whenever new personnel join the field team or if the scope of work changes significantly. The following topics will be discussed at these meetings.

- Project- and site-specific health and safety
- Objectives and scope of the fieldwork
- Training requirements
- Equipment maintenance
- Procedures
- Required QC measures
- Documents covering on-site fieldwork

8.2 READINESS CHECKLIST

Before implementation of the field program, all project personnel will review the work control documents to identify all field activities and materials required to complete task deliverables. Also, the following must be verified as available or completed:

- Personnel availability
- Training
- Field equipment
- Sampling equipment
- Site facilities and equipment
- Health and safety equipment

Before fieldwork begins, appropriate DOE prime contractor personnel will concur that readiness has been achieved.

8.3 FIELD LOGBOOKS

Field team personnel will use bound field logbooks with sequentially numbered pages for the maintenance of field records and for documenting any information pertinent to field activities. Field forms will be numbered sequentially or otherwise controlled. A designated field team member will record sampling activities and information from site exploration and observation in the field logbook. Field documentation will conform to approved procedures for use of field logbooks. An integral component of QA/QC for field activities will be the maintenance of accurate and complete field records and the collection of appropriate field data forms. The primary purpose of the logbook is to document each day's activities; the personnel on each sampling team; and any administrative occurrences, conditions, or activities that may have affected the fieldwork or data quality of any characterization or environmental samples for any given day. The level of detail of the information recorded in the field logbook should be such that an accurate reconstruction of the field events can be created from the logbook. The project name, logbook number, client, contract number, task number, document control number, activity or site name, and the start and completion dates will be listed on each logbook's front cover. Important phone numbers, radio call numbers, emergency contacts, and a return address should be recorded on the inside of the front cover.

8.4 SAMPLE LOG SHEETS

Sample log sheets will be used for all characterization samples. A sample log sheet will contain sample-specific information for each field sample collected, including field QC samples. Generally, sample log sheets will be preprinted from the data management system with the following information fields:

- Name of sampler
- Project name and number
- Sample identification number
- Sampling location, station code, and description
- Sample medium or media
- Sample collection date
- Sample collection device
- Sample visual description

- Collection procedure
- Sample type
- Analysis
- Preservative

In addition, all specific analytical requests will be preprinted from the data management system and will include the following for each analytical request.

- Analysis/method
- Container type
- Number of containers
- Container volume
- Preservative (type/volume)
- Destination laboratory

During sample collection, a field team member will record the remaining required information and will sign and date each sample log sheet. The following information will be recorded for each sample.

- Whether the sample was collected;
- The date and time of collection;
- The name of the collector;
- Collection methods and/or procedures;
- All required field measurements and measurement units;
- Instrumentation documentation, including the date of last calibration;
- Adherence to or deviation from the procedure and the RDSI characterization plan;
- Weather conditions at the time of sample collection;
- Activities in the area that could impact subsequent data evaluation;
- General field observations that could assist in subsequent data evaluation;
- Lot number of the sample containers used during sample collection;
- Sample documentation and transportation information, including unique COC form number, air bill number, and container lot number; and
- All relevant and associated field QC samples (for each sample).

If preprinted sample log sheets are not used, all information will be recorded manually. A member of the field sampling team (other than the recorder) will perform a QA review of each sample log sheet and document the review by signing and dating the log sheet. Notations of deviations will be initialed by the field operations manager as part of his/her review of the logbook.

8.5 FIELD DATA SHEETS

Field data sheets will be maintained, as appropriate, for the following types of data:

- Sample log sheets
- COCs
- Instrument calibration logs

Data to be recorded will include such information as the station name, sample matrix, sample type, and applicable sample analysis to be conducted. Field-generated data forms will be prepared, if necessary, based on the appropriate requirements. The same information may be included in the field logbook or, if not, the field logbook should reference the field data sheet. If preprinted data sheets are not used, all information will be recorded manually in the field logbook.

8.6 SAMPLE IDENTIFICATION, NUMBERING, AND LABELING

In addition to field logbooks and field data sheets, the sampling team will use labels to track sample holding times, ensure sample traceability, and initiate the COC record for the characterization samples. A pressure-sensitive gummed label will be secured to each sample container at the time of collection, including duplicates and trip or field blanks, at or before the completion of collection of that sample. Sample labels will be waterproof or will be sealed to the sample container with clear acetate tape after all information has been written on the label. Generally, sample labels will be preprinted with information from the data management system and will contain the following information:

- Station name
- Sample identification number
- Sample matrix
- Sample type (grab or composite)
- Type or types of analysis required
- Sample preservation (if required)
- Destination laboratory

A field sampling team member will complete the remaining information during sample collection, including these items:

- Date and time of collection
- Initials of sampler

The sample numbers will be recorded in the field logbook along with the time of collection and descriptive information previously discussed.

For waste characterization samples, the sample identification protocol is outlined as follows:

rrrrrrrrMA000

Where:

rrrrrrrr identifies the waste management request for disposal (RFD)

M identifies the media type (W identifies the sample as waste water, S identifies the sample as soil)

A identifies the sequential sample (usually “A” for primary sample and “B” for a secondary sample)

000 identifies the sequential sample for the RFD.

8.7 SAMPLE STORAGE

Samples are to be properly preserved, packaged, and delivered to the laboratory under adequate COC. Several procedures may exist to define requirements for sample storage:

- Quality assured data
- Field logbooks
- Chain-of-custody
- Data management coordination
- Sample tracking and handling guidance

Soil and water samples for laboratory analysis must be stored on-site until a radiological survey of the exterior of the sample containers releases the samples for off-site shipment. Field radiological surveys of the exterior or the sample containers will be sufficient to release the samples to an on-site field mobile laboratory. Typical COC protocol requires that environmental samples physically be kept in the presence of the sample custodian or in a secured facility with access control prior to delivery or shipment of the samples to the analytical laboratory. Where the samples must be maintained at 4°C for sample preservation (a common requirement), a calibrated (National Institute of Standards and Technology-traceable) thermometer will be used to monitor the temperature inside the sample storage container (ice chest or refrigerator). The sample custodian will document the temperature inside the sample storage container in a log of daily inspections.

8.8 SAMPLE COC

COC procedures will document sample possession from the time of collection, through all transfers of custody to receipt at the laboratory and subsequent analysis. COC records will accompany each packaged lot of samples; the laboratory will not analyze samples that are not accompanied by a correctly prepared COC record. A sample will be considered under custody if it is (1) in the possession of the sampling team or sample custodian, (2) in view of the sampling team or sampling custodian, or (3) transferred to a secured (i.e., locked) location.

COC records will follow the requirements as specified in a DOE prime contractor-approved procedure for keeping records. The COC form will be used to collect and track samples from collection until transfer to the laboratory. Copies of the signed COCs will be faxed or delivered to the DOE prime contractor’s Sample Management Office within three days of sample delivery.

The sampling team leader is responsible for reviewing and ensuring the accuracy and completeness of the COC form and for the custody of samples in the field until they have been properly transferred to the sample coordinator. He or she is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the analytical laboratory. If samples are not immediately transported to the analytical laboratory, they will remain in the custody of the sample

coordinator where they will be refrigerated and secured either by locking the refrigerator or by placing custody seals on individual containers.

Each COC form will be identified by a unique number in the upper-right corner, recorded on the sample log sheet at the time of sample collection. The laboratory COC will be the "official" custody record for the samples. Each COC form will contain the following information.

- The sample identification for each sample
- Collection data for each sample
- Number of containers for each sample
- Description of each sample (i.e., environmental matrix/field QC type)
- Analysis required for each sample
- Blocks to be signed as custody is transferred from one individual to another

The air bill number will be recorded on the COC form if applicable. The laboratory COC form will be placed in a resealable plastic bag and taped to the inside of the cooler lid if the samples are to be shipped off-site. A copy will be retained in the laboratory, and the original will be returned to the sample manager with the completed data packages.

At each point of transfer, the individuals relinquishing and receiving custody of the samples will sign in the appropriate blocks and record the date and time of transfer. When the laboratory sample custodian receives the samples, he or she will document receipt of the samples, record the time and date of receipt, and note the condition of the samples (e.g., cooler temperature, whether the seals are intact) in the comments section. The laboratory then will forward appropriate information to the sample manager. This information may include the following:

- A cover letter stating sample receipt date and any problems noted at the time of receipt; and

- A report showing the field sample identification number, the laboratory identification number, and the analyses scheduled by the laboratory for each sample.

8.9 SAMPLE SHIPMENT

An on-site laboratory will screen aliquots of the characterization samples before shipment to an off-site laboratory. Results from the screening process will be recorded in Paducah's Project Environmental Measurements System and will be reviewed prior to preparation for sample shipment off-site. Sample containers will be placed in the shipping container and packed with ice and absorbent packing for liquids. The completed COC form will be placed inside the shipping container unless otherwise noted. The container then will be sealed. In general, sample containers will be packed according to the following procedures.

- Glass sample containers will be wrapped in plastic insulating material to prevent contact with other sample containers or the inner walls of the container.

- Logbook entries, sample tags and labels, and COC forms will be completed with sample data collection information and names of all persons handling the sample in the field before packaging.

- Samples, temperature blanks, and trip blanks will be placed in a thermally insulated cooler along with ice that is packed in resealable plastic bags. After the cooler is filled, the appropriate COC form will be placed in the cooler in a resealable plastic bag attached to the inside of the cooler lid.

- Samples will be classified according to the U.S. Department of Transportation regulations pursuant to 49 *CFR* § 173. All samples will be screened for radioactivity to ensure that U.S. Department of Transportation limits of 2.0 nCi/mL for liquid waste and 2.0 nCi/g for solid waste are not exceeded.

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APPENDIX A

SAMPLING STRATEGY

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CONTENTS

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FIGURES

TABLES

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ACRONYMS

FFS	focused feasibility study
OREIS	Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
SI	site investigation
SWMU	solid waste management unit
VOC	volatile organic compound
WAG	waste area group

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A.1. INITIAL SAMPLING LOCATIONS

A.1.1 EVALUATION OF EXISTING DATA

Historical data used in the assessment of Solid Waste Management Unit (SWMU) 1 and the C-720 northeast and southeast sites were downloaded from Paducah's Oak Ridge Environmental Information System (OREIS). Additional data were obtained from the Site Investigation (SI) (DOE 2007) and the Revised Focused Feasibility Study (FFS) (DOE 2011a) reports. Figures 4.4 and 1.20 from each report, respectively, display historical trichloroethene (TCE) data results for the C-747-C Oil Landfarm. The dataset presents limitations for analysis[1] since not all of it is in the OREIS database and not all of it is found in one report. Only historical data in OREIS were used in order to maintain data quality. Several high-concentration sample locations are noted in the SI and FFS, but are not included in OREIS. Coordinates for these data points are not known, but the estimated locations are included within the sampling boundaries as discussed below.

The preliminary C-720 northeast and southeast sites boundaries shown in the Southwest Plume FFS were based on the fate and transport model grid for the C-720 area used in the waste area group (WAG) 27 RI (DOE 1999) and the Southwest Plume SI (DOE 2007). The Groundwater Operable Unit Feasibility Study (DOE 2001) also provided estimates of source area locations and dimensions. These estimates were used in the Southwest Plume FFS (Figure 1.21) to define the SWMU boundaries shown on Figure A.1. Figure A.2 provides an aerial view of the C-720 Building and vicinity.

A.1.2 INITIAL SAMPLING LOCATIONS

By combining data from these two reports as well as information obtained through OREIS, a new sample boundary was drawn for the C-720 northeast and southeast sites (Figure A.1). The new boundaries incorporate historical detections of TCE contamination and extend a short distance outward from these locations. Two sampling locations (720-018 and P4-H7/720-027) in the C-720 northeast site identified during the SI as having at least one detection at a concentration greater than 70 µg/kg are included within the sampling area. Table A.1 provides Paducah Gaseous Diffusion Plant (PGDP) coordinates for the sampling locations. Sampling grid spacing and sampling location coordinates will be revised as necessary to accommodate site obstructions and to facilitate the delineation of the source areas.

Figure 1.20 in the Revised FFS (DOE 2011a) displays TCE results documented in the SI Report for C-747-C Oil Landfarm. The horizontal extent of volatile organic compound (VOC) concentrations above cleanup levels is defined approximately; however, the vertical extent of VOC concentrations above cleanup levels has not been bounded. Table A.2 provides PGDP coordinates for the sampling locations at the C-747-C Oil Landfarm. Sampling grid spacing and sampling location coordinates will be revised as necessary to accommodate site obstructions.

The known extent of the VOC contamination at the C-747-C Oil Landfarm is very close to the north extent of SWMU 1 (Figure A.3). To bound the VOC levels to the north, one of the defined boring locations for this remedial design site investigation for the C-747-C Oil Landfarm lies outside of the SWMU 1 boundary. Some extended sampling locations (contingency borings), likewise, may be placed outside of the north SWMU 1 boundary. Figure A.4 provides an aerial view of the C-747-C Oil Landfarm.

[1] The primary limitation associated with the historical data set for the C-747-C Oil Landfarm is the absence of coordinates for some of the sample borings.

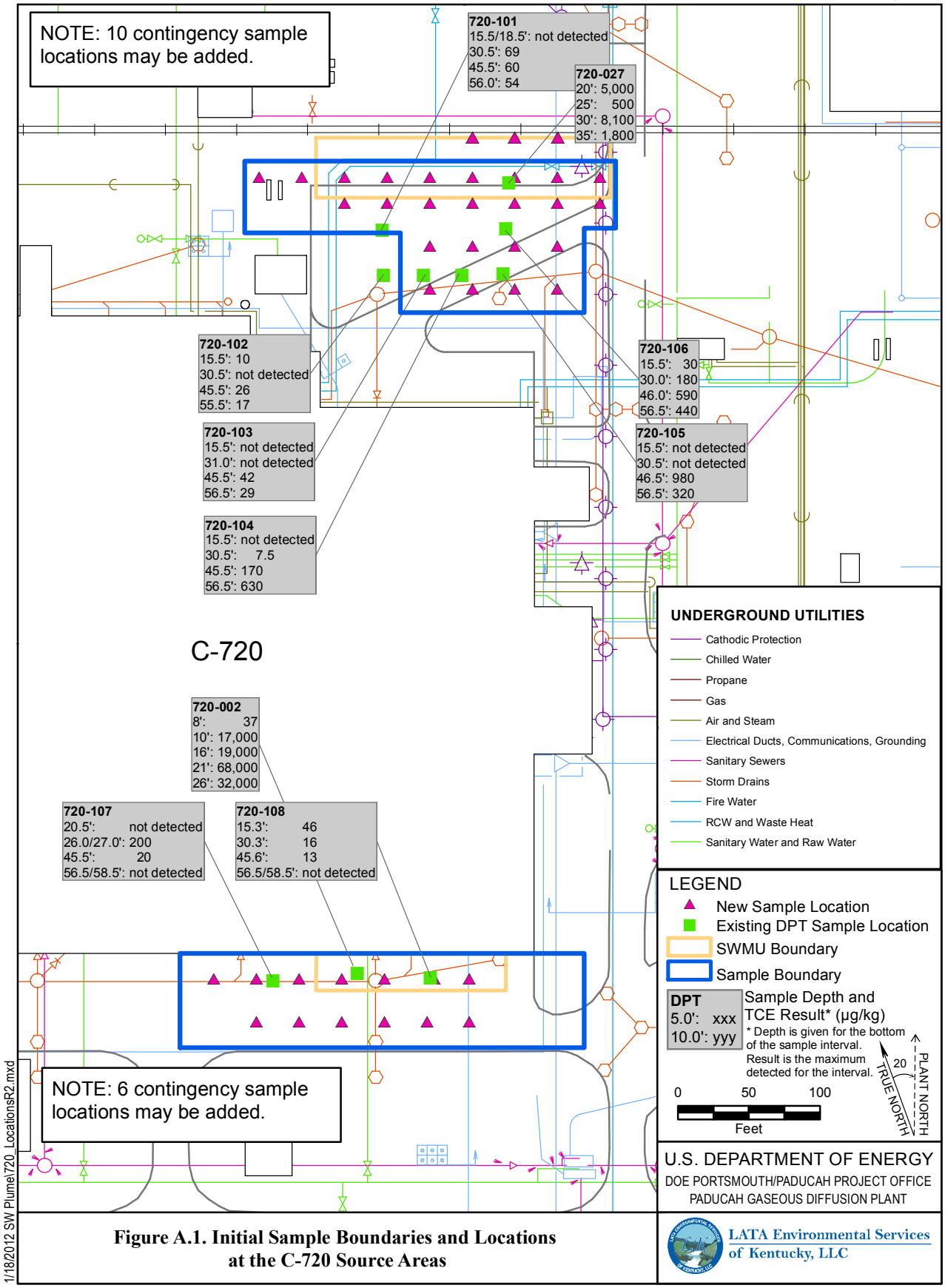

Figure A.1. Initial Sample Boundaries and Locations at the C-720 Source Areas

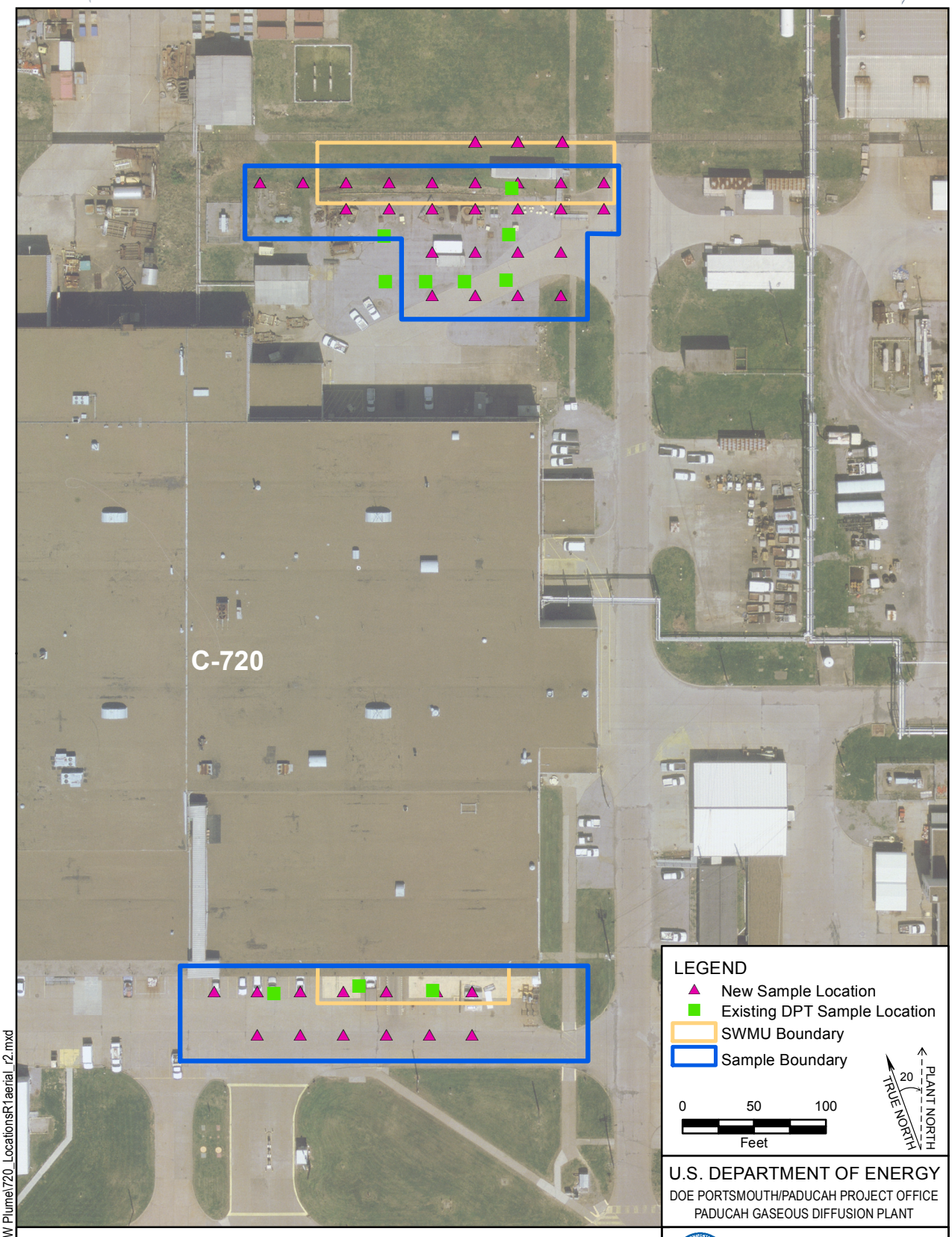

Figure A.2. C-720 Source Areas

Table A.1. PGDP Plant Coordinates for Proposed C-720 Source Area Sampling Locations

SWMU 211a, C-720 Northeast Site		
Sample Location Shown on Figure A.1	**x**	**y**
1	-5059	-2023
2	-5029	-2023
3	-4999	-2023
4	-5209	-2048
5	-5179	-2048
6	-5149	-2048
7	-5119	-2048
8	-5089	-2048
9	-5059	-2048
10	-5029	-2048
11	-4999	-2048
12	-4969	-2048
13	-5149	-2066
14	-5119	-2066
15	-5089	-2066
16	-5059	-2066
17	-5029	-2066
18	-4999	-2066
19	-4969	-2066
20	-5089	-2096
21	-5059	-2096
22	-5029	-2096
23	-4999	-2096
24	-5089	-2126
25	-5059	-2126
26	-5029	-2126
27	-4999	-2126

Table A.1. PGDP Plant Coordinates for Proposed C-720 Source Area Sampling Locations (Continued)

SWMU 211b, C-720 Southeast Site		
Sample Location Shown on Figure A.1	**x**	**y**
1	-5241	-2612
2	-5211	-2612
3	-5181	-2612
4	-5151	-2612
5	-5121	-2612
6	-5086	-2612
7	-5061	-2612
8	-5211	-2642
9	-5181	-2642
10	-5151	-2642
11	-5121	-2642
12	-5091	-2642
13	-5061	-2642

Table A.2. PGDP Plant Coordinates for Proposed C-747-C Oil Landfarm Source Area Sampling Locations

SWMU 1, C-747-C Oil Landfarm		
Sample Location Shown on Figure A.1	**x**	**y**
1	-6860	-1680
2	-6854	-1695
3	-6780	-1700
4	-6820	-1700
5	-6900	-1700
6	-6790	-1720
7	-6834	-1720
8	-6880	-1720
9	-6902	-1720
10	-6960	-1720
11	-6780	-1740
12	-6810	-1750
13	-6920	-1760
14	-6873	-1765
15	-6860	-1780
16	-6900	-1800

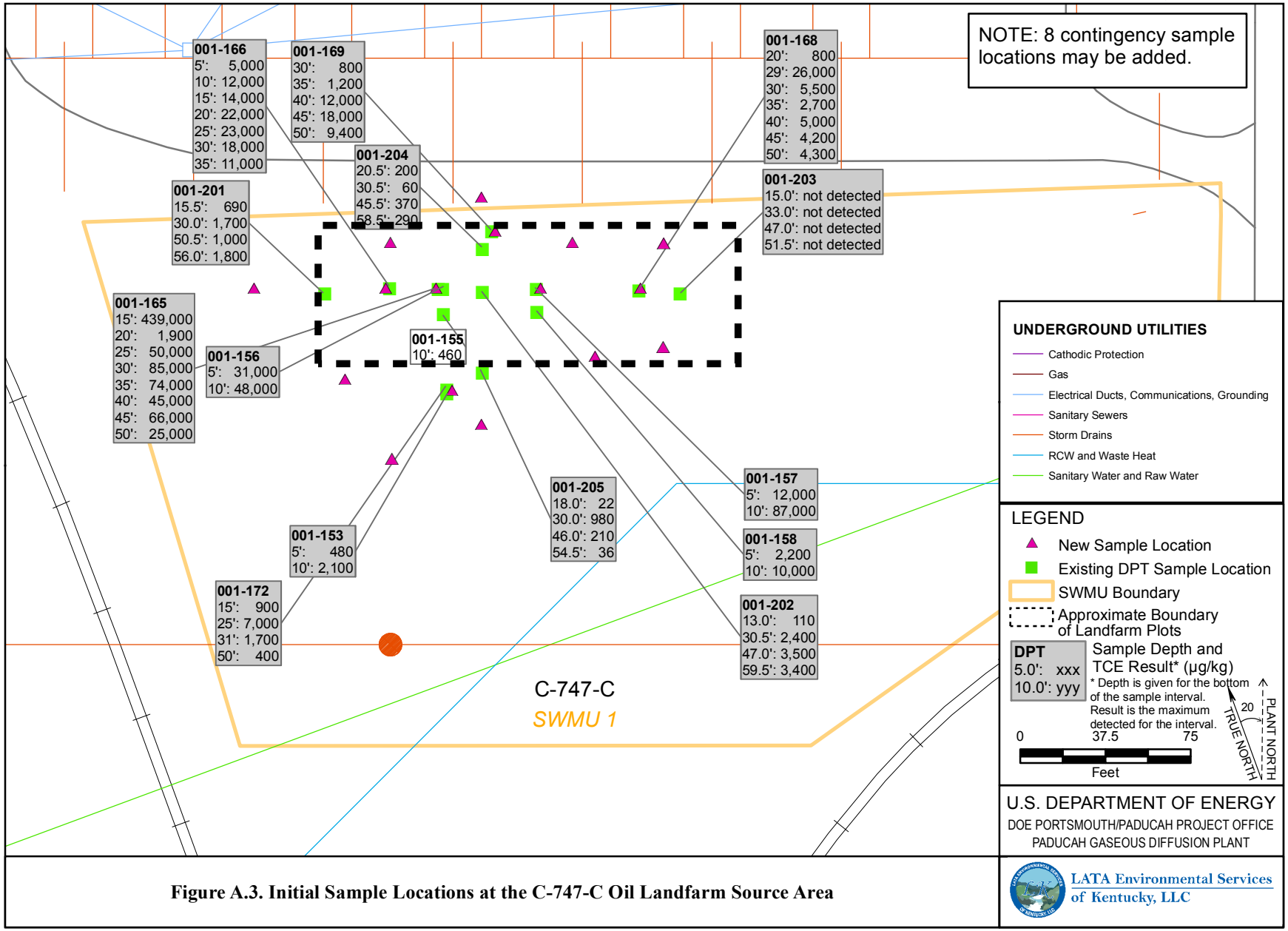

Figure A.3. Initial Sample Locations at the C-747-C Oil Landfarm Source Area

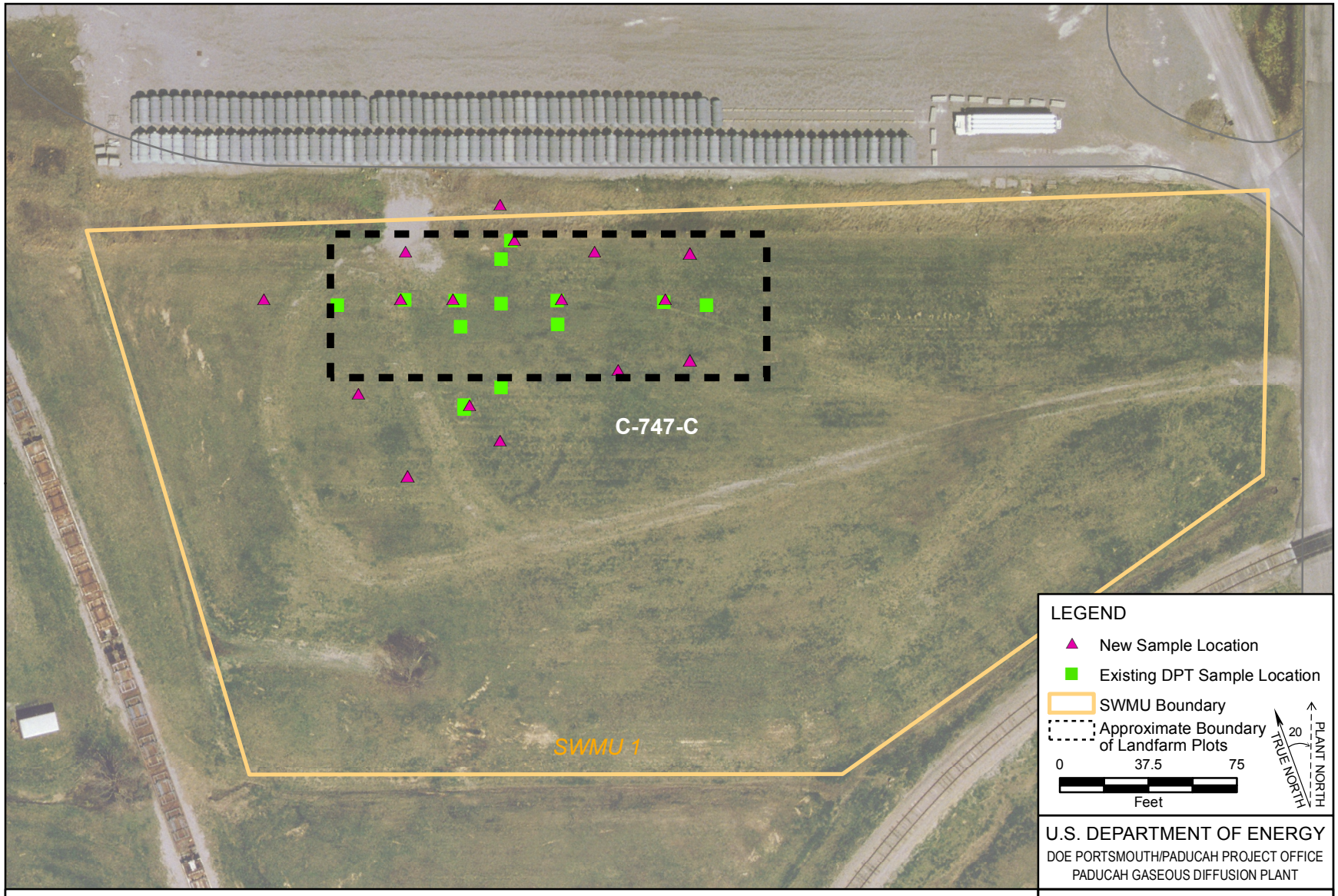

Figure A.4. C-747-C Oil Landfarm Source Area

A.2. APPROACH FOR CONTOURING DATA

If the sampling locations specified in Tables A.1 and A.2 do not bound the areas to be treated, limited additional sampling will be performed, as outlined in Section 5.3.1 (up to ten additional locations at the C-720 northeast source area, up to six additional soil borings the C-720 southeast source area, and up to eight additional locations at the C-747-C Oil Landfarm source area). The depth-averaged TCE concentrations from the initial characterization soil borings at the C-720 source areas and the C-747-C Oil Landfarm source area will be contoured (using linear interpolation and extrapolation) to assess the need for additional sampling and the placement of additional sample boreholes.

Follow-on assessments to better define the area to be treated and to estimate the mass of VOCs present may be based on more robust spatial analyses consistent with the derivation of the cleanup criteria. Additional three-dimensional analysis may be performed using computer mass estimating software such as Environmental Visualization System.

NOTE: All references cited in Appendix A can be accessed in the References section of the main text of this document.

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APPENDIX B

WASTE MANAGEMENT PLAN

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TABLES

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
IDW	investigation derived waste
KPDES	Kentucky Pollutant Discharge Elimination System
LDR	land disposal restriction
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RDSI	Remedial Design Support Investigation
RFD	request for disposal
SWMU	solid waste management unit
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
WAG	waste area group
WKWMA	West Kentucky Wildlife Management Area
WMP	Waste Management Plan
XRF	X-ray fluorescence

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B.1. OVERVIEW

This Waste Management Plan (WMP) provides information to supplement the LATA Environmental Services of Kentucky, LLC, (LATA Kentucky) sitewide WMP, *LATA Environmental Services of Kentucky, LLC Waste Management Plan for the Paducah Environmental Remediation Project,* PAD-PLA-ENV-001, for the management and disposition of soil cuttings, decontamination water, and investigation derived waste (IDW) that will be generated as a result of activities conducted during the Southwest Plume Remedial Design Support Investigation (RDSI). The guidance in this WMP will supersede any discrepancies identified between this plan and PAD-PLA-ENV-001. During the course of the investigation, approximately 88 direct push technology soil borings and 1 hollow stem auger boring will be drilled in 3 solid waste management units (SWMUs) associated with the Southwest Plume.

This WMP addresses the management of wastes generated on this project from the point of generation through final disposition. The Southwest Plume RDSI is being conducted as a part of the environmental remediation activities at the Paducah Gaseous Diffusion Plant (PGDP), which are managed by the U.S. Department of Energy's (DOE's) prime contractor. The DOE prime contractor will be responsible for waste management activities associated with this project. Standard practices and procedures outlined in this WMP and in PAD-PLA-ENV-001 regarding the generation, handling, transportation, and storage of waste will comply with all substantive requirements of DOE Orders and regulations, Resource Conservation and Recovery Act (RCRA) requirements, and Toxic Substances Control Act (TSCA) requirements should polychlorinated biphenyls (PCBs) become an issue.

The approach outlined in this 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 (e.g., analytical, transportation, and disposal costs), and use of the permitted storage and disposal facilities that are limited in number;
- Compliance with applicable or relevant and appropriate requirements (ARARs); and
- Selection of storage and/or disposal alternative(s) for the waste.

Waste management activities must comply with this WMP, PAD-PLA-ENV-001, applicable procedures, the *Waste Acceptance Criteria for the Department of Energy Treatment, Storage, and Disposal Units at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-WD-0011, and waste acceptance criteria (WAC) for other specific treatment, storage, and disposal facilities (TSDFs) that are designated to receive the waste.

During the course of this project, additional PGDP and DOE waste management requirements may be identified. Necessary revisions to the WMP will ensure the inclusion of these additional requirements into the daily activities of waste management personnel. DOE will inform the Federal Facility Agreement parties of any substantive changes to the WMP or to any of the other Southwest Plume RDSI Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents. The criteria for different levels of document changes will be those found in the *Guide to Preparing Superfund Proposed Plans, Records of Decision,* and *Other Remedy Selection Decision Documents,* EPA 540-R-98-031.

B.2. WASTE MANAGEMENT ROLES AND RESPONSIBILITIES

B.2.1 WASTE MANAGEMENT TRACKING RESPONSIBILITIES

Waste generated during sampling activities at PGDP will require a comprehensive waste-tracking system capable of maintaining an up-to-date inventory of waste. The inventory database will be used to store data that will enable determination of management, storage, treatment, and disposal requirements for the waste.

B.2.1.1 Waste Management Coordinator

The waste management coordinator (WMC) will ensure that all waste activities are conducted in accordance with PGDP facility requirements and this WMP. Responsibilities of the WMC also include coordinating activities with field personnel, overseeing daily waste management operations, and maintaining a waste management logbook that contains a complete history of generated waste and the current status of individual waste containers. Designated waste operators also may complete the waste management logbook.

The WMC will ensure that procurement and inspection of equipment, material, or services critical for shipments of waste to off-site TSDFs are conducted in accordance with appropriate procedures. In addition, the WMC will ensure that wastes are packaged and managed in accordance with applicable requirements (e.g., the WAC for the landfill).

Additional responsibilities of the WMC include the following:

- Maintaining an adequate supply of labels;
- Maintaining drum inventories at sites;
- Interfacing with all necessary personnel;
- Preparing Requests for Disposal (RFDs);
- Tracking generated waste;
- Ensuring that drums are properly labeled;
- Coordinating waste recycling, disposal, or transfers;
- Sampling waste containers to characterize wastes;
- Coordinating pollution prevention and waste minimization activities;
- Transferring characterization data to DOE prime contractor's data manager; and
- Ensuring that temporary project waste storage areas are properly established, maintained, and closed.

The WMC or designee will update a computer-generated status sheet that can be retrieved quickly and will list all waste generated during field activities. The waste status sheet will supply information such as the following:

- Generation date;
- RFD number;
- Waste origination point;
- Waste type (solid or liquid);
- Description [e.g., soil, personal protective equipment (PPE), plastic];
- Quantity of waste;
- Current location of waste;
- Sampling status;

- Sampling results status; and
- Resampling needed.

This status sheet will be prepared monthly or as necessary to report the status of project waste generation. Waste item container logs will be used to document each addition of waste to containers.

The WMC and waste operators will perform the majority of waste handling activities. These activities will involve coordination with the DOE prime contractor project manager or designee who will perform periodic inspections to verify that drums are labeled in accordance with the WMP guidelines.

The WMC will be responsible for ensuring characterization sampling of the waste is in accordance with the procedures outlined in this plan. When sampling is complete, the WMC will transfer the waste into the waste holding area established for this project, if necessary.

The WMC or designee will complete all chain-of-custody forms relating to the shipment of waste characterization samples. The chain-of-custody forms, along with the associated samples, will be transferred to the personnel responsible for packaging and delivery of the samples.

The WMC or designee will inspect the decontamination facility to ensure that waste generation is minimized to the extent possible and that the transfer of liquids to the waste holding area is arranged such that the work schedule is not delayed. If improper waste-handling activities are observed, the WMC will notify the DOE prime contractor project manager and temporarily stop decontamination activities. All activities not in compliance with the WMP will be identified and corrected before decontamination activities continue.

B.2.1.2 Coordination with Field Crews

The WMC will be responsible for daily coordination with all field crews involved in activities that generate waste. The WMC will perform daily rounds of each of the work sites to oversee the waste collection and will verify that procedures used by the field crews comply with the WMP guidelines. Deficiencies will be documented in the waste management logbook and appropriate direction will be given to the field crews. Site visits will be documented in the field logbook.

B.2.1.3 Coordination with Treatment, Storage, and Disposal Facilities

The waste streams generated as part of the Southwest Plume RDSI may be managed and disposed of in a variety of ways depending on characterization and classification. Waste will be temporarily stored on-site, as previously discussed. Waste that is to be shipped to an off-site TSDF must be done so in accordance with applicable DOE contractor procedures and U.S. Department of Transportation (DOT) requirements.

B.2.1.4 Waste Management Training

The WMC and other project personnel with assigned waste management responsibilities will be trained and qualified in accordance with DOE contractor-approved Training Position Descriptions.

B.2.2 SAMPLING

This WMP describes sampling and analysis of soil cutting, decontamination water, and IDW from the Southwest Plume RDSI. The debris and media generated during this project will be characterized and the results compared to health-based standards to determine whether or not any concentrations of

trichloroethene (TCE) and 1,1,1-trichloroethane (TCA) are above health-based levels listed in Table B.1. If the concentrations are below the levels contained in Table B.1, then the waste will not be deemed to contain or be contaminated with a RCRA-listed waste (based on TCE/TCA content) for the purposes of management at the site.

Table B.1. Health-Based Levels for TCE and 1,1,1-TCA

Constituent	Concentration in solids (ppm)	Concentration in Aqueous Liquids (ppb)
TCE	39.2	81
1,1,1-TCA	2,080	If aqueous liquids are below health-based level for TCE, then 1,1,1-TCA is declared below contained-in levels.

ppb = parts per billion; ppm = parts per million; TCE = trichloroethene; 1,1,1-TCA = trichloroethane

Because data from previous sampling events indicate that conditions for C-746-U Landfill disposal likely are to be met, those characterization efforts will be undertaken at the same time as the sampling for the required constituents. Land disposal restrictions (LDRs) generally apply to media and debris generated from this project that no longer contain or are no longer contaminated with RCRA hazardous waste. If a contained-in determination is made, the LDR is satisfied.

Health-based standards of 39.2 parts per million (ppm) TCE and 2,080 ppm 1,1,1-TCA in solids will be used as the criteria for making contained-in/contaminated-with determinations for environmental media and debris designated for disposal at the C-746-U Landfill. Solid wastes disposed of at landfills other than C-746-U will be subject to a contained-in/contaminated-with determination that will be approved by the Commonwealth of Kentucky and the state in which the receiving landfill is located. The Kentucky Energy and Environment Cabinet has agreed to consult with DOE and the state where the off-site facility is located to reach agreement on the appropriate health-based standard for making such determinations for waste that is to be shipped to such a facility.

Groundwater and any related aqueous wastes generated from well sampling, well development, and well purging shall be excluded from the definition of hazardous waste at the point of generation, if the TCE concentrations are below 1 ppm and the 1,1,1-TCA concentrations are below 25 ppm, provided the subject aqueous waste will be further treated in an on-site wastewater treatment facility and discharged through a PGDP Kentucky Pollutant Discharge Elimination System (KPDES)-permitted outfall consistent with 401 *KAR* 31:010, Section 3.

Other aqueous environmental media waste contaminated with TCE or 1,1,1-TCA that do not qualify for the exemption cited herein will use a health-based concentration of 0.081 ppm as the criterion for making contained-in determinations for media destined for on-site treatment and discharge through a KPDES-permitted outfall. This self-implementing waste characterization and RCRA status determination will be used to decide on treatment requirements, if applicable, and the appropriate waste disposal facility for the waste. Aqueous waste (including, but not limited to, well sampling, well development, well purging, and decontamination waters) that has undergone wastewater treatment and meets the KPDES discharge limits shall be considered to "no longer contain" listed hazardous waste (i.e., TCE). This treated wastewater may be discharged directly to permitted KPDES outfalls or on-site ditches that flow to permitted KPDES outfalls.

In lieu of providing notification to the Kentucky Energy and Environment Cabinet, as set forth in paragraph 63 of the October 3, 2003, *Agreed Order* (a procedural requirement), the contained-in/contaminated-with determination and supporting data will be documented in the post-Record of Decision file and will be made available upon request for on-site inspection.

B.2.3 WASTE PLANNING AND GENERATION

B.2.3.1 Waste Planning

A Waste Generation Forecast (WGF) is required before commencement of Southwest Plume RDSI activities that will result in the generation of waste. The WGF should be developed in accordance with PAD-PLA-ENV-001. The WGF is delineated in Table B.2. A revised WGF must be prepared if the amount of waste to be produced changes during the course of the project.

B.2.3.2 Waste Generation

A variety of waste will be generated during this project, including soil cuttings, IDW, and decontamination water. As such, the wastes generated from field-related activities have the potential to contain contaminants related to known or suspected past operational or disposal practices; therefore, this waste must be stored and disposed of in accordance with ARARs. Waste generated will be stored in CERCLA waste storage areas within the CERCLA area of contamination during the characterization period and prior to disposal in accordance with PRS-WSD-3010, *Waste Generator Responsibilities for Temporary On-Site Storage of Regulated Waste Materials at Paducah*. Consistent with EPA Policy, the generation, storage, and movement of waste during a CERCLA project and storing it on-site does not trigger the administrative RCRA storage or disposal requirements. On-site waste storage areas will be managed in accordance with the substantive RCRA hazardous waste storage standards. Among the substantive requirements are compatible containers in good condition, regular inspections, containment to control spills or leaks, and characterization of run-on and runoff, either by process knowledge or by sampling. In the event that any wastes are stored in temporary staging piles, plastic sheeting will be placed on the ground under the waste, and additional plastic sheets will be used to cover it to prevent the spread of contamination from rainfall in accordance with substantive RCRA standards for such piles. Final disposition of the materials will depend on final characterization.

If the analytical results for a sample indicates that TCE and/or 1,1,1-TCA concentrations are below the health-based levels listed in Table B.1, the associated IDW and soil cuttings (debris or media) will be considered to no longer contain or be contaminated with a listed hazardous waste and, if such waste is not characteristically hazardous, it may be disposed at the C-746-U Landfill (if WAC compliant) and managed on-site as nonhazardous waste. If the analytical result for a sample indicates that TCE and/or 1,1,1-TCA concentrations are above the health-based levels listed in Table B.1, then associated IDW and soil cuttings will be managed per the ARARs.

In addition to TCE/TCA-contaminated waste, there also is a potential to generate waste that also is contaminated with radionuclides and metals, depending on the SWMU being investigated. Soil cuttings and IDW characterization will consider these potential contaminants as well. Final disposition of the materials will depend on final characterization.

The WGF shows the estimated quantities of waste that may be generated during implementation of this task. Sections B.2.2.3 through B.2.2.7 of this WMP provide a brief description of each potential waste stream.

Table B.2. Waste Generation Forecast

Waste Stream	Volume (ft^3)	Container Type	Estimated Number of Containers	Preliminary Waste Category	Characterization Method	Analysis	Potential Treatment Method	Expected Disposition	Schedule	Comments
Drill cuttings from soil borings	175	55-gal drums	25	RM	Sampling and analysis	RAD, TCLP VOAs, Bulk VOAs, TCLP metals	NA	C-746-U Landfill	As needed	Contained-in determination
PPE	29.6	55-gal drums	4	RM	Use drill cutting/soil boring data for characterization	NA	NA	C-746-U Landfill	As needed	Contained-in determination
Purge/ Decontamination/ Drilling water	4,000 gal	1,000 gal portable tanks	4	RM/Solid waste based on TCE concentration at point of generation	Sampling and analysis	Turbidity	Filtration	C-612 Treatment System	As needed	

Note: Drill cutting estimate is based on 88-2 inch DPT borings to 60 ft bgs and 1-8 inch hollow stem auger boring to 60 ft bgs with a 25% swell factor.
PPE = personal protective equipment
RAD = radiological
RM = Resource Conservation and Recovery Act/mixed
TCE = trichloroethene
TCLP = Toxicity Characteristic Leaching Procedure
VOA = volatile organic analysis

B.2.3.3 PPE and Plastic Sheeting

PPE will be worn, as specified in the project environment, safety and health Plan, by personnel performing the field tasks during the RDSI. While site personnel use procedures and best management practices to minimize opportunities for contacting TCE-contaminated media and equipment, it is likely that some PPE or related debris (e.g., plastic sheeting) will come into contact with TCE-contaminated materials during the remediation process. Process knowledge, visual inspections, or direct sampling will be used to characterize PPE and any related debris. Based on the results of the characterization, any PPE or the related debris determined by site personnel to be contaminated by a listed waste or exhibiting a RCRA characteristic will be managed as hazardous waste, decontaminated, or a no longer contaminated-with determination will be made pursuant to Table B.1. In cases where site personnel conclude, based on the above characterization process, that the PPE or related debris has not been contaminated by a listed waste or does not exhibit a characteristic, then the materials will not be considered a RCRA hazardous waste. An estimate of the volume of PPE and plastic sheeting to be generated is included in Table B.2.

B.2.3.4 Soil Cuttings

Drilling cuttings will be generated from installation of the soil borings. It is assumed that all drill cuttings will have a 25% swell factor and that 48.6 gal (6.5 ft^3) of material (assuming 12% void space) is placed in each 55-gal (7.35 ft^3) drum. An estimate of the volume of drill cuttings to be generated is included in Table B.2.

All drill cuttings will be containerized as they are generated, labeled, and managed on-site according to the substantive requirements of RCRA, until they are moved either to permitted storage areas or an appropriate disposal facility. The soil will be sampled and the analytical results will be compared to the levels listed in Table B.1 for proper waste determination.

A portion of the drill cuttings from inside the areas mapped to have free-phase dense nonaqueous-phase liquid (DNAPL) may be determined to be characteristically hazardous and will be managed on-site in accordance with substantive requirements of RCRA. Wastes will be stored at the C-760 CERCLA storage area during characterization. The C-760 CERCLA storage area is managed according to the substantive requirements of RCRA. Wastes determined to be hazardous will be transferred to an on-site, permitted RCRA storage facility until such time as it is transferred off-site to an approved RCRA treatment and disposal facility.

The remainder of the drill cuttings that are not from the mapped areas of free-phase DNAPL is assumed not to be characteristically hazardous. This waste will be characterized and the concentrations of listed constituents, TCE and 1,1,1-TCA, will be compared to health-based levels for a “no longer contains” determination. If the concentrations are less than health-based levels, the waste will not be managed as a RCRA-listed waste. If analytical results show that this waste meets the WAC of the C-746-U Landfill, the waste will be disposed of there as nonhazardous waste.

All drill cuttings will be containerized and characterized by collecting two composite samples for each boring drilled. The target analytes for drill cuttings will be volatile organic compounds, Toxicity Characteristic Leaching Procedure (TCLP) semivolatile organic compounds and metals, and total radionuclides.

B.2.3.5 Miscellaneous Noncontaminated Construction Waste

DOE has implemented waste management activities for the segregation of all clean trash (i.e., trash that is not chemically or radiologically contaminated). Examples of clean trash are office paper, aluminum cans,

packaging materials, glass bottles not used to store potentially hazardous chemicals, aluminum foil, and food items. During implementation of this WMP, all clean trash will be segregated according to those guidelines and then collected and disposed of by the WMC once it has been approved for off-site disposal. An estimate of the volume of the waste to be generated is included in Table B.2.

B.2.3.6 Drilling Water

Water from sampling/drilling activities may be generated. An estimate of the volume of this waste water is included in Table B.2.

Waste will be accumulated and stored until it can be processed for removal of suspended solids, as necessary. The water then will be treated at the C-612 Northwest Plume Groundwater System or other acceptable facility and discharged to a KPDES-permitted outfall. The solids will be transferred to an appropriate temporary waste storage area. The mud will be containerized as it is removed from the sump, then sampled and managed similarly to drill cuttings (Section B.2.3.4).

B.2.3.7 Transportation of Waste

The areas where the Southwest Plume RDSI activities will be conducted are on DOE property. Transportation of waste on DOE property will be conducted in accordance with applicable DOE, PGDP, and DOE prime contractor policies and procedures. In the event that it becomes necessary to transport known or suspected hazardous waste over public roads, coordination will be initiated with PGDP security, as necessary, which may result in the temporary closing of roads. Once hazardous wastes are transported from a CERCLA site, they are subject to full RCRA regulation; therefore, all transportation and TSDF requirements under RCRA must be followed. Off-site shipments must be accompanied by a manifest. Off-site disposal of hazardous wastes will occur only at a RCRA facility in a unit in full compliance with the Subtitle C requirements. Transportation of known or suspected hazardous waste on public roads will be conducted in accordance with applicable DOT regulations (*CFR* Title 49).

B.2.3.8 Waste Characterization, Sampling and Analysis

Waste characterization sampling will be performed in accordance with procedure PAD-WD-0437, *Waste Characterization and Profiling.* Based on sample analyses, existing data, or process knowledge, the waste may be classified into one of the following categories:

- RCRA-listed hazardous waste
- RCRA characteristic hazardous waste
- PCB waste
- Transuranic waste
- Low-level waste
- Mixed waste
- Nonhazardous solid waste

B.2.3.9 Sample Residuals and Miscellaneous Waste Management

The Sample Management Office-approved analytical laboratory may generate sample residuals and laboratory wastes. The laboratory will manage and return listed-hazardous waste sample residuals to the project. Nonhazardous wastes will be disposed of by the laboratory if they have the appropriate resources. If not, all wastes will be returned to the project waste stream.

B.2.3.10 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, 435.1; and the DOE prime contractor's requirements. Requirements specified in the DOE prime contractor's WMP regarding waste generation, waste tracking, waste reduction techniques, and the waste reduction program, in general, also will be implemented, as outlined in PAD-PLA-ENV-001.

To support DOE's commitment to waste reduction, an effort will be made during field activities to minimize waste generation as much as possible, largely through ensuring that potentially contaminated wastes are localized and do not come into contact with any clean media (which could create more contaminated waste). Waste minimization also will be accomplished through waste segregation, selection of PPE, waste handling (spill control), and the use of alternate treatment standards.

Solid wastes such as Tyvek™ coveralls and packaging materials will be segregated. An attempt will be made to separate visibly soiled Tyvek™ coveralls from unsoiled ones. In some instances, partially soiled coveralls can be cut up and segregated. Other solid waste will not be allowed to contact potentially contaminated drill cuttings. Efforts will be made to keep Tyvek™ coveralls clean, reuse clean coveralls, and wear coveralls only when absolutely necessary. Proper waste handling and spill control techniques will help minimize waste, particularly around the decontamination areas where decontamination water must be contained. In addition, hoses used in the decontamination area will be managed to minimize leaking to avoid creating additional wastewater that would require disposal.

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APPENDIX C

DATA MANAGEMENT IMPLEMENTATION PLAN

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CONTENTS

ACRONYMS

DMIP	Data Management Implementation Plan
DOE	U.S. Department of Energy
DMC	Document Management Center
EDD	electronic data deliverable
GIS	geographic information system
GPS	Global Positioning System
OREIS	Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
PEMS	Project Environmental Measurements System
QA	quality assurance
RDSI	Remedial Design Support Investigation
RTL	ready to load
SOW	statement of work

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C.1. INTRODUCTION

The purpose of this Data Management Implementation Plan (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 Remedial Design Support Investigation (RDSI) for the C-747-C Oil Landfarm and C-720 southeast and northeast sites work plan project at the Paducah Gaseous Diffusion Plant (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 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 use 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 Oak Ridge Environmental Information System (OREIS), if available. Field data (including soil core dye data) are collected in field logbooks or field data forms and are entered into Paducah Project Environmental Measurements System (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. Radiological survey results are stored and reported separately from Paducah PEMS and Paducah OREIS.

To meet current regulatory requirements for U.S. Department of Energy (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, validating, reporting, consolidating, and archiving) must be planned and documented appropriately. The RDSI project team and the sample and data management organization are responsible for data collection and data management for this project.

The scope of this DMIP is limited to environmental information generated under the RDSI 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.

C.2. PROJECT MISSION

Requirements and responsibilities described in this plan apply to activities conducted by the project team in support of the RDSI project. Specific activities involving data include, but are not limited to, sampling of soil and groundwater; storing, analyzing, and shipping samples, when applicable; and evaluation, verification, validation, assessment, and reporting of analytical results.

C.3. DATA MANAGEMENT ACTIVITIES

Data management activities for the RDSI 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 C.8 contains a detailed discussion of the activities listed above.

C.4. DATA MANAGEMENT INTERACTIONS

The sample/data management manager oversees the use of Paducah PEMS and ensures that data deliverables meet DOE's standards. The data entry specialist enters information into Paducah PEMS related to the fixed-base laboratory data once the samples have been delivered and the sample/data coordinator has verified receipt of the samples. The fixed-base laboratory hard-copy data and the electronic data deliverables (EDDs) are loaded into Paducah PEMS by the data entry specialist. The data entry specialist will perform electronic data verification. The RDSI project team is responsible for data assessment. The sample/data management manager is responsible for preparing and transferring the data from Paducah PEMS to Paducah OREIS.

The sample/data coordinator develops the statement of work (SOW) to be performed by an analytical laboratory in the form of a project-specific laboratory SOW. Analytical methods, reporting limits, and deliverable requirements are specified in this SOW.

The sample/data coordinator receives EDDs, performs contractual screenings, and distributes data packages. The sample/data coordinator interacts with the sample/data management 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.

C.4.1 DATA NEEDS AND SOURCES

Multiple data types will be generated and/or assessed during this project. These data types include field data, analytical data, and geographic information system (GIS) data.

C.4.2 HISTORICAL DATA

Historical data that are available electronically will be downloaded from Paducah OREIS, as needed, and will be evaluated when necessary.

C.4.3 FIELD DATA

Field data for the project includes sample collection information and field screen measurement results, such as qualitative results for presence/absence of dense nonaqueous phase liquid.

C.4.4 ANALYTICAL DATA

Analytical data for the project consist of laboratory analyses for environmental and waste characterization.

C.4.5 GIS COVERAGE

The Paducah GIS network is used for preparing maps used in data analysis and reporting of both historical and newly generated data. Coordinates will be recorded as state plane coordinates. 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

C.5. DATA FORMS AND LOGBOOKS

Field logbooks, site logbooks, chain-of-custody forms, data packages with associated quality assurance (QA)/quality control information, and field forms are maintained according to the requirements defined in procedure PAD-RM-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 Management Center (DMC) and copies are maintained in the field office.

C.5.1 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 entry specialist.

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 group 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)	
- Sample preservation type	
- Analysis (e.g., TCE)	
- Sample container (volume, type)	

Sample identification numbers are identified in Paducah PEMS and are assigned by the Sample/Data Management Manager. An example of the sample numbering scheme used for the RDSI project is provided below.

sssMA000

Where:

sss Identifies the solid waste management unit (SWMU)/area of concern (AOC) being investigated

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

C.5.2 LITHOLOGIC DESCRIPTION FORMS

Lithologic description forms will be used as necessary for this project.

C.5.3 WELL CONSTRUCTION DETAIL FORMS

These forms are not necessary for use during this project.

C.5.4 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 PAD-ENM-2700, *Logbooks and Data Forms*.

C.6. DATA AND DATA RECORDS TRANSMITTALS

C.6.1 PADUCAH OREIS DATA TRANSMITTALS

Official data reporting for the RDSI project will be generated from data stored in Paducah OREIS. The sample/data management manager is responsible for transmitting the data to Paducah OREIS once verification, validation, and assessment have been completed.

C.6.2 DATA RECORDS TRANSMITTALS

The RDSI project personnel and the sample and data management organization will make records transfers to the DMC.

C.7. DATA MANAGEMENT SYSTEMS

C.7.1 PADUCAH PEMS

Paducah PEMS is the data management system that supports the project's sampling and measurement collection activities and generates Paducah OREIS ready to load (RTL) files. The data management staff accesses 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 data based 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 and security.

The information technology group performs system backups daily. The security precautions and procedures implemented by the sample and data management organization are designed to minimize the vulnerability of the data to unauthorized access or corruption. Only users approved by the sample and data management organization have access to the project's Paducah PEMS and the hard-copy data files. Users have installed password-protected screen savers.

C.7.2 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 RDSI 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)

C.7.3 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).

C.8. DATA MANAGEMENT TASKS AND ROLES AND RESPONSIBILITIES

C.8.1 DATA MANAGEMENT TASKS

The following data management tasks are numbered and grouped according to the activities summarized in Section C.3. An explanation of the data review process is provided in the following sections.

C.8.2 ACQUIRE EXISTING DATA

The primary background data for this project consists of historical analytical data from previous sampling events in the RDSI SWMUs/AOCs. Paducah OREIS and the Paducah OREIS Data Catalog were queried for the existing information.

C.8.3 PLAN DATA COLLECTION

Other documents for this project provide additional information for the tasks of project environmental data collection, including sampling and analysis planning, QA project plan, waste management, and health and safety. A laboratory SOW also will be developed for this project in accordance with PAD-ENM-5004, *Sample Tracking Lab Coordination, and Sample Handling Guidance.*

C.8.4 PREPARE FOR SAMPLING ACTIVITIES

The data management tasks involved in sample preparation, as specified in PAD-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, preparing sample kits and chains-of-custody, and coordinating sample delivery to the laboratory. The sample/data coordinator conducts activities associated with the analytical laboratories. Coordinates for sample locations will be obtained using a Global Positioning System (GPS), which will have submeter accuracy.

C.8.5 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) modifying planned activities and deviating from procedures will be recorded.

Before the start of sampling, the sample and data management organization 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 PAD-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*.

The RDSI 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 entry specialist enters the information from the chain-of-custody forms into Paducah PEMS.

C.8.6 SUBMIT SAMPLES FOR ANALYSIS

Before the start of sampling, the field sampling manager or designee coordinates the delivery of samples with the sample/data coordinator who, in turn, coordinates with the analytical laboratories, according to PAD-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*. The sample/data coordinator presents a general sampling schedule to the analytical laboratories. The sample/data coordinator also coordinates the receipt of samples and containers with the laboratories. The sample/data coordinator ensures that hard-copy deliverables and EDDs from the laboratories contain the appropriate information and are in the correct format.

C.8.7 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 PAD-ENM-5007, *Data Management Coordination*.

The field screen measurement data (e.g., test kit data) will be provided by the RDSI project team to the sample/data management manager for loading into Paducah PEMS. This data will be provided in a format specified by the sample/data management 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.

Radiological survey data is recorded on electronic data loggers incorporated with GPS information. This data is stored separately from Paducah PEMS.

C.8.8 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, methods used, EDDs, units, holding times, and reporting limits achieved. Contractual screening is performed for 100 percent of the data. The Sample/Data Coordinator is primarily responsible for the contractual screening upon receipt of data from the analytical laboratory according to PAD-ENM-5003, *Quality Assured Data.*

C.8.9 DATA VERIFICATION

Data verification is the process for comparing a data set against a set standard or contractual requirement. Verification is performed by the sample and data management organization electronically, manually, or by a combination of both, according to PAD-ENM-5003, *Quality Assured Data*. Verification is performed for 100% of data. Data verification includes contractual screening and criteria specific to the RDSI project. Verification qualifiers may be applied to the data based 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.

C.8.10 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 Sample and Data Management organization. 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 RI/FS samples will be validated for this project. Data Validation will apply only to the definitive data. Data packages chosen for data validation will be validated at 100%.

C.8.11 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% to ensure data is useable.

The data assessment is conducted by the RDSI project according to PAD-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.

C.8.12 DATA CONSOLIDATION AND USAGE

The data consolidation process consists of the activities necessary to prepare the evaluated data for the users. The Sample and Data Management organization prepares files of the assessed data from Paducah PEMS to Paducah OREIS for future use in accordance with PAD-ENM-1001, *Transmitting Data to OREIS.* The Sample/Data Management 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 Sample/Data Management Manager.

C.8.13 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.

C.8.13.1 Remedial Investigation Project Manager

The remedial investigation (RI) project manager (PM) is responsible for the day-to-day operation of the RDSI project. The RI PM ensures the requirements of policies and procedures are met. The RI PM, or designee assesses data in accordance with PAD-ENM-5003, *Quality Assured Data*. The RI PM is responsible for flowing down data management requirements to subcontractors, as required.

C.8.13.2 Project Team

The project team consists of the technical staff and support staff (including the data management team) who conducts the various tasks required to successfully complete the project.

C.8.13.3 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.

C.8.13.4 Data Entry Specialist

The data entry specialist 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 laboratory EDD is available to download, the data entry specialist loads the EDD to Paducah PEMS, performs electronic verification of the data, and then compiles the data assessment package. The data entry specialist also may prepare data for transfer from Paducah PEMS to Paducah OREIS.

C.8.13.5 Project Records Coordinator

The project records coordinator is responsible for the long-term storage of project records. The RDSI project team will interface with the project records coordinator and will transfer documents and records in accordance with DOE requirements.

C.8.13.6 Quality Assurance 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.

C.8.13.7 Sample/Data Management Manager

The sample/data management 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 sample/data management manager ensures compliance to procedures relating to data management with respect to the project and that the requirements of PAD-ENM-5003, *Quality Assured Data*, are followed.

C.8.13.8 Laboratory Coordinator

The sample/data coordinator is responsible for contracting any fixed-base laboratory utilized during the sampling activities. The sample/data coordinator also provides coordination for sample shipment to the laboratory, contractual screening of data packages, and transmittal of data packages to the DMC.

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN

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CONTENTS

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QAPP WORKSHEETS

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ACRONYMS

AES	atomic emission spectroscopy
ASTM	American Society for Testing and Materials
CA	corrective action
CAB	Citizens Advisory Board
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
CRQL	contract-required quantification limit
DMC	Document Management Center
DNAPL	dense nonaqueous-phase liquid
DOECAP	U.S. Department of Energy Consolidated Audit Program
DPT	direct push technology
DQI	data quality indicator
ECD	electron capture detector
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FFS	focused feasibility study
FID	flame ionization detector
GC	gas chromatograph
GPS	Global Positioning System
GWOU	Groundwater Operable Unit
ICP	inductively coupled plasma
ID	identification
KDEP	Kentucky Department for Environmental Protection
KY	Commonwealth of Kentucky
LATA Kentucky	LATA Environmental Services of Kentucky, LLC
MBWA	Management by Walking Around
MCL	maximum contaminant limit
MDL	method detection limit
MS	mass spectroscopy
N/A	not applicable
NAL	no action level
NCP	National Contingency Plan
NRDA	National Resource Damage Assessment
OREIS	Oak Ridge Environmental Information System
OU	operable unit
PGDP	Paducah Gaseous Diffusion Plant
PID	photoionization detector
PQL	practical quantitation limit
PT	proficiency testing
PTW	principal threat waste
QA	quality assurance
QA	quality control
QAPP	quality assurance program plan
RAO	remedial action objective
RCT	radiological control technician
RDSI	remedial design support investigation

RG	remediation goal
RGA	Regional Gravel Aquifer
SI	site investigation
SOP	standard operating procedure
SW	southwest
TBD	to be determined
TCE	trichloroethene
UCRS	Upper Continental Recharge System
VOC	volatile organic compound
WAG	waste area group

QAPP Worksheet #1
Title Page

Document Title: *Remedial Design Support Investigation Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Sites at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

Lead Organization: U.S. Department of Energy

Preparer's Name and Organizational Affiliation: LATA Environmental Services of Kentucky, LLC (LATA Kentucky)

Preparer's Address, Telephone Number, and E-mail Address: 761 Veterans Avenue, Kevil, KY, 42053, Phone (270) 441-5000

Preparation Date (Month/Year): 2/2012

Document Control Number: DOE/LX/07-0350&D1

LATA Kentucky Environmental Remediation Project Manager	Signature Mark J. Duff	Date
LATA Kentucky Regulatory Manager	Signature Myrna Espinosa Redfield	Date
LATA Kentucky Sample/Data Management Manager	Signature Lisa Crabtree	Date

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Paducah Gaseous Diffusion Plant
Site Location: Paducah, Kentucky
Site Number/Code: KY8890008982
Contractor Name: LATA Environmental Services of Kentucky, LLC
Contractor Number: DE-AC30-10CC40020
Contract Title: Paducah Gaseous Diffusion Plant Paducah Environmental Remediation Project
Work Assignment Number: N/A

1. Identify guidance used to prepare QAPP:

   Intergovernmental Data Quality Task Force, March 2005. The Uniform Federal Policy for Implementing Environmental Quality Systems, Version 2.0, 126 pages.

   Intergovernmental Data Quality Task Force, March 2005. The Uniform Federal Policy for Quality Assurance Project Plans: Part 1 UFP QAPP Manual, Version 1.0, 177 pages (DTIC ADA 427785 or EPA-505-B-04-900A).

   Intergovernmental Data Quality Task Force, March 2005. The Uniform Federal Policy for Quality Assurance Project Plans: Part 2A UFP QAPP Worksheets, Version 1.0, 44 pages.

   Intergovernmental Data Quality Task Force, March 2005. The Uniform Federal Policy for Quality Assurance Project Plans: Part 2B Quality Assurance/Quality Control Compendium: Minimum QA/QC activities, Version 1.0, 76 pages.

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707 (FFA)

3. Identify approval entity: DOE, EPA Region 4, and Kentucky Department for Environmental Protection (KDEP)

4. Indicate whether the QAPP is a generic or a (project-specific) QAPP (circle one).

5. List dates of scoping sessions that were held: February 2010-DQO Scoping: Southwest Plume Remedial Design Support Investigation

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

6. List dates and titles of QAPP documents written for previous site work, if applicable:

Title:	**Approval Date:**
Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities, DOE/OR/07-1595&D2 (DOE 1998b)	10/5/1998

7. List organizational partners (stakeholders) and connection with lead organization:
DOE, EPA Region 4, KDEP

8. List data users: DOE, LATA Kentucky, subcontractors, EPA Region 4, KDEP

9. If any required QAPP elements and required information are not applicable to the project, then indicate the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion here.

No elements specifically are omitted from this QAPP.

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
Project Management and Objectives		
2.1 Title and Approval Page	• Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	• Table of Contents • QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	• Distribution List • Project Personnel Sign-Off Sheet	3, 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	• Project Organizational Chart • Communication Pathways • Personnel Responsibilities and Qualifications Table • Special Personnel Training Requirements Table	5, 6, 7, 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	• Project Planning Session Documentation (including Data Needs tables) • Project Scoping Session Participants Sheet • Problem Definition, Site History, and Background • Site Maps (historical and present)	9, 10
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	• Site-Specific Project Quality Objectives • Measurement Performance Criteria Table	11, 12
2.7 Secondary Data Evaluation	• Sources of Secondary Data and Information • Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	• Summary of Project Tasks • Reference Limits and Evaluation Table • Project Schedule/Timeline Table	14, 15, 16

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	• Sampling Design and Rationale • Sample Location Map • Sampling Locations and Methods/SOP Requirements Table • Analytical Methods/SOP Requirements Table • Field Quality Control Sample Summary Table • Sampling SOPs • Project Sampling SOP References Table • Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17, 18, 19, 20, 21, 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	• Analytical SOPs • Analytical SOP References Table • Analytical Instrument Calibration Table • Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	23, 24, 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	• Sample Collection Documentation Handling, Tracking, and Custody SOPs • Sample Container Identification • Sample Handling Flow Diagram • Example Chain-of-Custody Form and Seal	26, 27
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	• QC Samples Table • Screening/Confirmatory Analysis Decision Tree	28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	• Project Documents and Records Table • Analytical Services Table • Data Management SOPs	29, 30

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	• Assessments and Response Actions • Planned Project Assessments Table • Audit Checklists • Assessment Findings and Corrective Action Responses Table	31, 32
4.2 QA Management Reports	• QA Management Reports Table	33
4.3 Final Project Report		
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	• Verification (Step I) Process Table • Validation (Steps IIa and IIb) Process Table • Validation (Steps IIa and IIb) Summary Table • Usability Assessment	34, 35, 36, 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3
Minimum Distribution List

The distribution for this project-specific QAPP will be the same as that used for other FFA documents. Below is the current version of this list.

Standard Distribution List—FFA Documents

REGULATORY DISTRIBUTION				
	D1 and D2 Documents			
	Document	Redline[a]	E-copy[b]	CD
Environmental Protection Agency (EPA)				
Turpin Ballard/Jennifer Tufts (original letter)	2	1	P	P
Jana Dawson, TLI (copy of letter)	1	-	P	P
State of Kentucky (KY)				
Todd Mullins (original letter)	3	1	P	3
Gaye Brewer (copy of letter)	1	-	P	1
U.S. Department of Energy (DOE)				
DOE[c]	1	1	P	1
Citizens Advisory Board (CAB)[d]	-	-	-	2
LATA Environmental Services of Kentucky, LLC (LATA Kentucky)[e]				
Document Management Center (DMC)				
DMC-RC (unbound)	1	1	P	-
Administrative Record (unbound)	1	1	P	1
National Resource Damage Assessment (NRDA) Trustees				
Kentucky Department of Fish & Wildlife				
Tim Kreher	-	-	-	1
Kentucky Energy and Environment Cabinet				
Dr. Len Peters, Cabinet Secretary	-	-	-	1
Tennessee Valley Authority				
Cynthia Anderson	-	-	-	1
Robert Casey	-	-	P	-
A. Stephens	-	-	P	-
U.S. Fish & Wildlife				
Tony Velasco	-	-	-	1
TOTAL DISTRIBUTION	10	5	-	15

[a] For KY, one redlined hard copy is sufficient if the document is less than 100 pages. If the document is greater than 100 pages, KY would like an additional redlined hard copy. For D2 documents, DOE has requested 3 redlined copies and 8 comment response summaries (CRS). Two additional redlined copies will be generated for the AR file and for the DMC file if the DOE letter cites that a redlined copy is enclosed. CRSs in response to DOE comments are provided to DOE only.
[b] Electronic distribution will be made via e-mail for documents less than 35 MB, otherwise the link to the Public Documents Web site will be provided. DOE will be responsible for sending the e-copy e-mail. LATA Kentucky is responsible for posting to the Public Documents Web site.
[c] CDs are provided to Kim Crenshaw.
[d] Environmental Reporting and Deliverables Quality (ERDQ)/Document Production (within the Regulatory Management group) will provide CDs to Eddie Spraggs who will make distribution of the CDs.
[e] Additional copies needed for LATA Kentucky personnel are not included in the above totals. ERDQ will provide copies to the appropriate administrative staff to complete distribution of these documents.

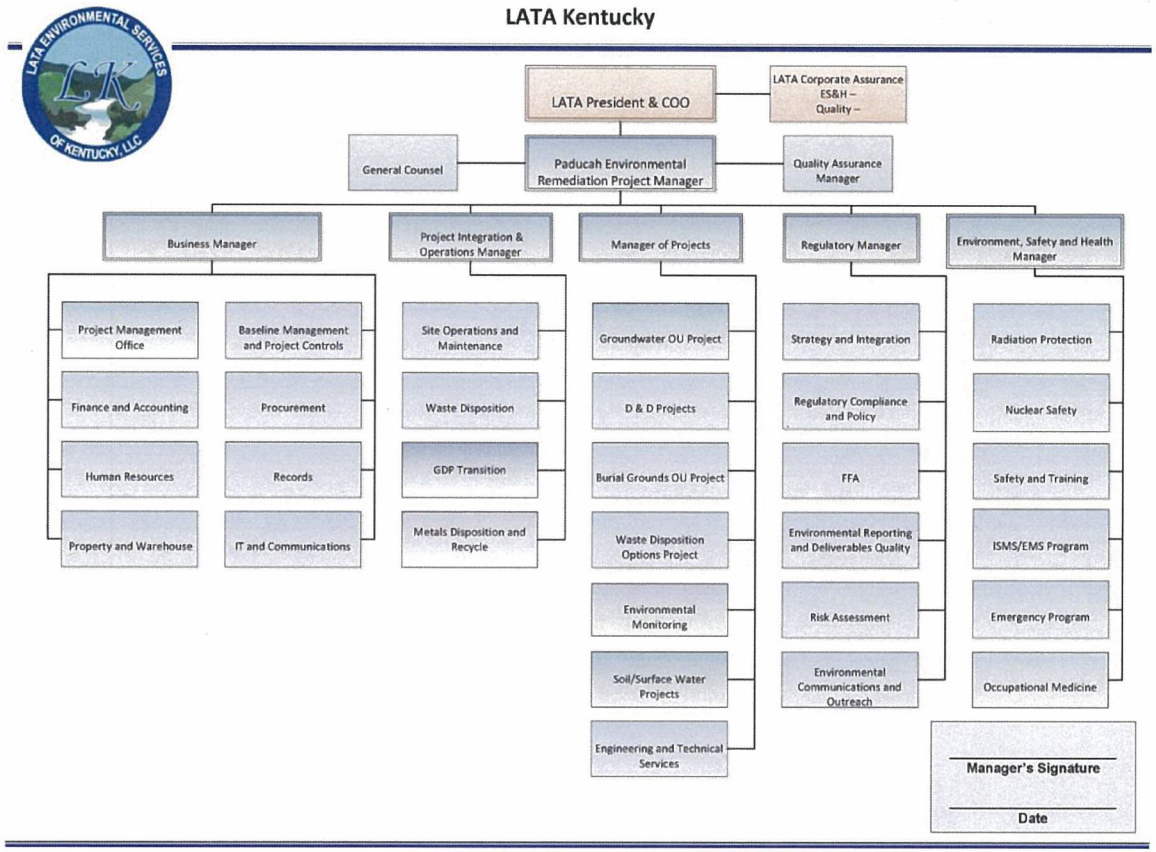
QAPP Worksheet #4
Project Personnel Sign-Off Sheet

Personnel actively engaged in sample collection, data analysis, and data validation for the projects is required to read applicable sections of this project-specific QAPP upon approval of its contents by all FFA parties. The master list of signatures will be kept with the project work control documentation and will be made available upon request.

Project Position Title	Organization	Signature	Date

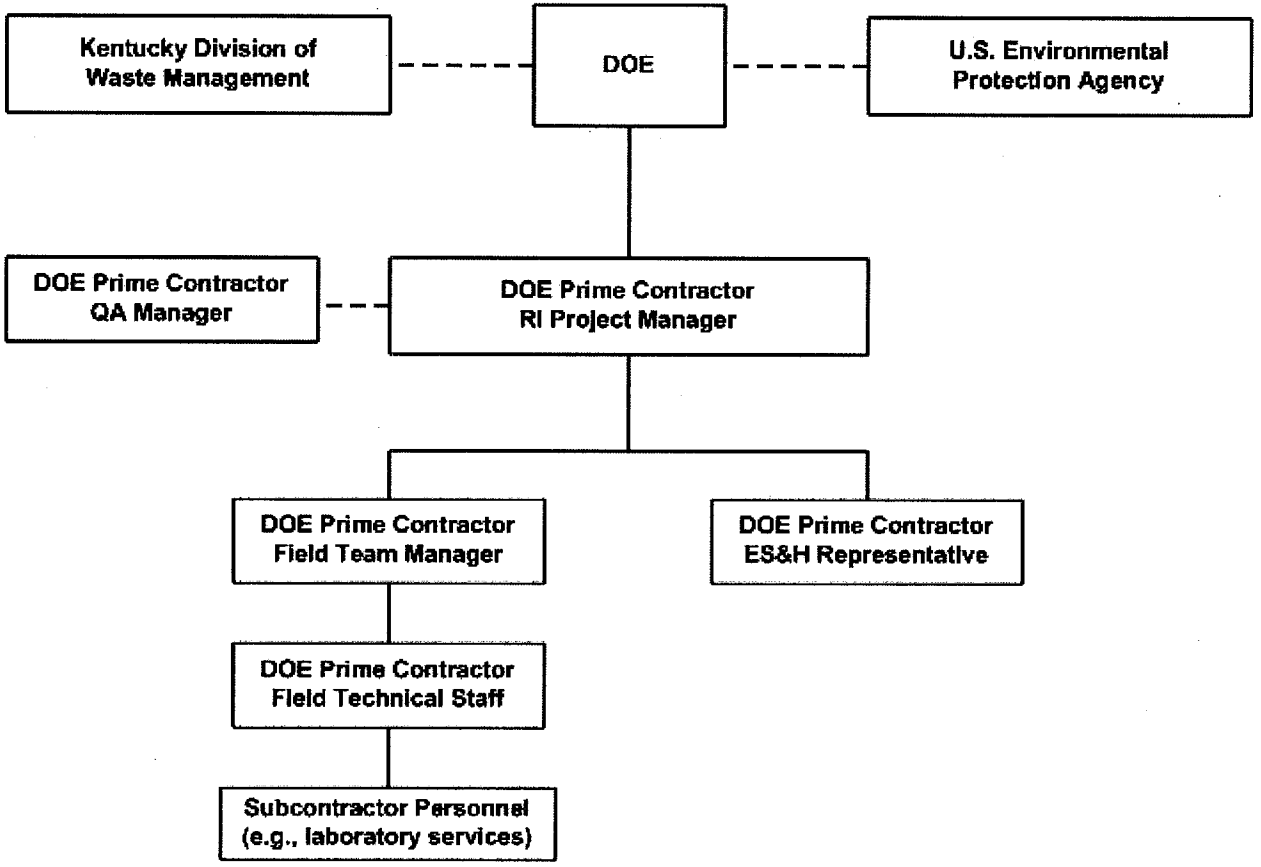
QAPP Worksheet #5-A
Project Contractor Organizational Chart*

This portion of the QAPP addresses the project organization as it provides for QA/QC coordination and responsibilities. This QAPP includes the overall project organization at the Remediation Project Manager level and its principal lines of communication and authority.



* A copy of the current organizational chart will be maintained at the LATA Kentucky Web site.

QAPP Worksheet #5-B
Project Level Organizational Chart



QAPP Worksheet #6
Communication Pathways

NOTE: Formal communication across company or regulatory boundaries occurs via letter. Other forms of communication, such as e-mail, meetings, etc., will occur throughout the project.

Communication Drivers	Organizational Affiliation	Position Title Responsible	Procedure
Federal Facility Agreement DOE/OR/07-1707	DOE Paducah Site Lead	Paducah Site Lead	All formal communication among DOE, EPA, and KDEP
Federal Facility Agreement DOE/OR/07-1707	DOE Paducah	Environmental Remediation Project Manager	All formal communication between DOE and contractor for Environmental Remediation Projects
All project requirements	LATA Kentucky	Environmental Remediation Project Manager	All formal communication between the project and the Site Lead
All project requirements	LATA Kentucky	Project Manager	All communication between the project and the LATA Kentucky Environmental Remediation Project Manager
Project QA requirements	LATA Kentucky	Quality Assurance Manager	All project quality related communication between the QA department and LATA Kentucky project personnel
FFA Compliance	LATA Kentucky	Regulatory Manager	All internal communication regarding FFA compliance with the LATA Kentucky Project Manager

Roles presented above are at the program level.

QAPP Worksheet #6 (Continued)
Communication Pathways

Communication Drivers	Organizational Affiliation	Position Title Responsible	Organizational Department Manager	Procedure
Sampling Requirements	LATA Kentucky	Sampling Lead	Project and Operations Manager	All internal communication regarding field sampling with the LATA Kentucky Project Manager
Analytical Laboratory Interface	LATA Kentucky	Laboratory Coordinator	Project and Operations Manager	All communication between LATA Kentucky and analytical laboratory
Waste Management Requirements	LATA Kentucky	Waste Coordinator	Project and Operations Manager	All internal communication regarding project waste management with LATA Kentucky Project Manager
Environmental Compliance Requirements	LATA Kentucky	Compliance Manager	Regulatory Manager	All internal correspondence regarding environmental requirements and compliance with the LATA Kentucky Project Manager
Subcontractor Requirements (if applicable)	LATA Kentucky	Subcontract Administrator	Business Manager	All correspondence between the project and subcontractors, if applicable
Health and Safety Requirements	LATA Kentucky	Environment, Safety, and Health Manager	Environment, Safety, and Health Manager	All internal communication regarding safety and health requirements with the LATA Kentucky Project Manager

NOTE: In the event the contractor changes, DOE will notify EPA and KDEP of the change, but not request approval of the report.

QAPP Worksheet #7
Personnel Responsibility and Qualifications Table

Position Title Responsible	Organization Affiliation	Responsibilities	Education and Experience Qualifications
Project Manager	LATA Kentucky	Overall project responsibility	> 4 years relevant work experience
Environmental Engineer	LATA Kentucky	Project sampling and analysis plan	Bachelor of Science plus > 1 year relevant work experience
Environmental Compliance Manager	LATA Kentucky	Project environmental compliance responsibility	Bachelor of Science plus > 4 years work experience
FFA Manager	LATA Kentucky	Project compliance with the FFA	> 4 years work relevant experience
Environmental Monitoring and Reporting Program Manager	LATA Kentucky	Support project on sampling and reporting activities	> 4 years relevant work experience
Sample/Data Management Manager	LATA Kentucky	Project sample and data management	> 1 year relevant work experience
Health and Safety Representative	LATA Kentucky	Project safety and health responsibility	Bachelor degree plus > 1 year relevant experience
Waste Coordinator	LATA Kentucky	Overall project waste management responsibility	> 4 years relevant experience
Data Validator	Independent third party contractor	Performing data validation according to specified procedures	Bachelor degree plus relevant experience
Analytical Laboratory Project Manager	Analytical Laboratory	Sample analysis and data reporting	Bachelor degree plus relevant experience

QAPP Worksheet #8
Special Personnel Training Requirements Table

Personnel are trained in the safe and appropriate performance of their assigned duties in accordance with requirements of work to be performed. There are no special training requirements other than what normally is required for work at the PGDP site. QAPP development uses a graded approach. A work control package will be generated prior to implementation of the FSP the package will list specific project-level training requirements.

Project Function	Specialized Training—Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates*
Drill Rig Operator	Kentucky Certified Well Driller	State of Kentucky	TBD	Drill Rig Operator	Drill Rig Operator/TBD	TBD

* Training records are maintained by the LATA Kentucky training department. If training records and/or certificates do not exist or are not available, this should be noted.
TBD = to be determined

QAPP Worksheet #9
Project Scoping Session Participants Sheet

Project scoping is the key to the success of any project and is part of the systematic planning process. A scoping meeting was held to develop the data quality objectives of the project.

Name of Project: RDSI Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Site
Date of Session: February 4, 2010
Scoping Session Purpose: Develop data quality objectives

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
Project Manager	Portage	John Keck	208-419-4149	jkeck@portageinc.com	Project management
GWOU Manager	LATA Kentucky	Jeff Carman	270-441-5229	jeff.carman@lataky.com	Program management
Risk Manager	Portage	Charleen Roberts	208-377-3281	croberts@portageinc.com	Technical support
Engineer	LATA Kentucky	Mike Clark	270-441-5791	michael.clark@lataky.com	Technical support
Geologist	LATA Kentucky	Ken Davis	270-441-5049	ken.davis@lataky.com	Technical support

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project:
PGDP Southwest Plume consists of groundwater in the RGA contaminated primarily with TCE. The C-747-C Oil Landfarm (SWMU 1) and the C-720 Building northeast and southeast sites (SWMUs 211-A and 211-B, respectively) are sources of contamination to the Southwest Plume. A revised FFS (DOE 2011a) was performed for the three Southwest Plume source areas. RAOs defined in the revised Southwest Plume FFS include these:

(1) Treat and/or remove the PTW consistent with the NCP;

(2a) Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (< 10 ft);

(2b) Prevent exposure to non-VOC contamination through interim land use controls within the Southwest Plume source areas (i.e., SWMU 1, SWMU 211 A, and SWMU 211 B) pending remedy selection as part of the Soils OU and the GWOU; and

(3) Reduce VOC migration from contaminated subsurface soils in the treatment areas at the Oil Landfarm and C-720 Northeast and Southeast sites so that contaminants migrating from the treatment areas do not result in an exceedance of MCLs in underlying RGA groundwater.

Soil RGs, volume-averaged TCE UCRS soil concentrations that would meet RAO 3, calculated in the revised Southwest Plume FFS Appendix C, are listed below:

- Oil Landfarm source area: 7.3E-02 mg/kg
- C-720 northeast and southeast source areas: 7.5E-02 mg/kg.

Previous investigations documented in the WAG 27 RI (CH2M HILL 1999) and the SI Report (DOE 2007) did not completely define either the areal and vertical extent of soil contaminated above RGs in the source areas nor the presence or extent of DNAPL TCE. These were identified in the Southwest Plume revised FFS (DOE 2011a) as data gaps to be resolved in the RDSI.

The Southwest Plume revised proposed plan (DOE 2011b) identified *in situ* source treatment using deep soil mixing with interim LUCs as the preferred alternative for SWMU 1 and final characterization of source extent and magnitude followed by either *in situ* source treatment using enhanced *in situ* bioremediation with interim LUCs or long-term monitoring with interim LUCs. An RDSI is proposed to resolve data gaps including areal and vertical extent of soil contaminated above RGs in the source areas; and the presence or extent of DNAPL TCE. The RDSI must produce data of sufficient quality and quantity to resolve the data gaps.

The environmental questions being asked:

1. What is the areal and vertical extent of TCE present at volume-averaged concentrations greater than RGs at the Southwest Plume source areas?

QAPP Worksheet #10 (Continued)
Problem Definition

Observations from any site reconnaissance reports:
Characterization data from the WAG 27 RI (DOE 1999) and SW Plume SI (DOE 2007) indicate that TCE is the primary contaminant but do not bound the extent of contamination.

A synopsis of secondary data or information from site reports:
Section 3 of *the* Characterization Plan summarizes the secondary data used to document the DQOs.

The possible classes of contaminants and the affected matrices:
Primarily, the contaminants are VOCs.
Affected matrices are expected to be as follows (if present):
Groundwater; Soils

The rationale for inclusion of chemical and nonchemical analyses:
Worksheet #11 presents rationale for inclusion of chemical and nonchemical analyses.

Information concerning various environmental indicators:
Groundwater investigations have indicated that the SWMU 1 and SWMUs 211A&B are contributors to the TCE contamination in the SW Plume.

Project decision conditions ("If..., then..." statements):
If TCE soil concentrations exceed volume-averaged cleanup levels for a given soil boring, then include the location in the treatment area. If soil concentrations do not exceed volume-averaged cleanup levels, then the area need not be included in the treatment area.

QAPP Worksheet #11
Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?

DOE and its contractors (e.g., PRC, LATA Kentucky), KDEP, and EPA.

What will the data be used for?

To identify the nature, extent, and release of contamination to determine if there is a potential risk to human health and/or the environment and identify potential response actions to minimize the risk.

What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)

Qualitative results using photoionization detector (PID) measurements. These qualitative results will be used to determine the depth interval to sample for VOCs by a field laboratory. Near real-time field laboratory VOC results will allow decision making in where to place contingency sample boring locations. Confirmation samples for VOCs will be sent to a fixed-laboratory at a rate of 10% along with VOCs needed for field QC samples. Analysis for analytes other than VOCs will be conducted at a fixed-laboratory.

How "good" do the data need to be in order to support the environmental decision?

Data needs to meet the measurement quality objective and data quality indicators established by the systematic planning process. All fixed-laboratory data will be verified and assessed with 10% validated at Level IV.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)

The numbers of samples to be submitted to the field and fixed-laboratories are identified in the RDSI Characterization Plan and Worksheet #18. Additionally soil samples will be qualitatively evaluated in the field for VOCs utilizing a photoionization detector.

Where, when, and how should the data be collected/generated?

See Characterization Plan.

Who will collect and generate the data?

A sample team of individuals who are properly trained and skilled in the execution of screening and sampling procedures will collect samples and perform the field screening measurements.

How will the data be reported?

Field data will be recorded on chain-of-custody forms, in field logbooks, and field data sheets. The field and fixed-laboratory will provide data in an Electronic Data Deliverable (EDD). Project data following verification, assessment and validation will be placed into and reported from the Paducah OREIS.

How will the data be archived?

Electronic data will be archived in OREIS. Hard copy data will be submitted to the Document Management Center.

QAPP Worksheet #12-A
Measurement Performance Criteria Table[1]

Sampling will follow the standard operating procedures included in the SAP. The following table provides the measurement performance criteria.

Analyte	CAS Number	EPA Method	Soil/Sediment Accuracy % Recovery	Aqueous Accuracy % Recovery	Soil/ Sediment Precision RPD Lab/Field	Aqueous Precision RPD	Soil/ Sediment PQL (µg/Kg)	Soil/ Sediment MDL* (µg/Kg)	Water PQL (µg/L)	Water MDL* (µg/L)
Volatile Organic Compounds										
1,1-Dichloroethene	75-35-4	SW-846, 8260	50-150	80-120	< 22/<50	< 25	10	5	5	2.5
cis-1,2-Dichloroethene	156-59-2	SW-846, 8260	50-150	70-125	< 22/<50	< 25	10	5	1	0.5
trans-1,2-Dichloroethene	156-60-5	SW-846, 8260	50-150	70-125	<22/<50	<25	10	5	1	0.5
Trichloroethene	79-01-6	SW-846, 8260	50-150	70-125	< 22/< 50	≤ 25	10	5	1	0.5
Vinyl Chloride	75-01-4	SW-846, 8260	50-150	50-145	< 22/< 50	≤ 25	10	5	2	1

[1] Additional information about quality control samples is found in Worksheet #28.
* The analytical laboratory may not be able to meet the project action limits established by contaminant transport modeling in Appendix C of *Revised Focus Feasibility Study for Solid Waste Management Units 1, 211A, and 211B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, [Revised Focused Feasibility Study (Revised FFS), DOE 2011a]. In those cases, LATA Kentucky will have the laboratory report to the method detection limit qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory practical quantitation limit.

QAPP Worksheet #12-B
Measurement Performance Criteria Table[1]

Analyte	CAS Number	EPA Method	Aqueous Accuracy % Recovery	Aqueous Precision RPD	Water PQL (µg/L)	Water MDL (µg/L)
Metals*						
Aluminum	7429-90-5	200.8/ 6010/6020	80-120	≤ 25	200	100
Chromium	7440-47-3	200.8/ 6010B/6020	80-120	≤ 25	10	5
Iron	7439-89-6	200.8/ 6010B/6020	80-120	≤ 25	200	100
Lead	7439-92-1	200.8/ 6010/6020	80-120	≤ 25	1.3	0.65
Manganese	7439-96-5	200.8/ 6010B/6020	80-120	≤ 25	5	2.5

[1] Additional information about quality control samples is found in Worksheet #28.
* Analyses for metals are total and dissolved.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
OREIS Database	Various	Various	Data will be used to optimize remedy selection and support remedial design.	Data have been verified, assessed, and validated (if validation required). Rejected data will not be used.
Historical Documentation	WAG 27 RI Report (DOE/OR/07-1777&D2)	DOE contractors, soil and water, 1998	Information will be used in conjunction with newly collected data to help fill data gaps identified in the Characterization Plan.	Data have been verified, assessed, and validated (if validation required). Rejected data will not be used. Subsequent excavation has removed some high-PCB areas at SWMU 1.
Historical Documentation	SW Plume SI Report (DOE/OR/07-2180&D2/R1)	DOE contractors, soil and water, 1997	Information will be used in conjunction with newly collected data to help fill data gaps identified in the Characterization Plan.	Data have been verified, assessed, and validated (if validation required). Rejected data will not be used.

QAPP Worksheet #14
Summary of Project Tasks*

Sampling Tasks:
Collect samples, prepare blanks, preserve samples, document field notes, complete chain-of-custody, label samples, package/ship samples per standard operating procedures Worksheet #21.

Analysis Tasks:
Receive samples, complete chain-of-custody, extract samples, analyze extract, review data, report data per standard methods Worksheet #21.

Quality Control Tasks:
QC will be per QAPP worksheets as follows:

- QC samples—Worksheets #20 and #28
- Equipment calibration—Worksheets #22 and #24
- Data review/validation—Worksheets #34, #35, #36, and #37

Secondary Data:
See Worksheet #13.

Data Management Tasks:
Data management will be per procedure PAD-ENM-5007, *Data Management Coordination* and the data management implementation plan found in the SW Plume RDSI Characterization Plan, DOE/LX/07-0350&D1

Documentation and Records:
Documentation and records will be per procedure PAD-RM-1009, *Records Management, Administrative Records, and Document Control.*

Assessment/Audit Tasks:
Assessments and audits will be per procedure PAD-QA-1420, *Conduct of Assessments.*

Prior to mobilization to perform fieldwork, an independent assessment (Internal Field Readiness Review) will be conducted to determine if the project is prepared to proceed (e.g., scope has been defined and is understood by workforce, scope has regulatory approval, scope properly contracts, personnel properly training to complete). One management assessment will be performed during DPT sampling at each area of field implementation (SWMU 1, C-720 northeast, and C-720 southeast) to verify work is being performed consistent with the SAP.

Data Review Tasks:
Data review tasks will be per procedure PAD-ENM-5003, *Quality Assured Data.*

* It is understood that SOPs are contractor specific.

QAPP Worksheet #15-A
Reference Limits and Evaluation Table

Matrix: Soil
Analyte Group: VOCs

VOCs	CAS Number	Project Action Limit/NAL (µg/kg)	Project Action Limit Reference*	Site COPC?	Laboratory-Specific	
					PQLs (µg/kg)	MDLs (µg/kg)
1,1-Dichloroethene	75-35-4	62.6	Worker Protection RGs	Yes	10	5
cis-1,2-Dichloroethene	156-59-2	600	Groundwater Protection RGs	Yes	10	5
trans-1,2-Dichloroethene	156-60-5	1,080	Groundwater Protection RGs	Yes	10	5
Trichloroethene	79-01-6	58.5	Worker Protection RGs	Yes	10	5
Vinyl chloride	75-01-4	34	Groundwater Protection RGs	Yes	10	5

* Project Action Limits shown are remedial goals from the lesser value of Table 2.1 and Table 2.2 of Revised FFS, DOE 2011. Table 2.1 provides worker protection RGs. Table 2.2 provides groundwater protection RGs.
** The analytical laboratory may not be able to meet the project action limits established by contaminant transport modeling in Appendix C of Revised FFS, DOE 2011. In those cases, LATA Kentucky will have the laboratory report to the method detection limit qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory practical quantitation limit.

QAPP Worksheet #15-B
Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: Volatile Organic Compounds

VOCs	CAS Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference*	Site COPC?	Laboratory-Specific**	
					PQLs (µg/L)	MDLs (µg/L)
1,1-Dichloroethene	75-35-4	7	MCL/Groundwater Protection RGs[1]	Yes	5	2.5
cis-1,2-Dichloroethene	156-59-2	70	Groundwater Protection RGs	Yes	1	0.5
trans-1,2-Dichloroethene	156-60-5	100	MCL/Groundwater Protection RGs	Yes	1	0.5
Trichloroethene	79-01-6	5	MCL/Groundwater Protection RGs	Yes	1	0.5
Vinyl Chloride	75-01-4	2	MCL/Groundwater Protection RGs	Yes	2	1

* Project Action Limits shown are remedial goals from Table 2.2 of Revised FFS, DOE 2011.
** The analytical laboratory may not be able to meet the no action levels (NALs) established by Methods for Conducting Risk Assessments and Risk Evaluation at PGDP (Risk Methods Document, DOE 2011b). In those cases, LATA Kentucky will have the laboratory report to the method detection limit qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory practical quantitation limit.

QAPP Worksheet #15-C
Reference Limits and Evaluation Table

Matrix: Groundwater
Analytical Group: Metals

Metals[1]	CAS Number	Project Action Limit[2]/NAL (mg/L)	Project Action Limit Reference	Site COPC?	Laboratory-Specific	
					PQLs (mg/L)	MDLs (mg/L)
Aluminum	7429-90-5	1	n/a	Yes	0.200	0,100
Chromium	7440-47-3	1	n/a	Yes	0.010	0.005
Iron	7439-89-6	10	(EPA 510-B-95-007)	Yes	0.200	0.100
Lead	7439-92-1	1	n/a	Yes	0.0013	0.00065
Manganese	7439-96-5	1	AFCEE 2007)	Yes	0.005	0.0025

[1] Both total and dissolved analyses are required.
[2] Iron: EPA 510-B-95-007, *How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A guide for Corrective Action Plan Reviewers*
Manganese: Air Force Center for Engineering and the Environment, *Final Protocol for In Situ Bioremediation of Chlorinated Solvents Using Edible Oil.*
Aluminum, Chromium, and Lead: In the absence of published standards, considered the same standard as for manganese.
NAL = no action level for child resident scenario for the Risk Methods Document (DOE 2011b)–not used above.

QAPP Worksheet #16
Project Schedule/Timeline Table

Section 5 of the SW Plume RDSI Characterization Plan and Worksheet #17 of this QAPP describe the staged approach to sampling to be used for field characterization, the results of planned sample locations influencing the location of contingency sample collection to complete definition of the area of TCE contamination exceeding the cleanup level. The total duration of the field sampling period is approximately three months. An actual start date and corresponding finish date are not forecast at this time, pending approval of the RDSI Characterization Plan.

A field laboratory will be utilized to provide next-day reporting of VOC analyses for groundwater and soil. Other fixed-laboratory analyses, including confirmatory VOC analyses and microbial and geotechnical analyses, are expected within 28 days of completion of the fieldwork.

QAPP Worksheet #17-A
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, judgmental statistical approach):

The nature and extent investigation will be implemented in stages. The first stage will utilize a field laboratory, for VOC analyses only (not including 10% confirmatory analyses or field QC analyses), to provide timely characterization of VOC levels within a defined sample grid. A second stage provides a limited number of contingency borings, as necessary with analysis by field laboratory (not including 10% confirmatory analyses or field QC analyses), to define the extent of any contiguous area with TCE levels that exceed the SWMU-specific cleanup goals. (A fixed-laboratory will perform the analysis of confirmatory samples and field QC samples.) The investigation will be based primarily on sampling from soil borings completed with DPT. In each soil boring, the investigation will characterize VOC trends using field PID readings at 0.5 ft depth intervals from surface to the base of the UCRS at a depth of approximately 60 ft. At least one soil sample will be collected for field laboratory analysis from each 5-ft depth interval.

The investigation also will collect samples for fixed laboratory analysis to support design of the remedial action at SWMU 1 and selection and design of the remedial action at SWMUs 211A&B. The additional sampling consists of geotechnical analysis to assess deep soil mixing at SWMU 1 and groundwater chemistry analyses, microbial population analyses, and geotechnical analyses to assess enhanced *in situ* bioremediation at SWMUs 211A&B. Nested wells will be completed at each of the investigation areas to assess groundwater levels and vertical gradients.

Describe the sampling design and rationale in terms of which matrices will be sampled:

Soil borings will be sampled at predetermined locations to compare TCE levels with SWMU-specific cleanup levels. Additional contingency soil borings, placed based on results of the predetermined locations, may be used, as necessary, to define the extent of TCE levels exceeding the cleanup levels.

Soil samples will also be collected to measure geotechnical properties at each of the SWMUs.

Limited groundwater sampling will be performed from wells at each site to assess general groundwater quality and VOC levels. Additional groundwater sampling will be performed as grab samples from wells installed during this investigation to assess groundwater parameters that relate to enhanced *in situ* bioremediation and long term attenuation.

QAPP Worksheet #17-A (Continued)
Sampling Design and Rationale

- **What analyses will be performed and at what method detection limits?**

  Standard Environmental Sampling:

  Volatile organic compounds (VOCs) by SW-846, 8260; metals analysis by SW-846, 200.8/6010B/6020. **See Worksheet #12 for method detection limit.**

  Engineering & Design Sampling:

  For soils: grain size analysis by ASTM D6913, *in situ* water content by ASTM D2216, pH by ASTM D4972, unconfined compressive strength by ASTM D2166, compressibility by ASTM D2850, index properties by ASTM D4318, permeameter testing by ASTM D5084.

  For groundwater: alkalinity by Hach® test kit Model AL-DT, ferrous iron by Hach® test kit Model IR-18C, dissolved methane, ethane, and ethane by modified R.S. Kerr SOP-175, microbial population analysis by the quantitative polymerase chain reaction method. See Worksheet 17-B for additional details.

- **Where are the sampling locations (including QC, critical, and background samples)?**

  See Worksheet #18.

- **How many samples to be taken?**

  See Worksheet #18.

- **What is the sampling frequency (including seasonal considerations)?**

  This is a one-time sampling event except for the monitoring wells. They will be sampled on three consecutive weeks.

QAPP Worksheet #17-B
Engineering and Design Sampling

	Media Type	Sample Location	Number of Samples	Test/Analytical Method	Project Action Limit	PQL
Geotechnical Analysis						
Grain Size Analysis	Soil	3/all HUs at each source area	27	ASTM D6913-04	N/A	N/A
Permeameter Testing	Soil	3/all HUs at each C-720 site	18	ASTM D5084-10	N/A	N/A
In Situ Water Content	Soil	3/all HUs at SWMU 1	9	ASTM D2216-10	N/A	N/A
pH	Soil	3/all HUs at SWMU 1	9	ASTM D4972-01	N/A	N/A
Unconfined Compressive Strength	Soil	3/all HUs at SWMU 1	9	ASTM D2166-06	N/A	N/A
Compressibility	Soil	3/all HUs at SWMU 1	9	ASTM D2850-03a	N/A	N/A
Index Properties	Soil	3/all HUs at SWMU 1	9	ASTM D4318-10	N/A	N/A

QAPP Worksheet #17-B (Continued)
Engineering and Design Sampling

	Media Type	Sample Location	Number of Samples	Test/Analytical Method	Project Action Limit	PQL
Microbial Analysis						
Microbial population	Water	nested wells at each source area	9	Quantitative Polymerase Chain Reaction Method	N/A	N/A
Field Parameters						
Dissolved Oxygen	Water	wells at each source area	27	Hach® Quanta Hydrolab	0.5 mg/L	0.2 mg/L
Oxidation Reduction Potential	Water	wells at each source area	27	Hach® Quanta Hydrolab	50 mV against Ag/AgCl	20 mV
pH	Water	wells at each source area	27	Hach® Quanta Hydrolab	5 to 9 Std Units	0.02 Std Units
Specific Conductance	Water	wells at each source area	27	Hach® Quanta Hydrolab	N/A	0.001 mS/cm

QAPP Worksheet #17-B (Continued)
Engineering and Design Sampling

	Media Type	Sample Location	Number of Samples	Test/Analytical Method	Project Action Limit	PQL
Ions						
Chloride	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056	N/A	2 mg/L
Nitrate	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056	N/A	4 mg/L
Sulfate	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056	N/A	2 mg/L
Field Parameters						
Alkalinity	Water	All existing wells at each C-720 site	27	Hach® Alkalinity Test Kit, Model AL-DT	N/A	0.1 – 10 mg/L
Ferrous Iron	Water	All existing wells at each C-720 site	27	Hach® Iron (Ferrous) Color Disc Test Kit, Model IR-18C, 0.2-10 mg/L	N/A	0.2 mg/L
Dissolved Gases						
Methane	Water	All existing wells at each C-720 site	27	Modified R. S. Kerr SOP-175	N/A	0.10 µg/L
Ethane	Water	All existing wells at each C-720 site	27	Modified R. S. Kerr SOP-175	N/A	0.025 µg/L
Ethene	Water	All existing wells at each C-720 site	27	Modified R. S. Kerr SOP-175	N/A	0.025 µg/L

N/A = not applicable

QAPP Worksheet #18-A
Sampling Locations and Methods/Standard Operating Procedure Requirements Table for Screening Samples

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
SWMU 1	Soil	Subsurface	VOCs	Up to 439 mg/kg TCE	192+10 field duplicates+19 confirmation samples	See Worksheet #21	See Worksheet #17
	Soil	Subsurface	Geotechnical-SWMU 1 (dual tube sampler)	n/a	9		
	Soil	Subsurface	Geotechnical (thin-walled sampler)	n/a	9		
	Soil	Subsurface	Microbial population	n/a	3		
	Groundwater	Subsurface	VOCs	TCE assumed 11,000 µg/L	9+0 field duplicates		
	Groundwater	Subsurface	Metals	See historical data	9		
	Groundwater	Subsurface	Ions	See historical data	9		
	Groundwater	Subsurface	Field	See historical data	9		
	Groundwater	Subsurface	Dissolved gas	See historical data	9		
	Groundwater	Subsurface	Microbial Population	n/a	3		

QAPP Worksheet #18-A (Continued)
Sampling Locations and Methods/Standard Operating Procedure Requirements Table for Screening Samples

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
C-720 Northeast Site	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	324+16 field duplicates+32 confirmation samples	See Worksheet #21	See Worksheet #17
	Soil	Subsurface	Geotechnical-C-720 (dual tube sampler)	n/a	9		
	Soil	Subsurface	Geotechnical (thin walled sampler)	n/a	0		
	Groundwater	Subsurface	Microbial Population	n/a	9		
	Groundwater	Subsurface	VOCs	TCE assumed 11,000 µg/L	9+0 field duplicates		
	Groundwater	Subsurface	Metals	See historical data	9+0 field duplicates		
	Groundwater	Subsurface	Ions	See historical data	9+0 field duplicates		
	Groundwater	Subsurface	Field	See historical data	9+0 field duplicates		
	Groundwater	Subsurface	Dissolved gas	See historical data	9+0 field duplicates		
C-720 Southeast Site	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	156+8 field duplicates+15 confirmation samples		
	Soil	Subsurface	Geotechnical-C-720 (dual tube sampler)	n/a	9		
	Soil	Subsurface	Geotechnical (thin walled sampler)	n/a	0		
	Groundwater	Subsurface	Microbial Population	n/a	9		
	Groundwater	Subsurface	VOCs	TCE assumed 11,000 µg/L	9+1 field duplicates		
	Groundwater	Subsurface	Metals	See historical data	9+1 field duplicates		
	Groundwater	Subsurface	Ions	See historical data	9+1 field duplicates		
	Groundwater	Subsurface	Field	See historical data	9+1 field duplicates		
	Groundwater	Subsurface	Dissolved gas	See historical data	9+1 field duplicates		

QAPP Worksheet #18-B
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
SWMU 1 Hotspot	Soil	Subsurface	VOCs	Up to 439 mg/kg TCE	0	See Worksheet #21	See Worksheet #17
C-720 Northeast Site Hotspot	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	4+1 field duplicate		
C-720 Southeast Site Hotspot	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	4		

QAPP Worksheet #18-C
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
SWMU 1 Contingency	Soil	Subsurface	VOCs	Up to 439 mg/kg TCE	96+5 field duplicates+10 confirmation samples	See Worksheet #21	See Worksheet #17
C-720 Northeast Site Contingency	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	120+6 field duplicates+12 confirmation samples		
C-720 Southeast Site Contingency	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	72+4 field duplicates+7 confirmation samples		

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume[1]	Containers (number, size, and type) [1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	Volatile Organic Compounds	Moderate	See Worksheet #12	250 g	9 oz. Glass	Cool to 4°C	14 days
Soil	Geotechnical	n/a	ASTM D6913	TBD	TBD	TBD	TBD
Soil	Geotechnical—C-720	n/a	ASTM D5084	TBD	TBD	TBD	TBD
Soil	Geotechnical—SWMU 1	n/a	ASTM D2216	TBD	TBD	TBD	TBD
Soil	Geotechnical—SWMU 1	n/a	ASTM D4972	TBD	TBD	TBD	TBD
Soil	Geotechnical—SWMU 1	n/a	ASTM D2166	TBD	TBD	TBD	TBD
Soil	Geotechnical—SWMU 1	n/a	ASTM D2850	TBD	TBD	TBD	TBD
Soil	Geotechnical—SWMU 1	n/a	ASTM D4318	TBD	TBD	TBD	TBD

QAPP Worksheet #19 (Continued)
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume[1]	Containers (number, size, and type) [1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Groundwater	Volatile Organic Compounds	High	See Worksheet #12	120 mL	3 x 40 mL Glass VOA vial	Cool < 4°C, HCl	14 days for preserved
Groundwater	Metals (total)	See historical data	See Worksheet #12	1 L	Plastic	Cool 4°C	6 months
Groundwater	Metals (dissolved)	See historical data	See Worksheet #12	1 L	Plastic	Cool 4°C, HNO3 to pH < 2	6 months
Groundwater	Ions	See historical data	SW846-9056	TBD	TBD	Cool 4°C	28 days
Groundwater	Field	See historical data	Hach® Alkalinity Test Kit	TBD	TBD	Cool 4°C	28 days
Groundwater	Field	See historical data	Hach® Iron (Ferrous) Color Disc Test Kit	TBD	TBD	Cool 4°C	28 days
Groundwater	Kerr method: dissolved gasses	See historical data	R. S. Kerr SOP-175	TBD	TBD	Cool 4°C, HCl to pH < 2, no headspace	14 days
Groundwater	Microbial population	n/a	Laboratory specific	TBD	TBD	TBD	TBD

NOTE: Sample volume container requirements will be specified by the laboratory.

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples[1]	Total No. of Samples to Lab[2]
Soil	VOCs	Moderate	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	VOCs	High	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	Metals (total)	See historical data	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	Metals (dissolved)	See historical data	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	Ions	See historical data	SW846-9056	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	Dissolved gasses	See historical data	Modified R.S. Kerr SOP-175	See Worksheet #17	5%	5%	5%	5%	n/a	See Worksheet #17

[1] PT sample will only be collected when required by a specific project.
[2] A field laboratory will perform groundwater and soil VOC analyses. Confirmation samples for VOCs will be sent to a fixed-laboratory at a rate of 10% along with VOCs needed for field QC samples. All other analyses will be performed by a fixed laboratory.

QAPP Worksheet #21
Project Sampling SOP References Table

Site-specific standard operating procedures (SOPs) have been developed for site sampling activities. Below is a list of site sampling procedures that projects will select from for implementing sampling activities.

Reference Number	Title, Revision Date, and/or Number[a]	Originating Organization[b]	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	PAD-ENM-0023, *Composite Sampling*	Contractor	Sampling	N	None
2	PAD-ENM-0026, *Wet Chemistry and Misc. Analyses Data Verification and Validation*	Contractor	N/A	N	None
3	PAD-ENM-1001, *Transmitting Data to the Paducah Oak Ridge Environmental Information System (OREIS)*	Contractor	N/A	N	None
4	PAD-ENM-1003, *Developing, Implementing, and Maintaining Data Management Implement. Plans*	Contractor	N/A	N	None
5	PAD-ENM-2100, *Groundwater Level Measurement*	Contractor	Sampling	N	None
6	PAD-ENM-2101, *Groundwater Sampling*	Contractor	Sampling	Y	None
7	PAD-ENM-2300 *Collection of Soil Samples*	Contractor	Sampling	N	None
8	PAD-ENM-2303, *Borehole Logging*	Contractor	Sampling	N	None
9	PAD-ENM-2700, *Logbooks and Data Forms*	Contractor	N/A	N	None
10	PAD-ENM-2702, *Decontamination of Sampling Equipment and Devices*	Contractor	Sampling	N	None
11	PAD-ENM-2704, *Trip, Equipment, and Field Blank*	Contractor	Sampling	N	None
12	PAD-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*	Contractor	Sampling	N	None
13	PAD-ENM-5003, *Quality Assured Data*	Contractor	N/A	N	None
14	PAD-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance*	Contractor	N/A	N	None
15	PAD-ENM-5007, *Data Management Coordination*	Contractor	N/A	N	None
16	PAD-ENR-0020, *Direct Push Technology Sampling*	Contractor	Sampling	N	None
17	PAD-ENM-5105, *ROAC1 Volatile and Semivolatile Data Verification and Validation*	Contractor	N/A	N	None
18	PAD-ENM-5107, *Inorganic Data Validation and Verification*	Contractor	N/A	N	None

[a] SOPs are posted to the LATA Kentucky intranet Web site. External FFA parties can access this site using remote access with privileges upon approval.
[b] The work will be conducted by LATA Kentucky staff or a subcontractor. In either case, SOPs listed will be followed.

N/A = not applicable

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Mini RAE Photoionization Detector (PID) Toxic Gas Monitor with 10.5 eV Lamp or Similar Meter	Calibration checked at the beginning and end of the day	As needed in the field; semi-annually by the supplier	Measure known concentration of isobutylene 100 ppm (calibration gas)	Upon receipt, successful operation	Calibrate am, check pm	± 10% of the calibrated value	Manually zero meter or service as necessary and recalibrate	Field Team Leader	Manufacturers specifications
Water Quality Meter	Calibrate at the beginning of the day	Performed monthly and as needed	Measure solutions with known values [National Institute for Standards and Technology (NIST) traceable buffers and conductivity calibration solutions]	Upon receipt, successful operation	Daily before each use	pH: ± 0.1 s.u. Specific Conductivity:± 3% ORP: ± 10 mV DO: ± 0.3 mg/L Temp.: ± 0.3ºC	Recalibrate or service as necessary	Field Team Leader	Manufacturers specifications

QAPP Worksheet #22 (Continued)
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
Ferrous Iron Colorimeter	Accuracy check at the beginning and end of the day	Return to instrument rental for replacement	Measure with standard solution	Upon receipt, successful operation	Check daily before each use	Pass/Fail	Return to rental company for replacement	Field Team Leader	Manufacturer's specifications
Titrator (for alkalinity)	Calibrate to manufacturer's solution weekly	As needed	Measure with standard solution	Upon receipt, successful operation	Daily before each use	With range of manufacturer's standard	Service by manufacturer	Field Team Leader	Manufacturer's specifications
Alpha Scintillator	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Return to rental company for replacement	RCT Supervisor	Manufacturer's specifications
Geiger Mueller	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Return to rental company for replacement	RCT Supervisor	Manufacturer's specifications
Gamma Scintillator or FIDLER	Annually or as specified by manufacturer	Annually or as needed	Daily prior to use	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Service by manufacturer	RCT Supervisor	Manufacturer's specifications
Field Equipment Global Positioning System (GPS)	Daily check of known point beginning and end of each field day	Per manufacturers specifications	Measure known control points and compare values	Upon receipt, successful operation	Daily prior to use	Pass/Fail	Service by manufacturer	Field Team Leader	Manufacturer's specifications

* Additional equipment may be needed: additional equipment will follow manufacturer's specifications for calibration, maintenance, inspection, and testing.
Calibration data will be documented in logbooks consistent with PAD-ENM-2700, *Logbooks and Data Forms*.

QAPP Worksheet #23
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
8260	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	VOAs	GC/MS	TBD	TBD
6010	Inductively Coupled Plasma-Atomic Emission Spectrometry	Definitive	Metals	ICP	TBD	TBD
6020	Inductively Coupled Plasma-Mass Spectrometry	Definitive	Metals	ICP-MS	TBD	TBD

* Information will be based on laboratory used. Analysis will be by the most recent revision.
TBD = to be determined

QAPP Worksheet #24
Analytical Instrument Calibration Table

All laboratory equipment and instruments used for quantitative measurements are calibrated in accordance with the laboratory's formal calibration program. Whenever possible, the laboratory uses recognized procedures for calibration such as those published by EPA or American Society for Testing and Materials (ASTM). If established procedures are not available, the laboratory develops a calibration procedure based on the type of equipment, stability, characteristics of the equipment, required accuracy, and the effect of operation error on the quantities measured. Whenever possible, physical reference standards associated with periodic calibrations such as weights or certified thermometers with known relationships to nationally recognized standards, are used. Where national reference standards are not available, the basis for the reference standard is documented. Equipment or instruments that fail calibration or become inoperable during use are tagged to indicate they are out of calibration. Such instruments or equipment are repaired and successfully recalibrated prior to reuse. All high resolution mass spectrometer instruments undergo extensive tuning and calibration prior to running each sample set. The calibrations and ongoing instrument performance parameters are recorded and reported as part of the analytical data package. Field test kits for Alkalinity and Ferrous Iron will be used. Calibration information for these test kits is provided below.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Hach® Alkalinity Test Kit	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	TBD	TBD	n/a
Hach®Model IR-18C, 0.2-10 mg/L or equivalent (ferrous iron)	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	TBD	TBD	n/a

TBD = to be determined
n/a = not applicable

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
GC-MS	Replace/clean ion source; clean injector, replace injector liner, replace/clip capillary column, flush/replace tubing on purge and trap; replace trap	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
GC	ECD/FID maintenance; replace/clip capillary column	QC standards	ECD, FID, injector, injector liner, column, column flow	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	Perform as needed	Initial and/or continuing calibration criteria must be met	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23

QAPP Worksheet #25 (Continued)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
ICP-MS	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23
pH meter	Clean probe	QC standards	Probe	As needed	The value for each of the certified buffer solutions must be within ± 0.05 pH units of the expected value	Repeat maintenance activity or remove from service	Laboratory Manager	See Worksheet #23

QAPP Worksheet #25 (Continued)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
Hach® Alkalinity Test Kit	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	TBD	TBD	n/a
Hach® Model IR-18C, 0.2-10 mg/L or equivalent (ferrous iron)	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	Per Manufacturer's instructions	TBD	TBD	n/a

* The laboratory is responsible for maintaining instrument and equipment maintenance, testing, and inspection information per their QA Plan. This information is audited annually by DOECAP. Laboratory(s) contracted will be DOECAP audited. Field survey/sampling instrumentation will be maintained, tested, and inspected according to manufacturer's instructions.
ECD = electron capture device
FID = flame ionization detector

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Sample Packaging (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Coordination of Shipment (Personnel/Organization):	Lab Coordinator/DOE Prime Contractor
Type of Shipment/Carrier:	Direct Delivery or Overnight/Federal Express
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Custody and Storage (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Preparation (Personnel/Organization):	Analysts/Contracted Laboratory
Sample Determinative Analysis (Personnel/Organization):	Analysts/Contracted Laboratory
SAMPLE ARCHIVING	
Field Sample Storage (No. of days from sample collection):	The field laboratory is required to analyze samples within 24 hours of collection. The sample archival time for these samples still needs to be determined. The fixed-laboratory archives samples after 6 months.
Sample Extract/Digestate Storage (No. of days from extraction/digestion):	See Worksheet #19
Biological Sample Storage (No. of days from sample collection):	n/a
SAMPLE DISPOSAL	
Personnel/Organization:	Waste Disposition/DOE Prime Contractor and Subcontractors
Number of Days from Analysis:	6 months

QAPP Worksheet #27
Sample Custody Requirements*

Chain-of-custody procedures are comprised of maintaining sample custody and documentation of samples for evidence. To document chain-of-custody, an accurate record of samples must be maintained in order to trace the possession of each sample from the time of collection to its introduction to the laboratory.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Field sample custody requirements will be per DOE Prime Contractor procedures, PAD-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*; and PAD-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance.*

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

When the samples are delivered to the laboratory, signatures of the laboratory personnel receiving them and the courier personnel relinquishing them will be completed in the appropriate spaces on the chain-of-custody record, unless the courier is a commercial carrier. This will complete the sample transfer. It will be every laboratory's responsibility to maintain internal logbooks and records that provide custody throughout sample preparation and analysis process.

Sample Identification Procedures:

Sample identification requirements will be specified in work package documents and will comply with the Data Management Implementation Plan included in the RDSI Characterization Plan.

Chain-of-custody Procedures:

Chain-of-custody requirements will be per DOE Prime Contractor procedures, PAD-ENM-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals*; and PAD-ENM-5004, *Sample Tracking, Lab Coordination, and Sample Handling Guidance.*

* It is understood that SOPs are contractor specific.

QAPP Worksheet #28
QC Samples Table

Matrix:	Aqueous/Soils
Analytical Group/Concentration Level:	VOC, Metals
Sampling SOP:	See Worksheet #21
Analytical Method/SOP Reference:	8260.200.8/6010/6020
Sampler's Name/Field Sampling Organization:	TBD
Analytical Organization:	TBD
No. of Sample Locations	See Section 5 and Appendix A of the characterization plan

QC Sample:	Frequency/ Number[1]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Split Samples	As requested by regulatory agency	N/A	N/A	N/A	N/A	N/A
Field Blank	Minimum 5%	≤ CRQL	Verify results; reanalyze	Laboratory should alert project	Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*
Trip Blank	1 per cooler containing VOC samples	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*
Equipment Blank	Minimum 5%	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*

QAPP Worksheet #28 (Continued)
QC Samples Table

QC Sample	Frequency/Number[1]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal standards, laboratory spiked blanks or spiked field samples	All samples and standards	See data validation procedures PAD-ENM-5105, 5107, 5103, 5102	Check calculations and instrument; reanalyze affected samples	Laboratory should alert project	Accuracy	See procedure PAD-ENM-5003, *Quality Assured Data*
Field duplicate	Minimum 5%	None	Data reviewer will place qualifiers on samples affected	Project	Homogeneity/ Precision	RPD ≤ 50% soils, RPD < 25% aqueous
Laboratory duplicate	Per laboratory procedure	See data validation procedures PAD-ENM-5105, 5107, 5103, 5102	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See procedure PAD-ENM-5003, *Quality Assured Data*

[1] The number of QC samples is listed on Worksheet #20.

QAPP Worksheet #29
Project Documents and Records Table

All project data and information must be documented in a format that is usable by project personnel. The QAPP describes how project data and information shall be documented, tracked, and managed from generation in the field to final use and storage in a manner that ensures data integrity, defensibility, and retrieval.

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records*	Other
Data logbooks and associated completed sampling forms; sample chains-of-custody	Laboratory data packages, OREIS database, and associated data packages	OREIS database and associated data packages	PAD-ENM-5003, Att. G, Data Assessment Review Checklist and Comment Form	Form QA-F-0004, Management/ Independent Assessment Report

* It is understood that SOPs are contractor specific.

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number) [1]	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) [1]
Soil/ Groundwater	VOCs	Moderate/High	SWMU 1 C-720 Southeast Site C-720 Northeast Site	See Worksheet #23	28-day	TBD	TBD
Soil	Geotechnical	n/a	SWMU 1 C-720 Southeast Site C-720 Northeast Site	ASTM D6913	28-day	TBD	TBD
Soil	Geotechnical —C-720	n/a	C-720 Southeast Site C-720 Northeast Site	ASTM D5084	28-day	TBD	TBD
Soil	Geotechnical —SWMU 1	n/a	SWMU 1	ASTM D2216 ASTM D4972 ASTM D2166 ASTM D2850 ASTM D4318	28-day	TBD	TBD
Groundwater	Microbial Population	n/a	SWMU 1 C-720 Southeast Site C-720 Northeast Site	Laboratory-specific	28-day	TBD	TBD
Groundwater	Metals	See historical data	SWMU 1 C-720 Southeast Site C-720 Northeast Site	See Worksheet #23	28-day	TBD	TBD
Groundwater	Ions	See historical data	SWMU 1 C-720 Southeast Site C-720 Northeast Site	SW846-9056	28-day	TBD	TBD
Groundwater	Field	See historical data	SWMU 1 C-720 Southeast Site C-720 Northeast Site	Manufacturer's instructions	28-day	TBD	TBD

QAPP Worksheet #30 (Continued)
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number) [1]	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) [1]
Groundwater	Kerr methods dissolved gasses	See historical data	SWMU 1 C-720 Southeast Site C-720 Northeast Site	R. S. Kerr SOP-175	28-day	TBD	TBD

TBD = to be determined
[1] Laboratory contracting will be subsequent to the completion of the RDSI Characterization Plan.

QAPP Worksheet #31
Planned Project Assessments Table

LATA Kentucky will ensure that protocol outlined in the QAPP is implemented adequately. Assessment activities help to ensure that the resultant data quality is adequate for its intended use and that appropriate responses are in place to address nonconformances and deviations from the QAPP. Below is a list of assessments project teams may use.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Independent Assessment/ Surveillance	A	Internal	Prime Contractor QA	QA Specialists, Contractor, or Independent Assessor	Project Management, Contractor	Project Management, Contractor	QA Specialist, Contractor
Laboratory Audit	Annual	External	DOE Consolidated Audit Program (DOECAP)	Laboratory Assessor	Laboratory	Laboratory	DOECAP
Management Assessments	Annual	Internal	Prime Contractor Project Management	Regulatory Management, Contractor	Regulatory Management, Contractor	Regulatory Management, Contractor	QA Specialist, Contractor
Management by Walking Around (MBWA)*	B	Internal	Project Management	Project Management	Project Management	Project Management	Project Management
MBWA Follow-up surveillances	Quarterly	Internal	Project Management	Project Management or designee, Contractor	Project Management/Designee, Contractor	Project Management, Contractor	Project Management

A = assessment frequency determined by QA Manager and conducted per PAD-QA-1420, *Conduct of Assessments*.
B = assessment frequency determined by regulatory manager and conducted per PAD-QA-1420.
* Reference: PAD-QA-1033 *Management by Walking Around (MBWA) Program.*

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses*

All provisions shall be taken in the field and laboratory to ensure that any problems that may develop shall be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Field modifications to procedures in the QAPP must be approved before the modifications are implemented and then documented. The process controlling procedure modification is PAD-PD-1107, *Development, Approval, and Change Control for LATA Kentucky Performance Documents*. Field modifications are documented through the work control process per PAD-WC-0021. Corrective action in the field may be necessary when the sampling design is changed. For example, a change in the field may include increasing the number or type of samples or analyses, changing sampling locations, and/or modifying sampling protocol. When this occurs, the project team shall identify any suspected technical or QA deficiencies and note them in the field logbook. Listed in Worksheet #32 is how project teams will address assessment findings.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Time frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Time Frame for Response
Management, Independent, and Surveillances	Form QA-F-004, Management/ Independent Assessment Report, and QA-F-0710, Issue Identification Form	Project management, issue owner, contractor	Upon issuance of Form QA-F-004, Management/ Independent Assessment Report, form QA-F-0710, Issue Identification Form, will be completed and attached to the assessment report	QA-F-0710, Issue Identification Form, documents the issue response and/or corrective actions	Action owner as designated by issue owner, contractor	Fifteen days for initial issue response, corrective action schedule determined by issue owner, per PAD-QA-1210

* It is understood that SOPs are contractor specific.

QAPP Worksheet #33
QA Management Reports Table

Reports to management include project status reports, field and/or laboratory audits, and data quality assessments. These reports will be directed to the QA Manager and Project Manager who have ultimate responsibility for assuring that any corrective action response is completed, verified, and documented.

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Change Requests	As needed	Ongoing	Field staff	QAPP recipients
QAPP Addenda	As needed	Not Applicable	Project Manager	QAPP recipients
Field Audit Report	TBD as determined by QA Manager	30 days after completion of audit	QA Manager	LATA Kentucky Project Manager QA Manager
Corrective Action Plan	As needed	Within 3 weeks of request	Project Manager	QA Manager

QAPP Worksheet #34
Verification (Step I) Process Table

This section of the QAPP provides a description of the QA activities that will occur after the data collection phase of the project is completed. Implementation of this section will determine whether the data conforms to the specified criteria satisfying the project objectives.

Verification Input	Description*	Internal/ External	Responsible for Verification (Name, Organization)
Field Logbooks	Field logbooks are verified per LATA Kentucky procedure, PAD-ENM-2700, *Logbooks and Data Forms*, and PAD-ENM-5003, *Quality Assured Data*.	Internal	Project Management or designee, Contractor
Chains-of-custody	Chains-of-custody are controlled by LATA Kentucky procedure, PAD-ENM-5004, *Sample Tracking, Lab Coordination and Sample Handling Guidance*. Chains-of-custody will be included in data assessment packages for review as part of data verification and data assessment.	Internal	Sample and Data Management, Project Management, and QA Personnel, Contractor
Field and Laboratory Data	Field and analytical data are verified and assessed per LATA Kentucky procedure, PAD-ENM-5003, *Quality Assured Data*. Data assessment packages will be created per this procedure. The data assessment packages will include field and analytical data, chains-of-custody, data verification and assessment queries, and other project- specific information needed for personnel to review the package adequately. Data assessment packages will be reviewed to document any issues pertaining to the data and to indicate if data met the data quality objectives of the project.	Internal	Sample and Data Management, Project Management, and QA Personnel**, Contractor
Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and proper sampling support using audit and sampling reports, field change requests and field logbooks.	Internal	Sample and Data Management, Project Management, and QA Personnel**, Contractor
Laboratory Data	All laboratory data will be verified by the laboratory performing the analysis for completeness and technical accuracy prior to submittal to LATA Kentucky. Subsequently, LATA Kentucky will evaluate the data packages for completeness and compliance.	External/ Internal	Laboratory Manager, LATA Kentucky Sample and Data Management
Electronic Data Deliverables (EDDs)	Determine whether required fields and format were provided.	Internal	Sample and Data Management
QAPP	All planning documents will be available to reviewers to allow reconciliation with planned activities and objectives.	Internal	All data users

* It is understood that SOPs are contractor specific.
** QA specialist performs general QA review.

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description*	Responsible for Validation (Name, Organization)
IIa	Data Deliverables, Analytes, and Holding Times	The documentation from the contractual screening will be included in the data assessment packages, per LATA Kentucky procedure, PAD-ENM-5003, *Quality Assured Data*.	Sample and Data Management Personnel, Contractor
IIa	Chain-of-Custody, Sample Handling, Sampling Methods and Procedures, and Field Transcription	These items will be validated during the data assessment process as required by LATA Kentucky procedure, PAD-ENM-5003, *Quality Assured Data*. The documentation of this validation will be included in the data assessment packages.	Sample and Data Management Personnel, Contractor
IIa	Analytical Methods and Procedures, Laboratory Data Qualifiers, and Standards	These items will be reviewed during the data validation process as required by LATA Kentucky data validation procedures. Data validation will be performed in parallel with data assessment. The data validation report and data validation qualifiers will be considered when the data assessment process is being finalized.	Data Validation Subcontractor, and Sample and Data Management, Project, Contractor
IIa	Audits	The audit reports and accreditation and certification records for the laboratory supporting the projects will be considered in the bidding process.	QA Personnel
IIb	Deviations and qualifiers from Step IIa	Any deviations and qualifiers resulting from Step IIa process will be documented in the data assessment packages.	Sample and Data Management, Project, and QA Personnel, Contractor
IIb	Sampling Plan, Sampling Procedures, Co-located Field Duplicates, Project Quantitation Limits, Confirmatory Analyses, Performance Criteria	These items will be evaluated as part of the data verification and data assessment process per LATA Kentucky procedure, PAD-ENM-5003, *Quality Assured Data*. These items will be considered when evaluating whether the project met their Data Quality Objectives.	Sample and Data Management, Project, and QA Personnel, Contractor

* It is understood that SOPs are contractor specific.

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
Step IIa/IIb	Soil/Groundwater	VOCs	Moderate/High	National Functional Guidelines; Worksheets #12, #15, and #28; and PAD-ENM-5105, *Volatile and Semivolatile Data Verification and Validation*	Data Validator, LATA Kentucky

QAPP Worksheet #37
Usability Assessment*

LATA Kentucky shall determine the adequacy of data based on the results of validation and verification. The usability step involves assessing whether the process execution and resulting data meet project quality objectives documented in the QAPP.

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Field and analytical data are verified and assessed per procedure PAD-ENM-5003, *Quality Assured Data*. Data assessment packages will be created per this procedure. Data assessment packages will include field and analytical data, chains-of-custody, data verification and assessment queries, and other project-specific information needed for personnel to review the package adequately. Data assessment packages will be reviewed to document any issues pertaining to the data and to indicate if data quality objectives of the project were met. For data selected for validation, the following procedures are used: PAD-ENM-0026, PAD-ENM-0811, PAD-ENM-5102, PAD-ENM-5105, and PAD-ENM-5107.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

PARCCS parameters (precision, accuracy, representativeness, comparability, completeness, and sensitivity) will be evaluated per procedure, PAD-ENM-5003, *Quality Assured Data*. This information will be included in the data assessment packages for review by project personnel. Data assessment also will include documentation of QC exceedances, trends, and/or bias in the data set. Data assessment will document any statistics used.

Identify the personnel responsible for performing the usability assessment:

Project and QA personnel.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

Data assessment packages will be created, which will include data assessment comments/questions and laboratory comments. Data verification and assessment queries indicating any historical outliers and background soil exceedances also will be included in the data assessment packages.

*It is understood that SOPs are contractor specific.

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