

**Addendum to the  
Remedial Design Work Plan for Solid Waste Management  
Units 1, 211-A, and 211-B Volatile Organic Compound  
Sources for the Southwest Groundwater Plume at the  
Paducah Gaseous Diffusion Plant,  
Paducah, Kentucky,  
Sampling and Analysis Plan**



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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  
U.S. Department of Energy  
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## ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	certified for construction
<i>CFR</i>	<i>Code of Federal Regulation</i>
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
EISB	enhanced <i>in situ</i> bioremediation
EPA	U.S. Environmental Protection Agency
E/PP	excavation/penetration permit
ES&H	environment, safety, and health
FFA	Federal Facility Agreement
FFS	focused feasibility study
KDEP	Kentucky Department for Environmental Protection
LUC	land use control
NEPA	National Environmental Policy Act
O&M	operation and maintenance
OU	operable unit
PGDP	Paducah Gaseous Diffusion Plant
PM	project manager
PP	proposed plan
PPE	personal protective equipment
RAO	remedial action objective
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RDR	remedial design report
RDSI	remedial design support investigation
RDWP	remedial design work plan
RG	remediation goal
RGA	Regional Gravel Aquifer
RI	remedial investigation
ROD	record of decision
SI	site investigation
SWMU	solid waste management unit
UCRS	Upper Continental Recharge System
VOC	volatile organic compound
WAG	waste area group

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## EXECUTIVE SUMMARY

This remedial design work plan (RDWP) defines the scope of activities and approach for implementing the remedial action for the *Record of Decision for Solid Waste Management Units 1, 211-A, 211-B, and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (ROD) (DOE 2011a). The selected remedy, as identified in the proposed plan and will be documented in a signed ROD.

- Oil Landfarm [Solid Waste Management Unit (SWMU) 1]—*in situ* source treatment using deep soil mixing with interim land use controls (LUCs).
- C-720 Building Northeast and Southeast Spill Site (SWMUs 211-A and 211-B)—Final characterization of source extent and magnitude followed by *in situ* source treatment using enhanced *in situ* bioremediation (EISB) with interim LUCs or long-term monitoring with interim LUCs.

Through these treatment processes, the contribution of contaminants from the Upper Continental Recharge System soils into the Regional Gravel Aquifer (RGA) groundwater will be reduced. This plan specifically addresses the location of the project, the nature of the work, the major work activities required to perform the design for the remedial action, the schedule, and the project applicable or relevant and appropriate requirements, as included in the ROD. This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act. The U.S. Department of Energy (DOE) is the owner and the lead agency for Paducah Gaseous Diffusion Plant (PGDP) cleanup activities. Both the U.S. Environmental Protection Agency and the Kentucky Department for Environmental Protection are supporting agencies providing oversight for DOE's environmental restoration of PGDP.

In support of designing and implementing the selected remedies, a Remedial Design Support Investigation (RDSI) Characterization Plan will be performed consistent with the requirements of the ROD. The following are the purposes of the RDSI:

- Collect soil contaminant concentration data from the SWMUs to allow the source treatment to be focused on the contamination areas necessary to meet the cleanup levels;
- Collect soil contamination concentration data from the C-720 SWMUs for source extent and magnitude to allow the Federal Facility Agreement (FFA) parties to review the information and identify whether treatment of areas will be by enhanced *in situ* bioremediation *in situ* source treatment using EISB with interim LUCs or long-term monitoring with interim LUCs; and
- Collect engineering and geological data to support the remedial design and implementation of the remedial actions to be performed.

The drilling, sampling, analytical testing activities, and other supporting functions to be performed in the RDSI are documented in the Remedial Design Support Investigation Characterization Plan, which is Appendix A.

The technical approach for reducing volatile organic compounds (VOCs) at the source areas has the following remedial action objectives:

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

- (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 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 and the Groundwater Operable Unit.
- (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 in underlying RGA groundwater.



# 1. INTRODUCTION AND PURPOSE

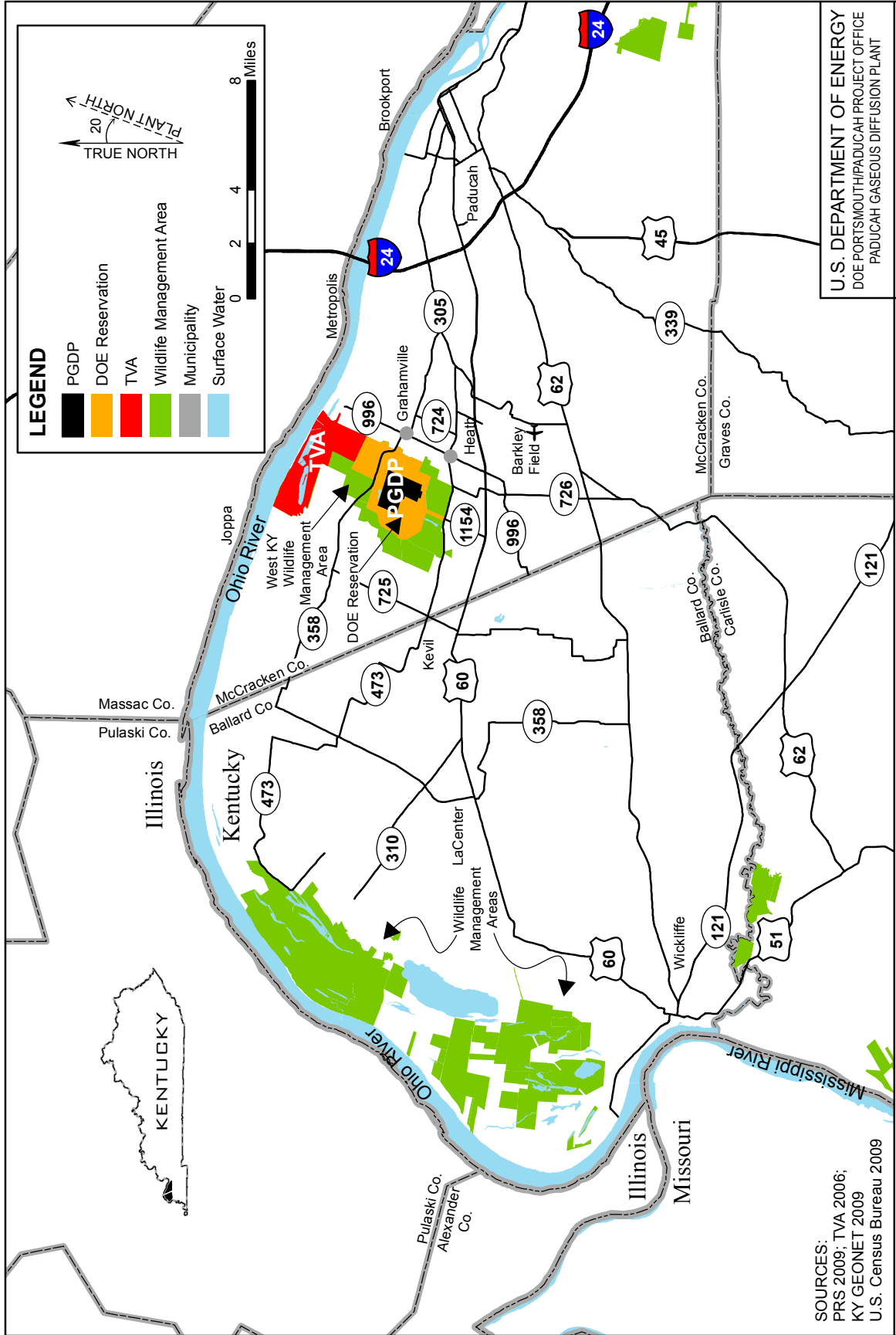
This Remedial Design Work Plan (RDWP) documents the design approach that will be followed to prepare to implement the remedial action for the Southwest Plume source areas for volatile organic compounds (VOCs) at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky (Figure 1). The remedial action addresses the source zones at the Southwest Plume source areas (Figure 2).

The RDWP is divided into six sections (BJC 2005). The Introductory and Purpose section details the purpose and scope of the RDWP; the regulatory drivers requiring the remedial action selected as identified by the record of decision (ROD) (DOE 2011a); and the method of accomplishment. Section 2 provides the project organization and the roles and responsibilities for the remedial action tasks. The site background is presented in Section 3, including site history, geophysical description, and the VOCs of concern. Section 3 also presents the technical approach, including the remedial design (RD) objectives, major components of the remedial action, and the regulatory considerations necessary to develop the design criteria and supporting assumptions. Section 4 of the RDWP describes the project schedule for the RD of the remedy. Section 5 contains the listing of the applicable criteria, codes, and standards for development of the RD. The Remedial Design Support Investigation (RDSI) Characterization Plan is presented as Appendix A while Appendix B provides the discussion of applicable or relevant and appropriate requirements (ARARs) that the action must meet. Information regarding remedial action planning is presented in Section 6. Section 7 provides the references utilized during RDWP preparation.

This remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and is the response action selected in the ROD (DOE 2011a). The U.S. Department of Energy (DOE) is the owner and lead agency for PGDP cleanup activities. Both the U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) are support agencies providing oversight for DOE's environmental restoration of PGDP, which was placed on the National Priority List in 1994. Section 120 of CERCLA required the negotiation and implementation of the PGDP Federal Facility Agreement (FFA) that integrates regulatory requirements from the Resource Conservation and Recovery Act (RCRA) and CERCLA (EPA 1998). Section 104 of CERCLA addresses the mitigation of releases or threatened releases of hazardous substances to the environment through response action. Executive Order 12580, "Superfund Implementation," delegates to DOE the authority for response actions for DOE facilities.

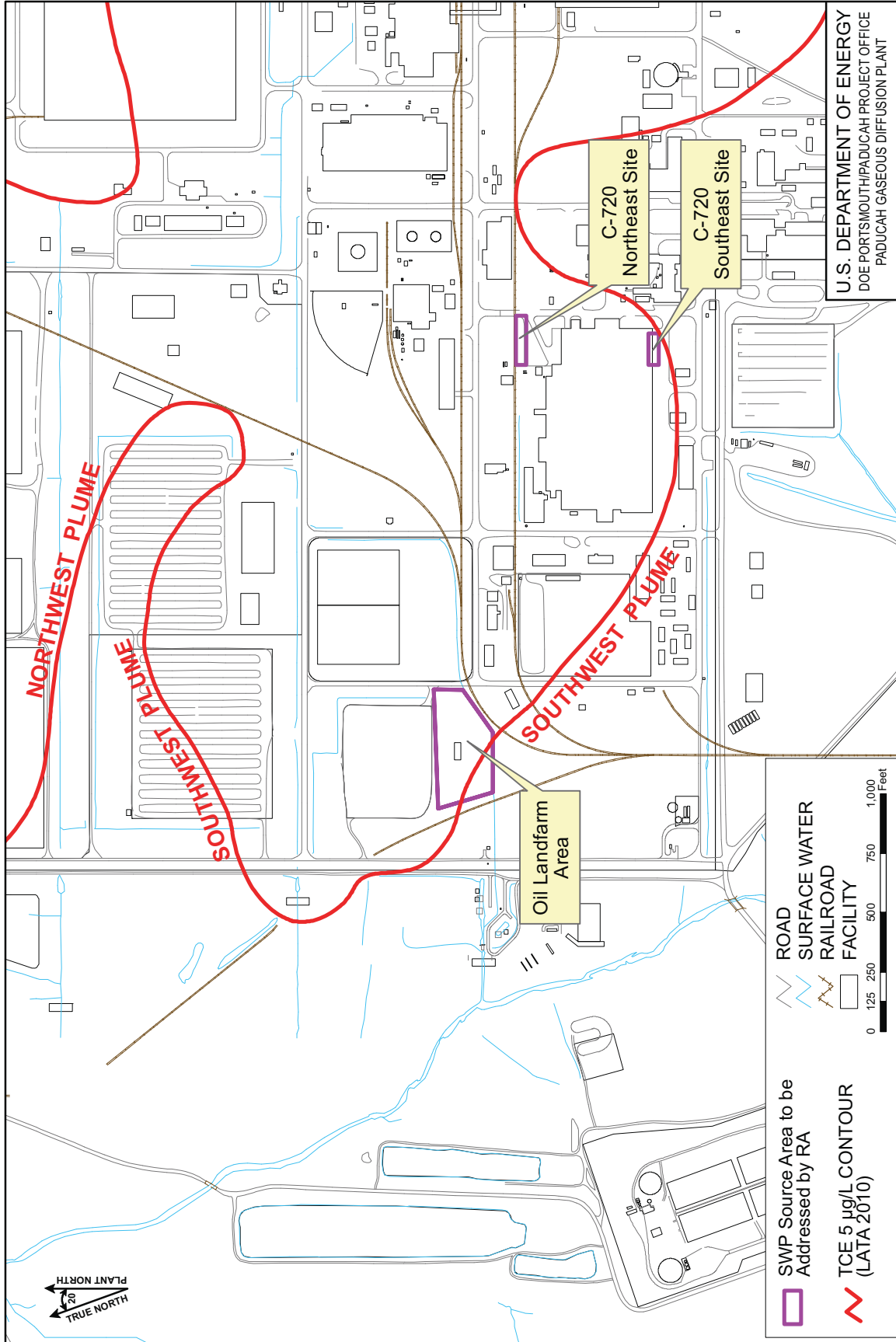
*The Revised Focused Feasibility Study for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (FFS) was submitted to EPA and Commonwealth of Kentucky in May 2011 (DOE 2011b). The FFS provided an evaluation of eight alternatives for remediation of three VOC sources to the Groundwater Operable Unit (OU). The FFS was approved in May 2011. Subsequently, the proposed plan (PP) was developed and approved in September 2011 (DOE 2011c). A public comment period for the PP was held from October 2, 2011, to November 16, 2011.

This RDWP defines the scope of activities necessary to design the engineering drawings and specifications for use in implementing the remedial action selected in the ROD. This RDWP specifically addresses the location of the project, the nature of the work, the major work activities required to perform the design for the remedial action, the schedule, and the ARARs, as stated in the ROD (DOE 2011a).



**Figure 1. Regional Location Map for Paducah Gaseous Diffusion Plant, Paducah, Kentucky**

Figure No. Site\_LocationRev5a.mxd  
 DATE 10-18-2011



SWP Source Area to be Addressed by RA  
~ TCE 5 µg/L CONTOUR (LATA 2010)

ROAD  
 SURFACE WATER  
 RAILROAD FACILITY

0 125 250 500 750 1,000 Feet

**Figure 3. Southwest Plume Source Areas Addressed by the Remedial Design**

Figure No. C5AC90005SK007R6\_2.mxd  
DATE 10-05-2011

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LATA Environmental Services  
of Kentucky, LLC

The RDSI Characterization Plan is contained in Appendix A, which supports implementing the selected remedies. Following are the purposes of the RDSI:

- Collect soil contaminant concentration data from the solid waste management units (SWMUs) to allow the source treatment to be focused on the contamination areas necessary to meet the cleanup levels;
- Collect soil contamination concentration data from the C-720 SWMUs for source extent and magnitude to allow the FFA parties to review the information and identify whether treatment of areas will be by *in situ* source treatment using enhanced *in situ* bioremediation (EISB) with interim land use controls (LUCs) or long-term monitoring with interim LUCs; and
- Collect engineering and geological data to support the RD and implementation of the remedial actions to be performed.

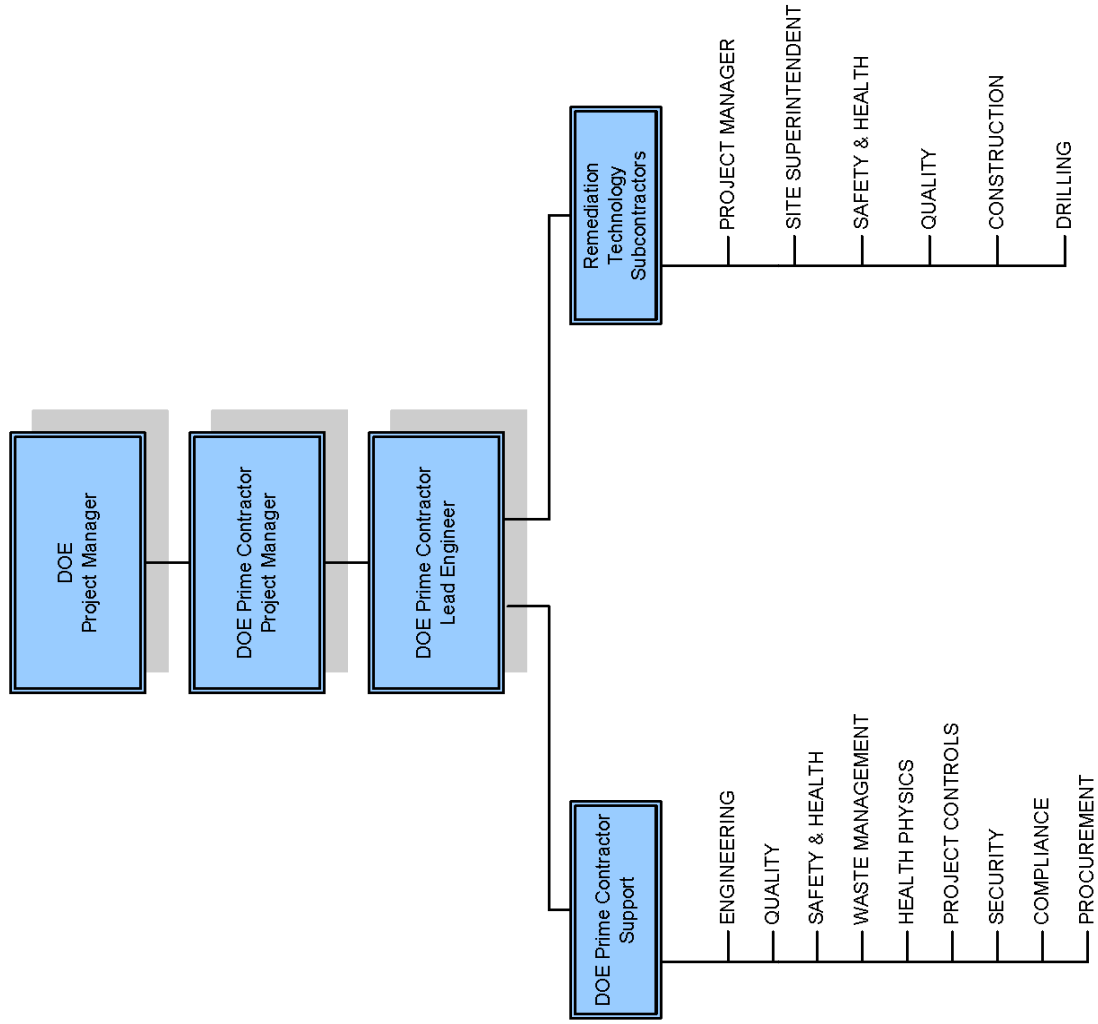
The drilling, sampling, analytical testing activities, and other supporting functions to be performed in the RDSI are documented in the RDSI Characterization Plan (see Appendix A).

A remedial design report (RDR), based on a design-build approach, will be produced by the DOE subcontractor. The 90% design, including drawings and specifications, will represent the D1 RDR, which will be submitted to EPA and KDEP for review, as required under the PGDP FFA. Following review, the drawings and specifications will be issued as certified for construction (CFC) and will represent the D2 RDR and also will become part of the procurement package to obtain a LATA Environmental Services of Kentucky, LLC, construction contractor.

## 2. PROJECT ORGANIZATION

The project organization chart showing relationships of key personnel and organizations is shown in Figure 3. The following are a description of responsibilities and authority of key personnel.

- DOE Project Manager (PM)—Serves as the point of contact with regulatory agencies and provides oversight for the overall completion of the remedial action in accordance with the approved ROD and RD. The PM establishes baseline scope, schedule, and budget and serves as the primary interface for environmental management activities implemented by DOE's prime contractor.
- DOE Prime Contractor PM—Serves as the primary point of contact with DOE to implement the remedial action. Performs work in accordance with the baseline scope and schedule and directs the day-to-day activities of DOE prime contractor personnel. Serves as the DOE prime contractor primary point of contact with the subcontractor during RD and remedial action activities. Verifies work is performed in accordance with the subcontract document and approved work plans.
- DOE Prime Contractor Lead Engineer—Performs technical review of the engineering submittals and ensures that the design drawings and specifications meet the design objectives and DOE prime contractor requirements. Interfaces with prime contractor PM to coordinate engineering support during the implementation of the remedial action by the subcontractor.
- Remediation Technology Subcontractor PM—Serves as the remedial action subcontractor's primary point of contact with the prime contractor PM and is responsible for the performance, quality, schedule, and budget. Provides overall project direction and execution; implements corrective actions, as necessary; verifies compliance with environment, safety, and health (ES&H) requirements; and participates in the readiness review.
- Remediation Subcontractor Project Superintendent—Oversees all remedial action field activities and verifies that field operations follow established and approved plans, designs, specifications, and procedures. Interfaces with the prime contractor PM and subcontractor technical and support personnel and lower-tier subcontractors.
- Prime Contractor Support Staff—Provides support to the prime contractor PM concerning technical and nontechnical aspects such as engineering, safety, quality, compliance, and waste management while implementing the remedial action.



Note: Only key personnel are identified. Additional project support functions from DOE, LATA, remedial subcontractors, or other DOE prime contracts will be identified and utilized as needed.

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**Figure 3. Project Organization for Southwest Plume Source Areas Remedial Action**

## 3. PROJECT DESCRIPTION

### 3.1 SITE HISTORY AND DESCRIPTION

PGDP is located approximately 10 miles west of Paducah, Kentucky, population approximately 26,000, and 3.5 miles south of the Ohio River in the western part of McCracken County (Figure 1). The plant is located on a DOE-owned site; approximately 650 acres are within a fenced security area, approximately 800 acres are located outside the security fence, and the remaining 1,986 acres are licensed to Kentucky as part of the West Kentucky Wildlife Management Area. Bordering the PGDP Reservation to the northeast, between the plant and the Ohio River, is a Tennessee Valley Authority reservation on which the Shawnee Fossil Plant is located (Figure 1). All plant and process water at PGDP is drawn from the Ohio River.

Before the PGDP was built, a munitions-production facility, Kentucky Ordnance Works, was operated during World War II at the current PGDP location and at an adjoining area southwest of the site. Construction of PGDP was initiated in 1951 and the plant began operations in 1952. Construction was completed in 1955, and PGDP became fully operational in 1955, supplying enriched uranium.

Trichloroethene (TCE), a chlorinated solvent that is a VOC, is the most widespread groundwater contaminant associated with PGDP. The TCE degradation products *cis*-1,2-dichloroethene (*cis*-1,2-DCE), *trans*-1,2-DCE, and vinyl chloride also are present in some areas. These contaminants have resulted in three dissolved-phase plumes that are migrating from PGDP toward the Ohio River. These groundwater plumes are the Northwest Groundwater Plume SWMU 201, the Northeast Groundwater Plume (SWMU 202), and the Southwest Groundwater Plume (SWMU 210).

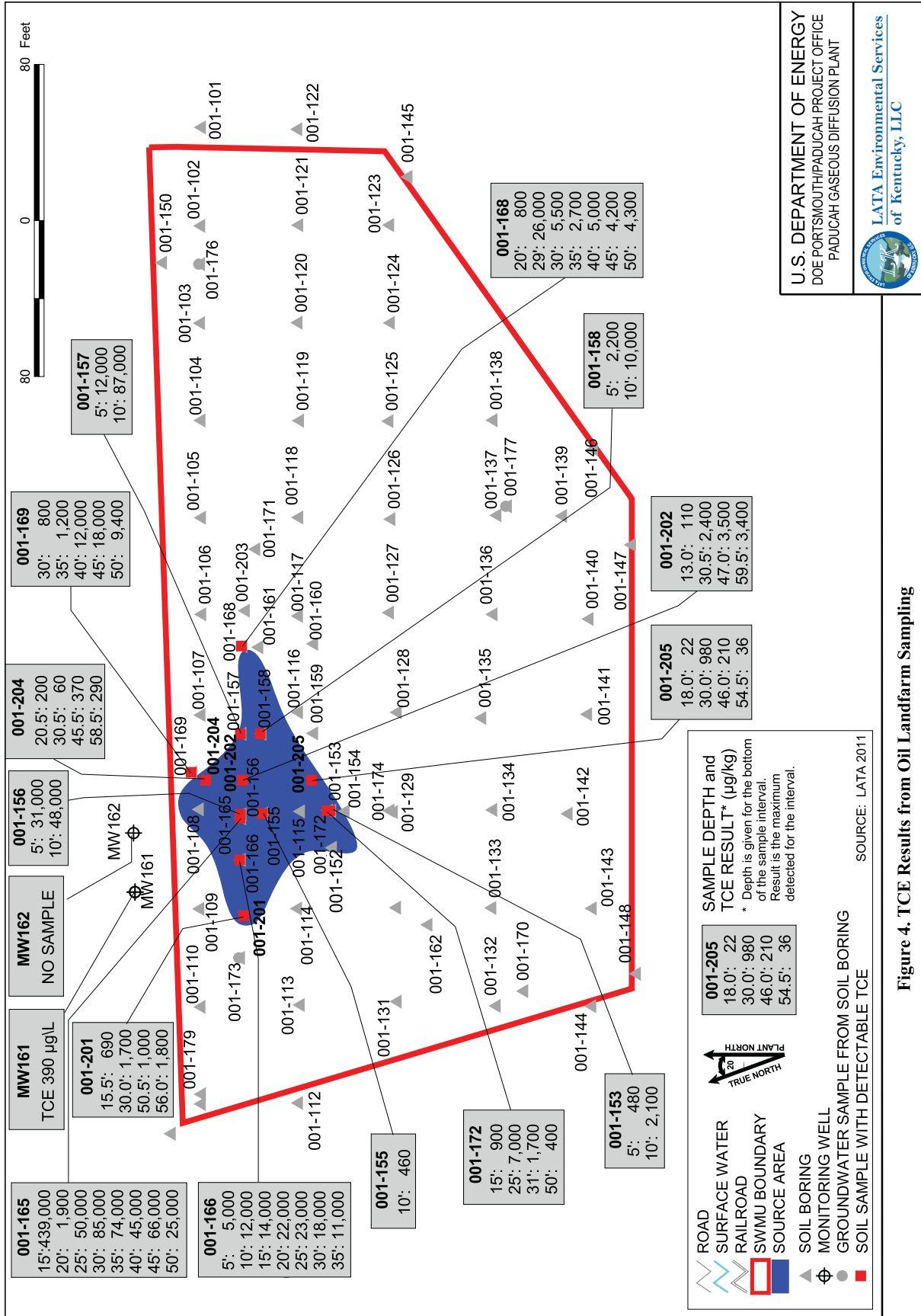
### 3.2 SOURCE AREAS AND NATURE AND EXTENT OF CONTAMINATION

The contamination from the three source areas to be addressed by this remedial action is summarized to assist with understanding the nature and extent of contamination. The data is discussed within the SWMU setting of each source area.

#### 3.2.1 C-747-C Oil Landfarm (SWMU 1)

Between 1973 and 1979, the Oil Landfarm was used for landfarming (mixing waste oils with soil to aid biodegradation of the oil in an area that prevents runoff) waste oils contaminated with TCE, uranium, polychlorinated biphenyls (PCBs), and 1,1,1-trichloroethane. These waste oils are believed to have been derived from a variety of PGDP processes. The landfarm consisted of two 1,125-ft<sup>2</sup> plots that were plowed to a depth of 1 to 2 ft. Waste oils were spread on the surface every three to four months; then the area was limed and fertilized.

Five soil borings were placed within and adjacent to the contaminated area defined in the Waste Area Group (WAG) 27 Remedial Investigation (RI). Figure 4 shows the locations and TCE results of the Upper Continental Recharge System (UCRS) soil sampling from the Southwest Plume Site Investigation and the previous investigations that were used to define the source zones (DOE 2007). No Regional Gravel Aquifer (RGA) groundwater samples were collected at this unit. Soils analysis showed the highest levels of TCE (3.5 mg/kg) during the site investigation (SI) were found in boring 001-202 from a sample located at 47 ft bgs (DOE 2007).



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DATE: 10-17-2011

Figure 4. TCE Results from Oil Landfarm Sampling



Significant levels of TCE (1.8 mg/kg) were detected in a second location (001-201) from all intervals collected to a depth of 56 ft, with the highest level of TCE detected at 56 ft bgs. A third location (001-205) exhibited lower levels of TCE with the highest level of TCE (0.98 mg/kg) detected at 30 ft bgs. Lower levels of TCE (0.37 mg/kg) were detected at 45.5 ft in a fourth sample location (001-204). The fifth location did not contain any detectable concentrations of TCE.

### 3.2.2 C-720 Building Area

The WAG 27 RI identified areas of TCE contamination at the C-720 Building Area. The FFS addresses two areas that were identified in the “Resolution of the Environmental Protection Agency Letter of Non-Concurrence for the Site Investigation Report for the Southwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky...” (DOE 2008). One area was underneath the parking lot and equipment storage area at the northeast corner of the Building C-720 Northeast (211-A). The second area was located underneath the parking lot adjacent to the loading docks at the southeast corner of C-720 Building Northeast (211-B).

**C-720 Northeast Site (SWMU 211-A).** Figure 5 shows the locations and TCE results of the UCRS soil sampling from the Southwest Plume SI and the previous investigations that were used to define the source zones (DOE 2007). During the Southwest Plume SI, six borings were placed between the north edge of the parking lot and a storm sewer to which all surface runoff for the parking lot flows. Results indicated that soils containing very low levels of TCE contamination were detectable in the subsurface of the northeast corner of the C-720 Building area. The highest level of TCE (0.98 mg/kg) was detected at 49.5 ft bgs (720-105). The second highest sample identified a maximum TCE concentration of 0.63 mg/kg at 56.5 ft (720-104). A third location (720-106) had a similar maximum detected TCE level of 0.6 mg/kg at 46 ft bgs. The remaining three locations (720-101/102/103) detected low levels of TCE (0.01 to 0.06 mg/kg) (DOE 2007).

Samples from a well cluster (MW203/MW204) completed in the UCRS and the RGA were the only groundwater samples collected during the investigation of this unit. The TCE levels declined from the UCRS to the RGA wells (280 to 99 µg/L).

**C-720 Southeast Site (SWMU 211-B).** The maximum TCE concentration detected during the WAG 27 RI was 68 mg/kg at 21 ft bgs. Figure 5 provides the TCE results from soil sampling of the area. Soil borings drilled in the area as part of the Southwest Plume SI showed low levels of TCE (maximum 0.20 mg/kg at 29 ft bgs). No groundwater samples were collected during the SI from this unit (DOE 2007).

## 3.3 REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) describe what the remedial action is expected to accomplish. The following are the RAOs for the Oil Landfarm and the C-720 Building area, as identified in the PP (DOE 2011c).

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

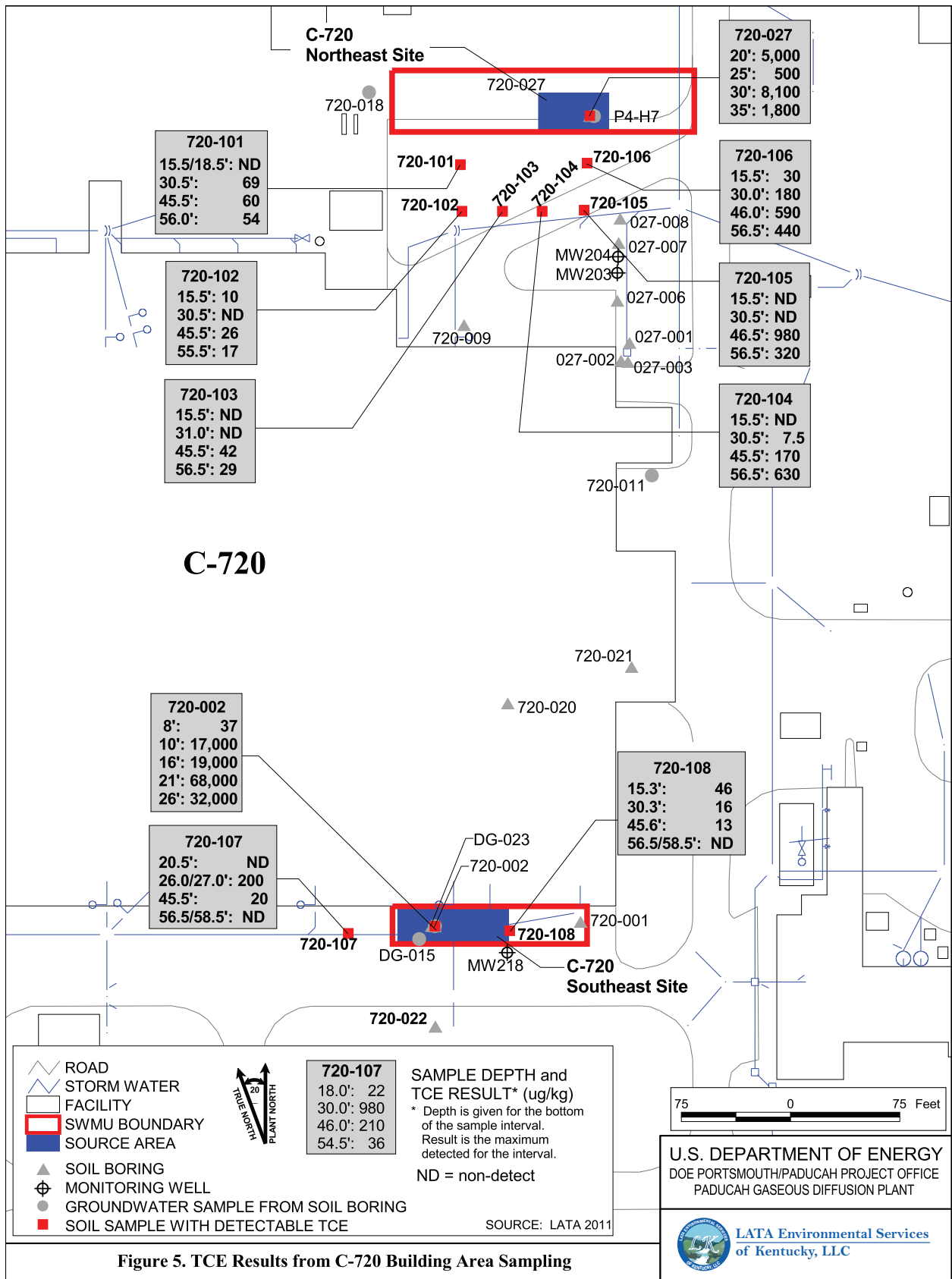


Figure 5. TCE Results from C-720 Building Area Sampling

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

Remediation goals (RGs) were calculated that would meet RAO 3 with no other controls in place. The modeling methodology used to calculate the RGs and the results are presented in the Southwest Plume FFS (DOE 2011b). Final RGs are presented in the Southwest Plume ROD.

### **3.4 SELECTED REMEDIES**

The following paragraphs provide descriptions of the selected alternatives for the SWMUs.

Interim LUCs are included in all three locations. Such controls are necessary for any residual or remaining VOC and non-VOC contamination that is not treated by this remedial action and whose concentrations prevent unrestricted use/unlimited exposure in the Southwest Plume Source areas.

The performance objective of these interim LUCs are as follows:

- Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (< 10 ft);
- Prevent exposure to non-VOC contamination and residual VOC contamination; and
- Prevent physical damage to monitoring wells or other remedy infrastructure from intrusive activities through notice of location to organization requesting excavation/penetration permits (E/PPs).

These interim LUCs will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.

These LUCs are further explained in Table 1. The interim LUCs are these:

- E/PP Program
- Warning signs

Signage that provides notice and warning of environmental contamination will be posted for the Southwest Plume VOC source areas before beginning field activities. The signs will (1) include lettering that is legible from a distance of least 25 ft; (2) contain contact information for DOE and/or contractor personnel; and (3) be visible from surrounding areas and at potential routes of entry into the Southwest Plume VOC Sources area. The warning signs shall contain language similar to the following:

**WARNING: CONTAMINATED AREA**

Hazardous Substances in Soil and Groundwater

Authorized Access Only

Contact: [Insert phone number]

The E/PP Program refers to the existing program administered by DOE's contractors at PGDP and is designed to provide a common sitewide system to identify and control potential personnel hazards related to trenching, excavation, and penetration. The E/PPs are issued by the Paducah Site's DOE prime contractor. The primary objective of the E/PP procedure is to provide notice to the organization requesting a permit of existing underground utility lines and/or other structures and to ensure that any E/PP activity is conducted safely and in accordance with all environmental compliance requirements pertinent to the area. Within 30 days of regulatory approval, the ROD will be made available to the organizations responsible for implementing the E/PP Program, and this information will be utilized by these organizations in reviewing an E/PP request. The information regarding extent of contamination in these documents will be utilized by these organizations and taken into account before authorizing any E/PP. DOE will notify EPA and KDEP of any material changes (such as significant revisions, cancellation, etc.) to the E/PP procedure that would affect implementation of this LUC and potentially affect the remedy effectiveness.

DOE is responsible for implementing, maintaining, monitoring, reporting on, and enforcing the LUCs. The E/PP Program and Warning Signs are being implemented by DOE and/or its contractors at PGDP. Although DOE may transfer these procedural responsibilities to another party by contract, transfer agreement, or through other means, DOE will retain ultimate responsibility for the remedy integrity, including the interim LUCs, to the extent provided by applicable law. DOE's ultimate responsibility will not diminish the transferee's responsibility for conducting such activities in accordance with any agreement with DOE. DOE will notify EPA and KDEP as soon as practicable, but no longer than 10 days, after discovery of any activity that is inconsistent with the interim LUC objectives or any other action that will interfere with the effectiveness of the LUCs. DOE will notify EPA and KDEP regarding how DOE has addressed or will address the breach within 10 days of sending EPA and KDEP notification of the breach. Any activity that is inconsistent with LUC objectives or any other action that may interfere with the effectiveness of the LUCs will be addressed by DOE as soon as practicable, but, in no case, will the process be initiated later than 10 days after DOE becomes aware of the breach.

After active remediation, DOE will verify on an annual basis that the contractor's E/PP Program for the Southwest Plume source areas is functioning properly and will conduct annual field inspections of warning signs in the source area to verify that they remain erect, legible, and the contact information is current. LUC monitoring results will be included in a separate annual report or as a section of another annual environmental report, if appropriate, and provided to EPA and KDEP. The annual monitoring reports will be used in preparation of the Five-Year Review to evaluate the effectiveness of the remedy. The annual monitoring report, submitted to EPA and KDEP by DOE, will evaluate the status of the LUCs and how any deficiencies or inconsistent land uses have been addressed. DOE will, in writing, notify EPA and KDEP 60 days in advance of any proposed land use changes that are inconsistent with the interim LUC objectives or the selected remedy.

DOE will not modify or terminate the aforementioned interim LUCs or implementation actions, or modify land use without approval by EPA and Kentucky. DOE shall seek prior EPA concurrence before taking any anticipated action that DOE anticipates would disrupt the effectiveness of the interim LUCs or any action that would alter or negate the need for interim LUCs. The request by DOE to modify/discontinue an interim LUC will include an adequate justification and must be in writing. The determination to modify or discontinue a particular interim LUC will be made by EPA and Kentucky. The approval to modify or discontinue an interim LUC will be documented in writing and placed in the Administrative Record file. If changes to the interim LUCs are deemed significant and affect the scope of the remedy, then an explanation of significant differences or amendment to the ROD may be required.

**Table 1. Summary of Interim LUCs for the Southwest Plume Source Areas**

Type of Control	Purposes of Control	Duration	Implementation	Affected Areas
Excavation/ Penetration Permits Program*	Requires review and approval of any proposed intrusive activities to protect workers and remedy integrity; process may prohibit or limit intrusive activities.	LUCs will be maintained until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure. The interim LUCs under the ROD will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.	Implemented by DOE and/or its contractors. Provide permits program with contamination information. Initiated by permit request.	Southwest Plume Source Areas
Warning Signs	Provides notice and warning of environmental contamination.	LUCs will be maintained until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and unlimited exposure. The interim LUCs under the ROD will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.	Warning signs will be posted for the SW Plume Southwest Plume source areas before beginning field activities that involve worker exposure to contaminated groundwater or soils.	Southwest Plume Source Areas

\*E/PP Program—Refers to the internal DOE/DOE contractor administrative program(s) that requires the permit request or to obtain authorization, usually in the form of a permit, before beginning any excavation/penetration activity (e.g., well drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities/structures, or in the case of contaminated soil or groundwater, will not disturb the affected area without the appropriate precautions and safeguards.

## SWMU 1—Oil Landfarm

- **Alternative 3: *In Situ* Source Treatment Using Deep Soil Mixing with Interim LUCs.** This alternative consists of an RDSI to refine the extent of VOC contamination and quantify parameters for selecting and applying treatment reagents. The extent and distribution of VOCs in the UCRS would impact the spacing/locations and depths of the augered areas. The amount and type of reagent chosen would be based on RDSI sampling results. The VOC contamination, including potential TCE dense nonaqueous-phase liquid (DNAPL), would be treated using large diameter augers to mix the soil with a potentially steam followed by a chemical reagent/slurry to destroy the VOC contamination. Amendment will be added from approximately 15 ft bgs to the lowest depth of VOC contamination (but no closer than within 10 ft of the UCRS/RGA contact). As the auger is advanced into the soil, a slurry would be pumped through the hollow stem of the shaft and injected into the soil at the tip. The auger would be rotated and raised and the mixing blades on the shaft would blend the soil and the slurry. When the design depth is reached, the auger would be withdrawn, and the mixing process would be repeated on the way back to the surface. This mixing technique would be repeated, as necessary, in each boring.

**SWMUs 211-A and 211-B**—SWMUs 211-A and 211-B would have either Alternative 2 or Alternative 8 implemented following the completion of the RDSI and evaluation by the FFA parties.

- **Alternative 2: Long-term Monitoring with Interim LUCs.** This alternative consists of groundwater monitoring and interim LUCs. It will not include treatment or removal of VOC contamination. The monitoring network would utilize wells in the RGA to monitor conditions of the source areas and determine the groundwater conditions over time. Alternative 2 would prevent the completion of exposure pathways.
- **Alternative 8: *In Situ* Source Treatment Using EISB with Interim LUCs.** In application of EISB at the SWMUs 211-A and 211-B, wells will be utilized to inject the bioamendment. The injection wells are needed at the 211 SWMUs because of infrastructure interferences at the C-720 Building, which prevent the use of the infiltration gallery approach. It is expected that because of not having the infiltration gallery, that amendment will be injected on three levels. The number of injection points will be determined in the design phase; for costing purposes, it was assumed that 211-A would have an estimated 6 locations and 211-B an estimated 12 locations. The monitoring well network is expected to be similar to the network required for all other alternatives with an estimated 4 wells each for SWMUs 211-A and 211-B.

At SWMUs 211-A and 211-B, a bioamendment mixture (i.e., microbes, nutrients, and reductants) would be introduced into the subsurface via vertical injection wells. The bioamendment would be reintroduced on a periodic basis to be determined during the RD and adjusted based upon ongoing monitoring of the performance of the bioremediation system). The specific bioamendment mixture would be determined using sample results from the RDSI. Due to characteristics that are similar to DNAPL, a lactate reductant potentially could be utilized to imitate more efficiently the DNAPL and follow similar migration pathways.

Confirmatory sampling in the treatment area would be required to determine posttreatment TCE soil concentrations. A confirmatory sampling plan would be prepared during remedial action work plan (RAWP) development. The conceptual design for confirmatory sampling includes soil coring using direct push technology and analysis for VOCs using EPA SW-846 Method 8260B or equivalent. Depths and locations of cores would be determined based on the results of the RDSI.

Secondary wastes produced under this alternative would include drill cuttings, personal protective equipment (PPE), and decontamination fluids from the RDSI and purge water from groundwater monitoring. For cost-estimating purposes, drill cuttings, PPE, and decontamination fluids were assumed to require containerization, dewatering, and testing prior to off-site disposal. PCBs potentially present at the Oil Landfarm would be expected to occur at concentrations below 50 ppm and would not require management as Toxic Substances Control Act waste. Groundwater monitoring purge water either would be used as makeup water or containerized and treated on-site prior to discharge. Actual disposal requirements would be determined by sampling of containerized soils, decontamination fluids, and purge water. All secondary wastes would be managed in accordance with all ARARs.

Site restoration activities would include demobilizing and removing all equipment; backfilling the horizontal infiltration trenches, if desired; sealing all borings, soil coring, and electron donor injection locations with bentonite; and reseeded disturbed vegetated areas at the SWMUs. Monitoring wells would be left in place until soil RGs were attained.

### **3.5 REMEDY COMPONENTS**

The following are the major components of the selected remedy.

#### **SWMU 1 (Alternative 3)**

- RDSI
- Injection and mixing of a reagent in the UCRS using the soil mixing process from the start of contamination (approximately 10 ft bgs) down to the lowest depth of VOC contamination as confirmed by the RDSI
- Confirmatory sampling
- Secondary waste management
- Site restoration
- Interim LUCs
- Groundwater monitoring

#### **SWMU 211-A and SWMU 211-B (Alternative 2 or 8)**

- Final characterization/RDSI
- Determination regarding use of Alternative 2 or Alternative 8 at SWMU 211-A and SWMU 211-B, based on the results of the collected data; the determination may be different at each SWMU

#### **Alternative 2**

- Interim LUCs
- Groundwater monitoring
- Secondary waste management

## Alternative 8

- Installation and operation of EISB system
- Introduction of bioamendment
- Confirmatory sampling
- Secondary waste management
- Site restoration
- Interim LUCs
- Groundwater monitoring

### **3.6 DELIVERABLES**

The remedial measures to be implemented at the Oil Landfarm and then at the C-720 SWMU 211-A and 211-B sites are going to be sufficiently different in scope that separate RDs will be warranted. The Oil Landfarm and C-720 sites each will have the following deliverables developed during the design process (EPA 1995a; EPA 1995b):

- 30% design document
- 60% design document
- 90% design document (issued as the D1 RDR)
- CFC design packages (D2 RDR)

Deliverables at each design stage will include, to the degree they are available at the percentage of development stage, specifications, drawings, and associated text. All submittals will be reviewed by the prime contractor and DOE. The 30% designs, 60% designs, and the D1 90% Design RDR will be submitted to DOE, KDEP, and EPA Region 4 for review. The CFC design packages will incorporate resolutions to comments received on the D1 RDR.

### **3.7 DESIGN CRITERIA AND ASSUMPTIONS**

The following are the assumptions utilized in the development of this RDWP for the remedial actions at all three SWMUs.

- The plan is based upon the selected alternative and background information included in the FFS (DOE 2011b); PP (DOE 2011c); and ROD (DOE 2011a).
- CFC designs and the RDR will be developed for each of the two active remedial measures, SWMU 1 and SWMU 211-A and 211-B, due to specialization in remedial action requirements and the need to evaluate final characterization data for the selection of either Alternative 2 or 8.
- Separate RAWPs will be developed for the SWMU 1—Oil Landfarm and the SWMUs 211-A and 211-B—C-720 Building sites due to the specialization in remedial action requirements.
- The criteria and approach to determine when to cease operations for each of the active remedies will be addressed in the RAWPs.
- An operation and maintenance (O&M) plan will be developed to describe the process and procedures for monitoring and evaluating system performance.



- A detailed project cost estimate will be provided with the 90% and final design package for each remedial action.
- The final design package will include the monitoring parameters and values to be utilized in determining when the remedial action is complete.
- The RAWP will include a compliance plan that will include the evaluation and crosswalk for the design to the project ARARs and exempted administrative requirements.
- The method for calculating the annual average discharge of technetium-99 will be detailed in the RAWP and will be based on the final design of the treatment and the outflows of the treatment system.

### **3.7.1 Soil Mixing—SWMU 1**

The soil mixing system, reagents, and mixing process will be specified based upon the best available and most effective technology and results from the RDSI. The following are the design and construction considerations that are potentially applicable to soil mixing and its associated treatment method.

- Refinement of estimates of the extent of VOC source zone contamination in the UCRS
- Location of a local power supply
- Sizing and selection of augers, drive equipment, pumps, and mixers
- Interface of surface soils with the augering and mixing systems and handling
- Steam generation equipment and processing (steam treatment only)
- Process water location and water chemical quality (steam treatment only)
- Vapor phase treatment system flow and treatment characteristics (steam treatment only)
- Potential water treatment system flow and discharge characteristics (steam treatment only)
- Depth to groundwater
- Groundwater chemical analysis
- Air emissions flow quantity and chemical content (steam treatment only)
- Soil characteristics (density, grain size analysis, soil chemical analysis, geotechnical properties, etc.)
- Waste classification
- Applicable standards and codes (American Society of Mechanical Engineers, etc.)
- ARARs (see Appendix B)
- Groundwater monitoring network
- Identification of utilities and/or obstructions and clearances

### **3.7.2 Enhanced *In Situ* Bioremediation—SWMUs 211-A and/or 211-B**

The EISB system will be specified based upon the best available and most effective technology and information obtained in the RDSI. The following are the design and construction considerations that are potentially applicable to EISB, soil mixing, and their associated treatment methods.

- Refinement of estimates of the extent of VOC source zone contamination in the UCRS
- Location of a local power supply
- Sizing and selection of treatment systems, pumps, tankage, and mixers
- Injection well design and capacity
- Potential water treatment system flow and discharge characteristics
- Depth to groundwater

- Groundwater chemical analysis
- Soil characteristics (density, grain size analysis, chemical analysis, etc.)
- Waste classification
- Applicable standards and codes (American Society of Mechanical Engineers, etc.)
- ARARs (see Appendix B)
- Groundwater monitoring network
- Identification of utilities and/or obstructions

### **3.8 REMEDIAL DESIGN SUPPORT INVESTIGATION**

The ROD for the source treatment at the three locations requires the performance of an RDSI. The following are the purposes of the support investigation:

- Collect soil contaminant concentration data from the SWMUs to allow the source treatment to be focused on the contamination areas necessary to meet the cleanup levels;
- Collect soil contamination concentration data from the C-720 SWMUs for source extent and magnitude; and
- Collect engineering and geological data to support the RD and implementation of the remedial actions to be performed.

The drilling, sampling, analytical testing activities and other supporting functions to be performed in the support investigation are documented in the Remedial Design Support Investigation Characterization Plan, which is Appendix A.

The data collected from the two C-720 Northeast and Southeast sites will be utilized by the FFA parties in determining the path for remediation of those two SWMUs. The ROD documented that the RDSI will determine the source extent and magnitude for those SWMUs. Following an assessment by the FFA parties, the FFA parties will determine if active treatment is warranted and will select for implementation at the SWMUs treatment by *in situ* source treatment using EISB with interim LUCs or long-term monitoring with interim LUCs. The selected remedial actions will be documented in an FFA Primary Document by the FFA parties as indicated in the ROD. Preliminary RDSI data and information will be included in the 60% of the RDR, and the final RDSI information and remedy selection will be documented in the 90% RDR.

## 4. REMEDIAL DESIGN SCHEDULE

The schedule for the remedial action is provided in Table 2. These are general planning dates for submittal of the CERCLA decision documents. Any extensions for reviewing documents, submitting comments, or responding to comments will impact the schedule. This schedule is included in this document for information purposes only and is not intended to establish enforceable schedules or milestones. Enforceable milestones are established in the FFA or Site Management Plan and updated in accordance with Sections XIX and/or XXXIX of the FFA (Table 2).

**Table 2. Remedial Design Schedule**

<b>Deliverable/Activity</b>	<b>Milestone</b>
	<b>SWMU 1, SWMUs 211-A and 211-B</b>
RDR (30% issued to regulators)	May 2012
RDR (60% issued to regulators)	August 2012
RDR (90% issued to regulators)	February 2013
RAWP	March 2013
D1 Remedial Action Completion Report	October 2015

Due to the need to review the final characterization data obtained as part of the RDSI and then select the remedial alternative, the time frames for SWMUs 211-A and 211-B design and construction may become separated from those of SWMU 1, as shown in Table 2. DOE will consult with EPA and Kentucky should the need occur, and any milestones impacted will be adjusted in the Site Management Plan once agreement is reached.

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## **5. DESIGN CRITERIA, CODES, AND STANDARDS**

The typical 30%, 60%, 90%, and CFC design packages will be developed during the design process, and the 90% design will be issued as the D1 RDR. The specifications will be prepared in Construction Specifications Institute format and organized in 18 major divisions. The drawings will be prepared in accordance with the PGDP Engineering Drafting Standards. The RDR will include CFC drawings and specifications that have been sealed/stamped by a professional engineer registered in the Commonwealth of Kentucky.

This remedial action also satisfies the requirements in 40 *CFR* § 300.430(f)(1)(ii) for remedial actions to meet ARARs. Appendix B to this document identifies ARARs pertinent to RD for the Southwest Plume source areas, based on those identified in the Southwest Plume FFS (DOE 2011b). A crosswalk to the specific technical requirements derived from the ARARs that must be met by the design will be performed and will document the method for attaining the requirement in the RAWP.

Consistent with the Secretary of Energy's National Environmental Policy Act (NEPA) policy, DOE relies on the CERCLA process for review of actions to be taken under CERCLA and, as such, will incorporate NEPA values to the extent practicable. These NEPA values will include analysis of cumulative impacts, off-site impacts, ecological and socioeconomic impacts, as well as environmental justice and land use issues, and the impacts to off-site transportation of wastes on the environment. The results of these analyses will be considered and incorporated into the RD documents.

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## **6. REMEDIAL ACTION PLANNING**

An RAWP will be developed as part of the design process. The RAWP will address the following:

- A list of each ARAR, the citation that mandates the ARAR, and, as appropriate, the drawing and/or specification that contractually implements or meets the substantive requirements of the ARAR;
- The target for the contaminant mass removal from the subsurface based on technology capability and the expected site conditions. This should include, to the extent possible, the technological analysis used to support the proposed setting;
- A description of the monitoring and testing that will be utilized to determine if the projected contaminant mass removal has been successful and independent verification protocols to ensure that remediation goals were attained;
- A summary level description of the program-specific plans such as the Construction Environmental Monitoring approach, the Best Management Practices approach, the Waste Management approach, and other plans and work guides that may be required to implement the remedial action; and

### **6.1 ENVIRONMENTAL, SAFETY, AND HEALTH**

To avoid the risk of bodily harm to employees associated with this remedial action, other personnel, and the general public and damage to property or the environment, the subcontractors will ensure that federal, state, and local ES&H regulations that apply to this remedial action are designed into the systems and implemented during the course of this work. The subcontractors shall follow, at a minimum, requirements associated with the handling of TCE, as well as other identified or unidentified hazards associated with this remedial action. These hazards will be identified in Activity Hazard Assessment forms prepared by the designated subcontractor and incorporated into the project health and safety plan prior to start of field activities.

### **6.2 ENVIRONMENTAL COMPLIANCE**

As defined in the signed ROD, this remedial action satisfies the requirements in 40 *CFR* § 300.430(f)(1)(ii) for remedial actions to meet ARARs. The subcontractors performing this remedial action shall comply with the approved ARARs. The subcontractors will prepare an Environmental Compliance Plan as part of the RAWP that identifies and describes activities to be implemented to comply with all ARARs.

### **6.3 WASTE MANAGEMENT**

The subcontractors will submit a Waste Management Plan as part of the RAWP that describes the quantities of waste materials expected to be generated during construction, implementation, and operations and the strategy for management, treatment, and disposal of the generated wastes. The strategy shall ensure the protection of the worker, the environment, and the public. Waste generated from the remedial action will be characterized in accordance with applicable requirements. The Waste Management Plan incorporates requirements for waste characterization, handling, disposal and transportation. The predominant feature of the Waste Management Plan is the waste management plan

checklist that contains specific responsibilities for each type of waste generated and for each organization involved in waste management.

#### **6.4 QUALITY ASSURANCE**

The subcontractors shall have an established Quality Assurance/Quality Control program that defines the administrative procedures for implementing and integrating good quality practices throughout the implementation of the remedial action work. The subcontractors shall ensure that all activities affecting quality are performed in a controlled and consistent manner and in accordance with all applicable procedures and requirements.

#### **6.5 O&M PLAN**

An O&M Plan will be prepared for implementation during the operational phase of the remedial actions. O&M requirements for the remedial action systems include routine maintenance of pumps, mixing units, pipes, gauges, and treatment units. The O&M Plan will contain the necessary working procedures and work guides to perform the remedial operations. The plan will be amended following completion of construction and prior to commencing to include the as-built drawings for the system to insure good conduct of operations.



## 7. REFERENCES

- BJC (Bechtel Jacobs Company LLC) 2005. Remedial Design Work Plan Annotated Outline, Bechtel Jacobs Company, Oak Ridge, TN.
- DOE 2007. *Site Investigation Report for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2180&D2/R1, U.S. Department of Energy, Paducah, KY, June.
- DOE 2008. Knerr, R., March 24, 2008, U.S. Department of Energy, Paducah, KY, letter to M. Guffy, Kentucky Department for Environmental Protection, Frankfort, KY, and H. Taylor, U.S. Environmental Protection Agency, Atlanta, GA, "Resolution of the Environmental Protection Agency Letter of Non-Concurrence for the Site Investigation Report for the Southwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-2180&D2) and Notice of Informal Dispute Dated November 30, 2007, McCracken County, Kentucky KY8-890-008-982."
- DOE 2011a. *Record of Decision for Solid Waste Management Units 1, 211-A, 211-B, and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0365&D2, U.S. Department of Energy, December.
- DOE 2011b. *Revised Focused Feasibility Study for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07/0362&D2, U.S. Department of Energy, Paducah, KY, May.
- DOE 2011c. *Revised Proposed Plan for Solid Waste Management Units 1, 211-A, 211-B, and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky*, DOE/LX/07-0363&D2/R2, Primary Document, U.S. Department of Energy, Paducah, KY, September.
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- EPA 1995b. *Remedial Design/Remedial Action Handbook*, EPA 54/R-95/059, U.S. Environmental Protection Agency, Washington, DC, June.
- EPA 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, U.S. Environmental Protection Agency, Atlanta, GA, February.

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**APPENDIX A**

**REMEDIAL DESIGN SUPPORT INVESTIGATION  
CHARACTERIZATION PLAN**

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## ACRONYMS

AHA	Activity Hazard Assessment
ASTM	American Society for Testing and Materials
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
<i>CFR</i>	<i>Code of Federal Regulations</i>
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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## A.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.

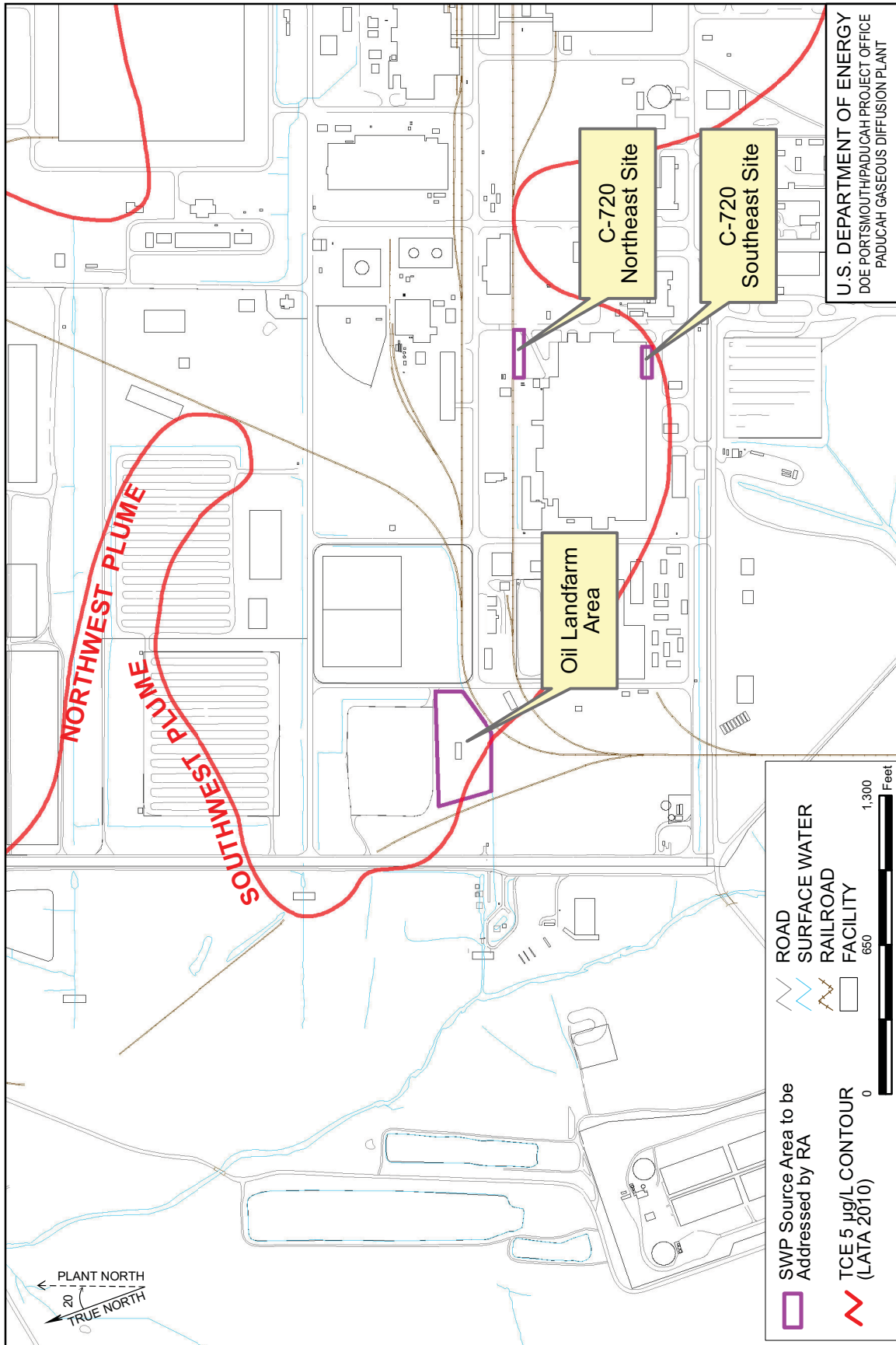
The potential source areas investigated in the SI (DOE 2007) included the C-747-C Oil Landfarm (Oil Landfarm, SWMU 1); the C-720 Building Area near the northeast and southeast corners of the building (C-720 Northeast Site, SWMU 211-A, and C-720 Southeast Site, SWMU 211-B); and the storm sewer system 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 A.1 and Figure A.1, respectively.

**Table A.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.



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



Figure A.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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## A.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.

### A.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.

### **A.2.2 REGIONAL GEOLOGY**

The stratigraphic sequence in the PGDP region consists of Cretaceous, Tertiary, and Quaternary sediments unconformably 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 A.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.

### **A.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.

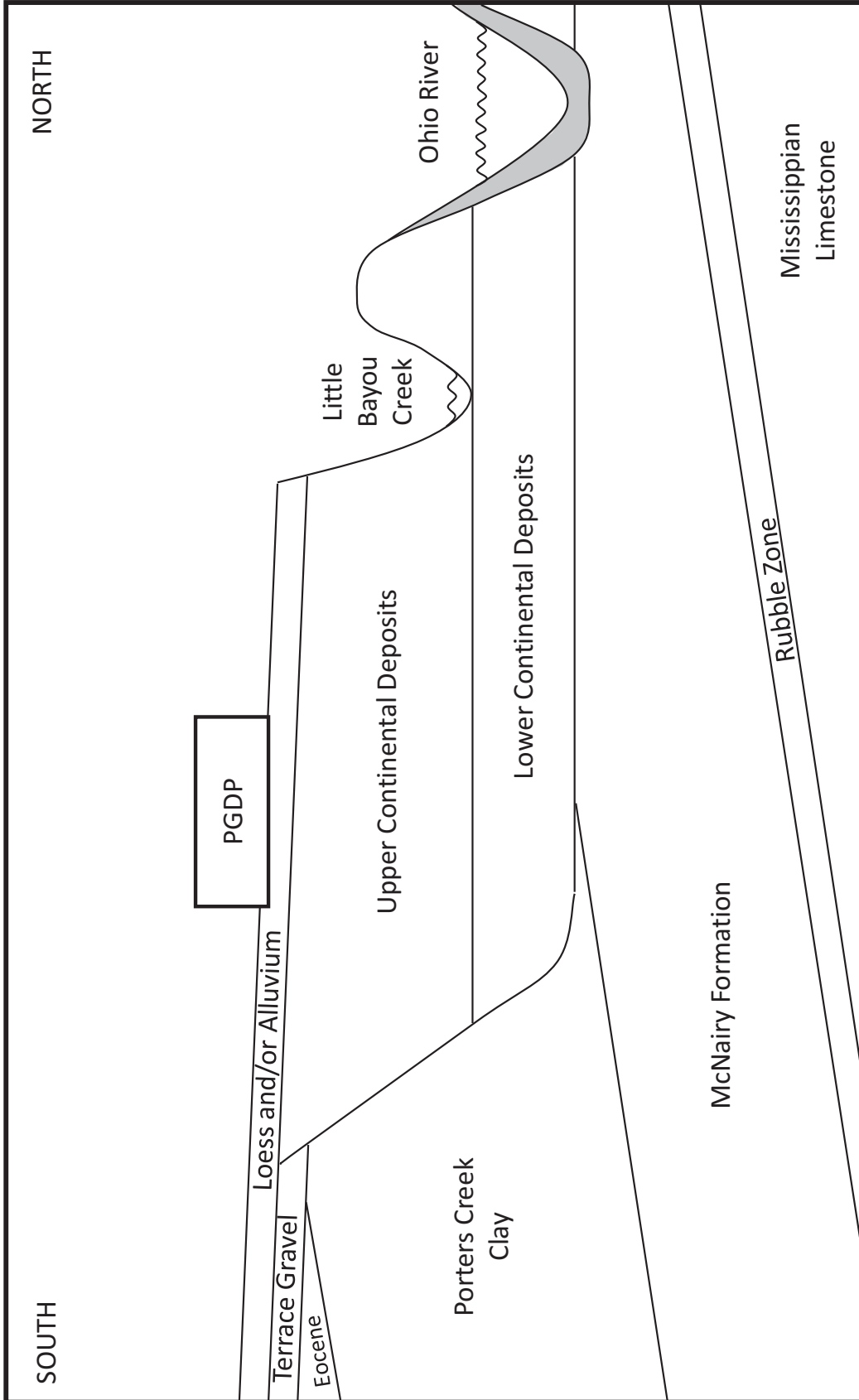
The first (shallowest) stratigraphic unit consists of fill and a layer of wind-deposited, silty clay (known as loess) extending from the surface to a depth of approximately 20 ft beneath PGDP. This loess overlies the Continental Deposits. In the Jackson Purchase, the Continental Deposits are divisible 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.





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Figure A.2. Geological Relationships Underlying the PGDP Area

#### **A.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.

### A.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 A.2. The resulting sampling and analysis plan is described in Section 6.

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Table A.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					
<p><b>Problem statement:</b> 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.</p> <p>A revised FFS (DOE 2011a) was performed for the three Southwest Plume source areas. RAOs defined in the Southwest Plume FFS include:</p> <ol style="list-style-type: none"> <li>(1) Treat and/or remove principal threat waste consistent with CERCLA, the NCP.</li> <li>(2a) Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (&lt; 10 ft depth bgs).</li> <li>(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.</li> <li>(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.</li> </ol> <p>Soil cleanup levels, soil boring-averaged TCE UCRS soil concentrations that would meet RAO #3, calculated in the Southwest Plume Revised FFS Appendix C, are listed below:</p> <ul style="list-style-type: none"> <li>• Oil Landfarm source area: 7.3E-02 mg/kg</li> <li>• C-720 northeast and southeast source areas: 7.5E-02 mg/kg.</li> </ul> <p>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.</p> <p>The Southwest Plume Proposed Plan (DOE 2011b) identified <i>In Situ</i> 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 <i>In Situ</i> Source Treatment Using Enhanced <i>In Situ</i> Bioremediation with Interim LUCs</p>	<p>PSQ-1: What is the areal extent of TCE and TCE degradation products present at soil boring-averaged concentrations higher than cleanup levels at the Southwest Plume source areas?</p> <p>PSQ-2: What are the SWMU-specific ranges of geotechnical and microbial properties that are important to the design of the remedial actions?</p>	<p>AA-1a: Remediation is required where the soil boring-averaged concentrations of TCE and TCE degradation products in soils of the UCRS exceed cleanup levels.</p> <p>AA-1b: Remediation is not required where the soil boring-averaged concentrations of TCE and TCE degradation products in soils of the UCRS do not exceed cleanup levels.</p>	<p>DS-1: Determine the extent of soil boring-averaged concentrations of TCE and TCE degradation products in soils of the UCRS and upper RGA in the Southwest Plume source areas that exceed cleanup levels and require remediation.</p> <p>DS-2: Determine where additional design-type information is required for the preferred alternatives.</p>	<ol style="list-style-type: none"> <li>1) Process knowledge of releases (DOE 2011a)</li> <li>2) Previous investigation results (DOE 2011a)</li> <li>3) Description of C-720 source areas in Appendix C of the GWOU FS (DOE 1999)</li> <li>4) Site conceptual model (DOE 2011a)</li> <li>5) Southwest Plume FFS Alternatives 2, 3, and 8 descriptions (DOE 2011a)</li> <li>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)</li> <li>7) TCE DLs by USEC = 5E-03 mg/kg (Watson 2010).</li> <li>8) Current estimates of source area dimensions shown in Southwest Plume FFS (DOE 2011a)</li> <li>9) Information requirements for design of the preferred alternatives as follows: <ul style="list-style-type: none"> <li>- Soil properties common to both soil mixing and <i>in situ</i> bioremediation - fraction organic carbon and grain size</li> <li>- Soil properties specific to soil mixing: <i>in situ</i> water content, pH, unconfined compressive strength,</li> </ul> </li> </ol>	<p><i>Spatial boundaries:</i> The vertical boundary of the study is the upper RGA as feasible (to the base of HU4 interval) at all sites. The results of soil TCE analyses will be provided to EPA and KDEP on a timely basis, and the FFA Parties will confer via teleconference regarding the need for further sampling in the RGA. TCE concentrations above cleanup levels are present at the maximum depths sampled in previous investigations. 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.</p> <p><i>Schedule boundaries:</i> 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.</p> <p><i>Operational boundaries:</i> 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.</p> <p><i>Administrative boundaries:</i> The investigation includes subcontracting for a field</p>	<p>DR-1: If soil boring-averaged concentrations of TCE and TCE degradation products in soil of the UCRS exceed cleanup levels for a given soil boring, then include the location in the treatment area. If the soil boring-averaged soil concentrations do not exceed cleanup levels, then the area need not be included in the treatment area.</p>	<p>Definitive data quality is assumed for fixed-base and field laboratory analysis. Screening level data quality is assumed for field analyses.</p> <p>The soil boring-averaged contaminant concentration will be derived solely from laboratory analyses from each 5-ft depth interval. The derived soil boring-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 in each 5-ft depth interval.</p>	<p>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.</p> <p>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.</p> <p>The contaminants of interest are TCE and degradation products: 1,1-dichloroethene; <i>cis</i>-1,2-dichloroethene; <i>trans</i>-1,2-dichloroethene; and vinyl chloride.</p> <p>The targeted depth of investigation is 60 ft bgs, which penetrates through the average depth of the base of the HU4 at SWMU 1 and at the C-720 sites.</p> <p>Where one or more soil boring-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 remediation area. At SWMU 1, successive contingency boring step outs nominally will be 75 ft. (Multiple contingency borings may extend the investigation beyond 75 ft of the SWMU boundary.) At the C-720 sites, contingency boring</p>

Table A.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. The RDSI will be performed at the Oil Landfarm and Building C-720 to better determine the lateral and vertical extent and distribution of VOCs and source material. The investigation will determine soil and groundwater parameters including geochemical parameters at each of the SWMUs. The extent and distribution of VOCs in the UCRS and upper RGA will impact the design of each remedial alternative. Results from the RDSI will guide decisions regarding the spacing, locations, and depths of augered areas at SWMU 1, and be utilized to design <i>in situ</i> bioremediation at SWMU 211 if this alternative is selected.				compressibility, and index properties - Soil properties specific to <i>in situ</i> bioremediation: permeability - Groundwater properties needed to assess <i>in situ</i> bioremediation: alkalinity, total and dissolved metals, ferrous iron, major anions, dissolved gasses, and microbial population.	laboratory to provide near real time analysis of VOCs in soil and groundwater. Establishment of a field laboratory facility will require development of additional work control.			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

## **A.4. RDSI PLANNING**

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

### **A.4.1 EVALUATION OF EXISTING DATA**

Evaluation of existing data used to develop the sampling strategy is described in Attachment A1. Attachment A2 provides summary tables of the VOC data related to each SWMU.

### **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.

### **A.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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## **A.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 upper RGA) 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 target sample collection for the laboratory analytical results. The average contaminant level in each soil boring will be compared to the site-specific remediation goals (RGs). The extent of soil boring 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.

Should VOC concentrations in the lower portion of the UCRS and upper RGA (HU4) indicate that source-based VOC mass may be present in the lower RGA (HU5, gravel zone), the FFA parties will convene and identify a path forward in regard to additional characterization requirements.

### **A.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.

### **A.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.

### A.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 subcontractor mobile field laboratory for VOC analyses, following protocols to provide quality assured data<sup>1</sup>, or quick-turnaround analyses from a fixed-base laboratory under the DOE Consolidated Audit Program (DOECAP). The sampling strategy design, detailed in Attachment A1, is based upon site background information, the cleanup levels, DQOs, and geospatial analysis of historical data. Proposed RDSI sampling locations are listed in Attachment A1. Should the defined number of contingency borings be inadequate to define the extent of contamination exceeding the cleanup goal, DOE will confer with EPA and KDEP to identify the need for and placement of additional borings prior to demobilization. The sampling strategy to meet the RDSI objectives is described in the following subsections.

#### A.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 upper RGA, 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 upper RGA, approximately 60 ft bgs.
- (4) Perform field scan of continuous core at 0.5 ft depth intervals using a field PID.<sup>2</sup>
- (5) Subsample the core in the field using En Core<sup>®</sup> samplers<sup>3</sup> 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.<sup>4</sup> Label, document, package, and preserve the soil samples as described in Section 8.

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<sup>1</sup> DOE will notify EPA and KDEP once a mobile field laboratory vendor is selected and provide the mobile laboratory SOPs once the SOPs have been reviewed and approved for use.

<sup>2</sup> The primary field PID instrument for assessing VOC trends in the soil core will be a ppb RAE PID or equivalent. The measurement range of the ppbRAE PID is 1 ppb to 10,000 ppm.

<sup>3</sup> 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.

<sup>4</sup> 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.

- (6) Repeat steps 3 through 5 for each of the remaining sample locations at the site. (There are 27 defined sample locations at the C-720 Northeast Site and 13 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 soil boring-averaged TCE concentration for each soil boring.
- (9) For the single soil boring location at each site with the highest soil boring-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 soil boring-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.

#### **A.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 18) to the upper RGA, 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<sup>®</sup> 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.<sup>5</sup> 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 18 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.
- (8) Obtain and evaluate VOC quick-turn analytical results and calculate the soil boring-averaged TCE concentration for each soil boring.
- (9) Contour the soil boring-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.

#### **A.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 all locations in each of 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.

#### **A.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.

#### **A.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

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<sup>5</sup> 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.

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.

#### **A.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 UCRS and upper RGA soils in which the TCE and TCE degradation products exceed cleanup levels and will require remediation. An indication of VOC source material in the lower UCRS and upper RGA will trigger an assessment of the need for VOC source characterization deeper in the RGA. 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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## A.6. SAMPLING AND ANALYSIS PLAN

### A.6.1 SOIL SAMPLING

Table A.3 summarizes measurements and sample collection activities for this investigation. DPT will be used for soil sampling to the upper RGA 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.<sup>6</sup>

Where the sample boring depth of 60 ft does not reach into the upper RGA, the project will continue downward collection of soil samples for VOC analysis into the RGA (HU 4 interval). The anticipated limit of the depth of sampling is the base of the HU4 sand interval of the RGA where present. The project will report sample results to EPA and KDEP weekly. DOE will confer with EPA and KDEP during the RDSI to assess the sample analyses for indications of a VOC source zone extending into the lower RGA (HU5 interval). If the assessment indicates the need for deeper characterization of the RGA, then the FFA parties will define the strategy for additional sampling.

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.<sup>7</sup>

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<sup>6</sup> 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.

<sup>7</sup> 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.

- (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<sup>®</sup> sampler.



**Table A.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
<b>SOIL</b>			
<b>DUAL TUBE SAMPLER</b>	<b>Number of Soil Borings (DPT)</b>		
<ul style="list-style-type: none"> <li>• Field VOC measurements with PID (120 measurements per boring, each 0.5 ft)</li> <li>• Laboratory VOC analysis (12 samples per boring, 1 per 5 ft interval)</li> </ul>			
— Initial sampling locations	18	27	13
— Vicinity of highest average VOCs	not in scope	4	4
— Contingency sampling locations	8	10	6
<ul style="list-style-type: none"> <li>• Permeameter testing (3 samples per boring, 1 per HU)</li> </ul>	not in scope	3	3
<ul style="list-style-type: none"> <li>• Fraction organic carbon</li> <li>• Grain size analysis (3 samples per boring, 1 per HU)</li> </ul>	3	3	3
<ul style="list-style-type: none"> <li>• Archive soil core (continuous, 0–60 ft bgs)</li> </ul>	2	2	2
<b>THIN-WALLED SAMPLER</b>	<b>Number of Soil Borings (DPT or HSA)</b>		
<ul style="list-style-type: none"> <li>• <i>In situ</i> water content</li> <li>• pH</li> <li>• Unconfined compressive strength</li> <li>• Compressibility</li> <li>• Index properties (9 samples per boring, 3 per HU)</li> </ul>	1	not in scope	not in scope
<b>GROUNDWATER</b>			
<b>EXISTING MONITORING WELLS</b>	<b>Number of Wells</b>		
— Water level measurements (weekly)	2	2	2
<ul style="list-style-type: none"> <li>• Field water quality parameters</li> <li>• VOCs</li> <li>• Alkalinity</li> <li>• Total and dissolved metals</li> <li>• Ferrous iron</li> <li>• Major anions</li> <li>• Dissolved gasses (3 samples per well)</li> </ul>	2	2	2
<b>INVESTIGATION NESTED WELLS</b>	<b>Number of Nested Wells</b>		
<ul style="list-style-type: none"> <li>• Water level measurements (3 measurements per well)</li> </ul>	3	3	3

**Table A.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
<ul style="list-style-type: none"> <li>Analyses as for existing monitor wells</li> <li>Microbial population (dehalococcoides) (1 sample per well)</li> </ul>	3	3	3
<ul style="list-style-type: none"> <li>Injection testing (1 test per well)</li> </ul>	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) D422] and fraction of organic carbon<sup>8</sup> (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.

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<sup>8</sup> 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 G51 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).

### A.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 A.4 identifies the associated wells.

**Table A.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. Water level measurements will be performed in each of the nested wells<sup>9</sup> over three consecutive weeks.

The investigation wells serve three purposes for the investigation:

- (1) Perform constant head injection testing (ASTM D4360-96 or equivalent) at representative depths. Of the UCRS at SWMUs 211A and 211B to assess the potential for injection of water-soluble amendments;
- (2) Measure the vertical hydraulic gradients within the UCRS; and
- (3) Collect water samples to assess the *in situ* bacterial population.

The assessment of the *in situ* bacterial population at SWMU 1 provides an evaluation of the potential impact of bioremediation as a long-term supplement to the engineered remedial alternative, deep soil mixing.

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<sup>9</sup> HU 1, the shallowest UCRS interval, may be unsaturated at one or more of the SWMUs. It is difficult to determine the water saturations of HU 1 (silt matrix) from soil core. The shallowest wells are necessary to bracket the depth of the water table, in the presence of a large hydraulic gradient, and to perform constant head injection testing at shallow depth.

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 A.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, lead, and manganese (using EPA SW-846, Method 6020 or equivalent);
- Iron<sup>2+</sup> (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);<sup>10</sup>
- 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,<sup>11</sup> 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 A.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*.

### **A.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 (Attachment A3).

### **A.6.4 ANALYTICAL REQUIREMENTS**

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

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<sup>10</sup> 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.

<sup>11</sup> It is unknown if HU1 is saturated in the C-720 source areas.

- Quantitative results for VOCs in soil and groundwater using EPA SW-846, Method 8260B (EPA 2008) or equivalent;<sup>12</sup>
- 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;
- 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.

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<sup>12</sup> 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.

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## **A.7. DATA MANAGEMENT**

The data management implementation plan (DMIP) is provided in Attachment A4 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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## **A.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 (Attachment A5) and the DMIP (Attachment A4). 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.

### **A.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

### **A.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.

### **A.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.

### **A.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.

### **A.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.

### **A.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:

rrrrrrrMA000

Where:

rrrrrrr 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.

### **A.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 of 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.

### **A.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.

#### **A.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 compliant packaging and shipment off-site as applicable.

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**ATTACHMENT A1**  
**SAMPLING STRATEGY**

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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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## A1.1. INITIAL SAMPLING LOCATIONS

### A1.1.1 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<sup>1</sup> 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. Table A1.1 summarizes total depth and screen length of the existing wells that will be used in this investigation.

**Table A1.1. Depths of Existing Monitoring Wells Associated with Each Investigation Area**

Investigation Area	Horizon	Well ID	Borehole Total Depth (ft)	Screen Depth (ft)
C-747-C Oil Landfarm	UCRS	MW162	25	18 – 24
	RGA	MW161	85	78 – 83
C-720 Northeast Site	UCRS	MW204	55	49.4 – 54.4
	RGA	MW203	80	71 – 76
C-720 Southeast Site	UCRS	MW217	50	39.5 – 49.5
		MW218	40	29 - 39
	RGA	None Available	--	--

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 A1.1. Figure A1.2 provides an aerial view of the C-720 Building and vicinity.

### A1.1.2 INITIAL SAMPLING LOCATIONS

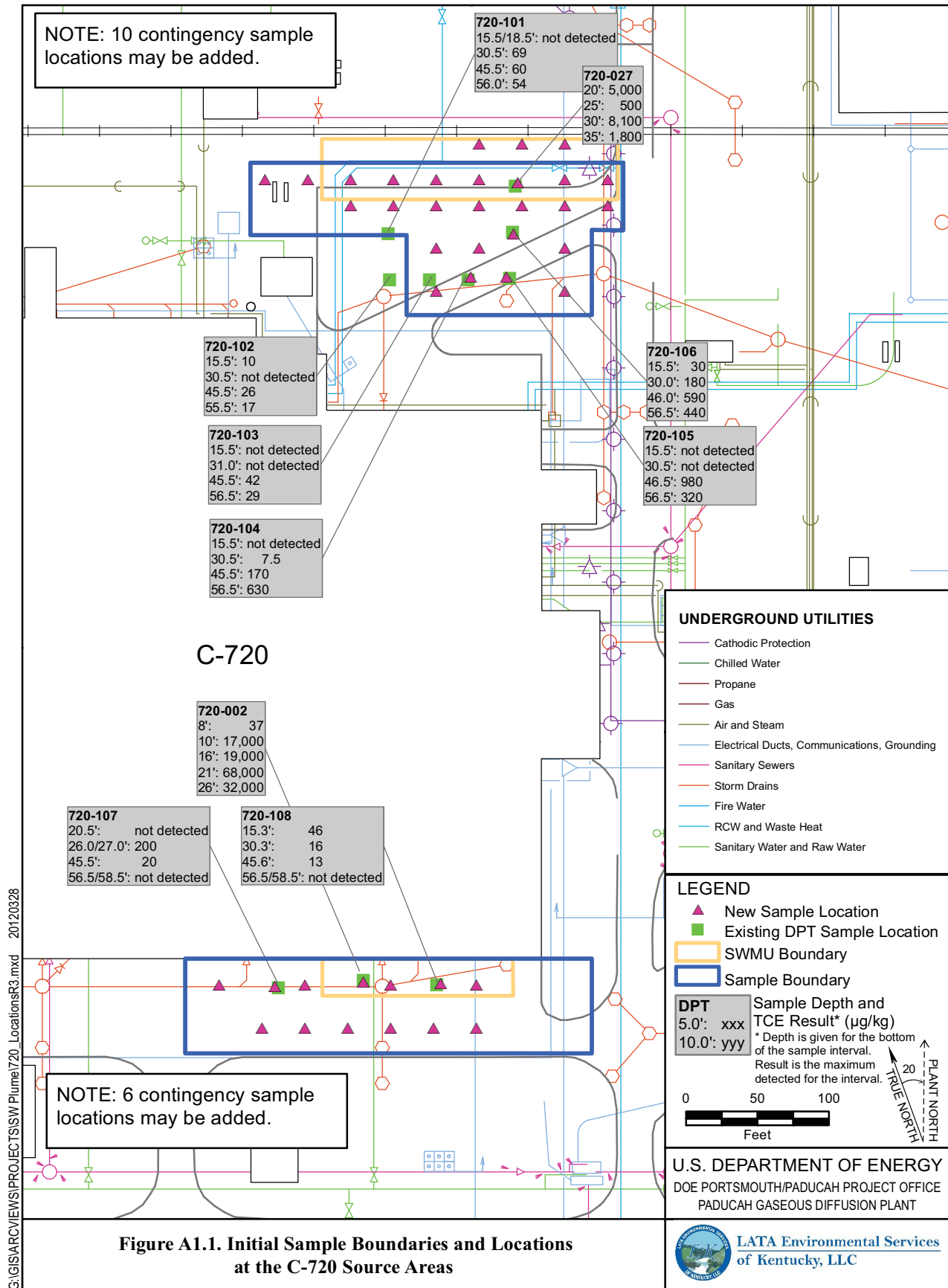
By combining data from these two reports as well as information obtained through OREIS, a new sample boundary was drawn for the C-720 northeast and southeast sites (Figure A1.1). The new boundaries incorporate historical detections of TCE contamination and extend a short distance outward from these locations. 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 A1.2 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.

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<sup>1</sup> 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 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 A1.3 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 A1.3). To bound the VOC levels to the north, two of the defined boring locations for this remedial design site investigation for the C-747-C Oil Landfarm lie outside of the SWMU 1 boundary. Some extended sampling locations (contingency borings), likewise, may be placed outside of the north SWMU 1 boundary. Figure A1.4 provides an aerial view of the C-747-C Oil Landfarm.



**Figure A1.1. Initial Sample Boundaries and Locations at the C-720 Source Areas**

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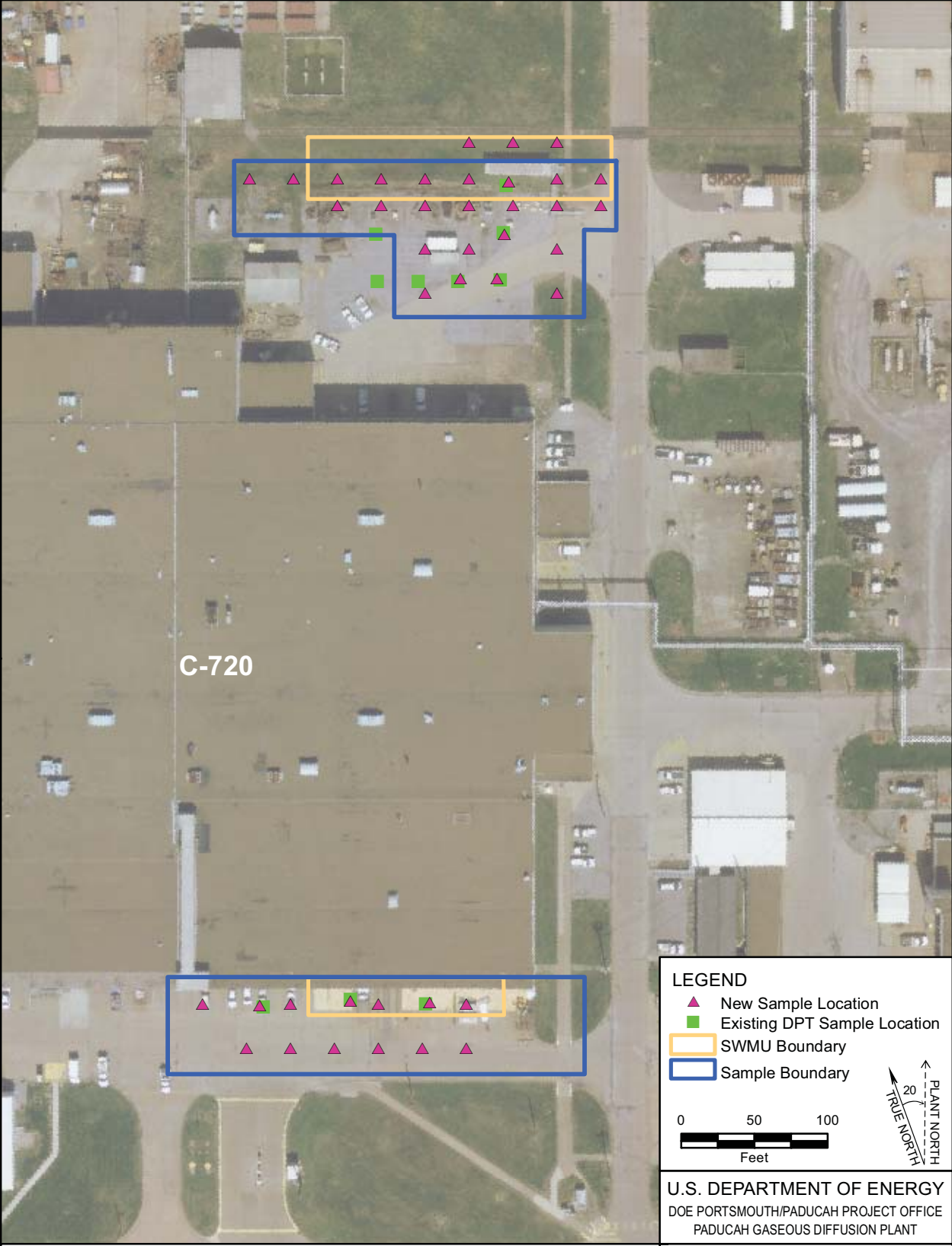


Figure A1.2. C-720 Source Areas


**LEGEND**

- ▲ New Sample Location
- Existing DPT Sample Location
- SWMU Boundary
- Sample Boundary

0 50 100  
Feet

TRUE NORTH  
20  
PLANT NORTH

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

 **LATA Environmental Services**  
of Kentucky, LLC

**Table A1.2. PGDP Plant Coordinates for  
Proposed C-720 Source Area  
Sampling Locations**

<b>SWMU 211a, C-720 Northeast Site</b>		
<b>Sample Location Shown on Figure A1.1</b>	<b>x</b>	<b>y</b>
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	-5032	-2050
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	-5035	-2086
23	-4999	-2096
24	-5089	-2126
25	-5065	-2116
26	-5040	-2116
27	-4999	-2126

**Table A1.2. PGDP Plant Coordinates for  
Proposed C-720 Source Area  
Sampling Locations (Continued)**

<b>SWMU 211b, C-720 Southeast Site</b>		
<b>Sample Location Shown on Figure A1.1</b>	<b>x</b>	<b>y</b>
1	-5241	-2612
2	-5202	-2613
3	-5181	-2612
4	-5140	-2610
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 A1.3. PGDP Plant Coordinates for  
Proposed C-747-C Oil Landfarm Source  
Area Sampling Locations**

<b>SWMU 1, C-747-C Oil Landfarm</b>		
<b>Sample Location Shown on Figure A1.1</b>	<b>x</b>	<b>y</b>
1	-6860	-1680
2	-6880	-1680
3	-6854	-1695
4	-6780	-1700
5	-6820	-1700
6	-6880	-1700
7	-6900	-1700
8	-6790	-1720
9	-6834	-1720
10	-6880	-1720
11	-6902	-1720
12	-6960	-1720
13	-6780	-1740
14	-6810	-1750
15	-6920	-1760
16	-6873	-1765
17	-6860	-1780
18	-6900	-1800

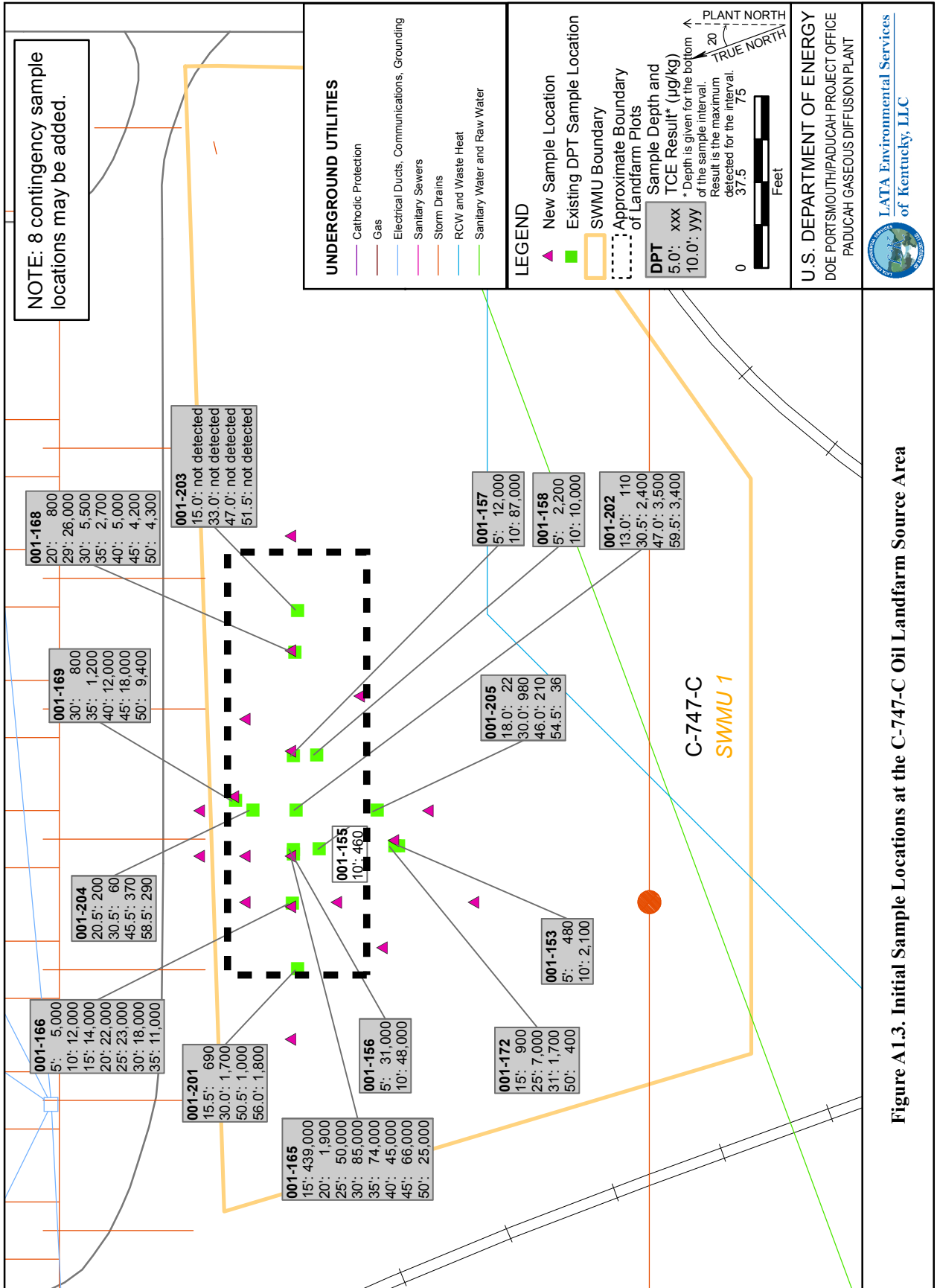


Figure A1.3. Initial Sample Locations at the C-747-C Oil Landfarm Source Area



## **A1.2. APPROACH FOR CONTOURING DATA**

If the sampling locations specified in Tables A1.2 and A1.3 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). Should the defined number of contingency borings be inadequate to define the extent of contamination exceeding the cleanup goal, DOE will confer with EPA and KDEP to identify the need for and placement of additional borings prior to demobilization. The soil boring-average 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.

**ATTACHMENT A2**  
**SUMMARY OF VOC DATA**

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Table A2.1. Summary of Soils VOC Data for SWMU 1

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-106	2/26/1998	5	600	U	600	U	600	U	600	U	600	U
		10	400	U	400	U	400	U	400	U	400	U
001-107	2/25/1998	5	600	U	600	U	600	U	600	U	600	U
		10	500	U	500	U	500	U	500	U	500	U
001-108	2/25/1998	5	600	U	600	U	600	U	600	U	600	U
		10	500	U	500	U	500	U	500	U	500	U
001-109	2/24/1998	5	500	U	500	U	500	U	500	U	500	U
		10	500	U	500	U	500	U	500	U	500	U
001-114	2/24/1998	5	600	U	600	U	600	U	600	U	600	U
		10	500	U	500	U	500	U	500	U	500	U
001-115	2/25/1998	5	600	U	600	U	600	U	600	U	600	U
		10	600	U	600	U	600	U	600	U	600	U
001-116	2/27/1998	5	500	U	500	U	500	U	500	U	500	U
		10	400	U	400	U	400	U	100	J	400	U
001-117	2/25/1998	5	500	U	500	U	500	U	500	U	500	U
		10	500	U	500	U	500	U	500	U	500	J
001-127	2/26/1998	5	500	U	500	U	500	U	500	U	500	U
		10	400	U	400	U	400	U	400	U	400	U
001-128	2/26/1998	5	700	U	700	U	700	U	700	U	700	U
		10	400	U	400	U	400	U	400	U	400	U
001-129	2/24/1998	5	600	U	600	U	600	U	600	U	600	U
		10	500	U	500	U	500	U	500	U	500	U
001-130	2/23/1998	5	500	U	500	U	500	U	500	U	500	U
		10	500	U	500	U	500	U	500	U	500	U

Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-152	3/5/1998	5	500	U	500	U	500		111		500	U
					1200	J	5000	U	500	U	4900	U
									55	J		
		10	500	U	500	U	800		500	U	5500	U
					1700	J	5500	U	163		500	U
						170	J					
001-153	3/5/1998	5	600	U	600	U	5500	U	1212		5000	U
					2400	J	1200		480		900	
									200	J		
		10	500	U	500	U	5000	U	1700		4800	J
					6000		4300		2100		700	
						5366						
001-154	3/5/1998	5	600	U	5500	U	5500	U	60	J	5500	U
					600	U	600	U	98		200	J
									600	U		
		10	600	U	5500	U	5500	U	26	J	5500	U
					600	U	600	U	18	J	600	U
						600	U					
001-155	3/6/1998	10	500	U	550	J	5000	U	460		4800	U
					500	U	100	J	1091		500	U
									300	J		
001-156	3/6/1998	5	1500	U	1500	U	1200	J	31000		1500	U
		10	2400	U	2400	U	6500		48000		2400	U
001-157	3/6/1998	5	600	U	600	U	1000		12000		600	U
			3000	U	3500	U	13000		79000		3500	U
		10	3500	U	3000	U	16000		87000		3000	U
001-158	3/6/1998	5	600	U	600	U	800		2200		400	J
		10	500	U	500	U	4400		10000		500	U
001-159	3/6/1998	10	500	U	500	U	1100		100	J	500	U
001-160	3/9/1998	5	500	U	500	U	500	U	100	J	500	U
		10	500	U	500	U	100	J	200	J	500	U



Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-161	3/6/1998	5	600	U	600	U	600	U	100	J	600	U
		10	500	U	500	U	500	U	200	J	500	U
001-165	3/16/1998	17	19000	U	19000	U	1200	J	439000		19000	U
	3/17/1998	20	900	U	900	U	900	U	1900		9500	U
					9500	U	360	J	1100		900	U
		25	2400	U	2400	U	300	J	50000		2400	U
		30	2900	U	2900	U	300	J	85000		2900	U
		35	2600	U	2600	U	600	J	74000		2600	U
		43	2400	U	2400	U	300	J	45000		2400	U
		45	2500	U	2500	U	300	J	66000		2500	U
50	1400	U	1400	U	1400	U	25000		1400	U		
001-166	3/18/1998	5	800	U	800	U	800	U	5000		800	U
		12	700	U	700	U	100	J	12000		700	U
		18	700	U	700	U	700	U	14000		700	U
		21	800	U	800	U	800	J	22000		800	U
		27	1200	U	1200	U	400	J	23000		1200	U
		33	900	U	8000	U	900	U	18000		900	U
					900	U	8000	U	17000		8000	U
		38	800	U	800	U	800	U	11000		800	U
		42	800	U	800	U	800	U	300	J	800	U
47	800	U	800	U	800	U	800	U	800	U		
50	700	U	700	U	700	U	700	U	700	U		
001-168	3/21/1998	5	900	U	900	U	900	U	900	U	900	U
		13	800	U	7000	U	7000	U	800	U	800	U
					800	U	800	U	170	J	7000	U
		18	800	U	800	U	800	U	40	J	800	U
		23	800	U	800	U	800	U	800		800	U
		25	1400	U	8000	U	1100	J	26000		8000	U
					1400	U	200	J	20000		1400	U
		29	1600	U	1600	U	400	J	26000		1600	U
		33	1100	U	1100	U	1100	U	5500		1100	U
		38	900	U	900	U	900	U	2700		900	U
		43	700	U	700	U	700	U	5000		700	U
47	800	U	800	U	800	U	4200		800	U		
50	900	U	900	U	900	U	4300		900	U		

Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-169	3/23/1998	18	900	U	900	U	900	U	900	U	900	U
		23	1000	U	9000	U	1000	U	42	J	1000	U
					1000	U	9000	U	1000	U	9000	U
		28	900	U	900	U	900	U	100	J	900	U
		33	700	U	700	U	30	J	800		700	U
		36	900	U	900	U	290	J	1200		900	U
					9000	U	900	U	600	J	10000	U
		38	900	U	900	U	900	U	700	J	900	U
	42	900	U	900	U	800	J	12000		900	U	
45	800	U	800	U	1400		18000		800	U		
3/24/1998	50	1000	U	1000	U	800	J	9400		1000	U	
001-171	4/2/1998	5	900	U	900	U	900	U	900	U	900	U
		10	900	U	900	U	900	U	900	U	900	U
		18	800	U	800	U	800	U	800	U	800	U
		20	1400	U	1400	U	1400	U	1400	U	1400	U
		25	900	U	900	U	900	U	900	U	900	U
		30	900	U	900	U	900	U	900	U	900	U
		35	1100	U	1100	U	1100	U	1100	U	1100	U
		40	1000	U	1000	U	1000	U	1400	U	1000	U
			1400	U	1400	U	1400	U	1000	U	1400	U
		45	900	U	900	U	900	U	900	U	900	U
50	1300	U	1300	U	1300	U	1300	U	1300	U		
001-172	4/3/1998	15	1100	U	1100	U	1500		900	J	1100	U
		20	900	U	900	U	20	J	900	U	900	U
		25	1000	U	1000	U	1500		7000		1000	U
	4/4/1998	31	1300	U	1300	U	1300	U	800	J	1300	U
					9000	U	9000	U	1700		9000	U
		35	1100	U	1100	U	1100	U	1100	U	1100	U
		40	900	U	900	U	900	U	900	U	900	U
		45	900	U	900	U	900	U	900	U	900	U
		50	1000	U	1000	U	600	J	400	J	1000	U

Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-173	4/6/1998	5	900	U	900	U	900	U	900	U	900	U
		13	10	U	10	U	900	U	10	U	900	U
			900	U	900	U	10	U	900	U	10	U
		18	900	U	900	U	900	U	900	U	900	U
		25	1000	U	10	U	10	U	10	U	10	U
			10	U	1000	U	10	U	10	U	11000	U
			10	U	10	U	10000	U	13	J	10000	U
			1200	U	11000	U	11000	U	15	J	10	U
			1200	U	10000	U	1200	U	1200	U	1200	U
					1200	U	1200	U	1200	U	1200	U
					1200	U	1000	U	1000	U	1000	U
		30	1400	U	1400	U	1400	U	1400	U	1400	U
		35	1100	U	1100	U	1100	U	1100	U	1100	U
		43	1100	U	1100	U	1100	U	1100	U	1100	U
		45	10	U	2	J	10	U	8	J	10	U
1100	U		1100	U	1100	U	1100	U	1100	U		
50	1000	U	1000	U	1000	U	1000	U	1000	U		
001-174	4/8/1998	15	900	U	900	U	900	U	900	U	900	U
		20	800	U	800	U	800	U	800	U	800	U
		28	1100	U	1100	U	1100	U	1100	U	1100	U
		30	1000	U	1000	U	1000	U	1000	U	8000	U
					8000	U	8000	U	200	J	1000	U
		38	1000	U	1000	U	1000	U	1000	U	1000	U
		43	900	U	900	U	900	U	900	U	900	U
		45	1000	U	1000	U	1000	U	1000	U	1000	U
50	800	U	800	U	800	U	800	U	800	U		
001-201	5/26/2004	15.5	20	U	46		19	U	690		9.6	U
			19	U	26		20	U	570		9.8	U
									300	EXY		
	5/27/2004	30	20	U	86		20	U	1700	EXY	9.9	U
									1000	E		
		50.5	2	U	2	JU	2	U	2	U	1	U
									1000	EXY		
56	19	U	23		19	U	210		9.7	U		
							1800	EXY				

Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
001-202	6/9/2004	0	6	U	29		0.45	J	86		4.5	J
			8.3		470	ER	6	U	780		6	U
					280				1300	ER		
		13	19	U	76		19	U	100	Y	9.4	U
									110			
		30.5	19	U	1200	E	19	U	1800	EY	12	
									2400	E		
		47	76		1000	E	19	U	2200	EY	9.5	
									3500			
		59.5	58		1500	E	19	U	1700	EY	18	
							3400					
001-203	5/27/2004	15	2	U	2	U	2	U	2	U	1	U
	5/28/2004	33	2	U	2	U	2	U	10	UXY	1	U
									200	Y		
									2	U		
		47	2	U	2	U	2	U	10	UXY	1	U
									2	U		
	51.5	2	U	2	JU	2	U	2	U	0.99	U	
							10	UXY				
001-204	6/10/2004	18						10	UXY			
		20.5	20	U	72		20	U	140		9.9	U
		30.5	18	U	30		18	U	33	Y	8.9	U
	6/11/2004	45.5							60			
			19	U	160		19	U	370	EY	9.4	U
		58.5	20	U	200		20	U	230	EY	9.9	U
								290				
001-205	6/2/2004	18							120	JX		
			2	U	26	J	2	U	22		3.3	
		30	44		1700	EJ	2.8		980	EXY	88	
									860			
		46	5		11	J	2	U	140	XY	1	U
									210			
54.5	2	U	2	JU	2	U	36	XY	1	U		
							3.2					

Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
23-0117-2	3/27/1996	5			450	JX			230	JX		
23-0117-3	3/27/1996	5			2400000	JX			6	U		
H009	1/6/1990	6	6	U					6	U	12	U
		12	31	U					31	U	62	U
		18	6	U					6	U	12	U
	1/7/1990	26	6	U					6	U	11	U
		32	6	U					13		12	U
	1/9/1990	38	6	U					6	U	12	U
		44	6	U					6	U	12	U
	1/10/1990	50	6	U					6	U	12	U
		55.5	6	U					6	U	12	U
		58	6	U					6	U	11	U
66		6	U					6	U	12	U	
H050	12/1/1989	1	6	U					6	U	11	U
	12/4/1989	4	6	U					6	U	12	U
		6	6	U					6	U	12	U
H051	12/1/1989	1	6	U					7	U	12	U
	12/4/1989	4	6	U					6	U	11	U
		6	6	U					6	U	12	U
H210	4/3/1991	1	7	U					1	U	14	U
	2/14/1991	5	6	U					1	U	1	U
		10	6	U					1	U	1	U
		15	6	U					1	U	1	U
		20	6	U					1	U	1	U
		25	6	U					1	U	1	U
		30	6	U					1	U	1	U
	2/19/1991	35	6	U					6	U	12	U
		40	6	U					1	U	11	U
		45	6	U					6	U	12	U
		50	6	U					6	U	12	U
			6	U					6	U	12	U
		55	6	U					6	U	12	U
		60	6	U					1	U	1	U
65		6	U					1	U	1	U	
70	6	U					1	U	1	U		

**Table A2.1. Summary of Soils VOC Data for SWMU 1 (Continued)**

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
H258	3/11/1991	1	6	U							1	U
		4	6	U					1	U	1	U
		6	6	U					1	U	1	U

**Table A2.2. Summary of Soils VOC Data for SWMU 211A**

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE		
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	
027-007	9/8/1998	9	4	U	4	U	4	U	4	U	2	U	
027-008	9/8/1998	9	4	U	4	U	4	U	4	U	2	U	
211-PL-01	8/18/2010	13	6.1	U	6.1	U	6.1	U	6.1	U	6.1	U	
720-027	5/5/1998	8	900	U	900	U	900	U	900	U	900	U	
		13	900	U	900	U	900	U	900	U	900	U	
		18	900	U	900	U	900	U	900	U	900	U	
		23	800	U	800	U	800	U	2800		800	U	
					7000	U	7000	U	5000		7000	U	
	28	800	U	800	U	800	U	500	J	800	U		
	5/7/1998	30	800	U	800	U	800	U	8100		800	U	
		35	800	U	8000	U	8000	U	1400		8000	U	
		35			800	U	800	U	1800		800	U	
		40	800	U	800	U	800	U	300	J	800	U	
45		900	U	900	U	900	U	900	U	900	U		
720-101	6/23/2004	15.5						5000	U				
		18.5	2	U	2	U	2	U	2	U	1	U	
		35.7						5000	UX				
		38	180		19	U	19	U	69		9.6	U	
	6/24/2004	48.5	48			19	U	19	U	60		9.4	U
									5000	UX			
		59	18	U	18	U	18	U	54		9	U	
								5000	UX				

Table A2.2. Summary of Soils VOC Data for SWMU 211A (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
720-102	6/14/2004	18.5	2	U	5.7		2	U	6.4		1	U
									10			
	6/15/2004	33.5	2	U	2	U	2	U	10	U	1	U
									2	U		
		48.5	15		6.8		2	U	18		1	U
									26			
58.5	2	U	2	U	2	U	17		1	U		
							5000	U				
720-103	6/16/2004	18.5	2	U	2	U	2	U	2	U	0.99	U
					2	U			5000	U		
		34	2	U	2	U	2	U	2	U	0.99	U
									5000	U		
		48.5	30		9		2	U	42		1	U
									5000	UX		
59.5	2.2		2	U	2	U	29		1	U		
							5000	U				
720-104	6/17/2004	19	2	U	2	U	2	U	2	U	0.99	U
									5000	U		
		33.5	2	U	2	U	2	U	7.5		0.99	U
									5000	U		
		48.5	19	U	19	U	19	U	170	J	9.7	U
									5000	U		
59.5	19	U	19	U	19	U	630	J	9.6	U		
							5000	UX				



Table A2.2. Summary of Soils VOC Data for SWMU 211A (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
720-105	6/18/2004	18.5	2	U	2	U	2	U	2	U	0.99	U
									5000	U		
	6/21/2004	33.5	2	U	2	U	2	U	5000	U	1	U
									2	U		
		49.5	22		52		20	U	980	J	10	U
									5000	U		
59.5	19	U	19	U	19	U	320		9.6	U		
							5000	U				
720-106	6/22/2004	0	5.6	U	1	J	5.6	U	11		5.6	U
		18.5	18	U	18	U	18	U	26	JY	9.1	U
									30			
		33	19	U	19		19	U	69	Y	9.4	U
									180			
		49	18	U	18	U	18	U	590	EY	9.1	U
							510					
59.5	19	U	19	U	19	U	440		9.6	U		
							380	EY				
SOU211-001	8/16/2010	4	5	U	5	U	5	U	5	U	5	U
SOU211-002	8/16/2010	4	5	U	5	U	5	U	5	U	5	U

Table A2.3. Summary of Soils VOC Data for SWMU 211B

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
720-001	3/3/1998	15.5	700	U	700	U	700	U	700	U	700	U
		23.5	800	U	800	U	800	U	800	U	400	J
		26	700	U	700	U	700	U	700	U	700	U
	3/4/1998	38	600	U	600	U	600	U	600	U	600	U
		40.5	500	U	500	U	500	U	500	U	500	U
		46	500	U	500	U	500	U	500	U	500	U
720-002	3/4/1998	8	800	U	3200	J	4600	U	37	J	4400	U
					800	U	800	U	800	U	400	J
		10	600	U	600	U	600	U	17000		200	J
		15.5	1000	U	750	J	450000	P	17000		5000	U
				1000	U	400	J	19000		1000	U	
	3/5/1998	23	1800	U	1800	U	1800	U	32000		1800	U
3500			U	3500	U	3500	U	68000		3500	U	
720-107	6/24/2004	22.4						5000	UX			
		24	2	U	2	U	2	U	1	U		
		28						5000	UX			
		29	18	U	18	U	18	U	200		9.2	U
	6/25/2004	46.5	2	U					5000	U		
		48.5	19	U	19	U	19	U	20		9.3	U
						2	U					
59.5					2	U	2	U	1	U		
								5000	UX			
720-108	6/28/2004	16.6						5000	UX			
		18.3	19	U	19	U	19	U	46		9.4	U
		31.4						5000	UX			
		33.5	2	U	2	U	2	U	16		0.99	U
		46.6							5000	UX		
		48.6	2	U	2	U	2	U	13		0.99	U
		59.5	2	U	2	U	2	U	2	U	1	U
								5000	U			

Table A2.3. Summary of Soils VOC Data for SWMU 211B (Continued)

STATION	DATE COLLECTED	SAMPLE DEPTH	1,1-DCE		<i>cis</i> -1,2-DCE		<i>trans</i> -1,2-DCE		TCE		VINYL CHLORIDE	
			(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
			RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER	RESULT	QUALIFIER
DG-023	6/21/1999	13	381	U	381	U	381	U	10	UX	10	U
			10	UY	210	U	10	U	5000	EJ	381	U
			21	U	10	U	210	U	2300		10000	U
		18	10	UY	373	U	373	U	110		10	U
			373	U	10	U	10	U	373	U	373	U
			10	UY	10	U	382	U	10	UX	10	U
		24	382	U	382	U	10	U	1800		382	U
			344	U	10	JUX	10	JU	2300	EJ	10	JU
			10	JUY	344	U	344	U	16000		344	U
	8/10/1999	34	10	JU	10	JUX	10	JU	330	EJ	10	JUY
			474	U	474	U	474	U	1500		474	U
	8/11/1999	38	10	JU	10	JU	260	U	160	EJ	10	JUY
			260	U	260	U	10	JU	1600		260	U
	8/12/1999	40	10	JU	10	JUX	390	U	360	EJ	10	JUY
			390	U	390	U	10	JU	1600		390	U
	8/11/1999	44	10	JU	10	JUX	10	JU	520	J	417	U
			417	U	417	U	417	U	1300		10	JU
		46	288	U	288	U	288	U	1200		288	U
			10	JU	10	JUX	10	JU	280	EJ	10	JU
		50	10	JU	10	JU	353	U	353	U	353	U
			353	U	353	U	10	JU	273	E	10000	U
	13	U	130	U	130	U	10	JU	10	JU		

Table A2.4. Summary of Groundwater VOC Data for MW161 (RGA) of SWMU 1

DATE COLLECTED	1,1-DCE (µg/L)		cis-1,2-DCE (µg/L)		trans-1,2-DCE (µg/L)		TCE (µg/L)		Vinyl chloride (µg/L)	
	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER
3/28/1991	6						560	D	1	U
							690			
5/8/1991	5						730		1	U
6/3/1993							600			
8/19/1993							1100			
11/8/1993							3100			
2/23/1994							2000			
5/26/1994							490			
8/29/1994							19000			
9/6/1994							22000			
3/28/1995							20000			
5/8/1995							23000			
5/14/1996	2500	U	2500	U	2500	U	750		5000	U
3/6/1998							83			
5/20/1998	50	U	50	U	50	U	37		50	UY
8/5/1999	1000	U	1000	U	1000	U	200	UY	1000	U
3/22/2000	5	U	5	UX	5	U	84		5	U
6/21/2000	5	U	5	UX	5	U	100		5	U
9/12/2000	5	U	5	UX	5	U	110		5	U
12/19/2000	5	UX	5	UX	5	U	110		2	U
3/8/2001	5	UX	5	UX	5	U	120	D	2	U
6/7/2001	10	U	10	UX	10	U	160	D	4	U
12/18/2001	25	U	25	UX	25	U	140	DX	10	U
3/20/2002	25	U	25	UX	25	U	210	DX	10	U
6/6/2002	50	U	50	UX	50	U	580	DX	20	U
9/6/2002	50	U	50	UX	50	U	350	DX	20	U
12/3/2002	25	U	25	UX	25	U	420	DX	10	JU
6/3/2003	50	U	50	UX	50	U	630	DX	20	U
12/4/2003	50	U	67	D	50	U	780	DX	20	U
6/2/2004	25	UX	58	D	25	U	750	DEX	10	U
	5	U	30	D	5	U	390	D	5	U
							880			
12/6/2004	5	U	18		5	U	230	X	2	U
6/13/2005	25	U	98	D	25	U	1100	DX	10	U
2/8/2006	100	U	100	U	100	U	1100	D	40	U
9/12/2006	100	U	130	D	100	U	1700	D	40	U
3/14/2007	100	U	200	D	100	U	1800	D	40	U
9/12/2007	20	U	150	D	20	U	1900	D	40	U
3/12/2008	26	D	190	D	20	U	2300	D	40	U
10/1/2008	25	U	200	D	25	U	2700	D	50	U
5/7/2009	100	U	190		20	U	2400		100	U
10/20/2009	20	U	200	D	20	U	1700	D	40	U
3/8/2010	20	U	180	D	20	U	2000	D	20	U
9/2/2010	50	U	250	D	50	U	2700	D	50	U

**Table A2.5. Summary of Groundwater VOC Data for MW162 (UCRS) of SWMU 1**

DATE COLLECTED	1,1-DCE (µg/L)		cis-1,2-DCE (µg/L)		trans-1,2-DCE (µg/L)		TCE (µg/L)		Vinyl chloride (µg/L)	
	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER
3/27/1991	6						150		1	U
							130			
5/8/1991	6						120		2	
6/3/1993							79			
8/19/1993							110			
11/4/1993							68			
2/21/1994							46			
5/25/1994			9	J	25	U	64			
8/29/1994							90			
10/26/1994							70			

Table A2.6. Summary of Groundwater VOC Data for MW203 (RGA) of SWMU 211A

DATE COLLECTED	1,1-DCE (µg/L)		cis-1,2-DCE (µg/L)		trans-1,2-DCE (µg/L)		TCE (µg/L)		Vinyl chloride (µg/L)	
	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER
4/25/1991	1	J					12		1	U
							15			
5/9/1991	5	U					11		10	U
6/24/1993							23	J		
9/20/1993							26			
12/3/1993							23			
3/21/1994			2	J			21	X		
6/2/1994							17	X		
9/6/1994							27	X		
12/19/1994							37			
8/28/1995							48			
8/14/1996	5	U	5	U	5	U	33		10	U
8/5/1997	5	U	5	U	5	U	35		5	U
8/6/1998	5	U	5	U	5	U	41		5	U
8/5/1999	5	U	5	UX	5	U	42		5	U
3/20/2000	5	UX	5	UX	5	U	38		5	U
3/13/2001	5	UX	5	UX	5	U	49		2	U
9/7/2001	5	UX	7		5	U	70		2	U
3/25/2002	50	U	50	U	50	U	740	DX	20	U
9/10/2002	10	UX	10	UX	10	U	100	DX	4	U
6/3/2003	50	U	50	UX	50	U	110	DX	20	U
12/4/2003	6		10		5	U	100		2	U
6/7/2004	50	U	50	UX	50	U	120	DX	20	U
7/21/2004	6.2		11		1	U	99		1	U
							103			
12/7/2004	6		9.2		5	U	90		2	U
6/9/2005	8.5		15		5	U	110		2	U
2/13/2006	5	UX	7.9	X	5	UX	71	X	2	UX
9/11/2006	9.8		18		5	U	100		2	U
3/14/2007	12		26		5	U	120		2	U
9/5/2007	12		45		1	U	130		2	JU
3/11/2008	9.2		19		1	U	120		2	U
8/25/2008	8.1		20		1	U	99		2	U
4/3/2009	5.3		15		1	U	83		2	U
9/21/2009	7.2		31		1	U	130	BY	2	U
3/9/2010	6.8		26		1	U	100		1	U
9/7/2010	5.7	J	14	J	1	UJ	82	J	1	UJ

**Table A2.7. Summary of Groundwater VOC Data for MW204 (UCRS) of SWMU 211A**

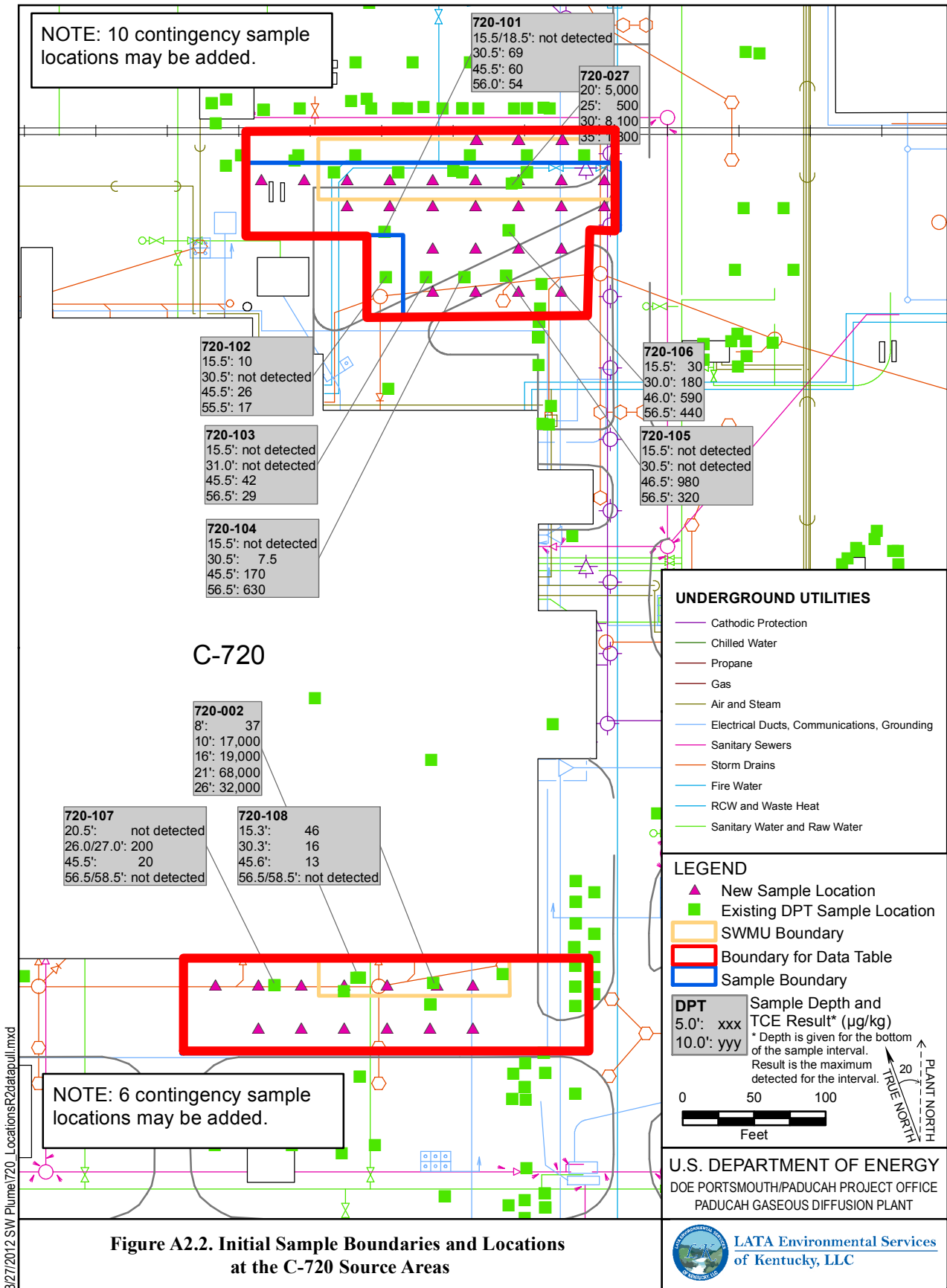
DATE COLLECTED	1,1-DCE (µg/L)		cis-1,2-DCE (µg/L)		trans-1,2-DCE (µg/L)		TCE (µg/L)		Vinyl chloride (µg/L)	
	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER
4/25/1991	86						180		1	U
							180			
5/9/1991	83						110		10	U
							160			
							190			
							200	X		
3/21/1994	150		8	J			210	X		
6/2/1994	150						200			
9/6/1994	200						280	X		
12/19/1994	91						320			
7/21/2004	51	D	8.5	D	5	U	280	D	5	U

**Table A2.8. Summary of Groundwater VOC Data  
for MW217 (UCRS) and MW218 (UCRS) of SWMU 211B**

DATE COLLECTED	TCE (µg/L)			
	MW217		MW218	
	RESULT	RESULT QUALIFIER	RESULT	RESULT QUALIFIER
2/10/1992			180	J
11/9/1993	30			
11/3/1994	1			
6/13/1993	1	U	59	
8/26/1993	1	UX		
2/23/1994	1	U		
5/9/1994	1	U		
5/26/1994	1	U		
8/30/1994	1	U		
3/6/1998			280	

Note: Analyses are unavailable for 1,1-DCE; *cis*-1,2-DCE; *trans*-1,2-DCE, and vinyl chloride.





3/27/2012 SW Plume\720\_LocationsR2\data\apl.mxd

**Figure A2.2. Initial Sample Boundaries and Locations at the C-720 Source Areas**

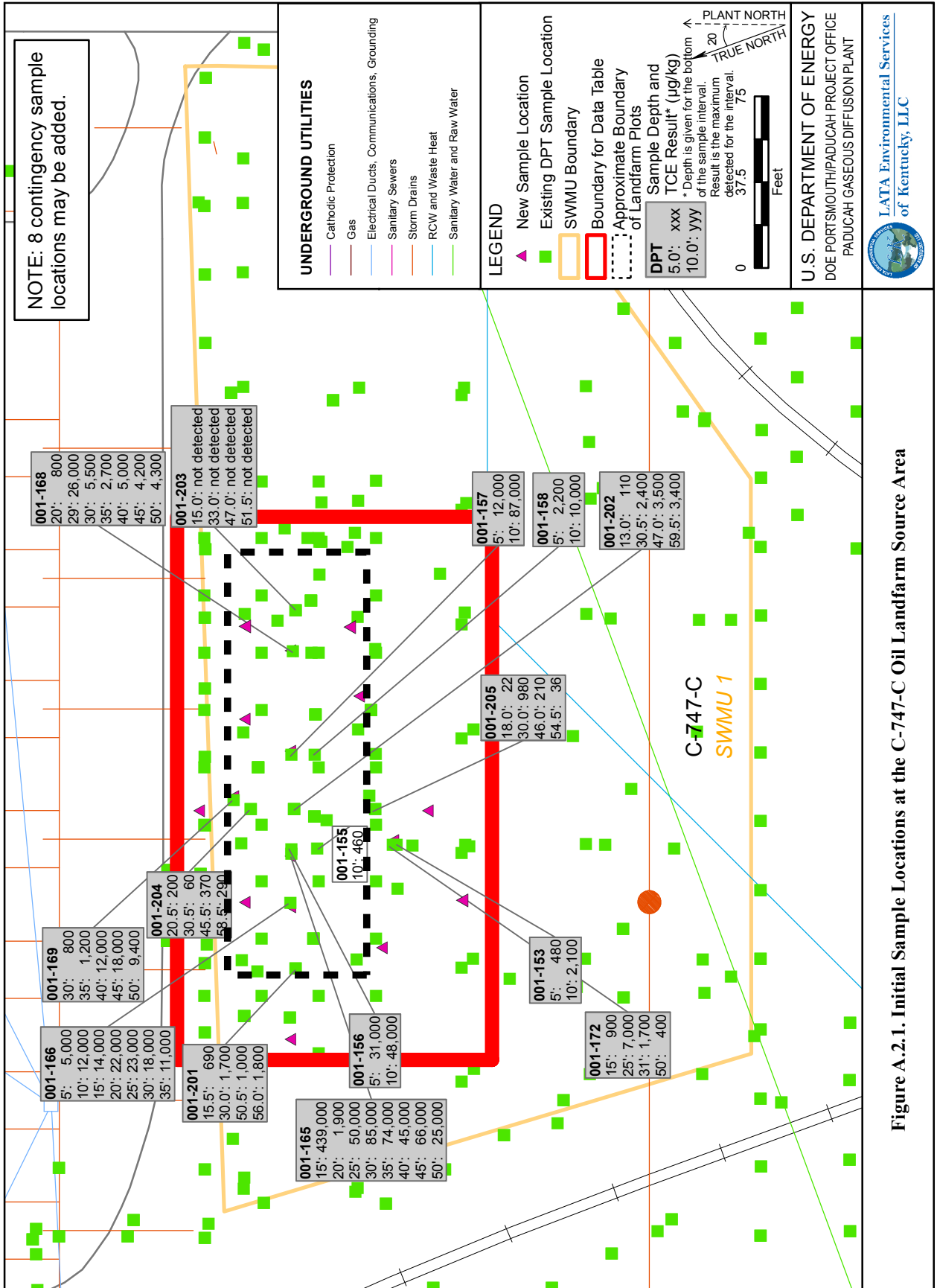


Figure A.2.1. Initial Sample Locations at the C-747-C Oil Landfarm Source Area

**ATTACHMENT A3**  
**WASTE MANAGEMENT PLAN**

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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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### A3.1. 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.

## **A3.2. WASTE MANAGEMENT ROLES AND RESPONSIBILITIES**

### **A3.2.1 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.

### **A3.2.2 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.

#### **A3.2.2.1 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.

#### **A3.2.2.2 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.

#### **A3.2.2.3 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.

### **A3.2.3 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 A3.1. If the concentrations are below the levels contained in Table A3.1, 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 A3.1. Health-Based Levels for TCE and 1,1,1-TCA**

<b>Constituent</b>	<b>Concentration in solids (ppm)</b>	<b>Concentration in Aqueous Liquids (ppb)</b>
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 for TCE; however, data must be obtained to verify that the LDR is met for 1,1,1-TCA.

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.

### **A3.2.4 WASTE PLANNING AND GENERATION**

#### **A3.2.4.1 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 A3.2. A revised WGF must be prepared if the amount of waste to be produced changes during the course of the project.

#### **A3.2.4.2 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 A3.1, 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 A3.1, 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.

Table A3.2. Waste Generation Forecast

Waste Stream	Volume (ft <sup>3</sup> )	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



The WGF shows the estimated quantities of waste that may be generated during implementation of this task. Sections A2.2.2.3 through A2.2.2.7 of this WMP provide a brief description of each potential waste stream.

#### **A3.2.4.3 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 A3.1. 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 A3.2.

#### **A3.2.4.4 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<sup>3</sup>) of material (assuming 12% void space) is placed in each 55-gal (7.35 ft<sup>3</sup>) drum. An estimate of the volume of drill cuttings to be generated is included in Table A3.2.

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 A3.1 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.

Waste may be containerized in drums, ST-90 boxes, or 25-yd<sup>3</sup> intermodal (IM) containers during generation. Specific sampling event plans (including parameters, required detection limits, and quality control requirements) will be identified when the proposed final waste containers have been presented to the waste characterization organization. Physical sampling will be performed in accordance with approved standard operating procedures. The target analytes for drill cuttings will be volatile organic

compounds, Toxicity Characteristic Leaching Procedure (TCLP) semivolatile organic compounds, metals, and total radionuclides.

#### **A3.2.4.5 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 A3.2.

#### **A3.2.4.6 Drilling Water**

Water from sampling/drilling activities may be generated. An estimate of the volume of this waste water is included in Table A3.2.

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 A3.2.3.4).

#### **A3.2.4.7 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 TSD 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).

#### **A3.2.4.8 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

#### **A3.2.4.9 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.

#### **A3.2.4.10 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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**ATTACHMENT A4**  
**DATA MANAGEMENT IMPLEMENTATION PLAN**

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## 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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## **A4.1. 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.

## **A4.2. 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.

### **A4.3. 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.

### **A4.4. 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.

#### **A4.4.1 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.

#### **A4.4.2 HISTORICAL DATA**

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

#### **A4.4.3 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.

#### **A4.4.4 ANALYTICAL DATA**

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

#### **A4.4.5 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

### **A4.5. 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.

#### **A4.5.1 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:

<b>Information that is preprinted:</b>	<b>Information that is entered manually:</b>
- 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

#### **A4.5.2 LITHOLOGIC DESCRIPTION FORMS**

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

#### **A4.5.3 WELL CONSTRUCTION DETAIL FORMS**

These forms are not necessary for use during this project.

#### **A4.5.4 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*.

### **A4.6. DATA AND DATA RECORDS TRANSMITTALS**

#### **A4.6.1 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.

#### **A4.6.2 DATA RECORDS TRANSMITTALS**

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

### **A4.7. DATA MANAGEMENT SYSTEMS**

#### **A4.7.1 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.

#### **A4.7.2 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)

#### **A4.7.3 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).

### **A4.8. DATA MANAGEMENT TASKS AND ROLES AND RESPONSIBILITIES**

#### **A4.8.1 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.

#### **A4.8.2 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.

#### **A4.8.3 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*.



#### **A4.8.4 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.

#### **A4.8.5 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.

#### **A4.8.6 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.

#### **A4.8.7 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.

#### **A4.8.8 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*.

#### **A4.8.9 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.

#### **A4.8.10 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%.

#### **A4.8.11 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.

#### **A4.8.12 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.

#### **A4.8.13 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.

##### **A4.8.13.1 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.

##### **A4.8.13.2 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.

##### **A4.8.13.3 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.

##### **A4.8.13.4 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.

#### **A4.8.13.5 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.

#### **A4.8.13.6 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.

#### **A4.8.13.7 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.

#### **A4.8.13.8 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.

**ATTACHMENT A5**  
**QUALITY ASSURANCE PROJECT PLAN**

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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

**Title:** RDSI Characterization Plan for SW Plume  
**Revision Number:** 1  
**Revision Date:** 4/2012

**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

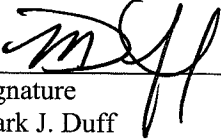
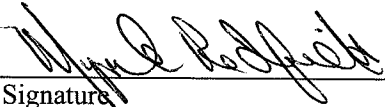

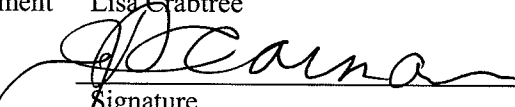
**Lead Organization:** U.S. Department of Energy

**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):** 4/2012

**Document Control Number:** DOE/LX/07-1268&D2/R1

LATA Kentucky Environmental Remediation Project Manager	 Signature Mark J. Duff	<u>4-25-12</u> Date
LATA Kentucky Regulatory Manager	 Signature Myrna Espinosa Redfield	<u>4/26/12</u> Date
LATA Kentucky Sample/Data Management Manager	 Signature Lisa Crabtree	<u>4/26/12</u> Date
LATA Kentucky Groundwater Operable Unit Project Manager	 Signature Jeff Carman	<u>4/25/12</u> Date

**Title:** RDSI Characterization Plan for SW Plume

**Revision Number:** 1

**Revision Date:** 4/2012

**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:

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

<b>Required QAPP Element(s) and Corresponding QAPP Section(s)</b>	<b>Required Information</b>	<b>Worksheet No.</b>
<b>Project Management and Objectives</b>		
2.1 Title and Approval Page	<ul style="list-style-type: none"> <li>• Title and Approval Page</li> </ul>	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	<ul style="list-style-type: none"> <li>• Table of Contents</li> <li>• QAPP Identifying Information</li> </ul>	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	<ul style="list-style-type: none"> <li>• Distribution List</li> <li>• Project Personnel Sign-Off Sheet</li> </ul>	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	<ul style="list-style-type: none"> <li>• Project Organizational Chart</li> <li>• Communication Pathways</li> <li>• Personnel Responsibilities and Qualifications Table</li> <li>• Special Personnel Training Requirements Table</li> </ul>	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	<ul style="list-style-type: none"> <li>• Project Planning Session Documentation (including Data Needs tables)</li> <li>• Project Scoping Session Participants Sheet</li> <li>• Problem Definition, Site History, and Background</li> <li>• Site Maps (historical and present)</li> </ul>	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	<ul style="list-style-type: none"> <li>• Site-Specific Project Quality Objectives</li> <li>• Measurement Performance Criteria Table</li> </ul>	11, 12
2.7 Secondary Data Evaluation	<ul style="list-style-type: none"> <li>• Sources of Secondary Data and Information</li> <li>• Secondary Data Criteria and Limitations Table</li> </ul>	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	<ul style="list-style-type: none"> <li>• Summary of Project Tasks</li> <li>• Reference Limits and Evaluation Table</li> <li>• Project Schedule/Timeline Table</li> </ul>	14, 15, 16



**QAPP Worksheet #2 (Continued)  
QAPP Identifying Information**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
<b>Measurement/Data Acquisition</b>		
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	<ul style="list-style-type: none"> <li>• Sampling Design and Rationale</li> <li>• Sample Location Map</li> <li>• Sampling Locations and Methods/SOP Requirements Table</li> <li>• Analytical Methods/SOP Requirements Table</li> <li>• Field Quality Control Sample Summary Table</li> <li>• Sampling SOPs</li> <li>• Project Sampling SOP References Table</li> <li>• Field Equipment Calibration, Maintenance, Testing, and Inspection Table</li> </ul>	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	<ul style="list-style-type: none"> <li>• Analytical SOPs</li> <li>• Analytical SOP References Table</li> <li>• Analytical Instrument Calibration Table</li> <li>• Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table</li> </ul>	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	<ul style="list-style-type: none"> <li>• Sample Collection Documentation Handling, Tracking, and Custody SOPs</li> <li>• Sample Container Identification</li> <li>• Sample Handling Flow Diagram</li> <li>• Example Chain-of-Custody Form and Seal</li> </ul>	26, 27
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	<ul style="list-style-type: none"> <li>• QC Samples Table</li> <li>• Screening/Confirmatory Analysis Decision Tree</li> </ul>	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	<ul style="list-style-type: none"> <li>• Project Documents and Records Table</li> <li>• Analytical Services Table</li> <li>• Data Management SOPs</li> </ul>	29, 30

**QAPP Worksheet #2 (Continued)**  
**QAPP Identifying Information**

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
<b>Assessment/Oversight</b>		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	<ul style="list-style-type: none"> <li>• Assessments and Response Actions</li> <li>• Planned Project Assessments Table</li> <li>• Audit Checklists</li> <li>• Assessment Findings and Corrective Action Responses Table</li> </ul>	31, 32
4.2 QA Management Reports	<ul style="list-style-type: none"> <li>• QA Management Reports Table</li> </ul>	33
4.3 Final Project Report		
<b>Data Review</b>		
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	<ul style="list-style-type: none"> <li>• Verification (Step I) Process Table</li> <li>• Validation (Steps IIa and IIb) Process Table</li> <li>• Validation (Steps IIa and IIb) Summary Table</li> <li>• Usability Assessment</li> </ul>	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 <sup>a</sup>	E-copy <sup>b</sup>	CD
<b>Environmental Protection Agency (EPA)</b>				
Turpin Ballard/Jennifer Tufts (original letter)	2	1	P	P
Jana Dawson, TLI (copy of letter)	1	-	P	P
<b>State of Kentucky (KY)</b>				
Todd Mullins (original letter)	3	1	P	1
Gaye Brewer (copy of letter)	1	-	P	-
<b>U.S. Department of Energy (DOE)</b>				
DOE <sup>c</sup>	1	1	P	1
Citizens Advisory Board (CAB) <sup>d</sup>	-	-	-	2
<b>LATA Environmental Services of Kentucky, LLC (LATA Kentucky)<sup>e</sup></b>				
<b>Document Management Center (DMC)</b>				
DMC-RC (unbound)	1	1	P	-
Administrative Record (unbound)	1	1	P	1
<b>National Resource Damage Assessment (NRDA) Trustees</b>				
<b>Kentucky Department of Fish &amp; Wildlife</b>				
Tim Kreher	-	-	-	1
<b>Kentucky Energy and Environment Cabinet</b>				
Dr. Len Peters, Cabinet Secretary	-	-	-	1
<b>Tennessee Valley Authority</b>				
Cynthia Anderson	-	-	-	1
Robert Casey	-	-	P	-
A. Stephens	-	-	P	-
<b>U.S. Fish &amp; Wildlife</b>				
Tony Velasco	-	-	-	1
<b>TOTAL DISTRIBUTION</b>	10	5	-	15

<sup>a</sup> 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.

<sup>b</sup> 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.

<sup>c</sup> CDs are provided to Kim Crenshaw.

<sup>d</sup> 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.

<sup>e</sup> 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.

**Title:** RDSI Characterization Plan for SW Plume  
**Revision Number:** 1  
**Revision Date:** 4/2012

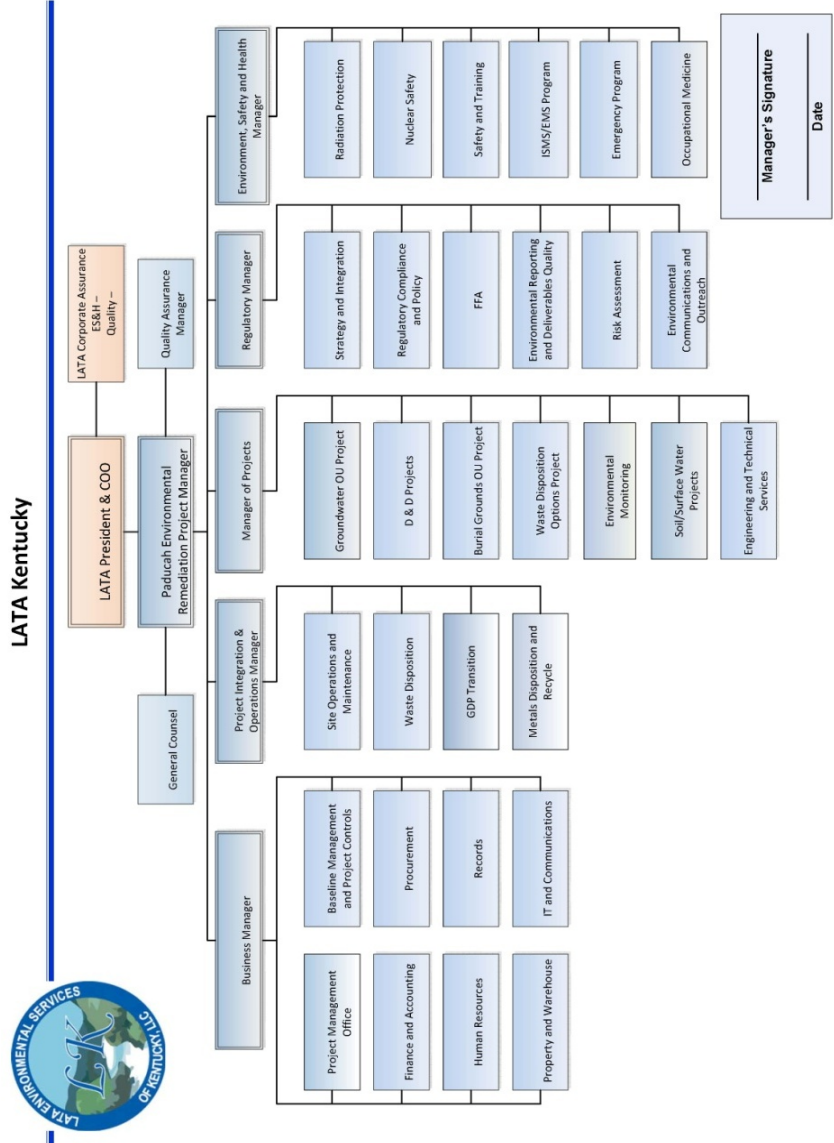
**QAPP Worksheet #4  
 Project Personnel Sign-Off Sheet**

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.

<b>Project Position Title</b>	<b>Organization</b>	<b>Signature</b>	<b>Date</b>
Project Manager			
Task Lead			
Data Coordinator			
Data Validator			
Data Reviewer			
QA Specialist			
Project Geologist			
Environmental Sampling Lead			
Sampler			

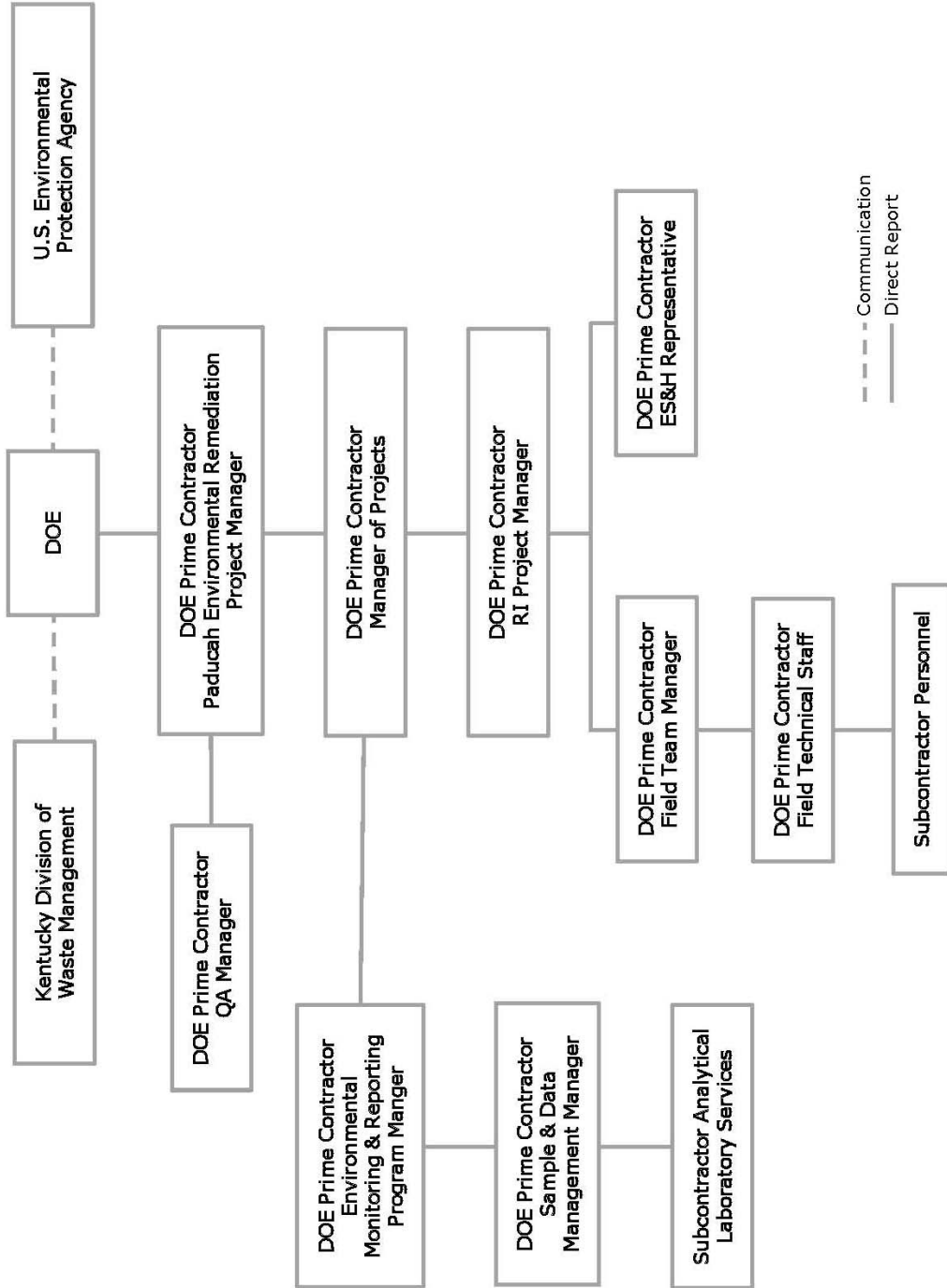
**QAPP Worksheet #5-A  
 Project Contractor Organizational Chart\***

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.

<b>Communication Drivers</b>	<b>Organizational Affiliation</b>	<b>Position Title Responsible</b>	<b>Procedure</b>
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**

<b>Communication Drivers</b>	<b>Organizational Affiliation</b>	<b>Position Title Responsible</b>	<b>Organizational Department Manager</b>	<b>Procedure</b>
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
Field and Analytical Corrective Actions	LATA Kentucky	Quality Assurance Specialist	Quality Assurance Manager	All internal communications regarding corrective actions for field and analytical issues
QAPP Amendments	LATA Kentucky	Environmental Monitoring and Reporting Project Manager	Environmental Monitoring and Reporting Project Manager	All internal communications regarding major changes to the QAPP

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**

<b>Position Title Responsible</b>	<b>Organization Affiliation</b>	<b>Responsibilities</b>	<b>Education and Experience Qualifications</b>
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
Quality Assurance Manager	LATA Kentucky	Project quality assurance responsibility	Bachelor degree plus > 1 year relevant experience
Field Project Manager	LATA Kentucky	Project compliance with the Characterization Plan	> 4 years relevant work experience
Environmental Sampling Lead	LATA Kentucky	Project sampling responsibility	> 4 years relevant work experience
Project Geologist	LATA Kentucky	Geologic characterization and interpretation of investigation-derived data	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.

<b>Project Function</b>	<b>Specialized Training— Title or Description of Course</b>	<b>Training Provider</b>	<b>Training Date</b>	<b>Personnel/Groups Receiving Training</b>	<b>Personnel Titles/ Organizational Affiliation</b>	<b>Location of Training Records/Certificates*</b>
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

**Title:** RDSI Characterization Plan for SW Plume  
**Revision Number:** 1  
**Revision Date:** 4/2012

**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.

<b>Name of Project:</b> RDSI Characterization Plan for the C-747-C Oil Landfarm and C-720 Northeast and Southeast Site						
<b>Date of Session:</b> February 4, 2010						
<b>Scoping Session Purpose:</b> Develop data quality objectives						
<b>Position Title</b>	<b>Affiliation</b>	<b>Name</b>	<b>Phone #</b>	<b>E-mail Address</b>	<b>Project Role</b>	
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 UCERS 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 21A&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<sup>1</sup>

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)
<b>Volatile Organic Compounds</b>										
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

<sup>1</sup> 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<sup>1</sup>

Analyte	CAS Number	EPA Method	Aqueous Accuracy % Recovery	Aqueous Precision RPD	Water PQL (µg/L)	Water MDL (µg/L)
<b>Metals<sup>2</sup></b>						
Aluminum	7429-90-5	EPA 200.8/ SW-846 6010/6020 <sup>3</sup>	80-120	≤25	200	100
Chromium	7440-47-3	EPA 200.8/ SW-846 6010B/6020 <sup>3</sup>	80-120	≤25	10	5
Iron	7439-89-6	EPA 200.8/ SW-846 6010B/6020 <sup>3</sup>	80-120	≤25	200	100
Lead	7439-92-1	EPA 200.8/ SW-846 6010/6020 <sup>3</sup>	80-120	≤25	1.3	0.65
Manganese	7439-96-5	EPA 200.8/ SW-846 6010B/6020 <sup>3</sup>	80-120	≤25	5	2.5

<sup>1</sup> Additional information about quality control samples is found in Worksheet #28.

<sup>2</sup> Analyses for metals are total and dissolved.

<sup>3</sup> A post digest spike will be analyzed when the matrix spike fails.



**QAPP Worksheet #13**  
**Secondary Data Criteria and Limitations Table**

<b>Secondary Data</b>	<b>Data Source (Originating Organization, Report Title, and Date)</b>	<b>Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)</b>	<b>How Data Will Be Used</b>	<b>Limitations on Data Use</b>
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) <sup>1</sup>	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) <sup>1</sup>	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.

<sup>1</sup>The data were generated with sufficient sensitivities (detection limits), analyte suites, and analytical methods for use in making decisions in the current characterization plan.

**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 Management 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
<i>cis</i> -1,2-Dichloroethene	156-59-2	600	Groundwater Protection RGs	Yes	10	5
<i>trans</i> -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 <sup>1</sup>	Yes	5	2.5
<i>cis</i> -1,2-Dichloroethene	156-59-2	70	Groundwater Protection RGs	Yes	1	0.5
<i>trans</i> -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 <sup>1</sup>	CAS Number	Project Action Limit <sup>2</sup> /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

<sup>1</sup> Both total and dissolved analyses are required.

<sup>2</sup> 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.

**Title:** RDSI Characterization Plan for SW Plume

**Revision Number:** 1

**Revision Date:** 4/2012

**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. An indication of VOC source material in the lower UCRS will trigger an assessment of the need for VOC source characterization in the RGA.

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 EPA 200.8 and SW-846, 6010B/6020. See Worksheet #12 for method detection limit.  
**Engineering & Design Sampling:**  
For soils: grain size analysis by ASTM D422, *in situ* water content by ASTM D2216, pH by ASTM G51, 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
<b>Geotechnical Analysis</b>					
Grain Size Analysis	3/all HUs at each source area	27	ASTM D422 <sup>a</sup>	N/A	N/A
Fraction Organic Carbon	3/all HUs at each source area	27	SW9060 as modified for soil samples <sup>b</sup>	N/A	N/A
Permeameter Testing	3/all HUs at each C-720 site	18	ASTM D5084-10 <sup>a</sup>	N/A	N/A
<i>In Situ</i> Water Content	3/all HUs at SW/MU 1	9	ASTM D2216-10 <sup>a</sup>	N/A	N/A
pH	3/all HUs at SW/MU 1	9	ASTM G51 <sup>a</sup>	N/A	N/A
Unconfined Compressive Strength	3/all HUs at SW/MU 1	9	ASTM D2166-06 <sup>a</sup>	N/A	N/A
Compressibility	3/all HUs at SW/MU 1	9	ASTM D2850-03a <sup>a</sup>	N/A	N/A
Index Properties	3/all HUs at SW/MU 1	9	ASTM D4318-10 <sup>a</sup>	N/A	N/A

<sup>a</sup>These tests will be performed by a fixed-base laboratory.

<sup>b</sup>The modification is in sample preparation and heat of combustion.

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

	Media Type	Sample Location	Number of Samples	Test/Analytical Method	Project Action Limit	PQL
<b>Microbial Analysis</b>						
Microbial population	Water	nested wells at each source area	9	Quantitative Polymerase Chain Reaction Method <sup>a</sup>	N/A	N/A
<b>Field Parameters</b>						
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

<sup>a</sup> These tests will be performed by a fixed-base laboratory.

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

	Media Type	Sample Location	Number of Samples	Test/Analytical Method	Project Action Limit	PQL
<b>Ions</b>						
Chloride	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056 <sup>a</sup>	N/A	2 mg/L
Nitrate	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056 <sup>a</sup>	N/A	4 mg/L
Sulfate	Water	All existing wells at each C-720 site	27	EPA 300.0/SW846-9056 <sup>a</sup>	N/A	2 mg/L
<b>Field Parameters</b>						
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
<b>Dissolved Gases</b>						
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

<sup>a</sup>These tests will be performed by a fixed-base laboratory.  
 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	216+11 field duplicates+22 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		
	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		
	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	156+8 field duplicates+16 confirmation samples		
C-720 Southeast Site	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	9		
	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	48+3 field duplicates+5 confirmation samples		
C-720 Southeast Site Hotspot	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	48+2 field duplicates + 5 confirmation samples		

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	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Volatile Organic Compounds	Moderate	See Worksheet #12	15 g	(3) 5g-Encore samplers	Cool to 4°C	7 days
Soil	Geotechnical	n/a	ASTM D6913	TBD	TBD	TBD	TBD
Soil	Geotechnical	n/a	SW9060	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	Containers (number, size, and type)	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	7 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. Sample bottle requirements will be documented and relayed to the field sampling team via labels and chain-of-custody forms generated by PEMS (Project Environmental Measurements System).



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 Field Blanks	No. of Equip. Blanks	No. of PT Samples <sup>1</sup>	Total No. of Samples to Lab <sup>2</sup>
						No. of MS	No. of MS				
Soil	VOCs	Moderate	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	VOCs	High	See Worksheet #12	See Worksheet #17	5%	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%	5%	n/a	See Worksheet #17
Groundwater	Metals (dissolved)	See historical data	See Worksheet #12	See Worksheet #17	5%	5%	5%	5%	5%	n/a	See Worksheet #17
Groundwater	Ions	See historical data	SW846-9056	See Worksheet #17	5%	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%	5%	n/a	See Worksheet #17

<sup>1</sup> PT sample will only be collected when required by a specific project.

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

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**Revision Date:** 4/2012

**QAPP Worksheet #21 (Continued)  
 Project Sampling SOP References Table**

Reference Number	Title, Revision Date, and/or Number <sup>a</sup>	Originating Organization <sup>b</sup>	Equipment Type	Modified for Project Work? (Y/N)	Comments
18	PAD-ENM-5107, <i>Inorganic Data Validation and Verification</i>	Contractor	N/A	N	None

<sup>a</sup> SOPs are posted to the LATA Kentucky intranet Web site. External FFA parties can access this site using remote access with privileges upon approval.  
<sup>b</sup> The work will be conducted by LATA Kentucky staff or a subcontractor. In either case, SOPs listed will be followed.  
<sup>c</sup> Work instructions for groundwater sampling will include a modification to the steps of PAD-ENM-2101 to incorporate sampling in wells with non-dedicated pumps.  
 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 Photionization 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.: ± 0.3°C	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
Titration (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 manufacturer's 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)
SW-846, 8260	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	VOAs	GC/MS	TBD	TBD
EPA 200.8 and SW-846, 6010B	Inductively Coupled Plasma-Atomic Emission Spectrometry	Definitive	Metals	ICP	TBD	TBD
EPA 200.8 and SW-846, 6020	Inductively Coupled Plasma-Mass Spectrometry	Definitive	Metals	ICP-MS	TBD	TBD
EPA 300.0/SW846-9056	Determination of Inorganic Ions by Ion Chromatography	Definitive	Anions	Ion Chromatograph	TBD	TBD
Modified R.S. Kerr SOP-175	Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique	Definitive	Dissolved Gasses	GC	TBD	YES
Vendor Specific	Quantitative Polymerase Chain Reaction Method	Definitive	Microbial Population	Quantitative Polymerase Chain Reaction	TBD	TBD

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

**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)
ASTM D422	Particle Size Distribution of Soils - Sieve Analysis	Definitive	Geotechnical	Soil Sieve	TBD	TBD
SW9060	Total Organic Carbon	Definitive	Geotechnical	Carbonaceous Analyzer	TBD	TBD
ASTM D5084-10	Hydraulic Conductivity of Saturated Porous Materials	Definitive	Geotechnical	Flexible-Wall Permeameter	TBD	TBD
ASTM D2216-10	Water Content of Soil and Rock by Mass	Definitive	Geotechnical	Scale	TBD	TBD
ASTM G51	pH of Soils	Definitive	Geotechnical	pH meter	TBD	TBD
ASTM D2166-06	Unconfined Compressive Strength of Cohesive Soil	Definitive	Geotechnical	Unconfined Compression Machine	TBD	TBD
ASTM D2850-03	Unconsolidated, Undrained Triaxial Compression Test	Definitive	Geotechnical	Triaxial Chamber	TBD	TBD
ASTM D4318-10	Liquid Limit, Plastic Limit, and Plasticity Index	Screening	Geotechnical	Spatula and Grooving Tool	TBD	TBD
Hach® Alkalinity Test Kit, Model AL-DT	Hach® Alkalinity Test Kit, Model AL-DT	Screening	Water Alkalinity	Test Kit	TBD	TBD
Hach® Iron (Ferrous) Color Test Kit, Model IR-18C	Hach® Iron (Ferrous) Color Disc Test Kit, Model IR-18C	Screening	Water Ferrous Iron	Test Kit	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.

<b>Instrument</b>	<b>Calibration Procedure</b>	<b>Frequency of Calibration</b>	<b>Acceptance Criteria</b>	<b>Corrective Action (CA)</b>	<b>Person Responsible for CA</b>	<b>SOP Reference</b>
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, 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 $\pm 0.05$ 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**

<b>Instrument/ Equipment</b>	<b>Maintenance Activity</b>	<b>Testing Activity</b>	<b>Inspection Activity</b>	<b>Frequency</b>	<b>Acceptance Criteria</b>	<b>Corrective Action</b>	<b>Responsible Person</b>	<b>SOP Reference*</b>
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 DOE/CAP. Laboratory(s) contracted will be DOE/CAP 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**

<b>SAMPLE COLLECTION, PACKAGING, AND SHIPMENT</b>	
<b>Sample Collection (Personnel/Organization):</b>	Sampling Teams/DOE Prime Contractor and Subcontractors
<b>Sample Packaging (Personnel/Organization):</b>	Sampling Teams/DOE Prime Contractor and Subcontractors
<b>Coordination of Shipment (Personnel/Organization):</b>	Lab Coordinator/DOE Prime Contractor
<b>Type of Shipment/Carrier:</b>	Direct Delivery or Overnight/Federal Express
<b>SAMPLE RECEIPT AND ANALYSIS</b>	
<b>Sample Receipt (Personnel/Organization):</b>	Sample Management/Contracted Laboratory
<b>Sample Custody and Storage (Personnel/Organization):</b>	Sample Management/Contracted Laboratory
<b>Sample Preparation (Personnel/Organization):</b>	Analysts/Contracted Laboratory
<b>Sample Determinative Analysis (Personnel/Organization):</b>	Analysts/Contracted Laboratory
<b>SAMPLE ARCHIVING</b>	
<b>Field Sample Storage (No. of days from sample collection):</b>	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.
<b>Sample Extract/Digestate Storage (No. of days from extraction/digestion):</b>	See Worksheet #19
<b>Biological Sample Storage (No. of days from sample collection):</b>	n/a
<b>SAMPLE DISPOSAL</b>	
<b>Personnel/Organization:</b>	Waste Disposition/DOE Prime Contractor and Subcontractors
<b>Number of Days from Analysis:</b>	6 months

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**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**

<b>Matrix:</b>	Aqueous						
<b>Analytical Group/Concentration Level:</b>	Metals						
<b>Sampling SOP:</b>	See Worksheet #21						
<b>Analytical Method/SOP Reference:</b>	EPA 200.8 and SW-846, 6010/6020						
<b>Sampler's Name/Field Sampling Organization:</b>	TBD						
<b>Analytical Organization:</b>	TBD						
<b>No. of Sample Locations</b>	See Section 5 and Appendix A of the characterization plan						
<b>QC Sample:</b>	<b>Frequency</b>	<b>Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Split Samples	As requested by regulatory agency	TBD	N/A	N/A	N/A	N/A	N/A
Field Blank	Minimum 5%	3	≤ CRQL	Verify results; reanalyze	Laboratory should alert project	Contamination– Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Equipment Blank	Minimum 5%	3	≤ CRQL	Verify results; reanalyze		Contamination– Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Prep Blank	1 per SDG <sup>1</sup>	TBD	See data validation procedure PAD-ENM-5107	Verify results; reanalyze	Data reviewer/Data validator	Contamination– Accuracy/bias	See data validation procedure PAD-ENM-5107

**QAPP Worksheet #28 (Continued)  
 QC Samples Table**

QC Sample	Frequency	Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post Digestion Spike	1 per SDG <sup>1</sup>	TBD	See data validation procedure PAD-ENM-5107	Verify results; reanalyze	Data reviewer/Data validator	Precision/Accuracy	See data validation procedure PAD-ENM-5107
Serial Dilution Test	1 per SDG <sup>1</sup>	TBD	See data validation procedure PAD-ENM-5107	Verify results; reanalyze	Data reviewer/Data validator	Precision/Accuracy	See data validation procedure PAD-ENM-5107
Internal standards, laboratory spiked blanks or spiked field samples (matrix spike samples <sup>2</sup> )	Minimum 5%	3	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, <i>Quality Assured Data</i>
Field duplicate	Minimum 5%	3	None	Data reviewer will place qualifiers on samples affected	Data reviewer/Project manager	Homogeneity/Precision	RPD < 25%
Laboratory duplicate	Per laboratory procedure	TBD	See data validation procedures PAD-ENM-5105, 5107, 5103, 5102	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>

<sup>1</sup> 1 per Sample Delivery Group (SDG) or 1 per 20 samples, whichever is most frequent.

<sup>2</sup> Both matrix spike samples and matrix spike duplicate samples are analyzed at a minimum frequency of 5%.

**QAPP Worksheet #28 (Continued)  
 QC Samples Table**

<b>Matrix:</b>	Aqueous/Soils						
<b>Analytical Group/Concentration Level:</b>	VOCs						
<b>Sampling SOP:</b>	See Worksheet #21						
<b>Analytical Method/SOP Reference:</b>	8260						
<b>Sampler's Name/Field Sampling Organization:</b>	TBD						
<b>Analytical Organization:</b>	TBD						
<b>No. of Sample Locations</b>	See Section 5 and Appendix A of the characterization plan						
<b>QC Sample:</b>	<b>Frequency</b>	<b>Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Split Samples	As requested by regulatory agency	TBD	N/A	N/A	N/A	N/A	N/A
Field Blank	Minimum 5%	57	≤ CRQL	Verify results; reanalyze	Laboratory should alert project	Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Trip Blank	1 per cooler containing VOC samples	~186	≤ CRQL	Verify results; reanalyze		Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Equipment Blank	Minimum 5%	57	≤ CRQL	Verify results; reanalyze		Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>



**QAPP Worksheet #28 (Continued)  
 QC Samples Table**

QC Sample	Frequency	Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per SDG <sup>1</sup>	TBD	See data validation procedure PAD-ENM-5105	Verify results; reanalyze	Data reviewer/Data validator	Contamination– Accuracy/bias	See data validation procedure PAD-ENM-5105
Surrogate Samples	All samples <sup>2</sup>	Total number of samples	See data validation procedure PAD-ENM-5105	Verify results; reanalyze	Data reviewer/Data validator	Accuracy	See data validation procedure PAD-ENM-5105
Internal standards, laboratory spiked blanks or spiked field samples (matrix spike samples <sup>3</sup> )	Minimum 5%	57	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, <i>Quality Assured Data</i>
Field duplicate	Minimum 5%	57	None	Data reviewer will place qualifiers on samples affected	Data reviewer/Project manager	Homogeneity/Precision	RPD ≤ 50% soils, RPD < 25% aqueous
Laboratory duplicate	Per laboratory procedure	TBD	See data validation procedures PAD-ENM-5105, 5107, 5103, 5102	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>

<sup>1</sup> 1 per Sample Delivery Group (SDG) or 1 per 20 samples, whichever is most frequent.

<sup>2</sup> Surrogate standards are added to all analytical samples, blanks and QC samples.

<sup>3</sup> Both matrix spike samples and matrix spike duplicate samples are analyzed at a minimum frequency of 5%.

**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.

<b>Sample Collection Documents and Records</b>	<b>On-site Analysis Documents and Records</b>	<b>Off-site Analysis Documents and Records</b>	<b>Data Assessment Documents and Records*</b>	<b>Other</b>
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	None

\* 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) <sup>1</sup>	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) <sup>1</sup>
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 SW9060	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 G51 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**

<b>Matrix</b>	<b>Analytical Group</b>	<b>Concentration Level</b>	<b>Sample Locations/ID Numbers</b>	<b>Analytical SOP</b>	<b>Data Package Turnaround Time</b>	<b>Laboratory/ Organization (Name and Address, Contact Person and Telephone Number) <sup>1</sup></b>	<b>Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) <sup>1</sup></b>
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

<sup>1</sup>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)
Audit/Surveillance	A	Internal	Prime Contractor QA	QA Specialists or Contractor	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	B	Internal	Prime Contractor Project Management	Regulatory Management, Contractor	Regulatory Management, Contractor	Regulatory Management, Contractor	QA Specialist, Contractor
Management by Walking Around (MBWA)*	Quarterly	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 = frequency determined by QA Manager and conducted per PAD-QA-1003, *Surveillance* or PAD-QA-1502, *Audits*.  
B = assessment frequency determined by regulatory manager and conducted per PAD-QA-1420, *Conduct of Management Assessments*.  
\* Reference: PAD-QA-1033 *Management by Walking Around (MBWA) Program*.

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**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	Form QA-F-004, Management Assessment Report and Checklist and QA-F-0710, Issue Identification Form	Project management, issue owner, contractor	Upon issuance of Form QA-F-0074, Management Assessment Report and Checklist, the 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 #32 (Continued)**  
**Assessment Findings and Corrective Action Responses\***

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
Audit and Surveillances	QA-F-0069, Audit Checklist, or QA-F-0072, Surveillance Report, and QA-F-0075, Nonconformance Report (NCR) Form or QA-F-0068, Condition Report (CF) Form	Project management, issue owner, contractor	Upon issuance of QA-F-0069, Audit Checklist, or QA-F-0072, Surveillance Report, the QA-F-0075, Nonconformance Report (NCR) Form or QA-F-0068, Condition Report (CF) Form, will be completed and attached to the report	QA-F-0075, Nonconformance Report (NCR) Form or QA-F-0068, Condition Report (CF) 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.

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**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
Audit/Surveillances	TBD as determined by QA Manager	30 days after completion of audit/surveillance	QA Manager	LATA Kentucky Project Manager QA Manager
Corrective Action Plan	As needed	Varies per PAD-QA-1210, <i>Issues Management</i>	Project Manager	QA Manager



**QAPP Worksheet #34  
Verification (Step 1) 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, <i>Logbooks and Data Forms</i> , and PAD-ENM-5003, <i>Quality Assured Data</i> .	Internal	Project Management or designee, Contractor
Chains-of-custody	Chains-of-custody are controlled by LATA Kentucky procedure, PAD-ENM-5004, <i>Sample Tracking, Lab Coordination and Sample Handling Guidance</i> . 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, <i>Quality Assured Data</i> . 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, <i>Quality Assured Data</i> .	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, <i>Quality Assured Data</i> . 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, <i>Quality Assured Data</i> . 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.

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**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, <i>Volatile and Semivolatile Data Verification and Validation</i>	Data Validator, LATA Kentucky

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**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.

## **APPENDIX B**

### **APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS**

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Table B.1. Location-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites

Location-specific ARARs						
Location	Requirement	Prerequisite	Citation	SWMU 1	C-720 NE	C-720 SE
<i>Cultural Resources</i>						
Presence of wetlands as defined in 10 <i>CFR</i> § 1022.4	Avoid, to the extent possible, the long- and short-term adverse effects associated with destruction, occupancy, and modification of wetlands.	DOE actions that involve potential impacts to, or take place within, wetlands— <b>applicable</b> .	10 <i>CFR</i> § 1022.3(a)	Ü	Ü	Ü
	Take action, to extent practicable, to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.		10 <i>CFR</i> § 1022.3(a)(7) and (8)	Ü	Ü	Ü
	Undertake a careful evaluation of the potential effects of any new construction in wetlands. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse impacts on wetlands.		10 <i>CFR</i> § 1022.3(b) and (d)	Ü	Ü	Ü
	Measures that mitigate the adverse effects of actions in a wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically-sensitive areas.		10 <i>CFR</i> § 1022.13(a)(3)	Ü	Ü	Ü
	If no practicable alternative to locating or conducting the action in the wetland is available, then before taking action design or modify the action in order to minimize potential harm to or within the wetland, consistent with the policies set forth in E.O. 11990.		10 <i>CFR</i> § 1022.14(a)	Ü	Ü	Ü
Location encompassing aquatic ecosystem as defined in 40 <i>CFR</i> § 230.3(c)	Except as provided under section 404(b)(2), no discharge of dredged or fill material is permitted if there is a practicable alternative that would have less adverse impact on the aquatic ecosystem or if it will cause or contribute to significant degradation of the waters of the United States.	Action that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands— <b>relevant and appropriate</b> .	40 <i>CFR</i> § 230.10(a) and (c)	Ü	Ü	Ü

Table B.1. Location-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Location-specific ARARs						
Location	Requirement	Prerequisite	Citation	SWMU 1	C-720 NE	C-720 SE
Nationwide Permit Program	<p>Except as provided under section 404(b)(2), no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken that will minimize potential adverse impacts of the discharge on the aquatic ecosystem. 40 <i>CFR</i> § 230.70 <i>et seq.</i> identifies such possible steps.</p> <p>Must comply with the substantive requirements of the NWP 38, General Conditions, as appropriate.</p>	<p>Discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands—<b>relevant and appropriate.</b></p>	<p>40 <i>CFR</i> § 230.10(d)</p> <p>Nationwide Permit (38) Cleanup of Hazardous and Toxic Waste 33 <i>CFR</i> § 323.3(b)</p>	ü	ü	ü

ARAR = applicable or relevant and appropriate requirement

*CFR* = Code of Federal Regulations

DOE = U.S. Department of Energy

E.O. = Executive Order

NWP = Nationwide Permit



Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
<i>Site Preparation, Construction, and Excavation Activities</i>						
Activities causing fugitive dust emissions	<p>No person shall cause, suffer, or allow any material to be handled, processed, transported, or stored, a building or its appurtenances to be constructed, altered, repaired, or demolished, or a road to be used without taking reasonable precaution to prevent particulate matter from becoming airborne. Such reasonable precautions shall include, when applicable, but not be limited to, the following:</p> <ul style="list-style-type: none"> <li>• Use, where possible, of water or chemicals for control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads or the clearing of land;</li> <li>• Application and maintenance of asphalt, oil, water, or suitable chemicals on roads, materials stockpiles, and other surfaces which can create airborne dusts;</li> <li>• Covering, at all times when in motion, open bodied trucks transporting materials likely to become airborne;</li> <li>• The maintenance of paved roadways in a clean condition; and</li> <li>• The prompt removal of earth or other material from a paved street which earth or other material has been transported thereto by trucking or earth moving equipment or erosion by water.</li> </ul>	Fugitive emissions from land-disturbing activities (e.g., handling, processing, transporting or storing of any material, demolition of structures, construction operations, grading of roads, or the clearing of land, etc.) <sup>3/4</sup> <b>applicable</b> .	401 KAR 63:010 § 3(1) and (1)(a), (b), (d), (e) and (f)		Ü	Ü
	No person shall cause or permit the discharge of visible fugitive dust emissions beyond the lot line of the property on which the emissions originate.		401 KAR 63:010 § 3(2)		Ü	Ü
Activities causing radionuclide emissions	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an EDE of 10 mrem/yr.	Radionuclide emissions from point sources at a DOE facility <sup>3/4</sup> <b>applicable</b> .	40 CFR § 61.92 401 KAR 57:002		Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Activities causing toxic substances or potentially hazardous matter emissions	Persons responsible for a source from which hazardous matter or toxic substances may be emitted shall provide the utmost care and consideration in the handling of these materials to the potentially harmful effects of the emissions resulting from such activities. No owner or operator shall allow any affected facility to emit potentially hazardous matter or toxic substances in such quantities or duration as to be harmful to the health and welfare of humans, animals and plants.	Emissions of potentially hazardous matter or toxic substances as defined in 401 KAR 63:020 § 2 (2) $\frac{3}{4}$ applicable.	401 KAR 63:020 § 3		Ü	Ü
Activities causing storm water runoff (e.g., clearing, grading, excavation)	Implement good construction techniques to control pollutants in storm water discharges during and after construction in accordance with substantive requirements provided by permits issued pursuant to 40 CFR § 122.26(c).	Storm water discharges associated with small construction activities as defined in 40 CFR § 122.26(b)(15) and 401 KAR 5:002 § 1 (157)— <b>applicable.</b>	40 CFR § 122.26(c)(1)(ii) (C) and (D) 401 KAR 5:060 § 8	Ü	Ü	Ü
	Storm water runoff associated with construction activities taking place at a facility with an existing Best Management Practices (BMP) Plan shall be addressed under the facility BMP and not under a storm water general permit.	Storm water discharges associated with small construction activities as defined in 40 CFR § 122.26(b)(15) and 401 KAR 5:002 § 1 (157)— <b>TBC.</b>	Fact Sheet for the KPDES General Permit for Storm Water Discharges Associated with Construction Activities, June 2009	Ü	Ü	Ü
	Best management storm water controls will be implemented and may include, as appropriate, erosion and sedimentation control measures, structural practices (e.g., silt fences, straw bale barriers) and vegetative practices (e.g., seeding); storm water management (e.g., diversion); and maintenance of control measures in order to ensure compliance with the standards in Section C.5. Storm Water Discharge Quality.	Storm water runoff associated with construction activities taking place at a facility [PGDP] with an existing BMP Plan— <b>TBC.</b>	Appendix C of the PGDP Best Management Practices Plan (2007)— Examples of Storm water Controls	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
<i>Monitoring, Extraction, and Injection Well Installation and Abandonment</i>						
Monitoring well installation	<p>Permanent monitoring wells shall be constructed, modified, and abandoned in such a manner as to prevent the introduction or migration of contamination to a water-bearing zone or aquifer through the casing, drill hole, or annular materials.</p>	Construction of monitoring well as defined in 401 KAR 6:001 § 1(18) for remedial action— <b>applicable.</b>	401 KAR 6:350 § 1(2)	Ü	Ü	Ü
	<p>All permanent (including boreholes) shall be constructed to comply with the substantive requirements provided in the following Sections of 401 KAR 6:350:</p> <ul style="list-style-type: none"> <li>• Section 2. Design Factors;</li> <li>• Section 3. Monitoring Well Construction;</li> <li>• Section 7. Materials for Monitoring Wells; and</li> <li>• Section 8. Surface Completion.</li> </ul>		401 KAR 6:350 § 2, 3, 7, and 8	Ü	Ü	Ü
	<p>If conditions exist or are believed to exist that preclude compliance with the requirements of 401 KAR 6:350, may request a variance prior to well construction or well abandonment.</p> <p><i>NOTE: Variance shall be made as part of the FFA CERCLA document review and approval process and shall include:</i></p> <ul style="list-style-type: none"> <li>• A justification for the variance; and</li> <li>• Proposed construction, modification, or abandonment procedures to be used in lieu of compliance with 401 KAR 6:350 and an explanation as to how the alternate well construction procedures ensure the protection of the quality of the groundwater and the protection of public health and safety.</li> </ul>		401 KAR 6:350 § 1(6)(a)(6) and (7)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Development of monitoring well	Newly installed wells shall be developed until the column of water in the well is free of visible sediment. This well-development protocol shall not be used as a method for purging prior to water quality sampling.	Construction of monitoring well as defined in 401 KAR 6:001 §1(18) for remedial action— <b>applicable</b> .	401 KAR 6:350 § 9	Ü	Ü	Ü
Direct Push monitoring well installation	Wells installed using direct push technology shall be constructed, modified, and abandoned in such a manner as to prevent the introduction or migration of contamination to a water-bearing zone or aquifer through the casing, drill hole, or annular materials.	Construction of direct push monitoring well as defined in 401 KAR 6:001 § 1(18) for remedial action— <b>applicable</b> .	401 KAR 6:350 § 5 (1)	Ü	Ü	Ü
	Shall also comply with the following additional standards: (a) The outside diameter of the borehole shall be a minimum of 1 inch greater than the outside diameter of the well casing; (b) Premixed bentonite slurry or bentonite chips with a minimum of one-eighth (1/8) diameter shall be used in the sealed interval below the static water level; and (c) 1. Direct push wells shall not be constructed through more than one water-bearing formation unless the upper water bearing zone is isolated by temporary or permanent casing. 2. The direct push tool string may serve as the temporary casing.		401 KAR 6:350 § 5 (3)	Ü	Ü	Ü
Monitoring well abandonment	A monitoring well that has been damaged or is otherwise unsuitable for use as a monitoring well, shall be abandoned within 30 days from the last sampling date or 30 days from the date it is determined that the well is no longer suitable for its intended use.	Construction of monitoring well as defined in 401 KAR 6:001 § 1(18) for remedial action— <b>applicable</b> .	401 KAR 6:350 §11 (1)	Ü	Ü	Ü
	Wells shall be abandoned in such a manner as to prevent the migration of surface water or contaminants to the subsurface and to prevent migration of contaminants among water bearing zones.		401 KAR 6:350 § 11 (1)(a)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	Abandonment methods and sealing materials for all types of monitoring wells provided in subparagraphs (a)-(b) and (d)-(e) shall be followed.		401 KAR 6:350 § 11 (2)	Ü	Ü	Ü
Extraction well installation	Wells shall be constructed, modified, and abandoned in such a manner as to prevent the introduction or migration of contamination to a water-bearing zone or aquifer through the casing, drill hole, or annular materials.	Construction of monitoring well for remedial action— <b>relevant and appropriate.</b>	401 KAR 6:350 § 1 (2)			
Reinjection of treated contaminated groundwater, or, injection of bioamendments, surfactants, or reagents	No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons.	Underground injection into an underground source of drinking water— <b>relevant and appropriate.</b>	40 CFR § 144.12(a)		Ü	Ü
Reinjection of treated contaminated groundwater	Wells are not prohibited if injection is approved by EPA or a State pursuant to provisions for cleanup of releases under CERCLA or RCRA as provided in the FFA CERCLA document.	Class IV wells [as defined in 40 CFR § 144.6(d)] used to reinject treated contaminated groundwater into the same formation from which it was drawn— <b>relevant and appropriate.</b>	40 CFR § 144.13(c) RCRA § 3020(b)			Ü
	Prior to abandonment any Class IV well, the owner or operator shall plug or otherwise close the well in a manner as provided in the FFA CERCLA document.	Class IV wells [as defined in 40 CFR § 144.6(d)] used to reinject of treated contaminated groundwater into the same formation from which it was drawn— <b>relevant and appropriate.</b>	40 CFR § 144.23(b)(1)			

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Plugging and abandonment of Class IV injection wells	Prior to abandoning the well, the owner or operator shall close the well in accordance with 40 <i>CFR</i> § 144.23(b).	Operation of a Class IV injection well [as defined in 40 <i>CFR</i> § 144.6(d)]— <b>relevant and appropriate.</b>	40 <i>CFR</i> § 146.10(b)			Ü
Injection of bioamendments, surfactants, or reagents	An injection activity cannot allow the movement of fluid containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of the primary drinking water standards under 40 <i>CFR</i> Part 141, other health based standards, or may otherwise adversely affect the health of persons. This prohibition applies to well construction, operation, maintenance, conversion, plugging, closure, or any other injection activity.	Class V wells [as defined in 40 <i>CFR</i> § 144.6(e)] used to inject bioamendments, surfactants, or reagents— <b>relevant and appropriate.</b>	40 <i>CFR</i> § 144.82(a)(1)		Ü	
	Wells must be closed in a manner that complies with the above prohibition of fluid movement. Also, any soil, gravel, sludge, liquids, or other materials removed from or adjacent to the well must be disposed or otherwise managed in accordance with substantive applicable Federal, State, and local regulations and requirements.		40 <i>CFR</i> § 144.82(b)		Ü	Ü
Management of PCB waste	Any person storing or disposing of PCB waste must do so in accordance with 40 <i>CFR</i> § 761, Subpart D.	Storage or disposal of waste containing PCBs at concentrations $\geq$ 50 ppm— <b>applicable.</b>	40 <i>CFR</i> § 761.50(a)	Ü	Ü	Ü
	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found.	Cleanup and disposal of PCB remediation waste as defined in 40 <i>CFR</i> § 761.3— <b>applicable.</b>	40 <i>CFR</i> § 761.61	Ü	Ü	Ü
Management of PCB/Radioactive waste	Any person storing such waste must do so taking into account both its PCB concentration and radioactive properties, except as provided in 40 <i>CFR</i> § 761.65(a)(1), (b)(1)(ii) and (c)(6)(i).	Generation of PCB/radioactive waste with $\geq$ 50 ppm PCBs for storage— <b>applicable.</b>	40 <i>CFR</i> § 761.50(b)(7)(i)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	<p>Any person disposing of such waste must do so taking into account both its PCB concentration and its radioactive properties.</p> <p>If, taking into account only the properties of the PCBs in the waste (and not the radioactive properties of the waste), the waste meets the requirements for disposal in a facility permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill (e.g., PCB bulk-product waste under 40 CFR § 761.62(b)(1)); then the person may dispose of PCB/radioactive waste, without regard to the PCBs, based on its radioactive properties in accordance with applicable requirements for the radioactive component of the waste.</p>	<p>Generation of PCB/radioactive waste with <math>\geq 50</math> ppm PCBs for disposal <b>not applicable.</b></p>	<p>40 CFR § 761.50(b)(7)(ii)</p>	Ü	Ü	Ü
<b>Waste Characterization</b>						
Characterization of solid waste	<p>Must determine if solid waste is excluded from regulation under 40 CFR § 261.4.</p> <p>Must determine if waste is listed as a hazardous waste in subpart D of 40 CFR Part 261.</p> <p>Must determine whether the waste is characteristic waste (identified in subpart C of 40 CFR Part 261) by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.</p> <p>Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.</p>	<p>Generation of solid waste as defined in 40 CFR § 261.2—<b>applicable.</b></p> <p>Generation of solid waste which is not excluded under 40 CFR § 261.4—<b>applicable.</b></p> <p>Generation of solid waste that is not listed in subpart D of 40 CFR Part 261 and not excluded under 40 CFR § 261.4—<b>applicable.</b></p> <p>Generation of solid waste which is determined to be hazardous waste—<b>applicable.</b></p>	<p>40 CFR § 262.11(a) 401 KAR 32:010 § 2</p> <p>40 CFR § 262.11(b) 401 KAR 32:010 § 2</p> <p>40 CFR § 262.11(c) 401 KAR 32:010 § 2</p> <p>40 CFR § 262.11(d) 401 KAR 32:010 § 2</p>	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Characterization of hazardous waste	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 <i>CFR</i> §§ 264 and 268.	Generation of RCRA-hazardous waste for storage, treatment or disposal— <b>applicable</b> .	40 <i>CFR</i> § 264.13(a)(1) 401 <i>KAR</i> 34:020 § 4	ü	ü	ü
Characterization of industrial wastewater	Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act, as amended, are not solid wastes for the purpose of hazardous waste management. [Comment: This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected, stored or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.] NOTE: For purpose of this exclusion, the CERCLA on-site treatment system for extracted VOCs and groundwater will be considered equivalent to a wastewater treatment unit and the point source discharges subject to regulation under CWA Section 402, provided the effluent meets all identified CWA ARARs.	Generation of industrial wastewater for treatment and discharge into surface water <sup>2/4</sup> <b>applicable</b> .	40 <i>CFR</i> § 261.4(a)(2) 401 <i>KAR</i> 31:010 § 4			
Determinations for management of hazardous waste	Must determine each EPA Hazardous Waste Number (Waste Code) to determine the applicable treatment standards under 40 <i>CFR</i> § 268.40 <i>et seq.</i> <i>Note:</i> This determination may be made concurrently with the hazardous waste determination required in 40 <i>CFR</i> § 262.11.	Generation of hazardous waste— <b>applicable</b> .	40 <i>CFR</i> § 268.9(a) 401 <i>KAR</i> 37:010 § 8	ü	ü	ü



Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	Must determine the underlying hazardous constituents [as defined in 40 <i>CFR</i> § 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non-wastewaters treated by CMBST, RORGs, or POLYM of Section 268.42 Table 1) for storage, treatment, or disposal— <b>applicable</b> .	40 <i>CFR</i> § 268.9(a) 401 <i>KAR</i> 37:010 § 8	Ü	Ü	Ü
	Must determine if the hazardous waste meets the treatment standards in 40 <i>CFR</i> §§ 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. <i>Note:</i> This determination can be made concurrently with the hazardous waste determination required in 40 <i>CFR</i> § 262.11.	Generation of hazardous waste— <b>applicable</b> .	40 <i>CFR</i> § 268.7(a) 401 <i>KAR</i> 37:010 § 7	Ü	Ü	Ü
Characterization of LLW	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility.	Generation of LLW for storage and disposal at a DOE facility— <b>TBC</b> .	DOE M 435.1-1(IV)(I)	Ü	Ü	Ü
	Characterization data shall, at a minimum, include the following information relevant to the management of the waste:		DOE M 435.1-1(IV)(I)(2)	Ü	Ü	Ü
	• Physical and chemical characteristics;		DOE M 435.1-1(IV)(I)(2)(a)	Ü	Ü	Ü
	• Volume, including the waste and any stabilization or absorbent media;		DOE M 435.1-1(IV)(I)(2)(b)	Ü	Ü	Ü
	• Weight of the container and contents;		DOE M 435.1-1(IV)(I)(2)(c)	Ü	Ü	Ü
	• Identities, activities, and concentration of major radionuclides;		DOE M 435.1-1(IV)(I)(2)(d)	Ü	Ü	Ü
	• Characterization date;		DOE M 435.1-1(IV)(I)(2)(e)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
<i>Waste Storage</i>						
	<ul style="list-style-type: none"> <li>Generating source; and</li> <li>Any other information that may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives.</li> </ul>		DOE M 435.1-1(IV)(D)(2)(f)	Ü	Ü	Ü
	<ul style="list-style-type: none"> <li>Any other information that may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives.</li> </ul>		DOE M 435.1-1(IV)(D)(2)(g)	Ü	Ü	Ü
Temporary on-site storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that	Accumulation of RCRA hazardous waste on-site as defined in 40 CFR § 260.10— <b>applicable.</b>	40 CFR § 262.34(a) 401 KAR 32:030 § 5	Ü	Ü	Ü
	<ul style="list-style-type: none"> <li>Waste is placed in containers that comply with 40 CFR § 265.171-173;</li> </ul>		40 CFR § 262.34(a)(1)(i) 401 KAR 32:030 § 5	Ü	Ü	Ü
	<ul style="list-style-type: none"> <li>The date upon which accumulation begins is clearly marked and visible for inspection on each container; and</li> </ul>		40 CFR § 262.34(a)(2) 401 KAR 32:030 § 5	Ü	Ü	Ü
	<ul style="list-style-type: none"> <li>Container is marked with the words “hazardous waste.”</li> </ul>		40 CFR § 262.34(a)(3) 401 KAR 32:030 § 5	Ü	Ü	Ü
	Container may be marked with other words that identify the contents.	Accumulation of 55 gal or less of RCRA hazardous waste or one quart of acutely hazardous waste listed in 261.33(e) at or near any point of generation— <b>applicable.</b>	40 CFR § 262.34(c)(1) 401 KAR 32:030 § 5	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Use and management of containers holding hazardous waste	If container is not in good condition or if it begins to leak, must transfer waste into container in good condition.  Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired.	Storage of RCRA hazardous waste in containers— <b>applicable</b> .	40 <i>CFR</i> § 265.171 401 <i>KAR</i> 35:180 § 2	ü	ü	ü
	Keep containers closed during storage, except to add/remove waste.		40 <i>CFR</i> § 265.172 401 <i>KAR</i> 35:180 § 3	ü	ü	ü
	Open, handle and store containers in a manner that will not cause containers to rupture or leak.		40 <i>CFR</i> § 265.173(a) 401 <i>KAR</i> 35:180 § 4	ü	ü	ü
	Area must have a containment system designed and operated in accordance with 40 <i>CFR</i> § 264.175(b).	Storage of RCRA hazardous waste in containers with free liquids— <b>applicable</b> .	40 <i>CFR</i> § 265.173(b) 401 <i>KAR</i> 35:180 § 4	ü	ü	ü
Storage of hazardous waste in container area	<ul style="list-style-type: none"> <li>Area must be sloped or otherwise designed and operated to drain liquid from precipitation, or</li> <li>Containers must be elevated or otherwise protected from contact with accumulated liquid.</li> </ul>	Storage of RCRA hazardous waste in containers that do not contain free liquids (other than F020, F021, F022, F023, F026, and F027)— <b>applicable</b> .	40 <i>CFR</i> § 264.175(a) 401 <i>KAR</i> 35:180 § 4	ü	ü	ü
Storage of PCB waste and/or PCB/radioactive waste in a RCRA-regulated container storage area	Does not have to meet storage unit requirements in 40 <i>CFR</i> § 761.65(b)(1) provided unit.	Storage of PCBs and PCB Items at concentrations ≥ 50ppm designated for disposal— <b>applicable</b> .	40 <i>CFR</i> § 761.65(b)(2)	ü	ü	ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	<ul style="list-style-type: none"> <li>Is permitted by EPA under RCRA § 3004 to manage hazardous waste in containers and spills of PCBs cleaned up in accordance with Subpart G of 40 <i>CFR</i> § 761;</li> <li>Qualifies for interim status under RCRA § 3005 to manage hazardous waste in containers and spills of PCBs cleaned up in accordance with Subpart G of 40 <i>CFR</i> § 761; or</li> <li>Is permitted by an authorized state under RCRA § 3006 to manage hazardous waste in containers and spills of PCBs cleaned up in accordance with Subpart G of 40 <i>CFR</i> § 761.</li> </ul>		40 <i>CFR</i> § 761.65(b)(2)(i)	Ü	Ü	Ü
	<p>NOTE: For purpose of this exclusion, CERCLA remediation waste, which is also considered PCB waste, can be stored on-site provided the area meets all of the identified RCRA container storage ARARs and spills of PCBs cleaned up in accordance with Subpart G of 40 <i>CFR</i> § 761.</p>					
Storage of PCB waste and/or PCB/radioactive waste in non-RCRA regulated unit	<p>Except as provided in 40 <i>CFR</i> § 761.65 (b)(2), (c)(1), (c)(7), (c)(9), and (c)(10), after July 1, 1978, owners or operators of any facilities used for the storage of PCBs and PCB Items designated for disposal shall comply with the storage unit requirements in 40 <i>CFR</i> § 761.65(b)(1).</p> <p>Storage facility shall meet the following criteria:</p> <ul style="list-style-type: none"> <li>Adequate roof and walls to prevent rainwater from reaching stored PCBs and PCB items;</li> </ul>	Storage of PCBs and PCB Items at concentrations $\geq$ 50ppm designated for disposal $\frac{3}{4}$ applicable.	40 <i>CFR</i> § 761.65(b)	Ü	Ü	Ü
			40 <i>CFR</i> § 761.65(b)(1) 40 <i>CFR</i> § 761.65(b)(1)(i)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	<ul style="list-style-type: none"> <li>Adequate floor that has continuous curbing with a minimum 6-inch high curb. Floor and curb must provide a containment volume equal to at least two times the internal volume of the largest PCB article or container or 25% of the internal volume of all articles or containers stored there, whichever is greater. <i>Note:</i> 6 inch minimum curbing not required for area storing PCB/radioactive waste;</li> <li>No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from curbed area;</li> <li>Floors and curbing constructed of Portland cement, concrete, or a continuous, smooth, non-porous surface that prevents or minimizes penetration of PCBs; and</li> <li>Not located at a site that is below the 100-year flood water elevation.</li> </ul>		40 <i>CFR</i> § 761.65(b)(1)(ii)	Ü	Ü	Ü
	<ul style="list-style-type: none"> <li>Storage area must be properly marked as required by 40 <i>CFR</i> § 761.40(a)(10).</li> </ul>		40 <i>CFR</i> § 761.65(b)(1)(v)	Ü	Ü	Ü
Risk-based storage of PCB remediation waste	<ul style="list-style-type: none"> <li>May store PCB remediation waste in a manner other than prescribed in 40 <i>CFR</i> § 761.65(b) if approved in writing from EPA provided the method will not pose an unreasonable risk of injury to human health or the environment.</li> <li><i>NOTE:</i> EPA approval of alternative storage method will be obtained by approval of the FFA CERCLA document.</li> </ul>	Storage of waste containing PCBs in a manner other than prescribed in 40 <i>CFR</i> § 761.65(b) (see above) <b>¾ applicable.</b>	40 <i>CFR</i> § 761.61(c)	Ü	Ü	Ü
Temporary storage of PCB waste (e.g., PPE, rags) in a container(s)	Container(s) shall be marked as illustrated in 40 <i>CFR</i> § 761.45(a).	Storage of PCBs and PCB items at concentrations ≥ 50ppm in containers for disposal— <b>applicable.</b>	40 <i>CFR</i> § 761.40(a)(1)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	Storage area must be properly marked as required by 40 <i>CFR</i> § 761.40(a)(10).		40 <i>CFR</i> § 761.65(c)(3)	Ü	Ü	Ü
	Any leaking PCB Items and their contents shall be transferred immediately to a properly marked nonleaking container(s).		40 <i>CFR</i> § 761.65(c)(5)	Ü	Ü	Ü
	Except as provided in 40 <i>CFR</i> § 761.65(c)(6)(i) and (c)(6)(ii), container(s) shall be in accordance with requirements set forth in DOT HMR at 49 <i>CFR</i> §§ 171-180.		40 <i>CFR</i> § 761.65(c)(6)	Ü	Ü	Ü
Staging of LLW	Shall be for the purpose of the accumulation of such quantities of wastes necessary to facilitate transportation, treatment, and disposal.	Staging of LLW at a DOE facility— <b>TBC</b> .	DOE M 435.1-1 (IV)(N)(7)	Ü	Ü	Ü
Temporary storage of LLW	Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water.	Temporary storage of LLW at a DOE facility— <b>TBC</b> .	DOE M 435.1-1 (IV)(N)(1)	Ü	Ü	Ü
	Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage.		DOE M 435.1-1 (IV)(N)(3)	Ü	Ü	Ü
	Shall be managed to identify and segregate LLW from mixed waste.		DOE M 435.1-1 (IV)(N)(6)	Ü	Ü	Ü
Packaging of LLW for storage	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container.	Storage of LLW in containers at a DOE facility— <b>TBC</b> .	DOE M 435.1-1 (IV)(L)(1)(a)	Ü	Ü	Ü
	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container.		DOE M 435.1-1 (IV)(L)(1)(b)	Ü	Ü	Ü
	Containers shall be marked such that their contents can be identified.		DOE M 435.1-1 (IV)(L)(1)(c)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Packaging of LLW for off-site disposal	Waste shall not be packaged for disposal in a cardboard or fiberboard box.	Packaging of LLW for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(b)	Ü	Ü	Ü
	Liquid waste shall be solidified or packaged in sufficient absorbent material to absorb twice the volume of the liquid.	Preparation of liquid LLW for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(c)	Ü	Ü	Ü
	Solid waste containing liquid shall contain as little free-standing and noncorrosive liquid as is reasonably achievable. The liquid shall not exceed one (1) percent of the volume.	Preparation of solid LLW containing liquid for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(d)	Ü	Ü	Ü
	Waste shall not be readily capable of <ul style="list-style-type: none"> <li>• Detonation;</li> <li>• Explosive decomposition or reaction at normal pressures and temperatures; or</li> <li>• Explosive reaction with water.</li> </ul>	Packaging of LLW for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(e)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	Waste shall not contain, or be capable of generating, quantities of toxic gases, vapors, or fumes harmful to a person transporting, handling, or disposing of the waste.	Packaging of LLW for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(f)	ü	ü	ü
	Waste shall not be pyrophoric.	Packaging of pyrophoric LLW for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility— <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.56 902 <i>KAR</i> 100:021 § 7 (1)(g)	ü	ü	ü
Labeling of LLW packages	Each package of waste shall be clearly labeled to identify if it is Class A, Class B, or Class C waste, in accordance with 10 <i>CFR</i> § 61.55 or Agreement State waste classification requirements.	Preparation for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility <sup>3/4</sup> <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.57 902 <i>KAR</i> 100:021 § 8	ü	ü	ü
<b>Waste Treatment and Disposal</b>						
Transport or conveyance of collected RCRA wastewater to a WWTU located on the facility	Any dedicated tank systems, conveyance systems, and ancillary equipment used to treat, store or convey wastewater to an on-site KPDES-permitted wastewater treatment facility are exempt from the requirements of RCRA Subtitle C standards. <i>NOTE:</i> For purposes of this exclusion, any dedicated tank systems, conveyance systems, and ancillary equipment used to treat, store or convey CERCLA remediation wastewater to a CERCLA on-site wastewater treatment unit that meets all of the identified CWA ARARs for point source discharges from such a facility, are exempt from the requirements of RCRA Subtitle C standards.	On-site wastewater treatment units (as defined in 40 <i>CFR</i> § 260.10) subject to regulation under § 402 or § 307(b) of the CWA (i.e., KPDES-permitted) that manages hazardous wastewaters <b>¾ applicable.</b>	40 <i>CFR</i> § 264.1(g)(6) 401 <i>KAR</i> 34:010 § 1		ü*	



Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Release of property with residual radioactive material to an off-site commercial facility	Prior to being released, property shall be surveyed to determine whether both removable and total surface contamination (including contamination present on and under any coating) are in compliance with the levels given in Figure IV-1 of DOE O 5400.5 and the contamination has been subjected to the ALARA process.	Generation of DOE materials and equipment with surface residual radioactive contamination— <b>TBC</b> .	DOE O 5400.5 (II)(5)(c)(1) and 5400.5(IV)(4)(d)	ü	ü	ü
	Material that has been radioactively contaminated in depth may be released if criteria and survey techniques are approved by DOE EH-1.	Generation of DOE materials and equipment that are volumetrically contaminated with radionuclides— <b>TBC</b> .	DOE O 5400.5 (II)(5)(c)(6)	ü	ü	ü
<b>Discharge of Wastewater from Groundwater Treatment System</b>						
General duty to mitigate for discharge of wastewater from groundwater treatment system	Take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of effluent standards which has a reasonable likelihood of adversely affecting human health or the environment.	Discharge of pollutants to surface waters— <b>applicable</b> .	401 KAR 5:065 § 2(1) and 40 CFR § 122.41(d)		ü*	
Operation and maintenance of treatment system	Properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve compliance with the effluent standards. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures.	Discharge of pollutants to surface waters— <b>applicable</b> .	401 KAR 5:065 § 2(1) and 40 CFR § 122.41(e)		ü*	
Criteria for discharge of wastewater with radionuclides into surface water	To prevent the buildup of radionuclide concentrations in sediments, liquid process waste streams containing radioactive material in the form of settleable solids may be released to natural waterways if the concentration of radioactive material in the solids present in the waste stream does not exceed 5 pCi (0.2 Bq) per gram above background level, of settleable solids for alpha-emitting radionuclides or 50 pCi (2 Bq) per gram above background level, of settleable solids for beta gamma-emitting radionuclides.	Discharge of radioactive concentrations in sediments to surface water from a DOE facility <sup>2/4</sup> <b>TBC</b> .	DOE O 5400.5 II(3)(a)(4)		ü*	

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Technology-based treatment requirements for wastewater discharge	<p>To protect native animal aquatic organisms, the absorbed dose to these organisms shall not exceed 1 rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways.</p> <p>To the extent that EPA promulgated effluent limitations are inapplicable, shall develop on a case-by-case Best Professional Judgment (BPJ) basis under § 402(a)(1)(B) of the CWA, technology based effluent limitations by applying the factors listed in 40 <i>CFR</i> § 125.3(d) and shall consider:</p> <ul style="list-style-type: none"> <li>The appropriate technology for this category or class of point sources, based upon all available information; and</li> <li>Any unique factors relating to the discharger.</li> </ul>	Discharge of pollutants to surface waters from other than a POTW— <b>applicable.</b>	DOE O 5400.5 II(3)(a)(5)		Ü*	
Water quality-based effluent limits for wastewater discharge	<p>Must develop water quality based effluent limits that ensure that:</p> <ul style="list-style-type: none"> <li>The level of water quality to be achieved by limits on point source(s) established under this paragraph is derived from, and complies with all applicable water quality standards; and</li> <li>Effluent limits developed to protect narrative or numeric water quality criteria are consistent with the assumptions and any available waste load allocation for the discharge prepared by the State and approved by EPA pursuant to 40 <i>CFR</i> § 130.7.</li> </ul>	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a State water quality standard established under § 303 of the CWA— <b>applicable.</b>	40 <i>CFR</i> § 122.44(d)(1)(vii)		Ü*	
	<p>Must attain or maintain a specified water quality through water quality related effluent limits established under § 302 of the CWA.</p>	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a State water quality standard— <b>applicable.</b>	40 <i>CFR</i> § 122.44(d)(2)		Ü*	

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	The numeric water quality criteria for fish consumption specified in Table 1 of 401 KAR 10:031 Section 6(1) provides allowable instream concentrations of pollutants that may be found in surface waters or discharged into surface waters.		401 KAR 10:031 § 6(1)		Ü*	
Monitoring requirements for groundwater treatment system discharges	In addition to 40 CFR § 122.48(a) and (b) and to assure compliance with effluent limitations, one must monitor, as provided in subsections (i) thru (iv) of 122.44(i)(1). <i>NOTE:</i> Monitoring parameters, including frequency of sampling, will be developed as part of the CERCLA process and included in a Remedial Design, RAWP, or other appropriate FFA CERCLA document.	Discharge of pollutants to surface waters— <b>applicable.</b>	40 CFR § 122.44(i)(1) 401 KAR § 5:065 2(4)		Ü*	
	All effluent limitations, standards and prohibitions shall be established for each outfall or discharge point, except as provided under § 122.44(k).		40 CFR § 122.45(a) 401 KAR § 5:065 2(5)		Ü*	
	All effluent limitations, standards and prohibitions, including those necessary to achieve water quality standards, shall unless impracticable be stated as: • Maximum daily and average monthly discharge limitations for all discharges.	Continuous discharge of pollutants to surface waters— <b>applicable.</b>	40 CFR § 122.45(d)(1) 401 KAR § 5:065 2(5)		Ü*	
Effluent limits for radionuclides in wastewater	Shall not exceed the limits for radionuclides listed on Table II—Effluent Limitations.	Discharge of wastewater with radionuclides from an NRC Agreement State licensed facility into surface waters <sup>3/4</sup> <b>relevant and appropriate.</b>	902 KAR 100:019 § 44 (7)(a)		Ü*	

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
General standards for process vents used in treatment of VOC contaminated groundwater	<p>Select and meet the requirements under one of the options specified below:</p> <ul style="list-style-type: none"> <li>Control HAP emissions from the affected process vents according to the applicable standards specified in §§ 63.7890 through 63.7893.</li> <li>Determine for the remediation material treated or managed by the process vented through the affected process vents that the average total volatile organic hazardous air pollutant (VOHAP) concentration, as defined in § 63.7957, of this material is less than 10 (ppmw). Determination of VOHAP concentration will be made using procedures specified in § 63.7943.</li> <li>Control HAP emissions from affected process vents subject to another subpart under 40 <i>CFR</i> Part 61 or 40 <i>CFR</i> art 63 in compliance with the standards specified in the applicable subpart.</li> </ul>	<p>Process vents as defined in 40 <i>CFR</i> § 63.7957 used in site remediation of media (e.g., soil and groundwater) that could emit hazardous air pollutants (HAP) listed in Table 1 of Subpart GGGGG of Part 63 and vent stream flow exceeds the rate in 40 <i>CFR</i> § 63.7885(c)(1)—<b>relevant and appropriate.</b></p>	<p>40 <i>CFR</i> § 63.7885(b) 401 KAR 63:002, §§ 1 and 2, except for 40 <i>CFR</i> § 63.72 as incorporated in § 2(3)</p>		Ü*	

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Emission limitations for process vents used in treatment of VOC contaminated groundwater	<p>Meet the requirements under one of the options specified below:</p> <ul style="list-style-type: none"> <li>Reduce from all affected process vents the total emissions of the HAP to a level less than 1.4 kilograms per hour (kg/hr) and 2.8 Mg/yr (3.0 pounds per hour (lb/hr) and 3.1 tpy);</li> <li>Reduce from all affected process vents the emissions of total organic compounds (TOC) (minus methane and ethane) to a level below 1.4 kg/hr and 2.8 Mg/yr (3.0 lb/hr and 3.1 tpy);</li> <li>Reduce from all affected process vents the total emissions of the HAP by 95 percent by weight or more; or</li> <li>Reduce from all affected process vents the emissions of TOC (minus methane and ethane) by 95 percent by weight or more.</li> </ul> <p><i>NOTE: These emission limits are for the remediation activities conducted at the PGDP by the DOE.</i></p>	<p>Process vents as defined in 40 <i>CFR</i> § 63.7957 used in site remediation of media (e.g., soil and groundwater) that could emit hazardous air pollutants (HAP) listed in Table 1 of Subpart GGGG of Part 63 and vent stream flow exceeds the rate in 40 <i>CFR</i> § 63.7885(c)(1)—<b>relevant and appropriate.</b></p>	<p>40 <i>CFR</i> § 63.7890(b)(1)-(4) 401 KAR 63:002, §§ 1 and 2, except for 40 <i>CFR</i> § 63.72 as incorporated in § 2(3)</p>		Ü*	
Standards for closed vent systems and control devices used in treatment of VOC contaminated groundwater	<p>For each closed vent system and control device you use to comply with the requirements above, you must meet the operating limit requirements and work practice standards in Sec. 63.7925(d) through (j) that apply to the closed vent system and control device.</p> <p><i>NOTE:</i> EPA approval to use alternate work practices under paragraph (j) in 40 <i>CFR</i> § 63.7925 will be obtained in FFA CERCLA document (e.g., Remedial Design).</p>	<p>Closed vent system and control devices as defined in 40 <i>CFR</i> § 63.7957 that are used to comply with § 63.7890(b)—<b>relevant and appropriate.</b></p>	<p>40 <i>CFR</i> § 63.7890(c)</p>		Ü*	
Monitoring of closed vent systems and control devices used in treatment of VOC contaminated groundwater	<p>Must monitor and inspect the closed vent system and control device according to the requirements in 40 <i>CFR</i> § 63.7927 that apply to the affected source.</p> <p><i>NOTE:</i> Monitoring program will be developed as part of the CERCLA process and included in a Remedial Design or other appropriate FFA CERCLA document.</p>	<p>Closed vent system and control devices as defined in 40 <i>CFR</i> § 63.7957 that are used to comply with § 63.7890(b)—<b>relevant and appropriate.</b></p>	<p>40 <i>CFR</i> § 63.7892</p>		Ü*	

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility.	Treatment of LLW for disposal at a LLW disposal facility— <b>TBC</b> .	DOE M 435.1-1(IV)(O)	Ü	Ü	Ü
Disposal of prohibited RCRA hazardous waste in a land-based unit	May be land disposed if it meets the requirements in the table “Treatment Standards for Hazardous Waste” at 40 <i>CFR</i> § 268.40 before land disposal.	Land disposal, as defined in 40 <i>CFR</i> § 268.2, of prohibited RCRA waste— <b>applicable</b> .	40 <i>CFR</i> § 268.40(a) 401 KAR 37:040 § 2	Ü	Ü	Ü
	All underlying hazardous constituents [as defined in 40 <i>CFR</i> § 268.2(i)] must meet the Universal Treatment Standards, found in 40 <i>CFR</i> § 268.48 Table UTS prior to land disposal.	Land disposal of restricted RCRA characteristic wastes (D001-D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well— <b>applicable</b> .	40 <i>CFR</i> § 268.40(e) 401 KAR 37:040 § 2	Ü	Ü	Ü
	Must be treated according to the alternative treatment standards of 40 <i>CFR</i> § 268.49(c) or according to the UTSs specified in 40 <i>CFR</i> § 268.48 applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal.	Land disposal, as defined in 40 <i>CFR</i> § 268.2, of restricted hazardous soils— <b>applicable</b> .	40 <i>CFR</i> § 268.49(b) 401 KAR 37:040 § 10	Ü	Ü	Ü
Disposal of RCRA hazardous debris in a land-based unit	Must be treated prior to land disposal as provided in 40 <i>CFR</i> § 268.45(a)(1)-(5) unless EPA determines under 40 <i>CFR</i> § 261.3(f)(2) that the debris no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard provided in 40 <i>CFR</i> § 268.40 for the waste contaminating the debris.	Land disposal, as defined in 40 <i>CFR</i> § 268.2, of RCRA-hazardous debris— <b>applicable</b> .	40 <i>CFR</i> § 268.45(a) 401 KAR 37:040 § 7		Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Disposal of RCRA characteristic wastewaters in an NPDES permitted wastewater treatment unit	<p>Are not prohibited, if the wastes are managed in a treatment system which subsequently discharges to waters of the U.S. pursuant to a permit issued under 402 of the CWA (i.e., NPDES permitted) unless the wastes are subject to a specified method of treatment other than DEACT in 40 <i>CFR</i> § 268.40, or are D003 reactive cyanide.</p> <p>NOTE: For purposes of this exclusion, a CERCLA on-site wastewater treatment unit that meets all of the identified CWA ARARs for point source discharges from such a system, is considered a wastewater treatment system that is NPDES permitted.</p>	Land disposal of hazardous wastewaters that are hazardous only because they exhibit a hazardous characteristic and are not otherwise prohibited under 40 <i>CFR</i> Part 268— <b>applicable</b> .	40 <i>CFR</i> § 268.1(c)(4)(i) 401 KAR 37:010 § 2		Ü*	
Disposal of bulk PCB remediation waste off-site (self-implementing)	<p>May be sent off-site for decontamination or disposal provided the waste either is dewatered on-site or transported off-site in containers meeting the requirements of DOT HMR at 49 <i>CFR</i> Parts 171-180.</p>	Generation of bulk PCB remediation waste (as defined in 40 <i>CFR</i> § 761.3) for off-site disposal— <b>relevant and appropriate</b> .	40 <i>CFR</i> § 761.61(a)(5)(i)(B)	Ü	Ü	Ü
	<p>Must provide written notice including the quantity to be shipped and highest concentration of PCBs [using extraction EPA Method 3500B/3540C or Method 3500B/3550B followed by chemical analysis using Method 8082 in SW-846 or methods validated under 40 <i>CFR</i> § 761.320-26 (Subpart Q)] before the first shipment of waste to each off-site facility where the waste is destined for an area not subject to a TSCA PCB Disposal Approval.</p>	Bulk PCB remediation waste (as defined in 40 <i>CFR</i> § 761.3) destined for an off-site facility not subject to a TSCA PCB Disposal Approval— <b>relevant and appropriate</b> .	40 <i>CFR</i> § 761.61(a)(5)(i)(B)(2)(iv)	Ü	Ü	Ü
	<p>Shall be disposed of in accordance with the provisions for cleanup wastes at 40 <i>CFR</i> § 761.61(a)(5)(v)(A).</p>	Off-site disposal of dewatered bulk PCB remediation waste with a PCB concentration < 50 ppm— <b>relevant and appropriate</b> .	40 <i>CFR</i> § 761.61(a)(5)(i)(B)(2)(ii)	Ü	Ü	Ü





Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	Shall be disposed according to 40 <i>CFR</i> § 761.60(a) or (e), or decontaminate in accordance with 40 <i>CFR</i> § 761.79.	Disposal of liquid PCB remediation waste— <b>applicable.</b>	40 <i>CFR</i> § 761.61(b)(1)	Ü	Ü	Ü
Risk-based disposal of PCB remediation waste	May dispose of in a manner other than prescribed in 40 <i>CFR</i> § 761.61(a) or (b) if approved in writing from EPA and method will not pose an unreasonable risk of injury to [sic] human health or the environment. <i>NOTE:</i> EPA approval of alternative disposal method will be obtained by approval of the FFA CERCLA document.	Disposal of PCB remediation waste— <b>applicable.</b>	40 <i>CFR</i> § 761.61(c)	Ü	Ü	Ü
Disposal of PCB cleanup wastes (e.g., PPE, rags, non-liquid cleaning materials) (self-implementing option)	Shall be disposed of <ul style="list-style-type: none"> <li>In a municipal solid waste facility under 40 <i>CFR</i> § 258 or non-municipal, nonhazardous waste subject to 40 <i>CFR</i> § 257.5 thru 257.30;</li> <li>In a RCRA Subtitle C landfill;</li> <li>In a PCB disposal facility; or</li> <li>Through decontamination under 40 <i>CFR</i> § 761.79(b) or (c).</li> </ul>	Generation of non-liquid PCBs during and from the cleanup of PCB remediation waste— <b>relevant and appropriate.</b>	40 <i>CFR</i> § 761.61(a)(5)(v)(A)	Ü	Ü	Ü
Disposal of PCB cleaning solvents, abrasives, and equipment (self-implementing option)	May be reused after decontamination in accordance with 40 <i>CFR</i> § 761.79; or For liquids, disposed in accordance with 40 <i>CFR</i> § 761.60(a).	Generation of PCB wastes from the cleanup of PCB remediation waste— <b>relevant and appropriate.</b>	40 <i>CFR</i> § 761.61(a)(5)(v)(B) 40 <i>CFR</i> § 761.60(b)(1)(i)(B)	Ü	Ü	Ü
Disposal of PCB decontamination waste and residues	Shall be disposed of at their existing PCB concentration unless otherwise specified in 40 <i>CFR</i> § 761.79(g)(1) through (6).	PCB decontamination waste and residues for disposal <sup>4</sup> <b>applicable.</b>	40 <i>CFR</i> § 761.79(g)	Ü	Ü	Ü
Disposal of LLW	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility.	Disposal of LLW at a LLW disposal facility— <b>TBC.</b>	DOE M 435.1-1(IV)(J)(2)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
<i>Decontamination/Cleanup</i>						
Decontamination of movable equipment contaminated by PCBs (self-implementing option)	<p>May decontaminate by</p> <ul style="list-style-type: none"> <li>Swabbing surfaces that have contacted PCBs with a solvent;</li> <li>A double wash/rinse as defined in 40 <i>CFR</i> § 761.360-378; or</li> <li>Another applicable decontamination procedure under 40 <i>CFR</i> § 761.79.</li> </ul>	Movable equipment contaminated by PCB and tools and sampling equipment— <b>applicable</b> .	40 <i>CFR</i> § 761.79(c)(2)	Ü	Ü	Ü
Decontamination of PCB containers (self-implementing option)	Must flush the internal surfaces of the container three times with a solvent containing < 50 ppm PCBs. Each rinse shall use a volume of the flushing solvent equal to approximately 10% of the PCB container capacity.	PCB Container as defined in 40 <i>CFR</i> § 761.3— <b>applicable</b> .	40 <i>CFR</i> § 761.79(c)(1)	Ü	Ü	Ü
Decontamination of PCB contaminated water	For discharge to a treatment works as defined in 40 <i>CFR</i> § 503.9 (aa), or discharge to navigable waters, meet standard of < 3 ppb PCBs; or	Water containing PCBs regulated for disposal— <b>applicable</b> .	40 <i>CFR</i> § 761.79(b)(1)(ii)	Ü	Ü	Ü
	The decontamination standard for water containing PCBs is less than or equal to 0.5 µg/L (i.e., approximately ≤ 0.5 ppb PCBs) for unrestricted use.		40 <i>CFR</i> § 761.79(b)(1)(iii)	Ü	Ü	Ü
<i>Unit Closure</i>						
Closure performance standard for RCRA container storage unit	<p>Must close the facility (e.g., container storage unit) in a manner that:</p> <ul style="list-style-type: none"> <li>Minimizes the need for further maintenance;</li> <li>Controls minimizes or eliminates to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or the atmosphere; and</li> <li>Complies with the closure requirements of this subpart, but not limited to, the requirements of 40 <i>CFR</i> § 264.178 for containers.</li> </ul>	Storage of RCRA hazardous waste in containers <sup>3/4</sup> <b>applicable</b> .	40 <i>CFR</i> § 264.111 401 KAR 34:070 § 2	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Closure of RCRA container storage unit	At closure, all hazardous waste and hazardous waste residues must be removed from the containment system. Remaining containers, liners, bases, and soils containing or contaminated with hazardous waste and hazardous waste residues must be decontaminated or removed. [Comment: At closure, as throughout the operating period, unless the owner or operator can demonstrate in accordance with 40 <i>CFR</i> § 261.3(d) of this chapter that the solid waste removed from the containment system is not a hazardous waste, the owner or operator becomes a generator of hazardous waste and must manage it in accordance with all applicable requirements of parts 262 through 266 of this chapter.]	Storage of RCRA hazardous waste in containers in a unit with a containment system <sup>3/4</sup> <b>applicable</b> .	40 <i>CFR</i> § 264.178 401 <i>KAR</i> 34:180 § 9	Ü	Ü	Ü
Clean closure of TSCA storage facility	A TSCA/RCRA storage facility closed under RCRA is exempt from the TSCA closure requirements of 40 <i>CFR</i> § 761.65(e).	Closure of TSCA/RCRA storage facility— <b>applicable</b> .	40 <i>CFR</i> § 761.65(e)(3)	Ü	Ü	Ü
<b>Waste Transportation</b>						
Transportation of samples (i.e., contaminated soils and wastewaters)	Are not subject to any requirements of 40 <i>CFR</i> Parts 261 through 268 or 270 when: <ul style="list-style-type: none"> <li>• The sample is being transported to a laboratory for the purpose of testing; or</li> <li>• The sample is being transported back to the sample collector after testing.</li> </ul>	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition <sup>3/4</sup> <b>applicable</b> .	40 <i>CFR</i> § 261.4(d)(1)(i) and (ii)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
	<p>In order to qualify for the exemption in paragraphs (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must:</p> <ul style="list-style-type: none"> <li>• Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements.</li> <li>• Assure that the information provided in (1) thru (5) of this section accompanies the sample.</li> <li>• Package the sample so that it does not leak, spill, or vaporize from its packaging.</li> </ul>		<p>40 <i>CFR</i> § 261.4(d)(2)(i)            40 <i>CFR</i> § 261.4(d)(2)(i)(A)            40 <i>CFR</i> § 261.4(d)(2)(i)(B)</p>	Ü	Ü	Ü
Transportation of RCRA hazardous waste on-site	The generator manifesting requirements of 40 <i>CFR</i> §§ 262.20- 262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 <i>CFR</i> § 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way.	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way— <b>applicable.</b>	<p>40 <i>CFR</i> § 262.20(f)            401 <i>KAR</i> 32:020 § 1</p>	Ü	Ü	Ü
Transportation of RCRA hazardous waste off-site	Must comply with the generator requirements of 40 <i>CFR</i> § 262.20- 23 for manifesting, § 262.30 for packaging, § 262.31 for labeling, § 262.32 for marking, § 262.33 for placarding, § 262.40, 262.41(a) for record keeping requirements, and § 262.12 to obtain EPA ID number.	Preparation and initiation of shipment of hazardous waste off-site— <b>applicable.</b>	<p>40 <i>CFR</i> § 262.10(h)            401 <i>KAR</i> 32:010 § 1</p>	Ü	Ü	Ü
Transportation of PCB wastes off-site	Must comply with the manifesting provisions at 40 <i>CFR</i> § 761.207 through 218.	Relinquishment of control over PCB wastes by transporting, or offering for transport— <b>applicable.</b>	<p>40 <i>CFR</i> § 761.207(a)</p>	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Determination of radionuclide concentration	<p>The concentration of a radionuclide may be determined by an indirect method, such as use of a scaling factor which relates the inferred concentration of one (1) radionuclide to another that is measured or radionuclide material accountability if there is reasonable assurance that an indirect method may be correlated with an actual measurement.</p> <p>The concentration of a radionuclide may be averaged over the volume or weight of the waste if the units are expressed as nanocuries per gram.</p>	Preparation for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility <sup>2/4</sup> <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.55 (a)(8) 902 <i>KAR</i> 100:021 § 6(8)(a) and (b)	Ü	Ü	Ü
Labeling of LLW packages	Each package of waste shall be clearly labeled to identify if it is Class A, Class B, or Class C waste, in accordance with 10 <i>CFR</i> § 61.55 or Agreement State waste classification requirements.	Preparation for off-site shipment of LLW to a commercial NRC or Agreement State licensed disposal facility <sup>2/4</sup> <b>relevant and appropriate.</b>	10 <i>CFR</i> § 61.57 902 <i>KAR</i> 100:021 § 8	Ü	Ü	Ü
Transportation of radioactive waste	Shall be packaged and transported in accordance with DOE Order 460.1B and DOE Order 460.2.	Preparation of shipments of radioactive waste— <b>TBC.</b>	DOE M 435.1-1(D)(1)(E)(11)	Ü	Ü	Ü
Transportation of LLW	To the extent practicable, the volume of the waste and the number of the shipments shall be minimized.	Preparation of shipments of LLW— <b>TBC.</b>	DOE M 435.1-1(IV)(L)(2)	Ü	Ü	Ü
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMR at 49 <i>CFR</i> §§ 171- 180 related to marking, labeling, placarding, packaging, emergency response, etc.	Any person who, under contract with a department or agency of the federal government, transports “in commerce,” or causes to be transported or shipped, a hazardous material— <b>applicable.</b>	49 <i>CFR</i> § 171.1(c)	Ü	Ü	Ü

Table B.2. Action-specific ARARs for the Oil Landfarm and the C-720 Northeast and Southeast Sites (Continued)

Action	Requirement	Prerequisite	Citation	Alt 2	Alt 3	Alt 8
Transportation of hazardous materials on-site	Shall comply with 49 CFR Parts 171-174, 177, and 178 or the site- or facility-specific Operations of Field Office approved Transportation Safety Document that describes the methodology and compliance process to meet equivalent safety for any deviation from the Hazardous material Regulations (i.e., <i>Transportation Safety Document for On-Site Transport within the Paducah Gaseous Diffusion Plant</i> , PAD-WD-0661).	Any person who, under contract with the DOE, transports a hazardous material on the DOE facility— <b>TBC</b> .	DOE O 460.1B(4)(b)	Ü	Ü	Ü
Transportation of hazardous materials off-site	Off-site hazardous materials packaging and transfers shall comply with 49 CFR Parts 171-174, 177, and 178 and applicable tribal, State, and local regulations not otherwise preempted by DOT and special requirements for Radioactive Material Packaging.	Preparation of off-site transfers of LLW <sup>3/4</sup> <b>TBC</b> .	DOE O 460.1B(4)(a)	Ü	Ü	Ü

Ü\* = ARAR trigger if steam utilized in soil mixing operations of Alternative 3 due to need to treat extracted vapor and entrained water.

ALARA = as low as reasonably achievable  
 ARAR = applicable or relevant and appropriate requirement  
 BMP = best management practices  
 BPI = best professional judgment  
 CERCLA = Comprehensive Environmental Response, Compensation and Liability Act  
 CFR = Code of Federal Regulations  
 CWA = Clean Water Act  
 DOE = U.S. Department of Energy  
 DOE O = DOE Order  
 DOE M = DOE Manual  
 DOT = U.S. Department of Transportation  
 EDE = effective dose equivalent  
 EPA = U.S. Environmental Protection Agency  
 E.O. = Executive Order  
 HAP = hazardous air pollutant  
 HMR = hazardous material regulations  
 KAR = Kentucky Administrative Regulations

KPDES = Kentucky Pollutant Discharge Elimination System  
 LLW = low-level waste  
 NPDES = Pollutant Discharge Elimination System  
 NRC = Nuclear Regulatory Commission  
 NWP = Nationwide Permit  
 PCB = polychlorinated biphenyl  
 PGDP = Paducah Gaseous Diffusion Plant  
 PPE = personal protective equipment  
 RCRA = Resource Conservation and Recovery Act  
 ROD = Record of Decision  
 TBC = to be considered  
 TSCA = Toxic Substances Control Act  
 UTS = Universal Treatment Standards  
 VOC = volatile organic compounds  
 VOHAP = volatile organic hazardous air pollutant  
 WAC = waste acceptance criteria

**APPENDIX C**

**SAMPLING AND ANALYSIS PLAN ADDENDUM FOR  
CHARACTERIZATION OF VOLATILE ORGANIC COMPOUND  
LEVELS IN THE REGIONAL GRAVEL AQUIFER AT SOLID WASTE  
MANAGEMENT UNITS 211-A AND 211-B**

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## ADDENDUM

### *Addendum to the Remedial Design Work Plan for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Sampling and Analysis Plan, DOE/LX/07-1268&D2/R2/A1*

**Introduction:** This addendum documents how groundwater samples will be collected from the Regional Gravel Aquifer (RGA) upgradient and downgradient of Solid Waste Management Units (SWMUs) 211-A and 211-B at the Paducah Gaseous Diffusion Plant (PGDP). The resulting sampling data will be evaluated, along with existing soil data collected from the Upper Continental Recharge System (UCRS) and uppermost RGA, to determine whether volatile organic compound (VOC) [primarily trichloroethene (TCE)] source levels are significant enough to warrant active remediation, Alternative 8, or if long-term monitoring with interim land use controls (LUCs), Alternative 2, is sufficient.

*Final Characterization Report for Solid Waste Management Units 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-1288&D2, (DOE 2013)* presents the results of a 2012 investigation of the soils in the area of SWMUs 211-A and 211-B down to a depth of 60 to 65 ft, including the upper RGA. Based on evaluation of the TCE levels in the investigation soil borings, the U.S. Department of Energy (DOE) issued a Notification Letter on July 10, 2013, (Blumenfeld 2013) in which DOE documented a reduced volume and mass of TCE present at SWMUs 211-A and 211-B, compared to volume and mass estimates presented in the Record of Decision (ROD) (DOE 2012a). As a result, DOE estimated a shortened time frame for meeting the remedial goals and recommended selection of Alternative 2, long-term monitoring with interim LUCs, as the final remedy for SWMUs 211-A and 211-B.

In a letter dated February 25, 2014, (Tufts 2014) the U.S. Environmental Protection Agency (EPA) noted the following project-related uncertainty:

...sources may be underestimated by sampling only soils which indicate concentrations at discrete points. Groundwater samples reflect cumulative impacts from source areas, and are necessary along with soil samples, for estimating contaminant volume and mass...Additional RGA monitoring wells should be installed at SWMU 211-A and 211-B so that an informed decision regarding the impact of the source areas to groundwater can be determined. This data can be used to refine the mass calculation and also determine source impact to RGA groundwater.

Under the provisions of Section XIX, Additional Work, of the PGDP Federal Facility Agreement (FFA), EPA requested that the work be performed under an amendment to *Remedial Design Work Plan for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2012b).

**Purpose:** Determine the TCE and degradation product levels in the RGA upgradient and downgradient of SWMUs 211-A<sup>1</sup> and 211-B before a remedy selection is made for the SWMUs. The FFA parties have agreed that the following sampling approach will provide a sufficient basis on which to evaluate SWMUs 211-A and 211-B and determine the appropriate remedy:

- Drill and sample and analyze TCE and TCE degradation product<sup>2</sup> levels in groundwater throughout the thickness of the RGA in 6 sample borings to characterize the VOC levels in groundwater upgradient and downgradient of the areas of SWMU 211-A (east and west areas) and SWMU 211-B.

**Boundary:** The physical boundaries are the SWMUs 211-A and 211-B areas, from a depth of 65 ft below ground surface<sup>3</sup> (bgs) to the base of the lower continental deposits (the main geologic member of the RGA), which is approximately 90 to 100 ft bgs. The investigation areas correspond to upgradient and downgradient sides of SWMU 211-A and within SWMU 211-B.<sup>4</sup>

**Number of Borings:** The six direct push technology (DPT) sample borings are shown in Figure C.1. Table C.1 provides the approximate coordinates for the DPT sample borings.

**Drilling Method:** DPT

**Sampling Method:** For the vertical profiling of TCE levels in RGA groundwater, the intent is to sample groundwater at 5-ft depth intervals beginning at a depth of 65 ft bgs and continuing to the base of the lower continental deposits. The following is the sampling approach:

1. Advance a DPT dual-tube sampler to a depth of 65 ft bgs, using a string of DPT inner rods with a bottom drive point within the sampler to keep soils from collecting inside the soil sample system.
2. At 65 ft depth, retract the inner sample rods to allow unimpeded groundwater flow into the string of outer DPT rods.
3. Using a water level probe, measure the depth to water within the string of outer DPT rods and determine the flooded volume of the outer DPT rods left in place.
4. Lower a cleaned purge/sample pump system into the string of outer DPT rods to within 3 ft of the bottom of the DPT rods.

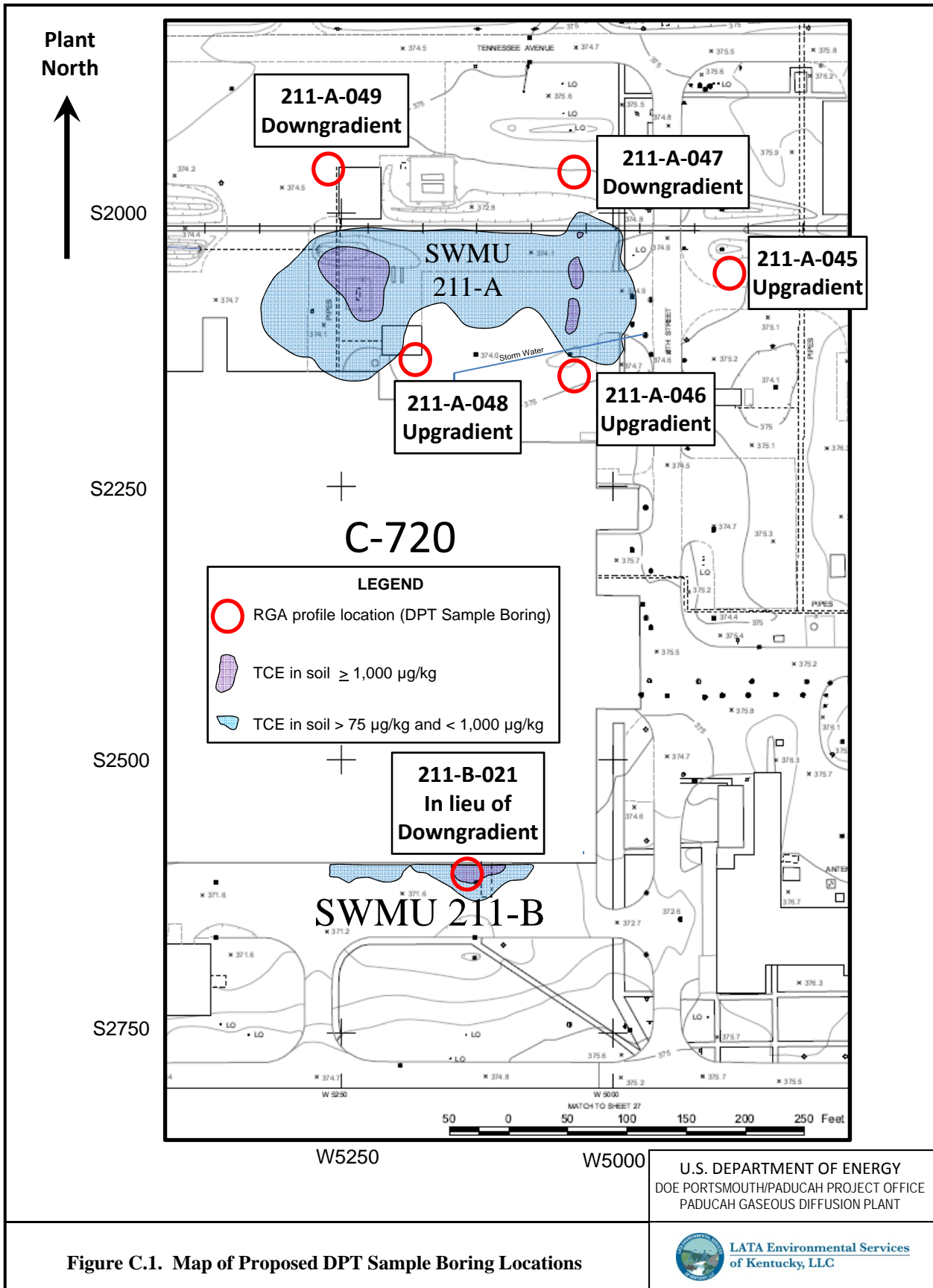
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<sup>1</sup> SWMU 211-A includes discrete east and west areas of higher levels of TCE contamination. For purposes of this addendum, the term “SWMUs” will designate SWMU 211-B and the discrete east and west areas of SWMU 211-A.

<sup>2</sup> For the purposes of this investigation, the analytes of interest are TCE; 1,1-dichloroethene (DCE) (1,1-DCE); *cis*-1,2-DCE; *trans*-1,2-DCE; and vinyl chloride.

<sup>3</sup> Soil samples collected for the 2012 Remedial Design Site Characterization provide results used to characterize VOC levels in soil down to a depth of 65 ft.

<sup>4</sup> Locations downgradient of SWMU 211-B are inaccessible because of the proximity of the C-720 Building. The characterization of the impact of SWMU 211-B on the RGA will be assessed with a DPT sample boring installed within the SWMU 211-B primary area of soil contamination, hereafter referred to as the “downgradient” location.



**Figure C.1. Map of Proposed DPT Sample Boring Locations**

**Table C.1 SWMUs 211-A and 211-B DPT Sample Borings and Monitoring Wells**

Sample Boring	Relationship	Approximate Plant Coordinates	
		East	North
Sample Boring 211-A-045 - East Side of East SWMU 211-A	Upgradient Location of East SWMU 211-A (see Table C.2) <sup>5</sup>	-4890	-2060
Sample Boring 211-A-046 - South Side of East SWMU 211-A	Upgradient Location of East SWMU 211-A (see Table C.2)	-5030	-2145
Sample Boring 211-A-047 - North Side of East SWMU 211-A	Downgradient Location of East SWMU 211-A	-5030	-1955
Sample Boring 211-A-048 - South Side of West SWMU 211-A	Upgradient Location of West SWMU 211-A	-5180	-2135
Sample Boring 211-A-049 - North Side of West SWMU 211-A	Downgradient Location of West SWMU 211-A	-5260	-1955
Sample Boring 211-B-021 - Internal Boring for SWMU 211-B	Beneath/“Downgradient” of SWMU 211-B	-5130	-2600

5. Purge groundwater from inside the string of DPT rods to remove the initial turbid water and develop a natural gravel pack at the bottom of the DPT rods. At a minimum, purge 3 times the determined volume of the flooded DPT rods.
6. After purging the minimum “3 times” volume and once turbidity has visually decreased and stabilized, continue pumping at a rate of 1 liter/minute or less and monitor the water stabilization parameters: specific conductance, pH, and turbidity with a water quality meter.
7. After the purge water quality parameters have stabilized—defined as 3 consecutive measurements taken 3 (or more) minutes apart with less than 10% variance of all 3 parameters—begin the process to collect the water sample by reducing the pumping rate to 300 milliliter/minute (or less)<sup>6</sup> and monitor for further stabilization of the sample water quality using a water quality meter coupled with an in-line flow cell.
8. Monitor for the parameters: specific conductance, pH, turbidity, dissolved oxygen, and temperature; continue pumping from the well until all 5 of the sampling parameters have stabilized. The sample water quality parameters have stabilized when measurements of all 5 of the parameters vary within approximately 10% over the last 2 consecutive measurements that are 3 (or more) minutes apart.
  - If the turbidity is 100 nephelometric turbidity units (NTUs) or less, reduce the sample stream rate to 100 milliliter/minute or less and collect samples for laboratory analysis directly from the effluent stream.
  - If the turbidity is greater than 100 NTUs, reduce the sample stream rate to 100 milliliter/minute or less and direct the sample stream through a clean groundwater sample filter prior to collection of samples for laboratory analysis.
9. Remove the pump system and sound the depth of the open string of outer DPT rods. The sounding tape must use a stainless steel weight. If sediment has accumulated inside the outer DPT rod string, retract the outer DPT rods, as required, for the

<sup>5</sup> Two upgradient sample locations will be evaluated for the East SWMU 211-A area to assess the uncertainty of local RGA flow directions (northerly or westerly). The location that has the higher TCE levels will be used as the upgradient location.

<sup>6</sup> A separate pump system, suitable for low-flow sampling, may be used.

sediments to fall out. Then, replace the inner string of DPT rods with the bottom drive point and advance the DPT dual-tube sample system 5 ft below the previous sample depth.<sup>7</sup>

10. Repeat the above sampling and advancement sequence to the base of the lower continental deposits, as indicated by a change in resistance to advancement of the DPT dual-tube sample system at a depth of 90 to 100 ft.

If a submersible or bladder pumping system is used, decontaminate the pumping system (using procedure PAD-ENM-2702, *Decontamination of Sampling Equipment and Devices*) before each purging/sampling event. If an inertial pumping system is used, clean the outside of the tubing of the inertial pump with deionized water and a clean, moist wipe; flush the interior of the tubing of the inertial pump with soap water, tap water, and analyte-free water, consistent with PAD-ENM-2702, before each depth's purging/sampling event.

### **Quality**

**Assurance:** Groundwater sampling and analysis to determine TCE levels across the thickness of the RGA upgradient and downgradient of the SWMUs were not included in the 2012 investigation of soils in the area of SWMUs 211-A and 211-B. Attachment C1 provides revised tables to the project Quality Assurance Project Plan, documented as Attachment A5 of the *Remedial Design Work Plan for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2012b), to incorporate the groundwater sampling and analysis.

### **Project**

#### **Documentation:**

The results of this additional sampling will be documented in an addendum to *Final Characterization Report for Solid Waste Management Units 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1288&D2 (DOE 2013).

### **Investigation**

#### **Decision Rules:**

The primary intent of the field investigation is to compare dissolved TCE levels in the RGA in associated upgradient and downgradient locations at SWMU 211-A and to compare TCE levels beneath SWMU 211-B to expected upgradient TCE levels (assumed to be less than 10 ppb based upon PGDP process history) to determine the impact of the SWMUs upon RGA groundwater quality. An initial assumption is the downgradient-upgradient comparisons will be depth-discrete.

The following are the general decision rules:

---

<sup>7</sup> If the dual-tube sampling systems meets refusal (is unable to penetrate farther) in the RGA, a continuous string of smaller diameter DPT probe rods will be used to "pre-probe" through the RGA to the next sample depth. Upon completion of "pre-probe" activities, the dual-tube sampling system will be advanced to the next sample depth and sampling will continue. Should DPT prove ineffective at sampling in the RGA, a small-diameter hollow stem auger rig with a center rod/pilot bit system would be used as the drilling method. Sampling would be conducted through the hollow stem augers.

- **IF** dissolved TCE levels in the RGA are substantially<sup>8</sup> higher in the downgradient side of the SWMU,<sup>9</sup> **THEN** the increased dissolved TCE level is a measure of the impact of the SWMU upon RGA groundwater quality.
- **IF** dissolved TCE levels equal or exceed 11,000 µg/L in either the upgradient or downgradient location, **THEN** the sampled groundwater may have come in contact with dense nonaqueous-phase liquid (DNAPL).

## Letter Notification

### Decision Rules:

Once the approved groundwater analyses are available for review, DOE will evaluate the data and prepare a revised Letter Notification, identifying DOE’s recommendation for final remedy selection for SWMUs 211-A and 211-B.

The data from DPT profiling will be evaluated holistically to determine impacts from SWMUs 211-A and 211-B on RGA groundwater quality (Table C.2 identifies interwell comparisons). In general, the following decision rules will be applied to the vertical characterization of RGA groundwater quality, with the exception of the case of a lower RGA DNAPL:

**Table C.2. DPT Sample Boring Comparisons**

<b>SWMU</b>	<b>DPT Borings for Upgradient/Downgradient Comparison</b>
211-A East	Either 211-A-045 or 211-A-046 (whichever has higher TCE) vs 211-A-047
211-A West	211-A-048 vs 211-A-049
211-B	211-B-021 vs assumed background (10 µg/L, or less, TCE)

### SWMU 211-A

The following are the general decision rules to be applied to SWMU 211-A (decisions will be based upon review of all data).

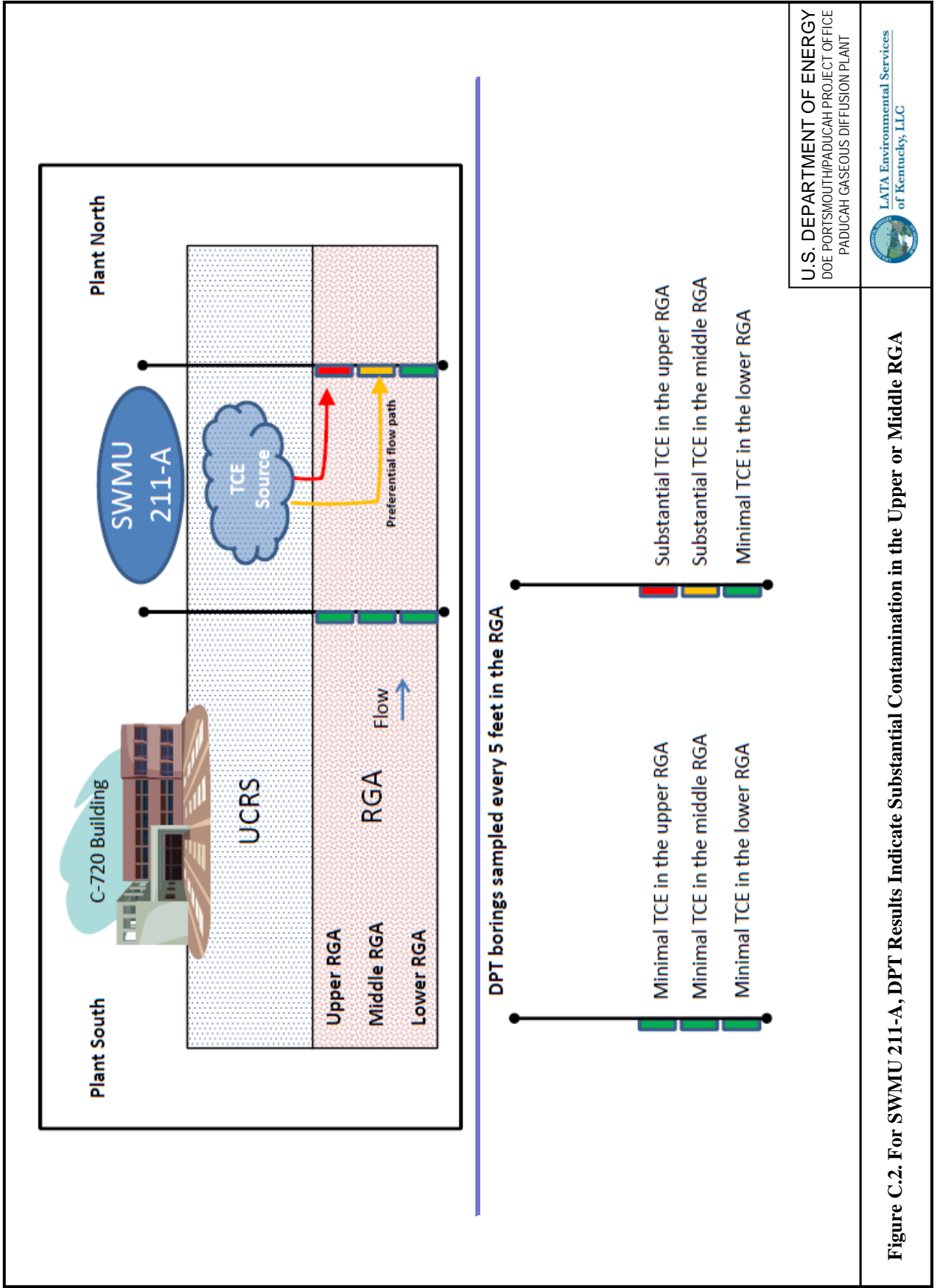
For the case where DPT results indicate substantial contamination in the upper or middle RGA [matches the conceptual site model (CSM) of the ROD] (Figure C.2):

- **IF** the average of downgradient minus upgradient TCE levels is less than approximately 400 ppb,<sup>10</sup> **THEN** the CSM and the predicted TCE mass in the UCRS are confirmed. The remedial action will be implementation of long-term monitoring.
- **IF** the average of downgradient minus upgradient TCE levels are greater than approximately 400 ppb and less than 11,000 ppb, **THEN** the CSM is valid, but the TCE mass in the UCRS is greater than estimated. The remedial action will be implementation of enhanced bioremediation and long-term monitoring.

<sup>8</sup> The term “substantial” is intended to mean a comparatively “significant” or “important” level, in the context of all other sample analyses of this investigation that are related to the SWMU. An absolute value or magnitude should not be inferred.

<sup>9</sup> For SWMU 211-B, located on the south side of C-720 where no upgradient dissolved TCE is suspected, dissolved TCE levels in the DPT samples collected beneath the SWMU will be assumed to represent the “downgradient” impact of the SWMU on the RGA.

<sup>10</sup> The 400 ppb exceeds the expected impact of SWMUs 211-A and 211-B to the RGA.



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**Figure C.2. For SWMU 211-A, DPT Results Indicate Substantial Contamination in the Upper or Middle RGA**

For the case where DPT results indicate substantial contamination in the lower RGA only in both the upgradient and downgradient locations (Figure C.3), an upgradient source is impacting TCE levels beneath the SWMU. The CSM is invalid. The FFA parties must confer to evaluate the impact of the upgradient source.

For the case where DPT results indicate substantial contamination throughout the RGA in both the upgradient and downgradient locations (Figure C.4), an upgradient source is impacting TCE levels beneath the SWMU (both upgradient and downgradient DPTs have substantial TCE levels). The FFA parties must confer to evaluate the impact of the upgradient source. If a SWMU 211-A remedial action is considered beneficial, the following decision rules apply in the upper or middle RGA (in the zone of higher TCE):

- **IF** the average of downgradient minus upgradient TCE levels is less than approximately 400 ppb, **THEN** the CSM and the predicted TCE mass in the UCRS are confirmed. The remedial action will be implementation of long-term monitoring.
- **IF** the average of downgradient minus upgradient TCE levels is greater than approximately 400 ppb and less than 11,000 ppb, **THEN** the CSM is valid, but the TCE mass in the UCRS is greater than estimated. The remedial action will be implementation of enhanced bioremediation and long-term monitoring.

For the case where DPT results indicate substantial contamination throughout the RGA in the downgradient location only, dispersed DNAPL ganglia are present throughout the RGA (only downgradient DPTs have substantial TCE levels). The CSM is invalid. The FFA parties must confer to evaluate the impact of the discovered DNAPL.

### **SWMU 211-B**

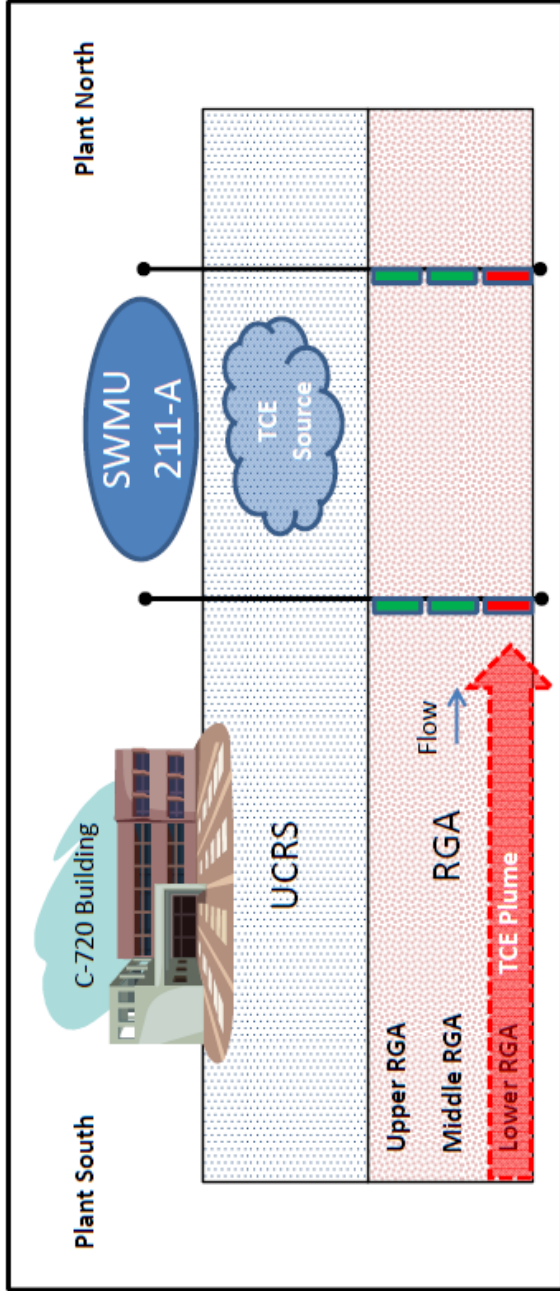
Decision rules for SWMU 211-B are similar to those above but modified to account for the single DPT. The following decision rules will be applied to SWMU 211-B (decisions will be based upon review of all data).

For the case where DPT results indicate substantial contamination in the upper or middle RGA (matches CSM of ROD) (Figure C.5):

- **IF** the average of TCE levels beneath SWMU 211-B is less than approximately 400 ppb, **THEN** the CSM and the predicted TCE mass in the UCRS is confirmed. The remedial action will be implementation of long-term monitoring.
- **IF** the average of TCE levels beneath SWMU 211-B is greater than approximately 400 ppb and less than 11,000 ppb, **THEN** the CSM is valid, but the TCE mass in the UCRS is greater than estimated. The remedial action will be implementation of enhanced bioremediation and long-term monitoring.

For the case where DPT results indicate substantial contamination in the lower RGA only (Figure C.6), an upgradient source is impacting TCE levels beneath the SWMU. The CSM may be invalid. The FFA parties must confer to evaluate the impact of the upgradient source.





DPT borings sampled every 5 feet in the RGA



Minimal TCE in the upper RGA

Minimal TCE in the middle RGA

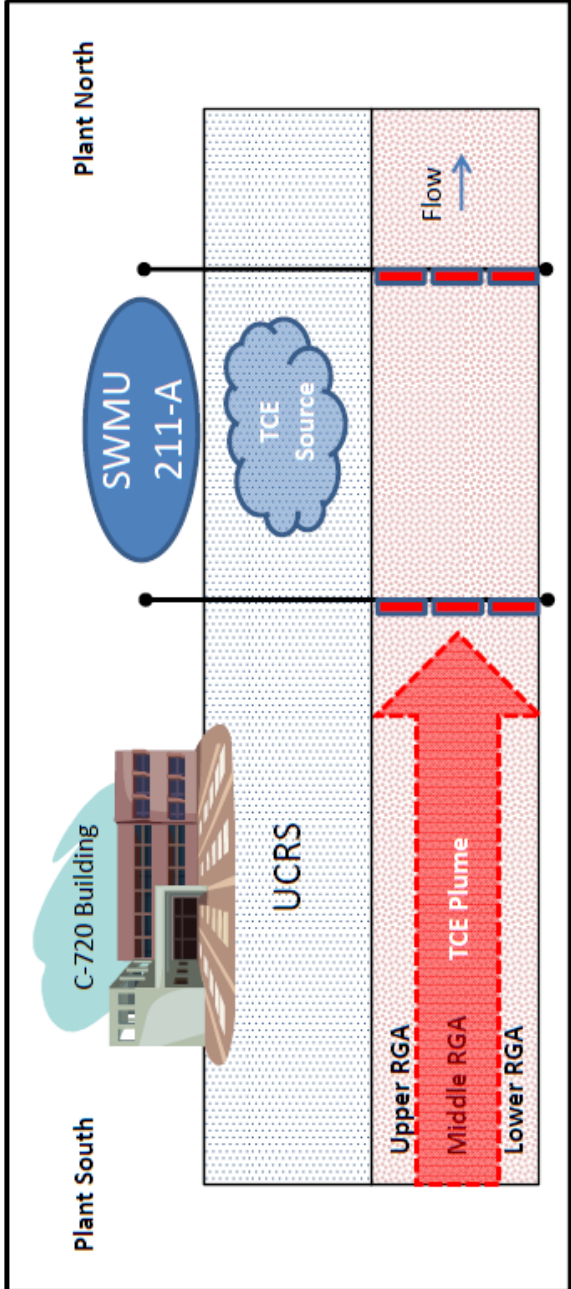
Substantial TCE in the lower RGA

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LATA Environmental Services  
of Kentucky, LLC

Figure C.3. For SWMU 211-A, DPT Results Indicate Substantial Contamination in the Lower RGA Only

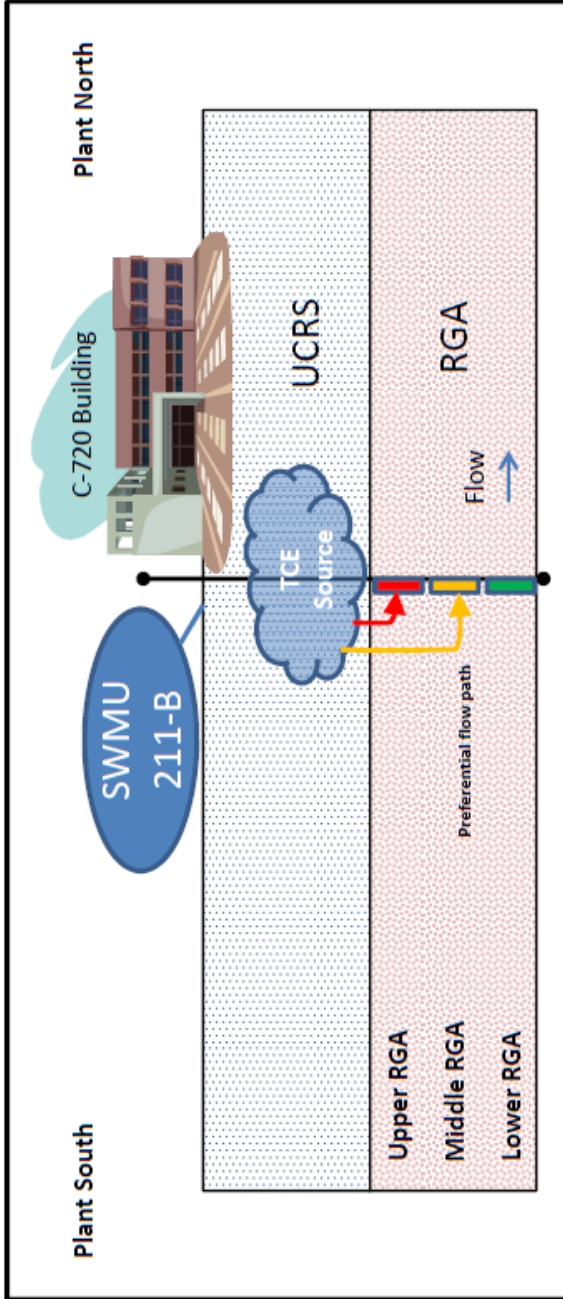


DPT borings sampled every 5 feet in the RGA

Substantial TCE throughout the RGA



Figure C.4. For SWMU 211-A, DPT Results Indicate Substantial Contamination Throughout the RGA



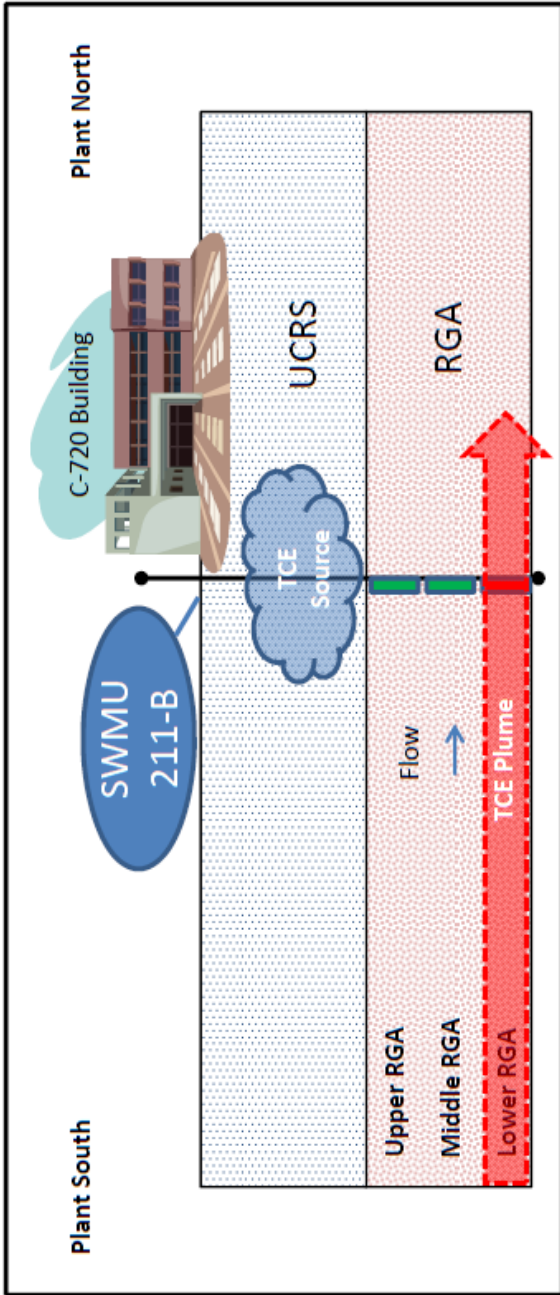
DPT borings sampled every 5 feet in the RGA

- Substantial TCE in the upper RGA
- Substantial TCE in the middle RGA
- Minimal TCE in the lower RGA

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Figure C.5. For SWMU 211-B, DPT Results Indicate Substantial Contamination in the Upper or Middle RGA



DPT borings sampled every 5 feet in the RGA

- Minimal TCE in the upper RGA
- Minimal TCE in the middle RGA
- Substantial TCE in the lower RGA

Figure C.6. For SWMU 211-B, DPT Results Indicate Substantial Contamination in the Lower RGA Only

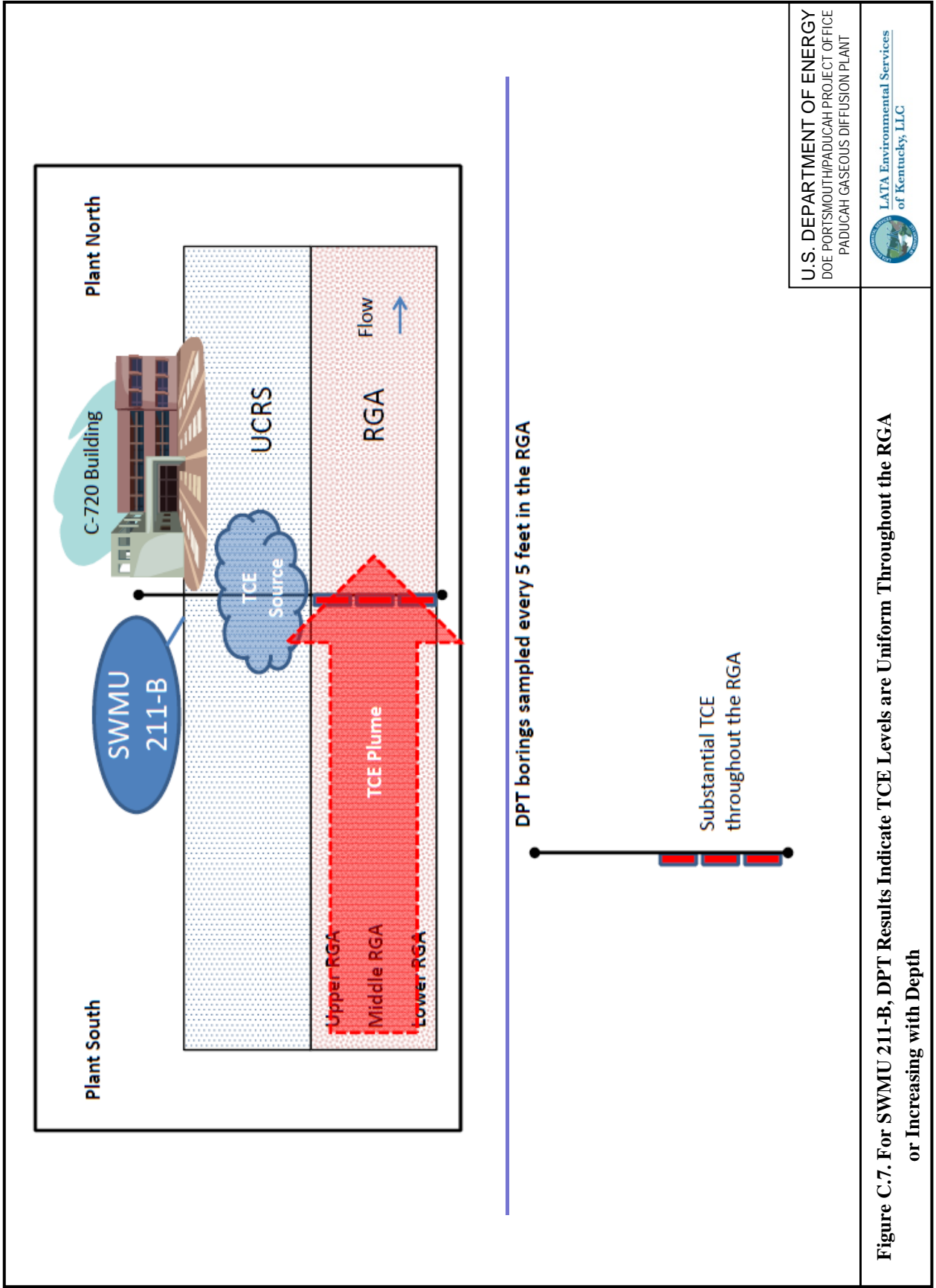
An unexpected case would be where DPT results indicate TCE levels are uniform throughout the RGA or increasing with depth (Figure C.7). An upgradient source is impacting TCE levels beneath the SWMU throughout the RGA. The FFA parties must confer to evaluate the impact of the upgradient source. If a SWMU 211-B remedial action is considered beneficial, the following decision rules apply in the upper or middle RGA (in the zone of higher TCE):

- **IF** the average of upper and middle RGA TCE levels is less than approximately 400 ppb, **THEN** the CSM and the predicted TCE mass in the UCRS are confirmed. The remedial action will be implementation of long-term monitoring.
- **IF** the average of upper and middle RGA TCE levels is greater than approximately 400 ppb and less than 11,000 ppb, **THEN** the CSM is valid, but the TCE mass in the UCRS is greater than estimated. The remedial action will be implementation of enhanced bioremediation and long-term monitoring.

## REFERENCES

- Blumenfeld, R. July 10, 2013. U.S. Department of Energy, Portsmouth/Paducah Project Office, Paducah, KY, letter to T. Mullins, Kentucky Department for Environmental Protection, Frankfort, KY, and J. Tufts, U.S. Environmental Protection Agency, Region 4, Atlanta, GA, “Final Characterization Notification for Solid Waste Management Unit 211-A and Solid Waste Management Unit 211-B at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,” PPPO-02-1979222-13B.
- DOE (U.S. Department of Energy) 2012a. *Record of Decision for Solid Waste Management Units 1, 211-A, and 211-B and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0365&D2/R1, U.S. Department of Energy, Paducah, KY, March.
- DOE 2012b. *Remedial Design Work Plan for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1268&D2/R2, U.S. Department of Energy, Paducah, KY, June.
- DOE 2013. *Final Characterization Report for Solid Waste Management Units 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1288&D2, U.S. Department of Energy, Paducah, KY, December.
- Tufts, J. February 25, 2014. U.S. Environmental Protection Agency, Region 4, Atlanta, GA, letter to R. Blumenfeld, U.S. Department of Energy, Portsmouth/Paducah Project Office, Paducah, KY, “EPA Modification Request to the Remedial Design Work Plan for SWMUs 1, 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, KY (DOE/LX/07-1268&D2/R2).”





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**Figure C.7. For SWMU 211-B, DPT Results Indicate TCE Levels are Uniform Throughout the RGA or Increasing with Depth**

**ATTACHMENT C1**

**QUALITY ASSURANCE PROJECT PLAN UPDATES**

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**Title:** RDSI Characterization Plan for SW Plume  
**Revision Number:** 2  
**Revision Date:** 2/2015

**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):** 2/2015

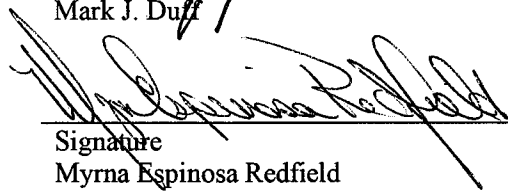
**Document Control Number:** DOE/LX/07-1268&D2/R2/A1

LATA Kentucky  
Environmental  
Remediation Project  
Manager

  
Signature  
Mark J. Duff

2-20-15  
Date

LATA Kentucky  
Regulatory Manager

  
Signature  
Myrna Espinosa Redfield

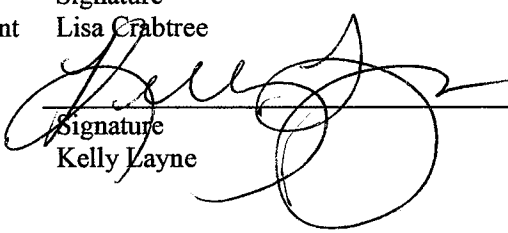
2/19/15  
Date

LATA Kentucky  
Sample/Data Management  
Manager

  
Signature  
Lisa Crabtree

2/19/15  
Date

LATA Kentucky  
Groundwater Operable  
Unit Project Manager

  
Signature  
Kelly Layne

2/19/15  
Date

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

**Who will use the data?**

DOE and its contractors (e.g., P2S, 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)**

For soils, 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 about where to place contingency sample boring locations. Confirmation samples for VOCs will be sent to a fixed-base 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-base laboratory.

For groundwater, fixed-base laboratory, quick turn, VOC results will support timely preparation of decision documents.

**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-base 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-base laboratories are identified in the RDSI Characterization Plan, RDSI Characterization Plan Appendix C (RGA groundwater samples), and Worksheet #18. Additionally soil samples will be qualitatively evaluated in the field for VOCs utilizing a PID.

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

See RDSI Characterization Plan and Appendix C.

**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/or field data sheets. The field and fixed-base 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.

**Title:** RDSI Characterization Plan for SW Plume  
**Revision Number:** 2  
**Revision Date:** 2/2015

**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 for soils 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.

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

For RGA groundwater samples, a fixed-base laboratory will be utilized to provide a quick turnaround time for VOC analyses.

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-base 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-base laboratory analysis to support design of the remedial action at SWMU 1 and selection and design of the remedial action at SWMUs 211-A & -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 211-A & -B. Nested wells will be completed at each of the investigation areas to assess groundwater levels and vertical gradients.

A final stage of the field investigation will involve the collection of groundwater samples for VOC analysis through the depth of the RGA to provide a vertical profile of VOC levels in downgradient and upgradient locations. These data will provide a basis for determination of the impact of the UCRS soil sources upon RGA groundwater quality and a basis for selecting the appropriate remedial action. It is intended that the data from these samples will be used to select the appropriate location and depth(s) for long-term monitoring for the SWMUs.

**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.

Additional groundwater samples will be collected to determine the impact of the SWMUs upon RGA groundwater quality. Groundwater samples will be collected at 5-ft depth intervals from a depth of 65 ft (immediately below the depth of soil characterization) to the base of the RGA (expected to be 90 to 100 ft).

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		
	RGA Groundwater	Subsurface	VOCs	TCE assumed 11,000 µg/L	40+5 field duplicates		

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 Southeast Site	Soil	Subsurface	VOCs	Up to 68 mg/kg TCE	156+8 field duplicates+16 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 duplicate		
	Groundwater	Subsurface	Metals	See historical data	9+1 field duplicate		
	Groundwater	Subsurface	Ions	See historical data	9+1 field duplicate		
	Groundwater	Subsurface	Field	See historical data	9+1 field duplicate		
	Groundwater	Subsurface	Dissolved gas	See historical data	9+1 field duplicate		
	RGA Groundwater	Subsurface	VOCs	TCE assumed 11,000 µg/L	8+1 field duplicate		

N/A = not applicable

QAPP Worksheet #28 (Continued)  
QC Samples Table

<b>Matrix:</b>	Aqueous/Soils						
<b>Analytical Group/Concentration Level:</b>	VOCs						
<b>Sampling SOP:</b>	See Worksheet #21						
<b>Analytical Method/SOP Reference:</b>	8260						
<b>Sampler's Name/Field Sampling Organization:</b>	TBD						
<b>Analytical Organization:</b>	TBD						
<b>No. of Sample Locations:</b>	See Section 5 and Appendix A of the RDSI Characterization Plan and Appendix C						
<b>QC Sample</b>	<b>Frequency</b>	<b>Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Split Samples	As requested by regulatory agency	TBD	N/A	N/A	N/A	N/A	N/A
Field Blank	Minimum 5%	60	≤ contract required quantitation limit (CRQL)	Verify results; reanalyze	Laboratory should alert project	Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Trip Blank	1 per cooler containing VOC samples	~200	≤ CRQL	Verify results; reanalyze		Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>
Equipment Blank	Minimum 5%	60	≤ CRQL	Verify results; reanalyze		Contamination-Accuracy/bias	See procedure PAD-ENM-5003, <i>Quality Assured Data</i>

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) <sup>1</sup>	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) <sup>1</sup>
Soil/ Groundwater	VOCs	Moderate/High	SWMU 1 C-720 Southeast Site C-720 Northeast Site	See Worksheet #23	28-day	TBD	TBD
RGA Groundwater	VOCs	Moderate/High	C-720 Southeast Site C-720 Northeast Site	See Worksheet #23	7-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



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) <sup>1</sup>	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number) <sup>1</sup>
Groundwater	Field	See historical data	SWMU 1 C-720 Southeast Site C-720 Northeast Site	Manufacturer's instructions	28-day	TBD	TBD
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

<sup>1</sup>Laboratory contracting will be subsequent to the completion of the RDSI Characterization Plan.

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