Department of Energy

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JUN 29 2012

Mr. Wm. Turpin Ballard
Remedial Project Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

PPPO-02-1474831-12

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

Dear Mr. Ballard and Mr. Mullins:

TRANSMITTAL OF THE ADDENDUM TO THE WORK PLAN FOR THE BURIAL GROUNDS OPERABLE UNIT REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, SOLID WASTE MANAGEMENT UNIT 4 SAMPLING AND ANALYSIS PLAN (DOE/OR/07-2179&D2/A2/R2) [REPLACEMENT PAGES FOR THE D2/A2/R1 DOCUMENT]

Reference: Letter from A. Webb to R. Knerr, "Conditional Concurrence on the Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study (SWMU 4 Sampling and Analysis Plan) (DOE/OR/07- 2179&D2/A2/R1)," dated May 24, 2012

Revision of the D2/A1/R1 documents is being accomplished using the enclosed replacement pages. A comment response summary also is included to aid in your review. The replacement pages contain the modifications made as a result of Kentucky Department for Environmental Protection (KDEP) comments dated May 24, 2012, and the verbal comments made by the U.S. Environmental Protection Agency (EPA) and KDEP during April and May of 2012. After discussions with EPA and KDEP, the Department of Energy also made two unsolicited changes as shown below.

1) Corrected spelling error and

2) The grid for the surface soil sampling was incorrectly applied across an area beyond the Solid Waste Management Unit 4 boundary. As a result of this correction, a new grid has been provided (Figure 12) and the sample count changed from 180 samples

to 154 samples for field lab samples and from 18 samples to 16 samples for fixed-base lab samples.

Since the modifications are limited and as agreed to by KDEP and EPA, the document revision is being accomplished by using replacement pages. The enclosed 16 pages need to be inserted into your D2/A2/R1 hard copy of the document to convert it to a D2/A2/R2:

- Cover page;
- Title page;
- Pages 21, 25, 31, 33, 37, 45, 46, 47, 48, 53, 54, 56, 114, and 118 in the body of the text.

A digital version of the entire document (clean and redline) will be distributed electronically. DOE respectfully request your concurrence on this D2/A2/R2 Sampling and Analysis Plan within 30 days of the receipt of this letter.

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

Sincerely,

Reinhard Knerr
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosures:
1. Certification Page
2. Replacement Pages for the Work Plan
3. Redline Replacement Pages for the Work Plan
4. Comment Response Summary
5. CD of Clean and Redline Document

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CERTIFICATION

Document Identification: ***Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study At The Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Solid Waste Management Unit 4 Sampling and Analysis Plan*** **DOE/OR/07-2179&D2/A2/R2**

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

LATA Environmental Services of Kentucky, LLC

Mark J. Duff, Paducah Project Manager — 6-29-12 Date Signed

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

U.S. Department of Energy (DOE)

Reinhard Knerr, Paducah Site Lead
Portsmouth/Paducah Project Office — 6/29/12 Date Signed

DOE/OR/07-2179&D2/A2/R2
Primary Document

Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Solid Waste Management Unit 4 Sampling and Analysis Plan

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DOE/OR/07-2179&D2/A2/R2
Primary Document

Addendum to the Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Solid Waste Management Unit 4 Sampling and Analysis Plan

Date Issued—June 2012

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

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

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concentration source in the UCRS rather than a DNAPL source at the base of the RGA. It appears that TCE from the UCRS at SWMU 4 migrates to the RGA and then moves downgradient in a north-northeast direction as shown in Figures 10 and 11. The potentiometric surface of the RGA beneath SWMU 4 is relatively flat, and precise flow direction is difficult to determine. Flow direction has been mapped in a range from west-northwest to north-northeast. The interpretation of flow direction depicted in Figure 11 is based on data collected as part of PGDP's Environmental Monitoring program, which is not conducted under CERCLA.

2.5 BASELINE RISK ASSESSMENT AND COCs

During the BGOU RI, the following COCs were identified for SWMU 4 based on quantitative risk and hazard results over all pathways relative to hazard benchmarks for land use scenarios of concern.[1] The benchmarks used for this comparison were (a) 0.1 for hazard index (HI) and (b) 1×10^{-6} for excess lifetime cancer risk (ELCR). Contaminants within a land use scenario of concern that exceeded these benchmarks were deemed COCs. The groundwater COCs are vinyl chloride, TCE, Tc-99 and *cis*-1,2-dichloroethene (DCE). The soil/waste COCs are listed below.

Barium	Uranium-234	Total PCBs	*cis*-1,2-DCE
Cadmium	Beryllium	Uranium-238	Manganese
Iron	Chromium	Vinyl chloride	Cesium-137
Uranium (metal)	Nickel	TCE	Uranium-235
Total dioxins/furans	Vanadium	Tc-99	

Although not a COC, uranium-235 was included based on information about isotopic ratios found in samples at PGDP. Potentially completed pathways resulting in the greatest threats are associated with ingestion of groundwater under unrestricted residential future use scenarios. In the absence of future residential use, there are but a few potential direct contact issues. Historical analysis has not indicated other constituents migrating from SWMU 4 at levels that cause an exceedance of maximum contaminant levels (MCLs) in the RGA.

[1] Land use scenarios of concern evaluated in the BGOU RI included current and future industrial workers; future outdoor workers; future residents within the SWMU 4 boundary; and future residents using groundwater drawn from the RGA at the boundary to the industrialized area and the DOE property boundary.

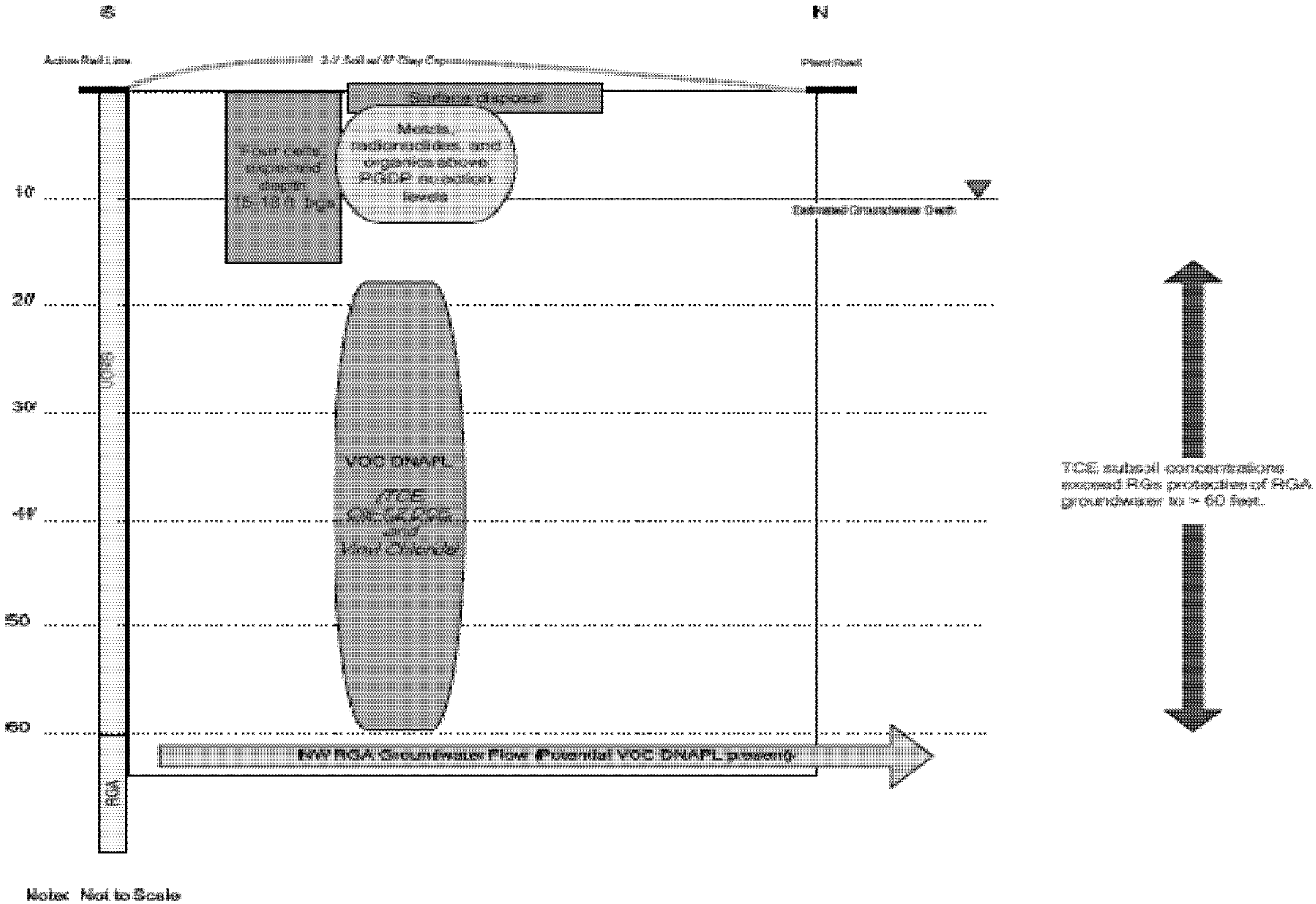

Figure 10. Conceptual Site Model for SWMU 4

3. CONCEPTUAL SITE MODEL

SWMU 4 consists of below ground burial cells in which various PGDP wastes have been placed and covered with soil. Incomplete soil coverage or cross-contamination between the waste and cover soil could result in contaminants from the waste being exposed at the ground surface. Once at the surface, the most likely pathway of contaminant migration would be surface water runoff (i.e., precipitation). Infiltration of water (i.e., precipitation) descending through the buried waste has mobilized contaminants within the waste resulting in contaminated subsurface soil. Additionally, TCE, a dense nonaqueous liquid, could migrate independently of infiltrating water and, like buried waste and contaminated soil, could serve as a source of contamination. Once mobilized by infiltrating water, the most likely pathway of contaminant migration would be downward through the UCRS soils, ultimately reaching the RGA (Figure 10). The potentiometric surface of the RGA beneath SWMU 4 is relatively flat, precise flow direction is difficult to determine. Flow direction has been mapped in a range from west northwest to north northeast. The interpretation of flow direction for this SAP and conceptual site model is seen in Figure 11. Some lateral movement of contaminants could occur in the UCRS, but these pathways are known to be limited. Based on this conceptual model, any contamination resulting from buried waste found at SWMU 4 would be expected to be found concentrated in the soils and groundwater of the UCRS immediately within and under the burial cells and landfills, with little lateral dispersion of contamination in the UCRS from the cells and immediately adjacent soils. The RI Report provides an assessment of analytical data that have been collected in and adjacent to SWMU 4 to evaluate the nature and extent of contamination (vertical and lateral) associated with the BGOU SWMUs.

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5. FIELD SAMPLING PLAN

This FSP describes how samples will be collected from the surface and subsurface at SWMU 4 and subsequently analyzed in order to help optimize the remedy selection. An understanding of the distribution of contaminants will support the development and evaluation of remediation alternatives.

5.1 SAMPLING MEDIA AND METHODS

Sampling of SWMU 4 will be conducted in a manner that addresses the ten data gaps and DQOs identified in Section 4 of this document. Five phases of investigation are identified in this FSP. Sections 5.1.1 through 5.1.5 each describes an investigation phase and links the phases to one or more data gaps.

5.1.1 Phase I—Passive Soil Gas and Surface Soil Sampling (0–1 ft)

<u>Associated Data Gaps</u>:

The desired outcome of this phase is to support closure of the following data gaps:

- #1—There are insufficient data at SWMU 4 to determine whether TCE is present in each of the burial cells, and the extent and mass of TCE contamination with sufficient accuracy to effectively and efficiently complete a remedial design for a TCE remedy in the burial cells.

- #8—It is uncertain whether the bedding materials surrounding the raw water pipe in the southeastern portion of the SWMU have been impacted by site constituents and act as a preferential pathway for migration outside of the SWMU.

Phase I sampling locations will close data gap #10:

- #10—There are insufficient data at SWMU 4 to determine the extent and mass of COCs in the surface soil within the SWMU 4 boundaries.

<u>Investigative Approach</u>:

Surface soil sampling

Surface soil samples will be collected at depths between 0 and 1 ft bgs with the use of a stainless-steel sampler, hand auger, spoon, trowel, spade, or scoop. Samples will be collected as five-point composites from 45-ft grids, as shown on Figure 12, resulting in 154 composite samples. Collection of the five points for each composite is shown in Figure 13. Unless otherwise noted, one grab sample will be collected from the center of the grid. Four additional grab samples will be collected 15 ft from the center point in each cardinal direction (north, south, east, and west). On alternating grids, grab samples will be collected from the center of the grid, and four additional grab samples will be collected 15 ft from the center point in each secondary direction (northeast, northwest, southeast, southwest).

Though not fully encompassing the entire SWMU, each sample point represents a 15 by 15 ft area (225 ft^2 or 25 yd^2). Should any individual sample point within the grid be obstructed, then the nearest possible location will be substituted. Grids will be positioned so that as much of the SWMU boundary is covered as possible or necessary.

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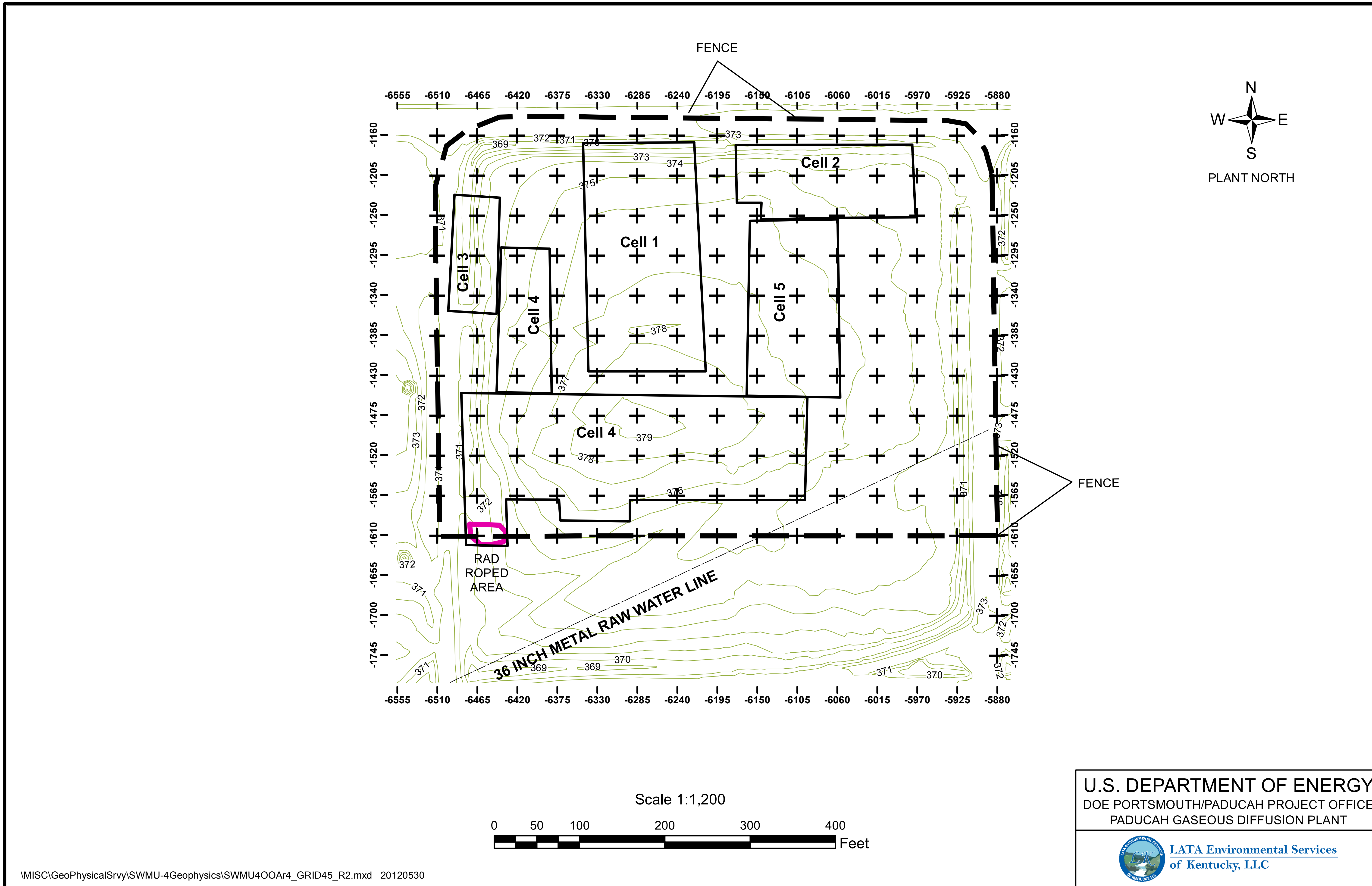

Figure 12. Surface Soil Sampling Grid

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

If other models, vendors, or contractor procedures are employed for field methods, the procedure for those operations will be added to the required reading for this FSP and the associated work package. All field methods shall be completed by a properly trained/qualified technician and those quantifiable (i.e., PCB test kits and XRF) will meet detection limits detailed in Section 6, QAPP Worksheets 15-E and 15-F.

Passive soil gas sampling

This first phase will utilize 65 passive soil gas samplers (modules) to identify areas within the SWMU that feature elevated VOC soil vapor readings. Passive gas soil samplers are being employed to obtain screening-level results. The passive gas samplers are quicker, easier, and less expensive to install than soil borings and are known, from past experience, to provide results of adequate quality for the data needs for this phase of the SWMU 4 effort. These elevated readings will indicate the presence of VOCs in soil, burial cells, or groundwater.

Forty-eight modules will be placed at the center of a 75 ft x 75 ft grid (except as noted below) in an impartial sampling program. A small roped-off area outside of SWMU 4 on the southwest corner potentially may be linked to SWMU 4; consequently, an additional grid and module will be placed over that area. Fourteen additional modules will be deployed above the burial cells: 10 above cell 4; 2 above cell 2; 1 above cell 1; and 1 above cell 5 (Figure 14). Historical data does not indicate a need for a biased location in Cell 3 or the vertical “leg” of Cell 4. The modules will be left in place for a period of time according to the manufacturer’s direction, after which they will be collected, placed in sample containers provided by the manufacturer, and shipped to the manufacturer’s laboratory for VOC analysis. The modules will be analyzed and a concentration map generated.

Two additional passive gas samplers will be installed to determine any effect the raw water line may be having on potential contaminant migration in the area. Placement of the gas samplers will be discussed with United States Enrichment Corporation (USEC) prior to installing them to ensure that enrichment operations are not jeopardized by placing them very near or above the line. Based on the discussion with USEC, the gas samplers will be placed as shown on Figure 14.

The modules will be installed using hand drilling tools to a depth below ground surface according to the manufacturer’s direction.

5.1.2 Phase II—Characterization of the Shallow Subsurface (1 to 20 ft)

<u>Associated Data Gaps:</u>

The desired outcome of this phase is to close the following data gaps:

- #1—There are insufficient data at SWMU 4 to determine whether TCE is present in each of the burial cells, and the extent and mass of TCE contamination with sufficient accuracy to effectively and efficiently complete a remedial design for a TCE remedy in the burial cells.

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Due to USEC operational concerns, it is not feasible to advance DPT borings within 15 ft of the raw water pipe. As described, the 150 ft by 150 ft sampling grid is oriented so that one of the systematic borings will be located between the raw water pipe and the nearest boundary of the southern burial cell.

Soil samples will be collected from every 5-ft interval below grade and sent to a fixed-base laboratory for analysis of VOCs and other COCs. One water sample will be collected from each boring that yields sufficiently. If sufficient water is available, samples will be collected for VOCs, PCBs, and SVOAs (in that order), but not for metals or radiological constituents. Soil samples from the same borehole will be available for metals and radiological constituent analysis.

Seven borings will be converted to piezometers to assist in determining the water table depth. The planned location of the piezometers is shown in Figure 15 and includes one in each of the five burial cells and two in undisturbed UCRS soils. Locations may require modification if it is determined that location will yield insufficient water. Water levels in the piezometers will be measured monthly for 12 months.

At least one test pit will be excavated in each of the five burial cells. There will be a minimum of one test pit in cells 1, 2, 3, and 5, and at least 2 in cell 4, due to its size, and the fact that cell 4 is known to have the highest VOC concentrations. Test pit locations will based on DPT refusals. The DPT refusal will be based on “final” refusal, after all “step outs.” If no DPT refusal is encountered in one or more of the cells, then the pit location will be selected after consulting with the DOE Project Manager, who will consult with the regulatory agencies. The test pits will be excavated using a hydraulic excavator or tractor backhoe at the first point of refusal. If there is no DPT refusal in a cell, then a location for the test pit will be determined based upon data obtained from the boring. Pit size will be approximately 5 ft wide by 10 ft long and as deep as 20 ft bgs. Depth adjustment may be required due to site conditions. Additional test pits may be excavated based on early results; see contingency investigations/decision rules below.

The pits will be backfilled as soon as possible, ideally within the same shift as they are opened. The spoil material will be replaced in the pits. Water will not be pumped from the pit. A maximum of six test pits will be excavated. Spoil piles not returned to the test pits during the same shift they are excavated (for example – due to quick onset of bad weather) will be covered and temporary silt fencing will be used around the perimeter of the piles to prevent releases of potentially contaminated materials prior to returning materials to the pit or transport to a treatment, storage, and disposal facility. Before returning spoils to test pits, a teleconference will be held with the FFA parties. The types of materials found and the appropriate path forward will be discussed, including disposition of the excavated materials.

Excavation of test pits is classified as a Phase II activity because of the depth interval in question; however, chronologically, the pits will be excavated at the end of the scheduled field activities (see Worksheet 16 of the QAPP). The excavations will present logistical complexities, including safety and security concerns and the necessity of mobilizing a separate field crew. These complexities could delay subsequent activities; therefore, the excavations have been scheduled so that there are no subsequent sampling activities.

It is recognized that excavating the test pits at the end of the fieldwork introduces an element of risk that data collected from the pit would have influenced where Phase II boring were installed. This scenario is addressed below in Contingency Investigations/Decision Rules.

Contingency Investigations/Decision Rules:

- Should the passive soil gas survey fail to identify any locations for judgmental sampling, the FFA parties will convene and discuss the appropriate path forward.

— One option to be considered in the event that the passive soil gas samplers do not identify locations for judgmental sampling is that borings will be placed at the locations of historic WAG 3 samples that indicated elevated levels of TCE. Those sample locations are 004-020, 004-021, 004-024, 004-026, 004-027, 004-030, 004-034, 004-035, 004-043, and 004-051. If the soil gas survey identifies between one and ten locations for judgmental sampling, then borings will be placed in those locations, with the balance coming from the historic WAG 3 locations to make up a total of 10 locations. The borings of interest and the order in which the co-located borings will be placed are as follows: 004-030, 004-024, 004-027, 004-035, 004-051, 004-043, 004-020, 004-026, 004-021, and 004-034.

- If water is encountered from borings, field personnel will record the elevation where encountered and collect 1 grab water sample from the base of each boring and send it to a fixed-base laboratory for VOC analysis. Borings that fail to yield sufficient water volume for VOC analysis within 60 minutes after reaching total depth will be not be sampled or converted to piezometers.

- Boring refusals and test pits:

— At least one test pit will be excavated in each of the 5 burial cells. There will be a minimum of one test pit in cells 1, 2, 3, and 5, and at least 2 in cell 4, due to its size and the fact that cell 4 is known to have the highest VOC concentrations.

Test pit locations will be based on DPT refusals. If no DPT refusal is encountered, then the location of the test pits will be selected after consulting with the DOE Project Manager, who will consult with the regulatory agencies.

— If DPT refusal is encountered, then relocate up to three times in any direction within a 5 ft radius of the original attempt. If a successful penetration is not made with a 5 ft radius, then make up to three additional attempts in the 5 to 10 ft radius. Continue in this manner (i.e., stepping out in 5 ft increments and making 3 attempts) until a successful penetration is achieved or until there are no additional untested locations remaining within the boundary of the cell.

— The depth of pits associated with DPT refusals will be to the base of visible debris or to a maximum of 20 ft bgs, whichever is less.

— The depth of pits not associated with DPT refusals will be 15 ft bgs unless debris is present, in which case, the excavation depth will be to the base of visible debris or to a maximum of 20 ft bgs.

— One soil sample will be collected from the base of each test pit. If the TCE concentration in the sample is greater than the tenth highest concentration in samples from the DPT borings (bottom samples), DOE will consult with the regulatory agencies to ascertain if additional borings are warranted or if the uncertainty can be managed.

— One water sample will be collected from the base of each test pit, if water is present.

— If an intact drum is encountered, the material inside the drum will be sampled; it will be removed only if it contains a mobile contaminant.

– If more than one intact drum is encountered in an excavation, these drums may be sampled at direction of the Prime Contractor Task Lead after consulting with the DOE Project Manager, who will consult with the regulatory agencies.

– Excavation of a test pit will be suspended if significant water inflow is detected (i.e., if water prevents observation of the base of the excavation).

5.1.3 Phase III—UCRS Sampling (20 to 58 ft)

Associated Data Gaps:

The desired outcome of this phase is to close the following data gaps:

- #2—There are insufficient data at SWMU 4 to determine the extent and mass of TCE contamination with sufficient accuracy to effectively and efficiently complete a remedial design for TCE in the UCRS (i.e., soils from ground surface to the top of the RGA not identified as burial cells).

- #5—There are insufficient data at SWMU 4 to determine the extent and mass of COCs other than TCE with sufficient accuracy to effectively and efficiently select and design a remedy for the UCRS (i.e., not burial cells or geophysical anomalies).

Investigative Approach:

Phase III of the investigation will focus on the UCRS at depths ranging from 20 ft bgs to the top of the RGA, expected to be approximately 58 ft bgs. Ten borings will be installed via DPT at the locations of the highest TCE results from Phase II borings (bottom samples). Soil samples will be collected from the borings at 10-ft depth intervals and sent to a fixed-base laboratory analysis. All samples will be analyzed for VOCs; additionally, the shallowest and the deepest sample from each borehole will be analyzed for other COCs.

Contingency Investigations/Decision Rules:

- If all 10 borings fall within the cells, two additional borings will be located outside the cells in order to close data gap #5. The two additional borings will be placed using results of earlier phases of the investigation and the geophysical survey so that the probability of not being in a burial cell is maximized. The location of the two additional borings will be selected after consulting with the DOE Project Manager, who will consult with the regulatory agencies.

- As a contingency measure, an additional four borings will be used for delineation of hot spots (TCE greater than 75 ppb). The location of the four additional borings will be selected after consulting with the DOE Project Manager, who will consult with the regulatory agencies. If the extent of elevated TCE (> 75 ppb) is not bounded by these four borings, then the FFA parties will convene to discuss the validity of the Conceptual Site Model.

5.1.4 Phase IV—RGA Sampling (59 to 105 ft)

Associated Data Gaps:

The desired outcome of this phase is to close data gap #3—There are insufficient data at SWMU 4 to determine the extent and mass of TCE source term with sufficient accuracy to effectively and efficiently complete a remedial design for source term in the RGA.

Investigation Approach:

Ten borings will be installed via HSA or rotosonic to the top of the McNairy formation, approximately 105 ft (Figure 16). The FFA parties will be consulted prior to finalizing the exact locations of these borings.

- One possibility for locating the borings is that five of these borings will be downgradient of SWMU 4, one will be located upgradient of SWMU 4, and four will be located inside the SWMU 4 boundary (Figure 16). The four borings inside SWMU 4 will be located to sample below the highest elevated TCE results from Phase III (bottom samples).

- Another possibility is that the five downgradient borings could be spread out to define more accurately the extent of the high concentration TCE plume to the west.

- Yet another possibility is to locate two of the five boring that were planned to be located downgradient of SWMU 4 to locations within the SWMU boundary. This would enable focusing on releases of PTW below the SWMU.

Borings will be installed at a sufficient angle, if necessary, to avoid penetration of the burial cell and obtain sample results from under the burial cells, as penetration of the burial cells would provide a migratory conduit into the RGA for potential COCs. Water samples will be collected every 5 ft within the RGA and analyzed for VOCs and Tc-99. Soil samples will be collected at the top of the RGA and the top of the McNairy and analyzed for VOCs and Tc-99 from borings inside the SWMU boundary.

Contingency Investigations/Decision Rules:

- If attempts to collect soil samples from the top of the RGA fail, then a second attempt will be made over the next 5-ft interval.

5.3 SAMPLING PROCEDURES

Fieldwork and sampling at PGDP will be conducted in accordance with DOE Prime Contractor-approved medium-specific work instructions or procedures (Table 3). Subcontractor drilling and sampling will comply with the subcontractor's operating procedures and will comply with applicable or relevant and appropriate requirements (ARARs), as required in the Scope of Work. DOE or its Prime Contractor will approve any deviations from these work instructions and procedures. The DOE Prime Contractor will document changes on Field Change Request forms as detailed in the QAPP (Section 6).

Drilling and sampling will be conducted in accordance with approved procedures. These procedures either will be DOE contractor procedures or subcontractor procedures that have been reviewed and approved by the DOE contractor as being complete and in compliance with ARARs. The procedures used during the sampling and data analysis effort are available at the following address: http://www.latakentucky.com/public_documents_dynamic.asp. The procedures have been added to the Administrative Record, as well. All quality assurance (QA) activities (trip blanks, duplicates, matrix spikes and matrix spike duplicates) will be collected and handled in accordance with approved procedures. Data validation and review will also be in accordance with approved procedures.

5.3.1 Soil Sampling

Surface soil samples will be obtained from a 45 ft grid place over the 675 ft x 525 ft area of SWMU 4, resulting in 154 5-point composite samples. The composite samples will follow the requirements set forth in *Composite Sampling*, PAD-ENM-0023. Once the samplers recover the soil sample, the soil will be placed in the sample preparation area. A health and safety officer (HSO) and radiation control technician will scan the soil sample for VOCs and radiation before releasing the sample to the sample crew. The HSO will use a photoionization detector (PID) with ultraviolet (UV) light source with an ionization potential (eV) of 10.6 to scan for the presence of VOCs. If contamination is found above project exposure limits, the HSO and radiation control technician will direct the field crew in any additional PPE requirements and appropriate handling precautions, in accordance with the project-specific Health and Safety Plan and the procedure, PAD-RAD-1110, *Radiation Surveys*. At that time, the Derivative Classifier will review the soil sample for any security items of concern. Any items found will be handled in accordance with the security protocols in place. Immediately upon approval from the HSO, radiation control technician, and Derivative Classifier to proceed with sampling, the field crew will collect the samples for analysis, the 5-point composite soil samples will be placed in a clean bowl and mixed thoroughly using the quartering procedure to composite the sample. Samplers will place the resulting soil mixture in the appropriate sample jars for analysis. This process will be repeated until all 154 composite samples are produced. Any excess sample material will be placed in the waste disposal containers specific to the sample location.

Table 2. Summary of SWMU 4 Sampling and Analysis[1]

	Method	Depth (ft)	Sampling Interval (ft/sample)	Soil Samples	Water Samples	Analysis	Comments
Phase I	Soil gas samplers	*	n/a	0	0	VOC	75 ft x 75 ft grid over the SWMU 4 area, resulting in 48 impartially placed samplers plus 17 additional samplers placed based on process knowledge (See Section 5.1.1)
	5-point Surface soil samples (field	0 to 1	0-1	154	0	Metals by XRF, and PCBs by	5-point composite samples from 154, 45-ft grids over the SWMU 4 area.

Table 2. Summary of SWMU 4 Sampling and Analysis (Continued)

	Method	Depth (ft)	Sampling Interval (ft/sample)	Soil Samples	Water Samples	Analysis	Comments
	screen)					field test kits	
	5-point composite surface soil samples	0 to 1	0-1	16	0	Fixed-base lab for full suite of analyses (less VOCs)	10% of the samples described on the previous line
Phase II	20 ft borings	20	0–5, 5–10, 10–15, 15–20	48	12	full suite	150 ft x 150 ft grid, 12 locations, take a water sample if present, analyze for TCE, record water level
Phase II	20 ft borings	20	0–5, 5–10, 10–15, 15–20	40	10	full suite	10 locations biased per highest concentrations from soil gas analysis of soil gas modules (includes mercury and lead for waste cell samples)
Phase III	58 ft borings	58	20–30, 30–40, 40–50, 50–58	40	10	20 VOC, 20 full suite	Extend the 10 biased boring locations from Phase II to 58 ft (top of RGA), sample every 10 ft beyond 20 ft bgs; 20 ft–30 ft and 50 ft–58 ft samples will be analyzed for the full suite of analytes; 30 ft–40 ft and 40 ft–50 ft samples will be analyzed for VOCs only; collect a water sample, if water is present and analyze for VOCs, record water level.
Phase IV	105 ft borings	105	every 5 in RGA	20	90	VOCs, Tc-99	Borings will be located upon consultation with EPA and KDEP.
Phase V	RGA monitoring wells				5		Install one well upgradient screened to middle of the RGA. Install one well down- gradient, twin of MW333, screened to bottom of the RGA. Install a three well cluster within the SWMU screened top, middle, and bottom of the RGA.
Test Pits	One in burial cells1, 2, 3, 5; two in burial cell 4.	20	NA	6	6 (if present)	VOC, PCBs, and SVOAs (in that order)	5 ft wide x 10 ft long x 20 ft deep one test pit in each cell and one more in cell 4

*Manufacturer's direction
[1] The values in this table are estimates and are subject to change based on results and a coordination among the FFA parties.

Table 3. Example Fieldwork and Sampling Activities Procedures*

Procedure Number	Procedure Title
PAD-DD-2701	Large Equipment Decontamination
PAD-ENM-0018	Sampling of Containerized Wastes
PAD-ENM-0021	Temperature Control for Sample Storage
PAD-ENM-0023	Composite Sampling
PAD-ENM-1003	Developing, Implementing and Maintaining Data Management Implementation Plans
PAD-ENM-2101	Groundwater Sampling
PAD-ENM-2300	Collection of Soil Samples
PAD-ENM-2303	Borehole Logging
PAD-ENM-2700	Logbooks and Data Forms
PAD-ENM-2702	Decontamination of Sampling Equipment and Devices
PAD-ENM-2704	Trip, Equipment and Field Blank Preparation
PAD-ENM-2708	Chain of Custody Forms, Field Sampling Logs, Sample Labels, and Custody Seals
PAD-ENM-5003	Quality Assured Data
PAD-ENM-5007	Data Management Coordination
PAD-ENM-5102	Radiochemical Data Verification and Validation
PAD-ENR-0020	Collection of Soil Samples with Direct Push Technology Sampling
PAD-ENR-0034	XRF Field Analysis of Soils
PAD-ENR-0035	Vapor Sampling
PAD-PLA-ENV-001	Waste Management Plan for the Paducah Environmental Remediation Project
PAD-PROJ-0025	Well and Temporary Boring Abandonment
PAD-QA-1020	Control and Calibration of Measuring and Test Equipment
PAD-RAD-1110	Radiation Surveys
PAD-WD-0016	Waste Handling and Storage in DOE Waste Storage Facilities
PAD-WD-0022	Waste Water Accumulation, Storage, Treatment and Disposal
PAD-WD-0621	Standard Operating Procedure Recessed Chamber Filter Press at the C-752-C Off-Site Decontamination Pad
PAD-WD-1017	Safe Handling and Opening of Sealed Containers
PAD-WD-3015	Waste Packaging
PAD-WD-3028	Off Site Shipping

*SOPs are posted to the LATA Kentucky external Web site at http://www.latakentucky.com/public_documents_dynamic.asp under Paducah Procedures.

Soil borings will be sampled with a DPT rig following the requirements of *Collection of Soil Samples with Direct Push Technology Sampling*, PAD-ENR-0020. A GeoProbe® Dual Tube 22 system (or equal) will be used to minimize contaminants migrating down into the UCRS from the disposal cells. The Dual Tube 22 uses a 2.25 inch outer diameter casing with an inner rod string. When driven into the subsurface, a 1.125 inch soil core is collected inside the inner rod string in a clear Teflon liner. Grab groundwater samples and temporary monitoring wells can be installed through the Dual Tube 22 system. As soon as the DPT crew recovers the Teflon liner containing the soil sample, the soil core will be placed in the sample preparation area. In order to protect the health and safety of response actions workers and ensure that no security concerns arise during sample collection and bottling, the following steps will be taken before the sample is put in the appropriate sample bottles:

- An HSO and radiation control technician will scan the Teflon liner and the ends of the soil core for VOCs and radiation before releasing the core to the sample crew. The HSO will use a PID with UV light source with an eV of 10.6 to scan for the presence of VOCs (1 minute).

- Once the soil core in the Teflon liner has been cleared initially, the sample crew will open the Teflon liner with a sample liner cutter and utility knife and an HSO and radiation control technician will scan the sample for contamination; then a derivative classifier will review the exposed surface for classified matter.

- If contamination is found above project exposure limits, the HSO and radiation control technician will direct the field crew in any additional PPE requirements and appropriate handling precautions (doffing time dependant on extra PPE required).

- The sample core will be split in half, at which time the derivative classifier will review the exposed surface for classified matter (1 minute).

- Immediately upon approval from the HSO, the radiation control technician, and the derivative classifier to proceed with sampling, the field crew will collect the samples for VOC analysis by filling three EnCore® samplers, consistent with Collection of Soil Samples, PAD-ENR-2300. The VOC sample will be collected first from the area of the core that indicates highest contamination based on field screening instrument. The time between retrieval of the Teflon liner to sealing the EnCore® sampler is expected to be approximately 5 minutes.

- The derivative classifier will review the soil core for any security items of concern while the sample material is being bottled. Any items found will be handled in accordance with the security protocols in place. At the same time, the project geologist will examine the soil core sample for lithologic description, consistent with Section 3.5 of *Borehole Logging*, PAD-ENM-2303.

The lithologic descriptions (and notes of the presence and general type of any buried materials that may be recovered) will be recorded in a project log book. As directed by *Collection of Soil Samples*, PAD-ENR-2300, after the collection of the VOC samples and the description of the lithology are completed, the remaining soil will be placed in a clean bowl and mixed thoroughly using the quartering procedure to composite the sample. Samplers will place the resulting soil mixture in the appropriate sample jars for analysis. (The analyses can be found in Section 6, QAPP).

Soil samples collected under Phases II through V will be screened using an *OilScreenSoil (Sudan IV* or *Scarlet Red)*® (or equivalent) field test kit capable of indicating the presence of DNAPL and the results will be appropriately documented.

Duplicate soil samples will be collected at a frequency of one duplicate for each 20 scheduled soil samples. Additional QA/Quality Control (QC) samples will be required for matrix spike samples and trip blanks. Any excess sample material will be placed in the waste disposal containers specific to the sample boring.

Any nondisposable sampling equipment that will come in contact with the soil samples must be decontaminated between samples, as directed by *Decontamination of Sampling Equipment and Devices*, PAD-ENM-2702. The DPT rig and other large field equipment will be decontaminated in accordance with *Large Equipment Decontamination*, PAD-DD-2701, before use on-site, before sampling outside the disposal cells, between moving among disposal cells, at any other time when the DPT rig becomes splattered with potentially contaminated mud, and after sampling has been completed. The DPT rigs will be maintained in relatively clean condition. The only decontamination activity that will be required between boreholes will be cleaning of the down-hole tool string. This tooling will be cleaned at the drill site and the decontamination water will be contained, collected, and transferred to the C-752-C facility for treatment and disposal. The decontamination water will be field screened for PCB contamination prior to transfer. The final decontamination of the rigs for off-site transportation also will take place at the C-752-C facility.

Worksheet #15-H (Continued)
Reference Limits and Evaluation Table

VOCs	CAS Number	Project Action Limit (µg/Kg)[a]	Project Action Limit Reference[b]	Site COPC?[c]	Laboratory-Specific*	
					PQLs (µg/kg)	MDLs (µg/kg)
Xylene o	95-47-6	2.38E+02	NAL	Yes	10	TBD

* The quantitation limits achievable by the contracted laboratory will be reported to the FFA parties in a letter after the laboratory contract has been finalized.
[a] PAL and NAL are taken from Table A.4 of the Risk Methods Document using the industrial worker NAL (DOE 2011b).
[b] NAL is for industrial worker scenario from the Risk Methods Document (DOE 2011b).
[c] Analytes marked with COPC are from Table 2.1 of the Risk Methods Document (DOE 2011b) and represent the list of chemicals, compounds, and radionuclides compiled from chemicals of potential concern retained as contaminants of concern in risk assessments performed at PGDP between 1990 and 2008.

Worksheet #16
Project Schedule/Timeline Table

Activities	Organization	Dates*		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
SWMU 4 Sampling	BGOU	05-Apr-12	31-Aug-13	N/A	N/A
Procurement/Work Package Development and Management Readiness Review	BGOU	05-Apr-12	31-Aug-12	Work Package	31-Aug-12
Phase 1					
Collection of Soil & Gas Samples****	BGOU	27-Aug-12	01-Nov-12	Samples	01-Nov-12
Sample Analysis	BGOU	04-Sep-12	31-Nov-12	Data	31-Nov-12
Determine 20 ft boring locations based on soil gas analysis**	BGOU	01-Dec-12	04-Jan-13	Locations of 20 ft borings	04-Jan-13
Phase 2					
Collection of Samples****	BGOU	15-Dec-12	18-Jan-13	Samples	18-Jan-13
Sample Analysis	BGOU	20-Dec-12	18-Feb-13	Data	18-Feb-13
Determine locations for 58 ft borings**	BGOU	26-Jan-13	18-Feb-13	Locations for 58 ft borings	18-Feb-13
Phase 3					
Collection of Samples****	BGOU	22-Jan-13	14-Mar-13	Samples	14-Mar-13
Sample Analysis	BGOU	25-Feb-13	14-Apr-13	Data	14-Apr-13
Determine RGA boring locations**	BGOU	21-Mar-13	30-Mar-13	RGA boring locations	30-Mar-13
Phase 4					
Collection of Samples****	BGOU	07-Apr-13	22-May-13	Samples	22-May-13
Sample Analysis	BGOU	10-Apr-13	22-Jun-13	Data	22-Jun-13
Determine RGA boring locations**	BGOU	29-May-13	12-Jun-13	RGA boring locations	12-Jun-13
Phase 5					
Install/Develop Monitoring Wells**	BGOU	18-Jun-13	01-Aug-13	Monitoring Wells	01-Aug-13
Water Sample and Analysis	BGOU	23-Jun-13	31-Aug-13	Data package for inclusion in OREIS	31-Aug-13
Slug test	BGOU	23-Jun-13	31-Aug-13	Field report for inclusion in the RI Report	31-Aug-13
Phase 2					
Test Pits***	BGOU	03-Aug-13	13-Aug-13	Test Pits	13-Aug-13

* These dates are for project planning purposes only, not enforceable milestones. Enforceable milestones are found in the Site Management Plan.
** This activity includes a "hold point" at which consultation with the FFA parties will occur prior to executing the subsequent Phase or for final selection of testing and sampling locations.
*** Consult regulators prior to returning waste or waste like materials to the pit.
**** A management assessment will occur as part of this activity.

Worksheet #17-B
Sampling Design and Rationale (Engineering and Design Sampling)

	Media Type	# of Samples	Test/Analytical Method	Project Action Limit	PQL
Grain Size Data	Soil	4 UCRS, 3 RGA	ASTM D6913-04	NA	NA
Air Permeability	Soil	1	ASTM D6539	10^{-10} cm^2	NA
Percolation Test	Soil	4 UCRS	ASTM D7242-06	10^{-5} cm/s	NA
Electrical Resistance	Soil	2	ASTM D6431-99 (2010)	NA	NA
Electron Donor Parameters					
Chemical Oxygen Demand	Water	2	EPA 410.4	NA	27 mg/L
Total Organic Carbon	Water	2	EPA 415.1/ SW846-9060	20 mg/L	1 mg/L
Dissolved Organic Carbon	Water	2	EPA 415.1/ SW856-9060	20 mg/L	1 mg/L
Field Parameters					
DO	Water	All Water	Hach Quanta Hydrolab	0.5 mg/L	0.2 mg/L
pH	Water	All Water	Hach Quanta Hydrolab	5 to 9 Std Units	02. Std Units
Redox	Water	All Water	Hach Quanta Hydrolab	50 mV against Ag/AgCl	20 mV
Temperature	Water	All Water	Hach Quanta Hydrolab	20°C	0.1°C
Specific Conductance		All Water	Hach Quanta Hydrolab	NA	0.001 mS/cm
Metals	Soil		XRF	See WS 12	WS 12
PCBs	Soil		PCB test kits	See WS 12	WS 12
Soil gas	gas		Passive gas samplers	See WS 12	WS 12
Microbial Parameters					
Microbial Community	Soil	2	Laboratory SOP	1,000 cells/mL of sample	
Molecular Parameter	Soil	2	Laboratory SOP		NA
Water Quality Parameters[1]					
Sulfate	Water	1	EPA 300.0/SW846-9056	20 mg/L	2 mg/L
Chloride	Water	1	EPA 300.0/SW846-9056	NA	2 mg/L
Calcium	Water	1	SW846-6010B	NA	1 mg/L
Nitrate	Water	1	EPA 300.0/SW846-9056	1 mg/L	4 mg/L
Ferrous Iron	Water	1	SM 3500-Fe B	1 mg/L	0.3 mg/L
Natural Oxidant Demand	Soil	2	ASTM D7262-10	NA	1 g $KMnO_4$/kg

[1] Water can be collected during remedial design from wells in or adjacent to SWMU 4.

Worksheet #18
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)[a]	Sampling SOP Reference[b]	Rationale for Sampling Location
TBD	Soil	0-3 ft, 3-8 ft, 8-13 ft, 13-18 ft, 18-28 ft, 28-38 ft, 38-48 ft, 48-58 ft	VOC	Low	141 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	0-3 ft, 3-8 ft, 8-13 ft, 13-18 ft, 18-28 ft, 48-58 ft	PCBs	Low	121 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	0-3 ft, 3-8 ft, 8-13 ft, 13-18 ft, 18-28 ft, 48-58 ft	Radiological	Low	121 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	0-3 ft, 3-8 ft, 8-13 ft, 13-18 ft, 18-28 ft, 48-58 ft	Metals (includes mercury and lead only for waste cell samples)	Low	121 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	0-1 ft	PCBs, SVOAs	Low	154 (field lab) 16 (fixed-base lab) (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Soil	From RGA Wells approximately 105 ft	VOCs, Metals, PCBs, Radiological	Low	8 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	From open test pit in each cell, appx. 20 ft	VOCs, Metals, PCBs, Radiological	Low	1 to 5 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	0-20 ft	VOCs and Tc-99	Low	22 (minimum of 5%)	See Worksheet #21	See Worksheet #17
TBD	Water	20-58 ft	VOCs and Tc-99	Low	10 (minimum of 5%)	See Worksheet #21	See Worksheet #17