Department of Energy

Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513
(859) 219-4000

FEB 23 2015

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

PPPO-02-2689461-15C

Ms. Jennifer Tufts
Federal Facility Agreement Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Mullins and Ms. Tufts:

TRANSMITTAL OF THE 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

Reference: Letter from J. Woodard to T. Mullins and J. Tufts, "Requested Modification 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, Kentucky (DOE/LX/07-1268&D2/R2)," (PPPO-02-2238593-15), dated October 29, 2014

Enclosed is a sampling and analysis plan to determine volatile organic compound concentrations in groundwater of the Regional Gravel Aquifer at Solid Waste Management Units (SWMUs) 211-A and 211-B, based on scoping meetings held with the Kentucky Department for Environmental Protection (KDEP) and the U.S. Environmental Protection Agency (EPA) on December 2 and December 5, 2014. This sampling and analysis plan is being submitted as outlined in the referenced letter.

Results of this sampling project will be referenced in the decision of the appropriate remedial action at SWMUs 211-A and 211-B, as required by *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/R1. Due to the contract transition from LATA Environmental Services of Kentucky, LLC to Fluor Federal Sercvices, Inc in July 2015, the U.S. Department of Energy

requests EPA and KDEP's approval no later than March 7, 2015 to ensure fieldwork is completed prior to transition.

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

Sincerely,

Jennifer Woodard

Jennifer Woodard
Federal Facility Agreement Manager
Portsmouth/Paducah Project Office

Enclosures:
1. Cert Page
2. SWMU 211 Sampling and Analysis Plan Addendum
3. SWMU 211 Sampling and Analysis Plan Addendum Redline

e-copy w/enclosures:
brad.montgomery@lataky.com, LATA/Kevil
brian.begley@ky.gov, KDEP/Frankfort
craig.jones@lataky.com, LATA/Kevil
darla.bowen@lataky.com, LATA/Kevil
dave.dollins@lex.doe.gov, PPPO/PAD
gaye.brewer@ky.gov, KDEP/PAD
jennifer.woodard@lex.doe.gov, PPPO/PAD
kelly.layne@lataky.com, LATA/Kevil
latacorrespondence@lataky.com, LATA/Kevil
leo.williamson@ky.gov, KDEP/Frankfort
mark.duff@lataky.com, LATA/Kevil
mike.guffey@ky.gov, KDEP/Frankfort
myrna.redfield@lataky.com, LATA/Kevil
pad.dmc@swiftstaley.com, SST/Kevil
paula.spear@lataky.com, LATA/Kevil
reinhard.knerr@lex.doe.gov, PPPO/PAD
stephaniec.brock@ky.gov, KYRHB/Frankfort
todd.mullins@ky.gov, KDEP/Frankfort
tracy.taylor@lex.doe.gov, PPPO/PAD
tufts.jennifer@epamail.epa.gov, EPA/Atlanta

CERTIFICATION

Document Identification: ***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**

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 — Date Signed: 2-20-15

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

Jennifer Woodard, Paducah Site Lead
Portsmouth/Paducah Project Office — Date Signed: 2/20/2015

DOE/LX/07-1268&D2/R2/A1
Primary Document

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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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

Date Issued—February 2015

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
under contract DE-AC30-10CC40020

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CONTENTS

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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[1] 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[2] 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[3] (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.[4]

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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[1] 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.

[2] 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.

[3] 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.

[4] 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.

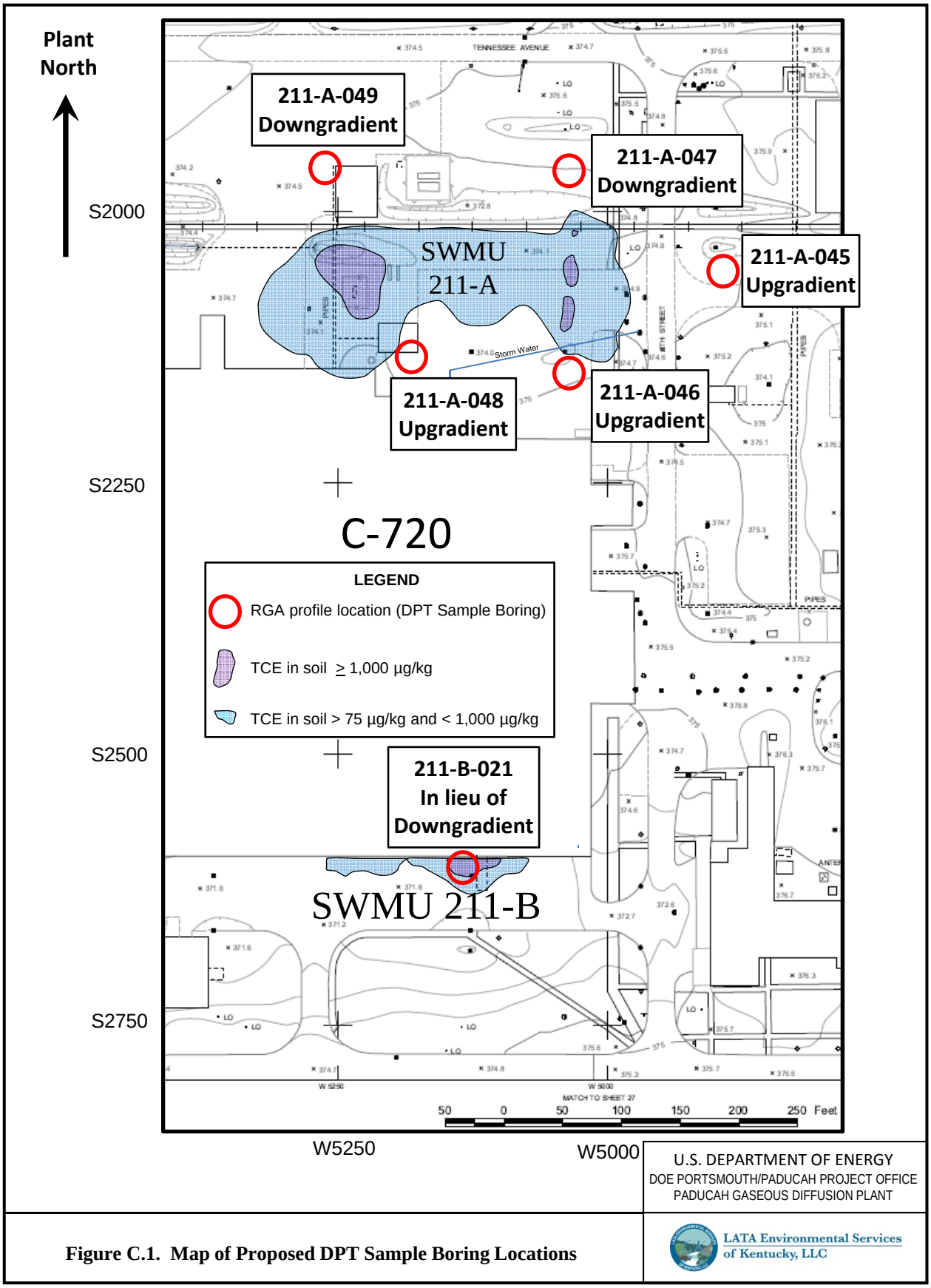

Figure C.1. Map of Proposed DPT Sample Boring Locations

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)[5]	-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)[6] 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

[5] 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.
[6] 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.[7]

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:

[7] 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[8] higher in the downgradient side of the SWMU,[9] **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

SWMU	DPT Borings for Upgradient/Downgradient Comparison
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,[10] **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.

[8] 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.
[9] 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.
[10] The 400 ppb exceeds the expected impact of SWMUs 211-A and 211-B to the RGA.

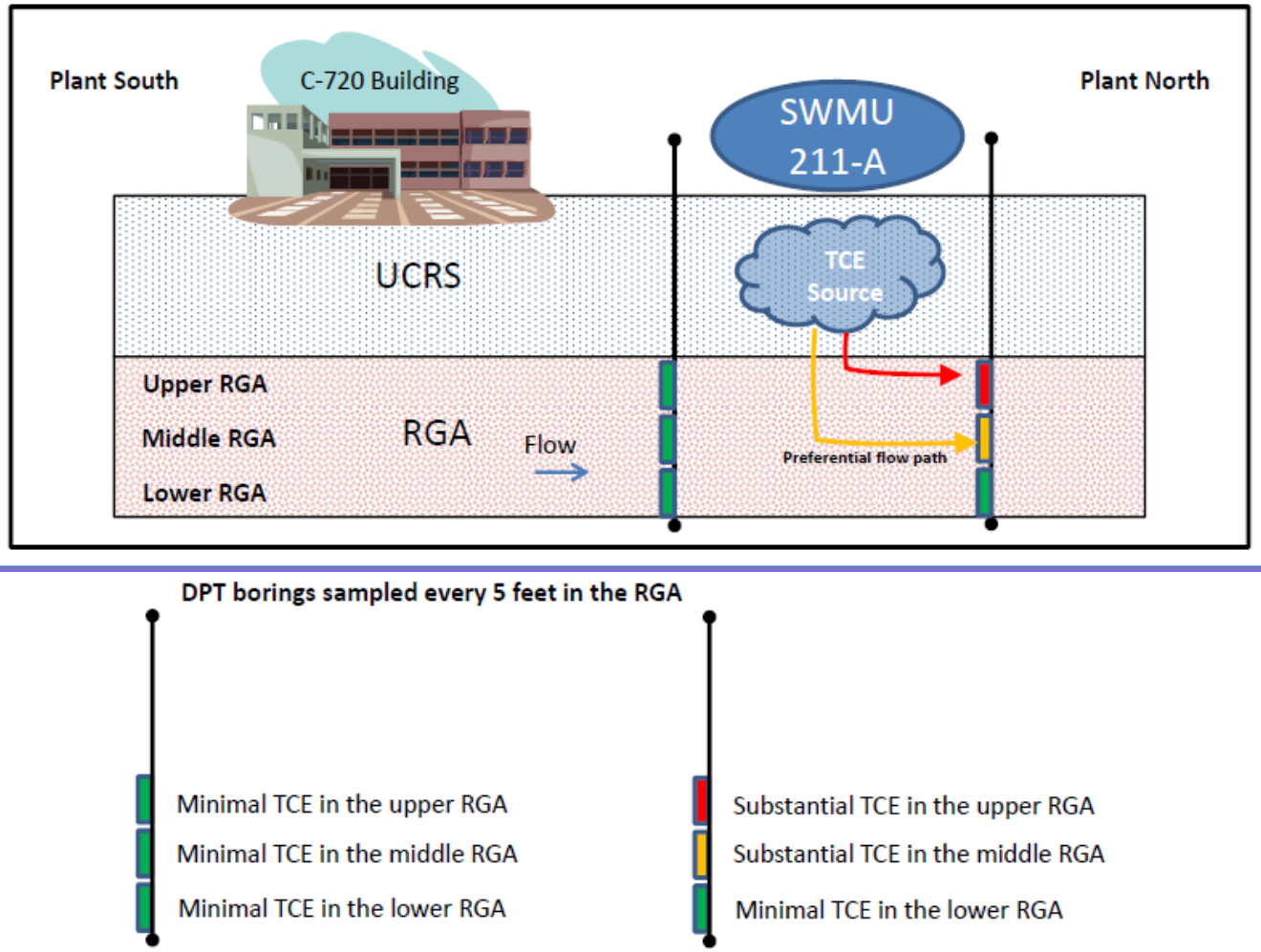

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Figure C.2. For SWMU 211-A, DPT Results Indicate Substantial Contamination in the Upper or Middle RGA

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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

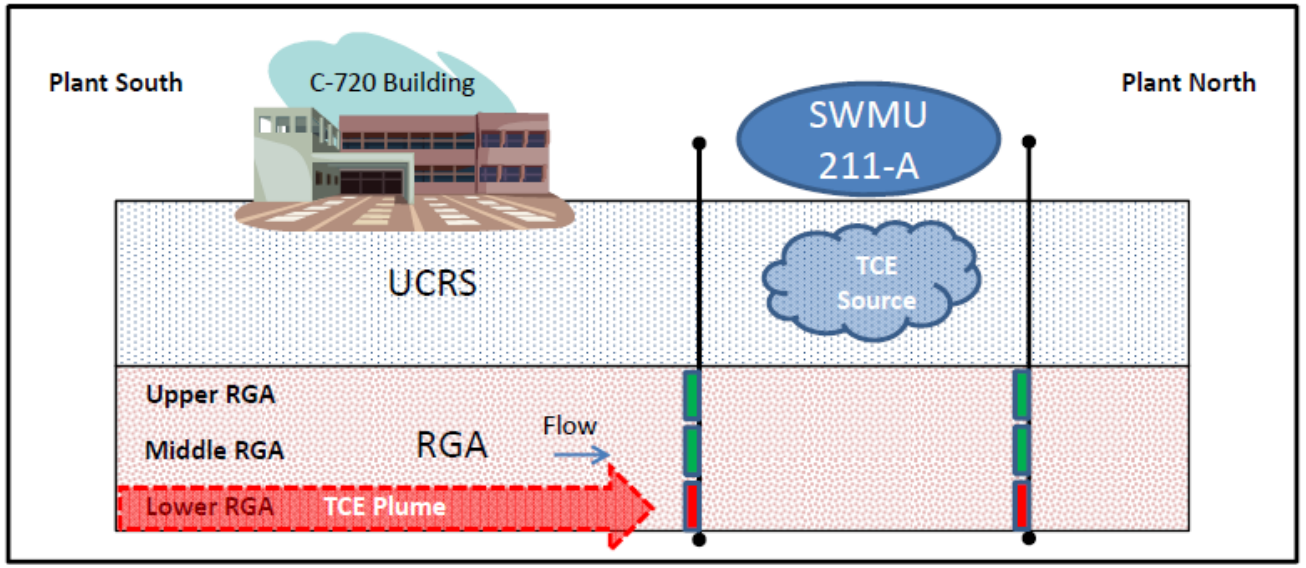
Decision rules for SWMU 211-B are similar to those above but modified to account for the single DPT. The following decision rules well be applied to SWMU 211-B (decisions will be based upon review of all data).

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.



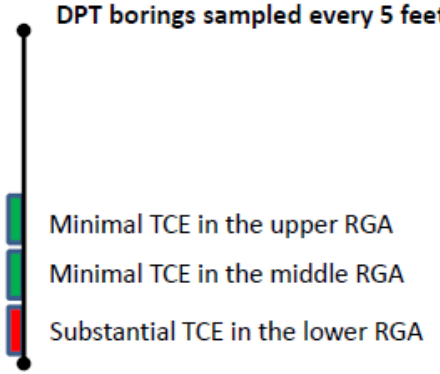


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Figure C.3. For SWMU 211-A, DPT Results Indicate Substantial Contamination in the Lower RGA Only

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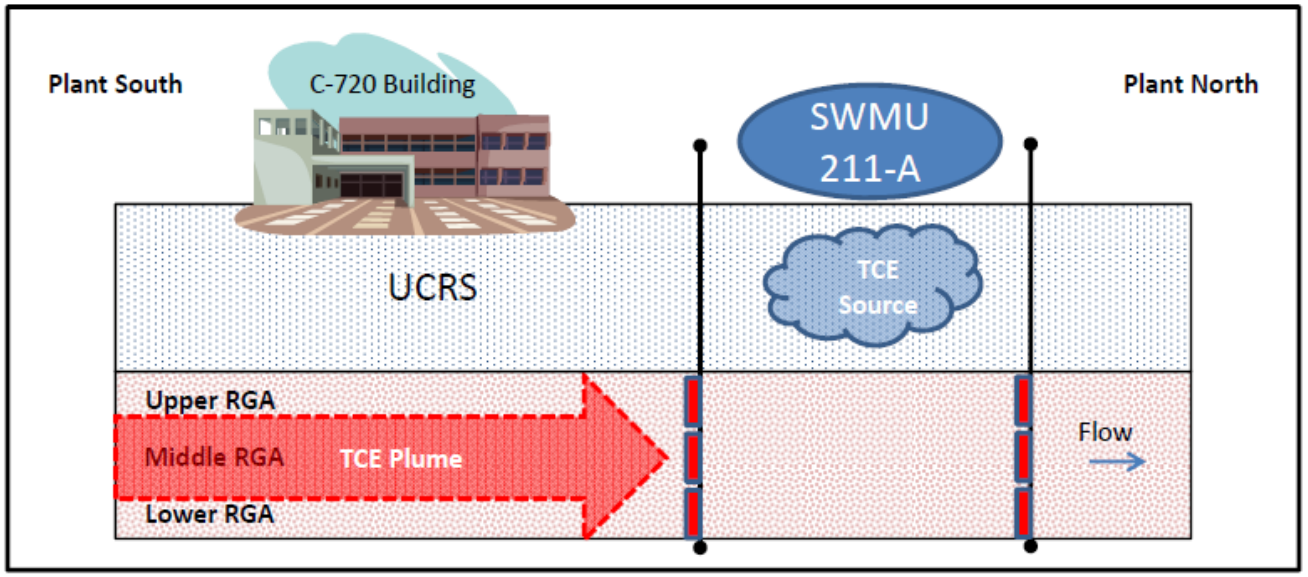

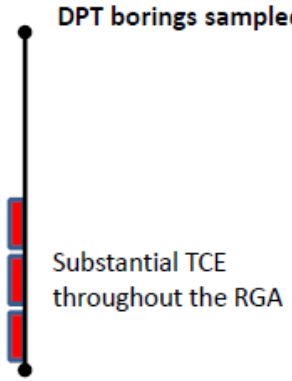

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Figure C.4. For SWMU 211-A, DPT Results Indicate Substantial Contamination Throughout the RGA

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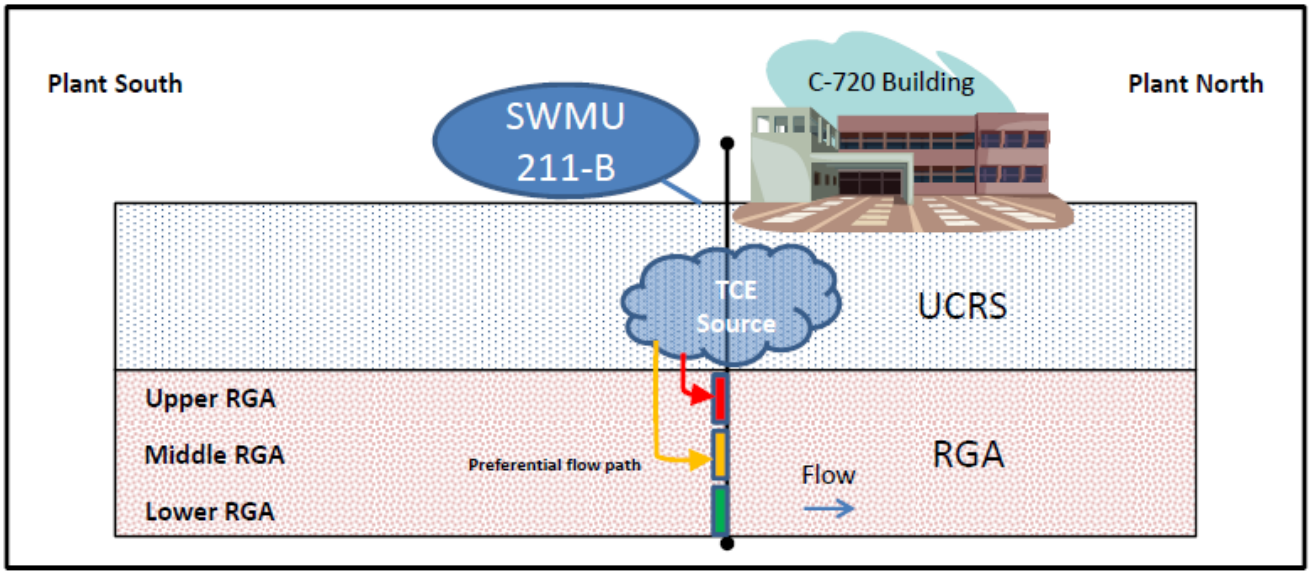

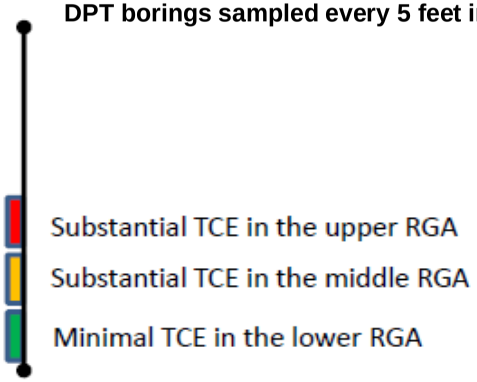

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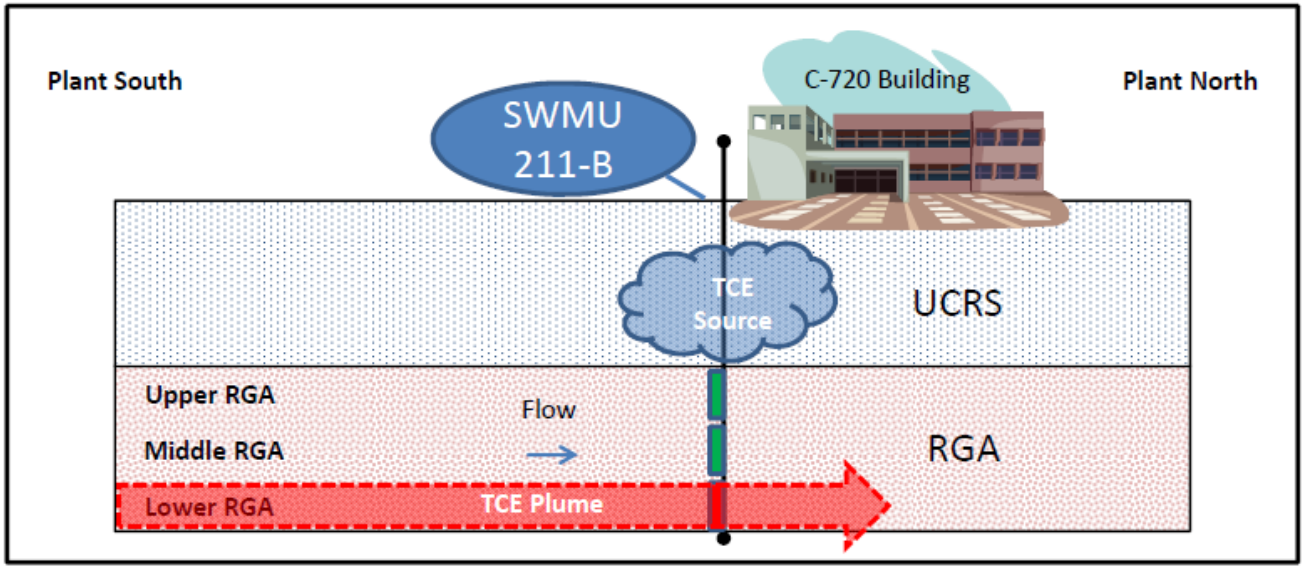
Figure C.5. For SWMU 211-B, DPT Results Indicate Substantial Contamination in the Upper or Middle RGA

LATA Environmental Services of Kentucky, LLC



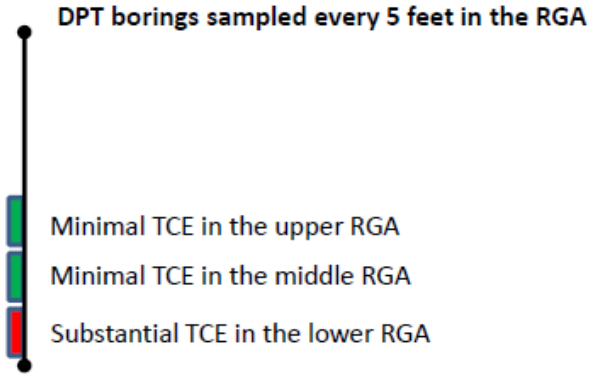


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Figure C.6. For SWMU 211-B, DPT Results Indicate Substantial Contamination in the Lower RGA Only

LATA Environmental Services of Kentucky, LLC

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.

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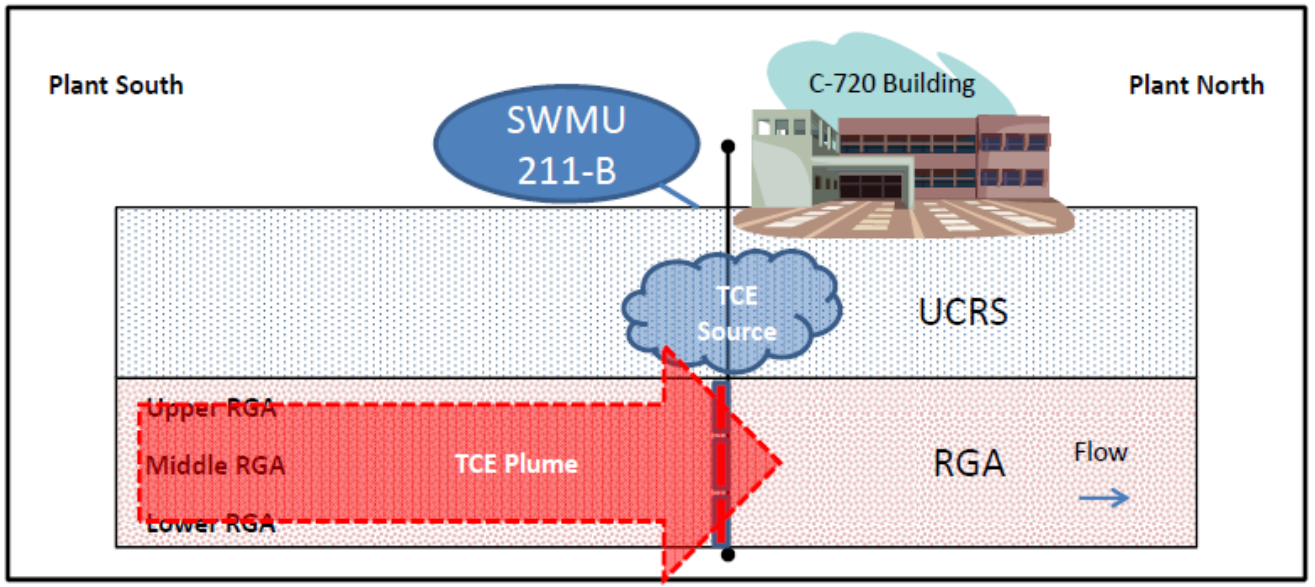

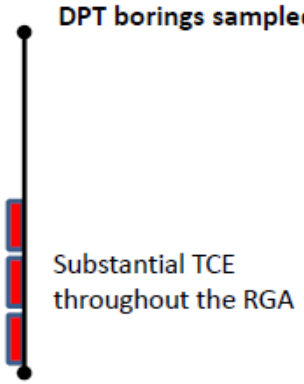

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DOE PORTSMOUTH/PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

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

LATA Environmental Services of Kentucky, LLC

ATTACHMENT C1

QUALITY ASSURANCE PROJECT PLAN UPDATES

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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.

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

Matrix:	Aqueous/Soils
Analytical Group/Concentration Level:	VOCs
Sampling SOP:	See Worksheet #21
Analytical Method/SOP Reference:	8260
Sampler's Name/Field Sampling Organization:	TBD
Analytical Organization:	TBD
No. of Sample Locations:	See Section 5 and Appendix A of the RDSI Characterization Plan and Appendix C

QC Sample	Frequency	Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Split Samples	As requested by regulatory agency	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, *Quality Assured Data*
Trip Blank	1 per cooler containing VOC samples	~200	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*
Equipment Blank	Minimum 5%	60	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)[1]	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Soil/ Groundwater	VOCs	Moderate/High	SWMU 1 C-720 Southeast Site C-720 Northeast Site	See Worksheet #23	28-day	TBD	TBD
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)[1]	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
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
[1] Laboratory contracting will be subsequent to the completion of the RDSI Characterization Plan.

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CERTIFICATION

Document Identification: ***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**

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

2-20-15
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

Jennifer Woodard, Paducah Site Lead
Portsmouth/Paducah Project Office

2/20/2015
Date Signed