DOE/LX/07-2200&D2
Secondary Document

Sampling and Analysis Plan to Support the Additional Action for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Secondary Document

Sampling and Analysis Plan to Support the Additional Action for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—May 2015

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Revised by
LATA Environmental Services of Kentucky, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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TABLES

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ACRONYMS

DOE	U.S. Department of Energy
DPT	direct push technology
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
PGDP	Paducah Gaseous Diffusion Plant
RGA	Regional Gravel Aquifer
SAP	sampling and analysis plan
TIC	top of inner casing
TOC	top of casing
UCRS	Upper Continental Recharge System
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
WWR	Well Wizard riser

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1. INTRODUCTION

This Sampling and Analysis Plan (SAP) documents how groundwater samples will be collected and analyzed in a screening study to determine whether volatile organic compound (VOC) [primarily trichloroethene (TCE)] concentrations warrant a vapor intrusion study at certain locations within the Water Policy Area outside the Paducah Gaseous Diffusion Plant (PGDP).

The *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1, (Five-Year Review) (DOE 2014a) presents the results of a 2012 review of the Water Policy Removal Action. In a letter dated September 30, 2014, (EPA 2014a) the U.S. Environmental Protection Agency (EPA) noted the following project-related uncertainty:

> The protectiveness determination of the removal action for the Water Policy cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater from their wells, and a vapor intrusion study is conducted if current groundwater data indicate a study is warranted.

Three meetings were held to scope this concern raised by EPA. The meetings were held on August 8, 2014, February 24, 2015, and April 22, 2015. The meeting presentations are located in Appendices B, C, and D, respectively. As a result of these meetings, the Federal Facility Agreement (FFA) parties agreed to undertake this screening study to determine whether a vapor intrusion study is warranted. This study is being accomplished under the provisions of Section XXX, Five-Year Review, of the PGDP FFA, as documented in the Record of Conversation letter dated August 1, 2014 (DOE 2014b).

2. PURPOSE

Collect first-available water samples from four locations within the Water Policy Area near the residences located above the TCE Plume. The FFA parties have agreed that this sampling approach will provide a sufficient basis on which to determine whether a vapor intrusion study is warranted, as follows:

- Advance Direct Push Technology (DPT) rods into the Upper Continental Recharge System (UCRS) to allow collection of water from the first-available depth.
- Sample groundwater from the first available depth and analyze for VOCs.
- Compare groundwater analytical results to the respective Vapor Intrusion Screening Level (VISL) for groundwater calculated using the VISL Calculator (EPA 2014b).

3. INVESTIGATION BOUNDARY

The screening study boundaries are first available UCRS water from DPT rods installed near six residences (4 locations) within the TCE plume, as detailed in this plan. Samples will be taken within 100 ft laterally, where possible, from the residence but no further than 300 ft for this study.

4. NUMBER OF BORINGS

In order to determine the first available water at each of the 4 locations shown in Figure 1, 3 DPT borings at each of the 4 locations will be advanced to targeted depths, for a total of 12 borings. Table 1 provides the approximate coordinates for the four DPT sample boring groups.

Table 1. Five-Year Review Screening Study DPT Sample Borings Locations

Sample Boring Group	Approximate Location of Boring from Residence	DPT Depths (bgs) Paired RGA well	Approximate Plant Coordinates	
			East	North
NW1	~ 80 ft North (Figure 2)	12 ft, 22 ft, 32 ft MW451	-7123	4924
NW2	~ 100 ft West (Figure 3)	12 ft, 22 ft, 32 ft MW236	-5010	7417
NE1 (3 residences—1 boring location)	Left Residence ~ 110 ft Northeast Middle Residence ~ 40 ft North Right Residence ~ 235 ft West (Figure 4)	12 ft, 22 ft, 32 ft MW148	3190	5820
NE2	~ 65 ft South (Figure 5)	12 ft, 22 ft, 32 ft MW253	4716	3708

5. DRILLING METHOD

For this field characterization effort, the investigation will use a DPT rig and dual tube sampling system. The drill crew will advance the sample system with a center rod and drive point assembly to 5 ft short of the target depth (See Section 6) and withdraw the drive point for the bottom 5 ft, allowing the sampler to fill with soil over the bottom 5 ft. This will minimize the compaction of soils over the bottom 5 ft. Compaction by the DPT rods in the overlying soils will result in an effective temporary seal for the DPT rods.

The drill crew will extract the soil core from the bottom of the hole and pull the outer rods up 0.5 ft to expose the soils and allow shallow groundwater to flow into the interior of the DPT rods. Because the shallow groundwater samples will be collected the next day, no additional measures will be required to maintain the DPT borings prior to sampling. Upon completion of sampling, the DPT boreholes will be abandoned by pulling the DPT rods from the ground and filling the boreholes with 3/8-inch particle size bentonite to within 2 ft of ground surface, hydrating the bentonite in 3-ft lifts. The top 2 ft of the borehole will be filled with materials consistent with the surrounding ground surface.

If DPT cannot advance to the targeted depth, up to three ten-ft step-out attempts will be made, or if the resident requests a different location, then this will be documented in the report.

Residents will be contacted to access their property and to obtain agreement on the location of sampling; these interactions will be documented in the report. DOE will keep within the designated boundary conditions (see Section 3 above).

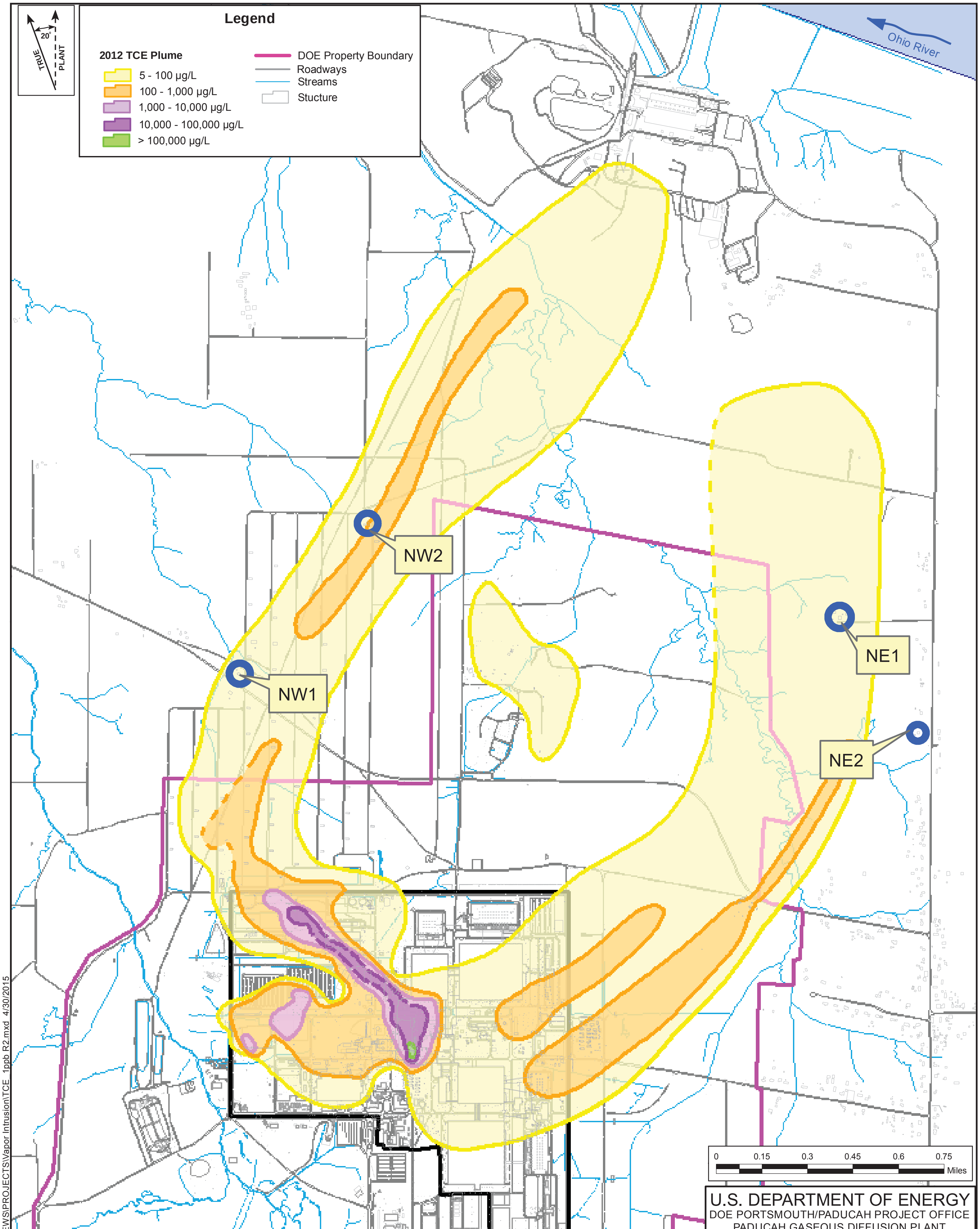

Figure 1. Map of Proposed DPT Sample Boring Locations

LATA Environmental Services of Kentucky, LLC

6. SAMPLING METHOD

At each of four locations, DPT rods will be advanced to three depths [nominally 12 ft below ground surface (bgs), 22 ft bgs, and 32 ft bgs, see Table 1], assuring that all samples are collected more than 5 ft above the potentiometric surface of the nearby Regional Gravel Aquifer (RGA) (i.e., > 37 ft bgs).[1]

When target depth has been reached at each boring, the DPT rod will be retracted 0.5 ft to allow for groundwater to enter. The rods will remain in that position overnight. The following steps will be repeated for each sample of the four samples.

1. Identify the shallowest DPT with water. Using a water level probe, measure the depth to water within the shallowest DPT rod with water.
2. Lower a discrete depth sampler and collect a sample from the first available water for VOC analysis.
3. Document the temperature of the water sample.

Table 1 also provides the approximate boring locations in reference to the residences. Figures 2–5 provide a map of the approximate locations. Each location is paired with an RGA well. Before installing DPTs, the water level in the paired RGA well will be measured to ensure that the 32 ft bgs DPT boring is at least 5 ft above the RGA potentiometric surface on the day of installation. Table 2 details additional information concerning the RGA well for each location by these reference points: top of casing (TOC), top of inner casing (TIC), and Well Wizard riser (WWR).

Table 2. RGA Paired Well Information

Sample Boring Group	Paired RGA MW	Approx. Plant Coordinates		Reference Point	Reference Elevation (ft)	Ground Elevation (ft)
		X	Y			
NW1	MW451	-8,031.59	4,211.78	TOC	367.22	364.68
NW2	MW236	-5,090.64	7,919.36	WWR	369.05	369.28
NE1	MW148	3,289.83	5,755.06	TOC	374.00	371.08
NE2	MW253	3,572.22	3,669.88	TIC	370.86	368.90

7. QUALITY ASSURANCE

Appendix A provides the Quality Assurance Project Plan.

[1] The potentiometric surface of the RGA occurs within the UCRS, slightly above the top of the RGA. The RGA potentiometric surface provides a measurable and reliable reference to assure that the deepest sample depth represents the UCRS and is close to (approximately 10 ft above) the top of the RGA.

Figure 2. Location of Proposed NW1 DPT Sample Borings

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Figure 3. Location of Proposed NW2 DPT Sample Borings

Figure 4. Location of Proposed NE1 DPT Sample Borings

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Figure 5. Location of Proposed NE2 DPT Sampling Borings

LATA Environmental Services of Kentucky, LLC

8. PROJECT DOCUMENTATION

The results of this screening investigation will be documented in an addendum to the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1.

9. INVESTIGATION DECISION RULES

The intent of this screening study is to compare TCE (and other selected chlorinated VOCs) concentrations in the first available water against VISLs developed using default parameter assumptions. VOCs of concern for this investigation are TCE, *cis*-1,2-dichloroethene, *trans*-1.2-dichloroethene, and vinyl chloride. The temperature of the sampled water will be measured in the field.

The following are the decision rules:

- **IF** groundwater data for selected VOCs are less than the associated VISL or nondetect, **THEN** no additional groundwater sampling is needed and the vapor intrusion pathway does not pose a concern for the residence.

- **IF** groundwater data for selected VOCs are greater than or equal to the associated VISL, **THEN** reevaluate and scope the next step to address the potential for a vapor intrusion concern.

The data from first available water screening samples will be evaluated against the above decision rules to determine whether a vapor intrusion study is warranted.

10. REFERENCES

DOE (U.S. Department of Energy) 2014a. The *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1, U.S. Department of Energy, Paducah, KY.

DOE 2014b. Jennifer Woodard, U.S. Department of Energy, Kevil, KY, letter to Jennifer Tufts, U.S. Environmental Protection Agency, Atlanta, GA, and Todd Mullins, Kentucky Department for Environmental Protection, Frankfort, KY, "Transmittal of the Record of Conversation Concerning the U.S. Environmental Protection Agency Recommendation for Modification and Additional Action to the Five-Year Review," Paducah, KY, August 1.

DOE 2015. *Remedial Design Work Plan for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1268&D2/R2/A1, U.S. Department of Energy, Paducah, KY.

EPA (U.S. Environmental Protection Agency) 2014a. Jennifer Tufts, U.S. Environmental Protection Agency, Region 4, Atlanta, GA, letter to Jennifer Woodard, U.S. Department of Energy, Paducah, KY, September 30.

EPA 2014b. OSWER Vapor Intrusion Screening Level (VISL) Calculator http://www.epa.gov/oswer/vaporintrusion/documents/VISL-Calculator.xlsm.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

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CONTENTS

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QAPP WORKSHEETS

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ACRONYMS

ASTM	American Society for Testing and Materials
CA	corrective action
CAB	Citizens Advisory Board
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
CRQL	contract-required quantification limit
DMC	Document Management Center
DOECAP	U.S. Department of Energy Consolidated Audit Program
DPT	direct push technology
DQI	data quality indicator
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
GC	gas chromatograph
ID	identification
KDEP	Kentucky Department for Environmental Protection
KY	Commonwealth of Kentucky
LATA Kentucky	LATA Environmental Services of Kentucky, LLC
MBWA	Management by Walking Around
MDL	method detection limit
MS	mass spectroscopy
N/A	not applicable
NRDA	National Resource Damage Assessment
OREIS	Paducah Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
PQL	practical quantitation limit
QA	quality assurance
QC	quality control
QAPP	quality assurance program plan
RDSI	remedial design support investigation
RGA	Regional Gravel Aquifer
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
TBD	to be determined
UCRS	Upper Continental Recharge System
VOC	volatile organic compound

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QAPP Worksheet #1
Title Page

Document Title: *Sampling and Analysis Plan to Support the Additional Action for the CERCLA Five-Year Review 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): 5/2015

Document Control Number: DOE/LX/07-2200&D2

LATA Kentucky Environmental Remediation Project Manager	[signature] for Signature Mark J. Duff	5/20/15 Date
LATA Kentucky Regulatory Manager	[signature] Signature Myrna Espinosa Redfield	5/20/15 Date
LATA Kentucky Sample/Data Management Manager	Lisa Crabtree for Signature Jaime Morrow	5/20/15 Date

QAPP Worksheet #2
QAPP Identifying Information

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

1. Identify guidance used to prepare QAPP:

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

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

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

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

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

3. Identify approval entity: DOE, EPA Region 4, and Kentucky Division of Waste Management (KDWM)

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

5. List dates of scoping sessions that were held:

   August 2014 Conference Call: Vapor Intrusion for the Water Policy Area
   February 2015 DQO Scoping: Vapor Intrusion for the Water Policy Area
   April 2015 DQO Scoping: Vapor Intrusion for the Water Policy Area

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

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

Title:	Approval Date:
Not Applicable (N/A)	

7. List organizational partners (stakeholders) and connection with lead organization:
DOE, EPA Region 4, KDWM, for connection please see Worksheet #5-B.

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

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

No elements specifically are omitted from this QAPP.

QAPP Worksheet #2 (Continued)
QAPP Identifying Information

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

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Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	• Sampling Design and Rationale • Sample Location Map • Sampling Locations and Methods/SOP Requirements Table • Analytical Methods/SOP Requirements Table • Field Quality Control Sample Summary Table • Sampling SOPs • Project Sampling SOP References Table • Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17, 18, 19, 20, 21, 22, and Sampling and Analysis Plan (SAP) page 4.
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	• Analytical SOPs • Analytical SOP References Table • Analytical Instrument Calibration Table • Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	23, 24, 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	• Sample Collection Documentation Handling, Tracking, and Custody SOPs • Sample Container Identification • Sample Handling Flow Diagram • Example Chain-of-Custody Form and Seal	26, 27
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QAPP Worksheet #2 (Continued)
QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Worksheet No.
Assessment/Oversight		
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5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	• Verification (Step I) Process Table • Validation (Steps IIa and IIb) Process Table • Validation (Steps IIa and IIb) Summary Table • Usability Assessment	34, 35, 36, 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		

QAPP Worksheet #3
Minimum Distribution List

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

Standard Distribution List—FFA Documents

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

[a] For KY, one redlined hard copy is sufficient if the document is less than 100 pages. If the document is greater than 100 pages, KY would like an additional redlined hard copy. For D2 documents, DOE has requested 3 redlined copies and 8 comment response summaries (CRS). Two additional redlined copies will be generated for the AR file and for the DMC file if the DOE letter cites that a redlined copy is enclosed. CRSs in response to DOE comments are provided to DOE only.
[b] Electronic distribution will be made via e-mail for documents less than 25 MB; otherwise, the link to the LATA Kentucky FTP and Public Documents Web site will be provided. DOE will be responsible for sending the e-copy e-mail. LATA Kentucky will be responsible for posting to the LATA Kentucky FTP and Public Documents Web site. Note: EPA/KY limits attachments via external e-mail to 10 MB. DOE and LATA Kentucky can receive and send up to 50 MB.
[c] CDs are provided to Kim Knerr.
[d] Environmental Reporting and Deliverables Quality (ERDQ)/Document Production (within the Regulatory Management group) will provide CAB CDs to Eddie Spraggs who will make distribution of the CDs.
[e] Additional copies needed for LATA Kentucky personnel are not included in the above totals. ERDQ will provide copies to the appropriate administrative staff to complete distribution of these documents.

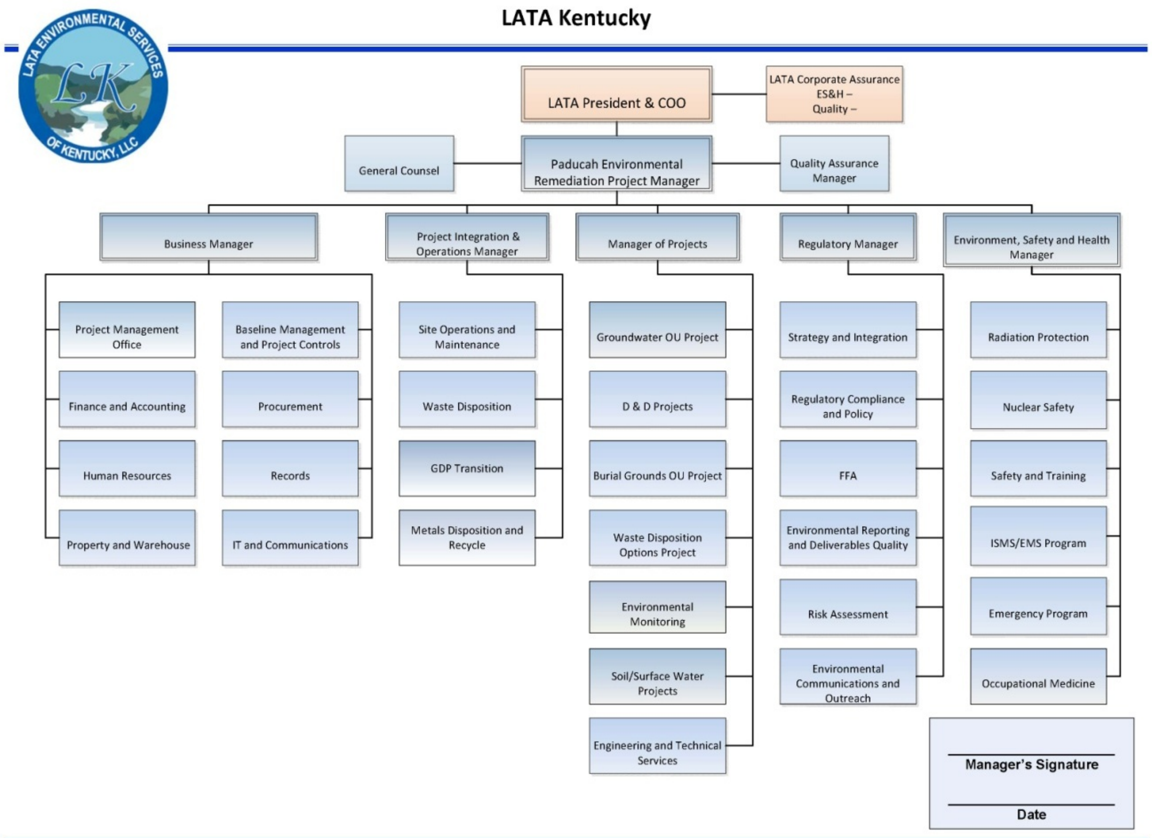
QAPP Worksheet #4
Project Personnel Sign-Off Sheet

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

Project Position Title	Organization	Signature	Date

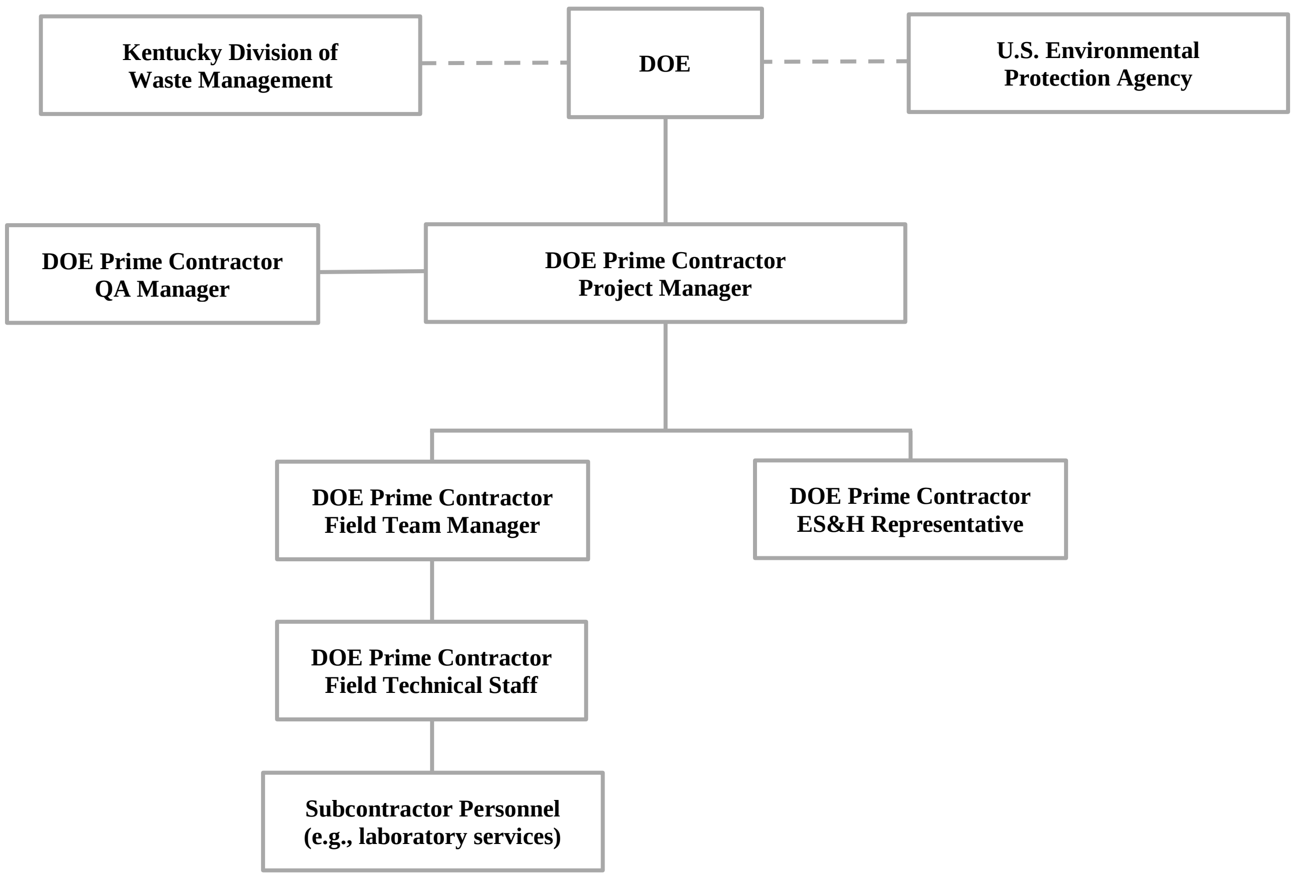
QAPP Worksheet #5-A
Project Contractor Organizational Chart*

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



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

QAPP Worksheet #5-B
Project Level Organizational Chart



QAPP Worksheet #6
Communication Pathways

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

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

Roles presented above are at the program level.

QAPP Worksheet #6 (Continued)
Communication Pathways

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

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

QAPP Worksheet #7
Personnel Responsibility and Qualifications Table

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

QAPP Worksheet #8
Special Personnel Training Requirements Table

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

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

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

QAPP Worksheet #9
Project Scoping Session Participants Sheet

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

Name of Project: Addendum for the Five-Year Review, SAP
Date of Session: August 21, 2014
Scoping Session Purpose: Develop data quality objectives

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
LATA Kentucky Project Manager	LATA Kentucky	Teresa Overby	270-441-5188	teresa.overby@lataky.com	Project management
DOE Project Manager	DOE	Cynthia Zvonar	859-219-4066	cynthia.zvonar@lex.doe.gov	Program management
Risk Manager	DOE	Rich Bonczek	859-219-4051	rich.bonczek@lex.doe.gov	Technical support
FFA Manager	KDEP	Todd Mullins		todd.mullins@ky.gov	Project management
Geologist	LATA Kentucky	Ken Davis	270-441-5049	ken.davis@lataky.com	Technical support
FFA Manager	EPA	Jennifer Tufts	404-562-8513	tufts.jennifer@epa.gov	Project management
Technical Advisor	KDEP	Mike Guffey	502-564-1299	mike.guffey@ky.gov	Technical support
Technical support	DOE PPPO Contractor, Pro2Serve	Tracey Duncan	270-441-5060	tracey.duncan@lataky.com	Technical support
Technical support	DOE PPPO Contractor, Strategic Management Solutions, LLC (SMSI)	Bobette Nourse	865-712-2669	bobette.nourse@lex.doe.gov	Technical support
LATA Kentucky Risk Manager	LATA Kentucky	Joe Towarnicky	270-441-5134	joseph.towarnicky@lataky.com	Technical support

QAPP Worksheet #9 (Continued)
Project Scoping Session Participants Sheet

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

Name of Project: Addendum for the Five-Year Review, SAP
Date of Session: February 24, 2015
Scoping Session Purpose: Develop data quality objectives

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
LATA Kentucky Project Manager	LATA Kentucky	Teresa Overby	270-441-5188	teresa.overby@lataky.com	Project management
DOE Project Manager	DOE	Cynthia Zvonar	859-219-4066	cynthia.zvonar@lex.doe.gov	Program management
Risk Manager	DOE	Rich Bonczek	859-219-4051	rich.bonczek@lex.doe.gov	Technical support
FFA Manager	KDEP	Todd Mullins		todd.mullins@ky.gov	Project management
Geologist	LATA Kentucky	Ken Davis	270-441-5049	ken.davis@lataky.com	Technical support
FFA Manager	EPA	Jennifer Tufts	404-562-8513	tufts.jennifer@epa.gov	Project management
Technical Advisor	KDEP	Mike Guffey	502-564-1299	mike.guffey@ky.gov	Technical support
Facilitator	LATA Kentucky	Tracey Duncan	270-441-5060	tracey.duncan@lataky.com	Facilitator
Technical support	DOE PPPO Contractor, SMSI	Bobette Nourse	865-712-2669	bobette.nourse@lex.doe.gov	Technical support
LATA Kentucky Risk Manager	LATA Kentucky	Joe Towarnicky	270-441-5134	joseph.towarnicky@lataky.com	Technical support
Groundwater Project Manager	DOE	David Dollins	270-441-6819	dave.dollins@lex.doe.gov	Technical support
Technical Advisor	EPA	Ben Bentkowski	404- 562-8507	bnentkowski.ben@epa.gov	Technical support
Technical Advisor	KDEP	Brian Begley	502- 564-6716	brian.begley@ky.gov	Technical support
Technical Advisor	EPA	Jon Richards	404-562-8648	richards.jon@epa.gov	Technical support

QAPP Worksheet #9 (Continued)
Project Scoping Session Participants Sheet

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

Name of Project: Addendum for the Five-Year Review, SAP
Date of Session: April 22, 2015
Scoping Session Purpose: Develop data quality objectives

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
LATA Kentucky Project Manager	LATA Kentucky	Teresa Overby	270-441-5188	teresa.overby@lataky.com	Project management
DOE Project Manager	DOE	Cynthia Zvonar	859-219-4066	cynthia.zvonar@lex.doe.gov	Program management
Risk Manager	DOE	Rich Bonczek	859-219-4051	rich.bonczek@lex.doe.gov	Technical support
FFA Manager	KDEP	Todd Mullins		todd.mullins@ky.gov	Program management
Geologist	LATA Kentucky	Ken Davis	270-441-5049	ken.davis@lataky.com	Technical support
FFA Manager	EPA	Julie Corkran	404-562-8547	corkran.julie@epa.gov	Program management
Technical Advisor	KDEP	Mike Guffey	502-564-1299	mike.guffey@ky.gov	Technical support
Project Support	LATA Kentucky	Tracey Duncan	270-441-5060	tracey.duncan@lataky.com	Facilitator
Technical Advisor	DOE PPPO Contractor, SMSI	Bobette Nourse	865-712-2669	bobette.nourse@lex.doe.gov	Technical support
Risk Manager	LATA Kentucky	Joe Towarnicky	270-441-5134	joseph.towarnicky@lataky.com	Technical support
Groundwater Project Manager	DOE	David Dollins	270-441-6819	dave.dollins@lex.doe.gov	Technical support
Technical Advisor	EPA	Ben Bentkowski	404- 562-8507	bentkowski.ben@epa.gov	Technical support
Technical Advisor	KDEP	Brian Begley	502- 564-6716	brian.begley@ky.gov	Technical support
Technical Advisor	EPA	Jon Richards	404-562-8648	richards.jon@epa.gov	Technical support

QAPP Worksheet #9 (Continued)
Project Scoping Session Participants Sheet

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

Name of Project: Addendum for the Five-Year Review, SAP
Date of Session: April 22, 2015
Scoping Session Purpose: Develop data quality objectives

Position Title	Affiliation	Name	Phone #	E-mail Address	Project Role
Technical Advisor	KDWM	Jeri Higgenbotham		jeri.higginbotham@ky.gov	Technical support
Technical Advisor	Geosyntec	Helen Dawson	703-533-3148	hdawson@geosyntec.com	Technical support
Technical Advisor	EPA	Noman Ahsanuzzamen		ahsanuzzaman.noman@epa.gov	Technical support
Technical Advisor	EPA	Glenn Adams		adams.glenn@epa.gov	Technical support
Technical Advisor	KDWM	Gaye Brewer	270-898-8468	gaye.brewer@ky.gov	Technical support
Technical Advisor	DOE PPPO Contractor, Pro2Serve	Allison Keefer	270-441-6809	allison.keefer@lex.doe.gov	Technical support
Technical Advisor	DOE PPPO Contractor, Pro2Serve	Tracy Taylor	270-441-6866	tracy.taylor@lex.doe.gov	Technical support

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project: The problem being addressed is a concern that volatile organic compounds (VOCs) vapors including *cis*-1,2-dichloroethene (*cis*-1,2-DCE), *trans*-1.2-dichloroethene (*trans*-1,2-DCE) trichloroethene (TCE), and vinyl chloride (VC) may be migrating from the PGDP Regional Gravel Aquifer (RGA) plume through the overlying Upper Continental Recharge System (UCRS) and into the residences located over the bifurcated plume. This screening study seeks to sample first available groundwater near six residences and analyze the groundwater for these constituents in order to evaluate (on a screening level) whether VOC concentrations in groundwater warrant a vapor intrusion study.

The environmental questions being asked:

1. Are there detectable concentrations of target VOCs in first available water taken from UCRS sample locations in the vicinity of the six residences?
2. If target VOCs are detected, are they present at concentrations that exceed the Vapor Intrusion Screening Level (VISL), if available, for that parameter.

Observations from any site reconnaissance reports: Historical data show UCRS groundwater concentrations typically are not above the VISLs, but existing wells are not located within 100-300 ft of residences.

A synopsis of secondary data or information from site reports:

Soil vapor samples have been difficult to collect; therefore, soil vapor migration is not likely due to tight near-surface soils. .

The possible classes of contaminants and the affected matrices:

VOCs: *cis*-1,2-DCE, *trans*-1,2-DCE, TCE, and VC.

Affected matrices are expected to be as follows (if present):

Groundwater

The rationale for inclusion of chemical and nonchemical analyses:

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

Information concerning various environmental indicators:

Not Applicable

Project decision conditions ("If..., then..." statements):

The intent of this screening study is to compare TCE (and other selected chlorinated VOCs) concentrations in the first available water against VISLs developed using default parameter assumptions. VOCs of concern for this investigation are *cis*-1,2-DCE, *trans*-1,2-DCE, TCE, and VC. The temperature of the sampled water will be measured and recorded in the field for each groundwater sample taken.

QAPP Worksheet #10 (Continued)
Problem Definition

The following are the decision rules:

- **IF** groundwater data for selected VOCs are less than the associated VISL or nondetect, **THEN** no additional groundwater sampling is needed, and the vapor intrusion pathway does not pose a concern for the residence.
- **IF** groundwater data for selected VOCs are greater than or equal to the associated VISL, **THEN** reevaluate and scope the next step to address the potential of a vapor intrusion concern.

The data from first available water screening samples will be evaluated against the above decision rules to determine whether a vapor intrusion study is warranted.

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

Who will use the data?

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

What will the data be used for?

Screening against the EPA VISL for groundwater to determine if a vapor intrusion study is warranted.

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

Samples for VOCs (*cis*-1,2-DCE, *trans*-1,2-DCE, TCE, and VC) will be sent to a fixed-laboratory plus 100% field and equipment blanks and 5% duplicates. The temperature of the sampled water will be measured and recorded in the field for each groundwater sample taken.

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 (Worksheet #12-A). All fixed-laboratory data will be verified and assessed with 100% validated at Level III.

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

The numbers of samples to be submitted to the field and fixed-laboratories are identified in Worksheet #18.

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

See SAP.

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. Fixed-base laboratory analysis will be performed by a DOECAP audited laboratory.

How will the data be reported?

Field data will be recorded on chain-of-custody forms and sample data forms. The fixed-base laboratory will provide data in an Electronic Data Deliverable (EDD). Project data, including the temperature of the sampled water, following verification assessment and validation will be placed into and reported from the Paducah Oak Ridge Environmental Information System (OREIS). Data loaded into Paducah OREIS will be made available to the public stakeholders via the Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System (PEGASIS).

How will the data be archived?

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

QAPP Worksheet #12
Measurement Performance Criteria Table[1]

Analyte	CAS Number	EPA Method	Water Practical Quantitation Limit (PQL) (μg/L)	Water Method Detection Limit (MDL)* (μg/L)
cis-1,2-Dichloroethene	156-59-2	SW-846, 8260	1	0.3
trans-1,2-Dichloroethene	156-60-5	SW-846, 8260	1	0.3
Trichloroethene	79-01-6	SW-846, 8260	1	0.3
Vinyl Chloride	75-01-4	SW-846, 8260	1	0.3

[1] Additional information about quality control samples is found in Worksheet #28.
*LATA Kentucky will have the laboratory report to the method detection limit qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory practical quantitation limit.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
OREIS Database	Various	Various	Data will be compared against the appropriate VISL (as available) to determine if a vapor intrusion study is warranted.	Data have been verified, assessed, and validated. Rejected data will not be used.

QAPP Worksheet #14
Summary of Project Tasks*

Sampling Tasks:

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

Analysis Tasks:

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

Quality Control Tasks:

QC will be per QAPP worksheets as follows:

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

Secondary Data:

See Worksheet #13.

Data Management Tasks:

Data management will be per procedure PAD-ENM-5007, *Data Management Coordination.*

Documentation and Records:

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

Assessment/Audit Tasks:

Assessments and audits will be per procedure PAD-QA-1420, *Conduct of Assessments.*

Prior to mobilization to perform fieldwork, an independent assessment (Internal Field Readiness Review) will be conducted to determine if the project is prepared to proceed (e.g., scope has been defined and is understood by workforce, scope has regulatory approval, scope properly contracts, personnel properly trained to complete). One management assessment will be performed during DPT sampling to verify work is being performed consistent with the SAP.

Data Review Tasks:

Data review tasks will be per procedure PAD-ENM-5003, *Quality Assured Data,* and PAD-ENM-0063 R2, *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky.*

*It is understood that SOPs are contractor specific.

QAPP Worksheet #15
Reference Limits and Evaluation Table

Matrix: Water
Analyte Group: VOCs

VOCs	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference*	Site COPC?	Laboratory-Specific	
					PQLs* (µg/L)	MDLs (µg/L)
cis-1,2-Dichloroethene	156-59-2	N/A		Yes	1	0.3
trans-1,2-Dichloroethene	156-60-5	N/A		Yes	1	0.3
Trichloroethene	79-01-6	1.2	VISL, v3.1.1, May 2014	Yes	1	0.3
Vinyl chloride	75-01-4	0.15	VISL, v3.1.1, May 2014	Yes	1	0.3

*The analytical laboratory may not be able to meet the project action limits. In those cases, LATA Kentucky will have the laboratory report to the method detection limit, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory practical quantitation limit.

QAPP Worksheet #16
Project Schedule/Timeline Table

The total duration of the fieldwork is approximately two weeks. Fieldwork start date is forecast for June 1, 2015,[1] pending approval of the Sampling and Analysis Plan.

An addendum report to the Five-Year Review will be submitted October 19, 2015.[1]

[1] These dates are estimates for planning and are included here for informational purposes only and are not intended to establish enforceable schedules or milestones. Enforceable milestones are contained in Appendix C of the FFA and Appendix 5 of the Site Management Plan.

QAPP Worksheet #17
Sampling Design and Rationale

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

The screening study was negotiated during scoping using professional judgment. The first available groundwater samples will be collected from DPTs installed in the UCRS at locations within 100 ft of the residences, where possible, and no further than 300 ft. One sample is to be collected in the vicinity of three residences (NE1) at a location central to the three residences.

The screening study will collect water samples for fixed laboratory analysis and results will be compared to the appropriate VISL, if available.

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

Three DPTs will be advanced at each of four locations at depths of 12 ft, 22 ft, and 32 ft bgs (as long as the 32 ft boring is at least 5 ft above the RGA water level in the RGA well, paired with the respective DPT boring) in order to identify the first available water. VOC concentrations in first available water will be used to estimate the potential for vapor intrusion by comparing the concentrations in first available water to appropriate VISLs.

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

Standard Environmental Sampling:

VOCs by SW-846, 8260. **See Worksheet #12 for method detection limit.**

Engineering & Design Sampling:

For measuring depth to groundwater, Solinst or equivalent.

For measuring temperature, Hach® Quanta Hydrolab or equivalent.

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

See Worksheet #18.

How many samples to be taken?

See Worksheet #18.

What is the sampling frequency (including seasonal considerations)?

This is a one-time sampling event.

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

Sampling Location/ID Number	Matrix	Depth	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference	Rationale for Sampling Location
NW1	Groundwater	Subsurface	VOCs	Near method detection limit	1+1 field duplicates	See Worksheet #21	See Worksheet #17
NW2	Groundwater	Subsurface	VOCs	Near method detection limit	1+0 field duplicates		
NE1	Groundwater	Subsurface	VOCs	Near method detection limit	1+0 field duplicates		
NE2	Groundwater	Subsurface	VOCs	Near method detection limit	1+0 field duplicates		

QAPP Worksheet #19
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume[1]	Containers (number, size, and type)[1]	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Groundwater	Volatile Organic Compounds	Low	See Worksheet #12	120 mL	3 x 40 mL Glass VOA vial	Cool < 4°C, HCl	14 days for preserved

[1] Sample volume container requirements will be specified by the laboratory.

QAPP Worksheet #20
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of Proficiency Testing (PT) Samples[1]	Total No. of Samples to Lab[2]
Groundwater	VOCs	Low	See Worksheet #12	See Worksheet #17	5%	5%	100%	100%	N/A	See Worksheet #18

[1] PT sample will only be collected when required by a specific project.
[2] All analyses will be performed by a fixed laboratory.

QAPP Worksheet #21
Project Sampling SOP References Table

Site-specific standard operating procedures (SOPs) have been developed for site sampling activities. Below is a list of site sampling procedures that projects will select from for implementing sampling activities. Appendix E contains the project-specific sampling process for the discrete depth sampler.

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

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

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

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Water Quality Meter	Calibrate at the beginning of the day	Performed monthly and as needed	Measure solutions with known values [National Institute for Standards and Technology (NIST) traceable buffers and conductivity calibration solutions]	Upon receipt, successful operation	Daily before each use	Temp.: ± 0.3ºC	Recalibrate or service as necessary	Field Team Leader	Manufacturers specifications

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

QAPP Worksheet #23
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
8260	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	Definitive	VOCs	GC/MS	TBD	TBD

*Information will be based on laboratory used. Analysis will be by the most recent revision.

QAPP Worksheet #24
Analytical Instrument Calibration Table

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

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
GC-MS	Replace/clean ion source; clean injector, replace injector liner, replace/clip capillary column, flush/replace tubing on purge and trap; replace trap	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23

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

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT	
Sample Collection (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Sample Packaging (Personnel/Organization):	Sampling Teams/DOE Prime Contractor and Subcontractors
Coordination of Shipment (Personnel/Organization):	Lab Coordinator/DOE Prime Contractor
Type of Shipment/Carrier:	Direct Delivery or Overnight/Federal Express
SAMPLE RECEIPT AND ANALYSIS	
Sample Receipt (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Custody and Storage (Personnel/Organization):	Sample Management/Contracted Laboratory
Sample Preparation (Personnel/Organization):	Analysts/Contracted Laboratory
Sample Determinative Analysis (Personnel/Organization):	Analysts/Contracted Laboratory
SAMPLE ARCHIVING	
Field Sample Storage (No. of days from sample collection):	The fixed-base laboratory will archive samples for 4 months or less depending on project-specific requirements.
Sample Extract/Digestate Storage (No. of days from extraction/digestion):	120 Days
Biological Sample Storage (No. of days from sample collection):	N/A
SAMPLE DISPOSAL	
Personnel/Organization:	Waste Disposition/DOE Prime Contractor and Subcontractors
Number of Days from Analysis:	6 months

QAPP Worksheet #27
Sample Custody Requirements*

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

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

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

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

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

Sample Identification Procedures:

Sample identification requirements will comply with PAD-ENM-0063 R2, *Environmental Monitoring Data Management Implementation Plan*.

Chain-of-custody Procedures:

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

*It is understood that SOPs are contractor specific.

QAPP Worksheet #28
QC Samples Table

Matrix:	Aqueous
Analytical Group/Concentration Level:	VOC
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 6 of the SAP

QC Sample:	Frequency/ Number[1]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Split Samples	As requested by regulatory agency	N/A	N/A	N/A	N/A	N/A
Field Blank	100%	≤ Contract-Required Quantification 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	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*
Equipment Blank	100%	≤ CRQL	Verify results; reanalyze		Contamination–Accuracy/bias	See procedure PAD-ENM-5003, *Quality Assured Data*

QAPP Worksheet #28 (Continued)
QC Samples Table

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

[1] The number of QC samples (not including trip blanks) is listed on Worksheet #20.

QAPP Worksheet #29
Project Documents and Records Table

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

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

*It is understood that SOPs are contractor specific.

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)[1]	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)[1]
Groundwater	VOCs	Low	NW1, NW2, NE1, NE2	See Worksheet #23	28-day	TBD	TBD

[1] Laboratory contracting will be subsequent to the approval of the SAP to Support Additional Action for the CERCLA Five-Year Review.

QAPP Worksheet #31
Planned Project Assessments Table

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

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

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

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses*

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

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

*It is understood that SOPs are contractor specific.

QAPP Worksheet #33
QA Management Reports Table

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

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

QAPP Worksheet #34
Verification (Step I) Process Table

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

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

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

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

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

*It is understood that SOPs are contractor specific.

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

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

QAPP Worksheet #37
Usability Assessment*

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

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

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

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

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

Identify the personnel responsible for performing the usability assessment:

Project and QA personnel.

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

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

*It is understood that SOPs are contractor specific.

APPENDIX B

PROTECTIVENESS DETERMINATION PRESENTATION

AUGUST 20, 2014

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DRAFT Preliminary Evaluation of Vapor Intrusion and Protectiveness at PGDP

Review Issue / Comment Responses
Approach: Review Existing Data / Information
Present Preliminary Evaluation
Discuss Sufficiency of Information
Identify Data Gaps

8/20/2014

Approach: Review Existing Data/Information

Is Information Sufficient to Confirm Short-Term Protectiveness?

Approach:

- Review Vapor Intrusion Issue / Comments on Five-Year (5-yr) Review
- Review Applicable Regulation and Potentially-Relevant Guidance
  - Establish area-specific, pathway-specific targets
- Review PGDP Data / Information
  - Evaluate results to determine degree of support for protectiveness determination
- Preliminarily Evaluate Potential for Vapor Intrusion
  - Water Policy Area
  - On-Site Structures
    - C-400
    - C-720
- Present Results
  - Identify Data Gaps
- Identify Needed Changes to 5-yr Review
  - Identify path forward to address vapor intrusion issues

Issue: Need to Support Protectiveness Statements in Five-Year Review (or modify)

- Areas of Concern: Vapor Intrusion
  - Water Policy Area
    - Protective of residents in current structures? Note: groundwater use limited by water policy
  - Site Buildings
    - C-400: Protective of current workers [through next 5-year review]?
    - C-720: Protective of current workers [through next 5-year review]?

- Questions Raised by Comments
  - Do data support short-term protectiveness statement for Water Policy Area
    - Are limits on groundwater use documented? and
    - Is groundwater from shallow wells (UCRS) above the plume not contaminated? or
    - Should protectiveness statement be deferred
  - Do data support short-term protectiveness statement for C-400 and C-720
    - Concerning current workers (or should statement be deferred until after vapor intrusion study conducted as part of subsequent action)

- Are There Data Gaps That Affect Protectiveness Statements?

Potential Area-Specific Benchmarks Used

To Evaluate Short-Term Protectiveness

- Protectiveness Benchmarks Under *Current* Conditions
  - Water Policy Area: Residents in current structures
    - Trichloroethene (TCE) MCL = 5 ug/L; TCE Residential Vapor Intrusion Screening Level (VISL) Target in Groundwater = 1.2 ug/L
    - Vinyl Chloride (VC) MCL = 2 ug/L; VC Residential VISL Target in Groundwater = 0.15 ug/L
  - NOTE 1: ***Groundwater use restricted***, limiting potential for vapor exposure from contaminated RGA groundwater.
  - NOTE 2: ***UCRS groundwater physically between plume and structures***
  - NOTE 3: VISL screening level used to estimate potential for lifetime (70 years) exposure. ***MCL may be more-appropriate benchmark to estimate against in 5-year review***

  - Site Buildings
    - C-400: OSHA Limits on current [USEC] workers through next five-year review [Fluor-LATA]
      - Before use allows non-workers on site, should meet commercial VISL limits or limit access by non-workers
    - C-720: OSHA Limits on current [USEC] workers through next five-year review [Fluor-LATA]
      - Before use can change, meet commercial VISL limits or maintain access limits by non-workers

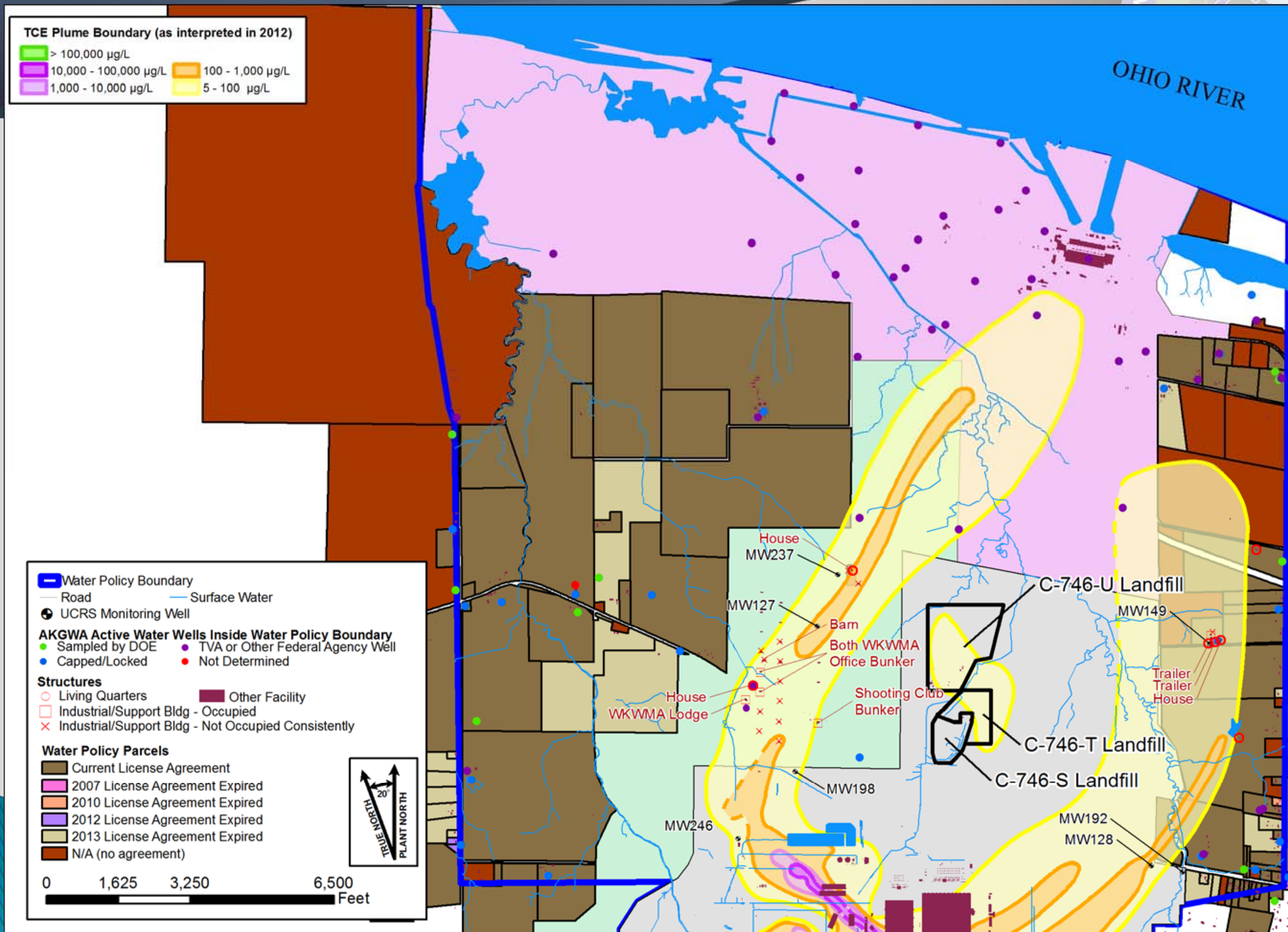
- Protectiveness Benchmarks Under Future Conditions
  - Water Policy Area: Residential (both current and future structures)
  - On-site buildings:
    - OSHA limits for future workers
    - Before building use can change, meet commercial VISL limits or maintain access limits by non-workers

Preliminary Evaluation:

Water Policy Area: Vapor Intrusion at Levels of Concern Unlikely

- Water policy limits use of groundwater, minimizing the major exposure pathway
- ***No active residential wells within plume***
- Only five private occupied structures physically above the TCE plume (Plume identified as areas where RGA concentrations are >5 ug/L)
- No private structures ***with active wells*** over RGA plume
- Distal plume concentrations low relative to other areas (and decreasing)
- ***Soils in PGDP vicinity not conducive to vapor migration***
  - 2005 EPA Vapor measurements (3) in area showed no TCE (2 samples had no recovery)
  - ***EPA Investigation showed soils tight / vapor migration limited***
- There is clean UCRS groundwater at elevation between plume and structures
  - UCRS groundwater has no VOCs above MCL except for 5 of ~200 results
  - Only two of the five results that exceed MCLs were obtained since 1991
  - Wells with historical results that exceed MCLs have more-recent results below MCLs
- There are five occupied residences above the plume; 2 trailers; 3 houses
  - None has an active well
  - Water bills paid by DOE; water usage monitored

Map of Structure Locations Within Plume



Preliminary Evaluation (continued):

Water Policy Area Groundwater

- Five residences located above RGA Plume
- No residence within plume has an active well
- There is clean UCRS water at elevation between contaminated RGA and residences and this clean water limits potential for vapor migration from RGA to structures
  - Five UCRS monitoring wells in the vicinity; these show current concentrations below MCLs
  - Current UCRS well concentrations at S, T, U Landfills below MCLs
- UCRS Water Evaluation: five wells / ~200 VOC analyses
  - Five results (of ~200) historically exceeded 5 ug/L TCE MCL.
    - MW149 conc's at 26 ug/L (2009), 7.9 ug/L (2011); most recent (2013) result = 4.9 ug/L
    - MW198 conc's at 610, 530, and 11 ug/L in 1991; most recent (2003) result = non-detect
  - No detections of VC
- Over 600 UCRS S, T, & U landfill well analyses (quarterly analyses)
  - Two UCRS wells with historical (2003/2009) MCL exceedance had non-detect TCE (2013)
  - Both 2009 historical exceedances (MW362, MW365) flagged as "MS/MSD recovery and/or RPD failed acceptance criteria"
  - 2003 exceedance (MW365) had TCE at 9 ug/L

Preliminary Evaluation:

On-site Buildings: C-400

- C-400 Has the Highest Potential for Vapor Intrusion Because
  - High UCRS/RGA TCE concentrations are located in vicinity of building
  - UCRS soils near C-400 have more sand than elsewhere at PGDP
- Thus, if vapor intrustion determined NOT to be an issue at C-400, then the potential for vapor intrusion is low at other buildings or at distal areas of the plume

- Our Review Determined That There is Low Potential for C-400 Vapor Intrusion Because:
  - Multiple soil gas/Industrial Hygiene (IH) monitoring has shown no vapors at levels of concern
  - Vapor measurements during six-phase study showed no issue
    - Concern heightened due to heated soils adjacent to C-400
    - Measurements showed two TCE detections at 2.8 ppmv and 0.2 ppmv – attributed at the time to outgassing from affected groundwater that infiltrated in the building
  - Multiple other studies showed VOCs only detected in immediate location of VOC contamination with little to no migration via a vapor pathway

Summary of Relevant Vapor Studies

Results show vapor found only in high concentration/source areas
Vapor migration not evident

1. 1986 Tracer Soil Gas Survey
   - 28 Samples; TCE concentrated in SE corner of C-400
   - Occurred before the degreaser use discontinued and the C-400 Tank and Line remediation (early 1990s)
2. 1990 Soil Gas Survey Phase I Site Investigation (includes C-400)
   - 250' intervals around C-400 plus near other site buildings (43 locations, 41 samples)
   - *TCE only at two locations*
     - 2.9 ppmv at SE corner, C-400, [former tank location]
     - 0.28 ppmv at NW corner, C-400 [NW Plume centerline}
     - *"Sample collection at all locations was more difficult than expected due to the tightness of the soil formation being sampled."*
3. 2000 IH Summa monitoring at C-400, C-300, C-333, C-337, and EW-230
   - Only 1 of 277 IH samples had detectable TCE or VC: NW Plume extraction well (EW)-230 had 26.6 ppmv).
   - No detectable TCE or VC at C-400
4. 2003 Indoor air study ***during*** Six-Phase
   - Identified only 2 samples with detectable TCE (and these detections were attributed to off-gas of TCE from the sump).
   - ~70 Draeger Tubes; all ND
5. 2005 EPA Soil Gas Study
   - 3 samples attempted in water policy; 1 collected; no TCE
6. 2013 SWMU 4: above TCE plume
   - Two (of 69 passive samples) had detectable TCE (near detection limit)
   - 29 ng and 54 ng (detection limit of 25 ng

Preliminary Evaluation: Vapor Intrusion at C-400 Not an Issue with Current Workers

- Issue: Evaluate current worker safety / compare to OSHA limits
- USEC evaluated issue (incorporating process knowledge)
  - Monitored workers at C-400 while degreaser in use (personal air pump)
  - Monitored air while tank/piping issue addressed, determined no indoor monitoring needed
- Air monitoring during six-phase showed no concentrations above 2.8 ppmv
- LATA monitors air in vicinity of C-400 during remediation for IH purposes
- UCRS soil and RGA groundwater in vicinity of C-400 has high concentrations of TCE
  - But no persistent indoor air issue even during six-phase
  - C-400 is large building that is not sealed (i.e., ventilated)
  - If no persistent indoor issue at C-400, unlikely to see issue at other buildings (C-720) and at distal areas of plume (both with much lower VOC concentrations)
- Soils not conducive to vapor migration
  - Phase I soil gas: 41 samples, only two with TCE in vicinity of C-400 (2.9 ppmv, 0.28 ppmv)
  - SWMU 4 soil gas showed near-detection-limit TCE in two of 69 samples even though samples collected above known TCE plume

Potential Data Gaps

1. Water Policy Area NE Plume
   - MW-149 (UCRS well in NE Plume) has historically had concentrations that exceeded the TCE MCL; the recent concentration (2013) is just below 5 ug/L
   - MW-149 is near a property with no active license agreement (but property does not have a residence [farm only].
   - MW-149 is near three residences (two trailers and one house) but none of these has an active well

2. Water Policy Area NW Plume
   - Some areas with no active license agreement; however
   - No active residential groundwater wells
   - UCRS wells in vicinity have no TCE above MCL
   - MW198 had historical concentrations above MCL (1991) but non-detect in most-recent result (2003)

3. Historical C-400 Vapor Data Does Not Show Issue
   - Most-recent direct investigation was 2003

Question: Is Information Sufficient to Support Short-Term Protectiveness Statements?

For Water Policy Area:

- If so, no change is needed to 5-year protectiveness statements
- If not, what information could be provided with the 5-year review revision to allow short-term protectiveness statements to be retained?
  - Potential data gaps do not appear large enough to counter protectiveness evaluations

For C-400 / C-720

- If so, no change is needed to 5-year protectiveness statements
- If not, what information could be provided with the 5-year review revision to allow short-term protectiveness statements to be retained?
  - Potential data gaps do not appear large enough to counter protectiveness evaluations

B-15

BACKUP

Proposals (3) / Path Forward

1. No change to 5-Year Review Document
   a. Provided Water Policy Area data support short-term protectiveness statement in 5-year review
   b. Provided C-400/C-720 Area data support short-term protectiveness statement in 5-year review

2. Add appendix to 5-Year Review document/change document to provide information that documents short-term protectiveness
   a. Provided Water Policy Area information supports short-term protectiveness statement in 5-year review
   b. Provided C-400/C-720 Area information supports short-term protectiveness statement in 5-year review

3. Change protectiveness statements in 5-year review to "deferred"
   a. Provided Water Policy Area information determined not sufficient to support short-term protectiveness statement in 5-year review
   b. Provided C-400/C-720 Area information determined not sufficient to support short-term protectiveness statement in 5-year review

Water Policy Summary: Short-Term Protectiveness Statement Supported with Current Information

- Water Policy Area Short-Term Protectiveness Statement Can Remain Because:
  - Properties overlying the plume are utilizing municipal water
  - Municipal water usage is reviewed monthly
  - No active residential wells within plume
  - PGDP personnel installed locks to prevent unauthorized use of wells
  - Property ownership is verified at least annually
  - Groundwater in UCRS above the plume not contaminated above MCLs
  - Soils in PGDP vicinity not conducive to vapor migration
  - EPA Vapor measurements in area (3) showed no TCE (2 samples had no recovery)
  - Only five residential structures above the TCE plume (Plume where >5 ug/L)
  - Distal plume concentrations low relative to other areas (and decreasing)

- Additional Text May Need to be Added to the 5-Year Review

C-400/C-720 Summary: Short-Term Protectiveness Statement Supported with Current Information

- C-400/C-720 Short-Term Protectiveness Statement Can Remain Because
  - Soils in PGDP vicinity not conducive to vapor migration based on previous studies
  - Direct vapor measurements at C-400 during six-phase treatability study showed no vapors at levels of concern
  - Groundwater at C-400 is contaminated with higher TCE concentrations than C-720, thus if there is no indoor issue at C-400, there would be no issue at C-720
  - Vapor intrusion study planned to evaluate risk from vapors associated with potential future land uses (Recommendation in Five-Year Review)

Reviewed Guidance:

- Vapor Intrusion Screening Level (VISL) Calculator and VISL Users Guide, EPA 2013, http://www.epa.gov/oswer/vaporintrusion/documents/VISL-Calculator.xlsm

- Assessing Protectiveness at Sites for Vapor Intrusion; Supplement to the Comprehensive Five-Year Review Guidance OSWER Directive 9200.2-84

- Vapor Intrusion Pathway: A Practical Guideline, January 2007, Prepared by The Interstate Technology & Regulatory Council Vapor Intrusion Team, ITRC

- OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002, EPA 530-D-02-004

- EPA 2008. *Brownfields Technology Primer: Vapor Intrusion Considerations for Redevelopment*, EPA-542-R-08-001, Office of Solid Waste and Emergency Response, Washington, DC, March.

Vapor Intrusion Screening Levels
OSHA Limits

- Vapor Intrusion Screening Levels (2013 Guidance)
  - Uses ***reasonable worst-case exposure*** scenarios
    - Much more restrictive than needed for clayey soils at PGDP
  - Levels protective for ***70-year residential exposure***
    - More conservative that for a 5-year exposure ***with no groundwater use***
  - Screening Levels (in air) provided for residential and commercial exposures
    - TCE: 0.48 ug/m^3, residential; 3.0 ug/m^3, commercial
    - VC: 0.17 ug/m^3, residential; 2.8 ug/m^3, commercial
  - Sub-slab screening levels an order of magnitude > indoor air screening

- OSHA limits
  - TCE Permissible Exposure Limit =100 ppmv 8-hr Time-Weighted Average
  - VC Permissible Exposure Limit = 1 ppmv 8-hr Time-Weighted Average

Paducah Risk Methods Document (2014)

Groundwater No Action Levels (NALs) and Action Levels (Als)

- Child Resident NALs and Als (all indoor uses of water including bathing to incorporate vapor emissions from water usage)
  - Estimate impact for 30 years' exposure for ELCR-based values
  - Estimate impact for 6 years' exposure for HI-based values
- Child Resident NAL in 2014 Risk Methods Document uses Risk Assessment Information System (RAIS)
  - Vinyl chloride: 0.0111 ug/L NAL for inhalation only=0.322 ug/L (based on resident ELCR=1E-06)
  - TCE: 0.195 ug/L NAL for inhalation only=0.417 ug/L (based on child HQ=0.1)
- Child Resident AL in 2014 Risk Methods Document
  - Vinyl chloride: 1.11 ug/L
  - TCE: 6.81 ug/L

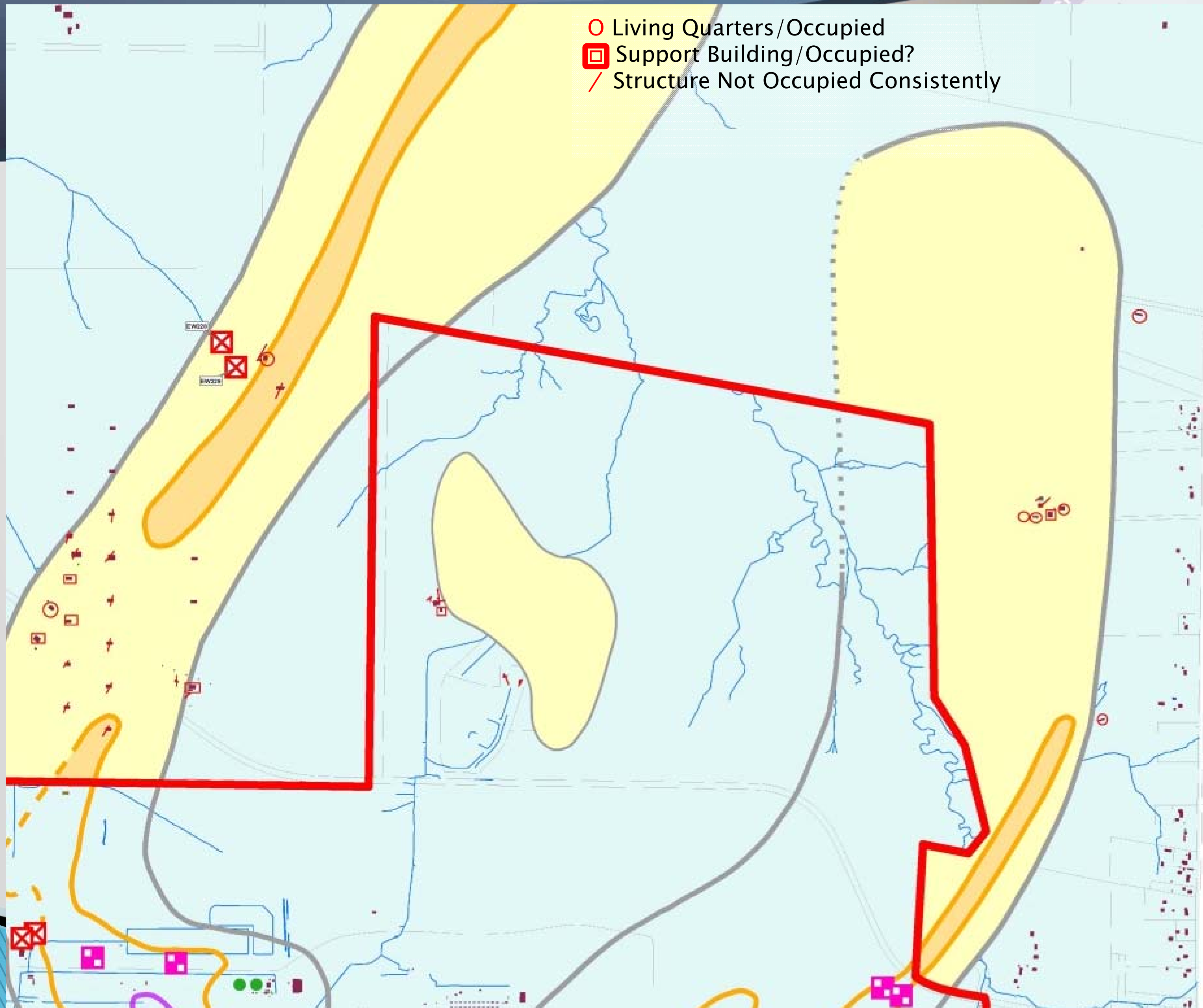
Water Policy

- DOE provided municipal water to all existing residences and businesses within the affected area surrounding PGDP
- DOE paid for installation of water supply mains and connection of residences
- DOE pays the reasonable costs of water bills in the affected area
  - Usage is reviewed monthly
- Each household or business in the Water Policy Box has been asked to sign an agreement with DOE
  - No new water supply wells or use of existing water wells
  - PGDP personnel are permitted access to the property for sampling
  - PGDP personnel installed locks to prevent unauthorized use of wells
- DOE samples residential and MWs to track migration of contaminants

Water Policy Area
Summary of Structures

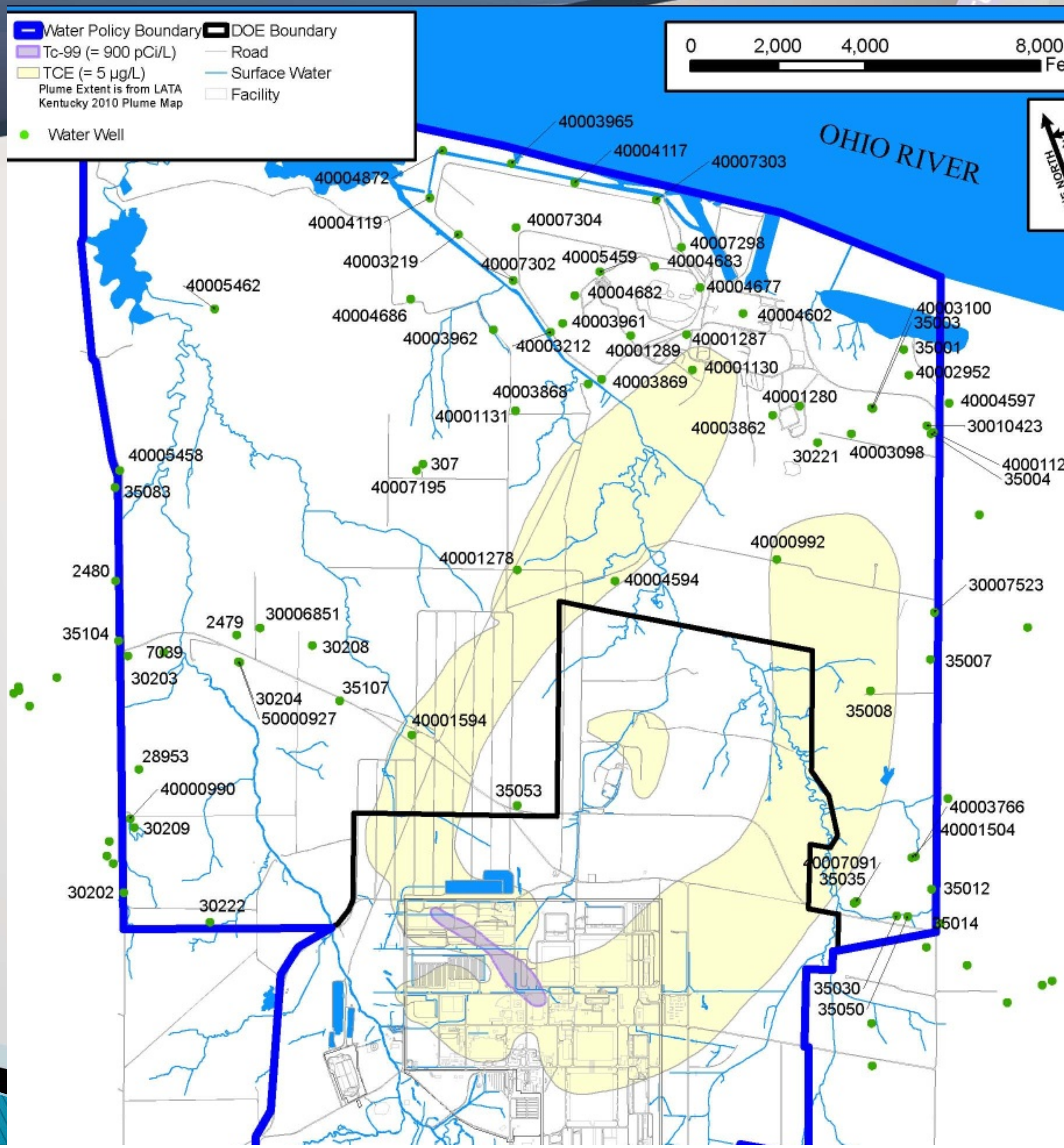
Facility Type	Northwest Plume		Northeast Plume	
	Number of Structures	Map Symbol	Number of Structures	Map Symbol
Living Quarters/Occupied	2	○	5	○
Industrial/Support Building – Not Occupied Consistently	12	X	1	X
Industrial/Support Building – Occupied	4	□	1	□
Open-Air/Bunker Facility	9	None	2	None
Total Number of Structures	27		9	
Notes:	No structures inside or immediately adjacent to the PGDP fenced area were counted in the analysis.			
	Living Quarters/Occupied assumes the facility was a home or other structure that could have occupants inside throughout a 24 hour day			
	Industrial/Support Building-Occupied assumes a business, office, or other structure that would be occupied typically during work hours.			
	Industrial/Support Building – Not Occupied Consistently assumes a structure such as a garage, barn, etc. that would be only occupied intermittently for short periods of time.			
	Open-Air/Bunker Facility assumes an open structure that is not enclosed and would only be occupied periodically for short periods of time. Examples include KOW bunkers or concrete pads.			
	One Living Quarters identified on Google Map Satellite view was not present on GIS Structure			
	Structures not visible on GIS Structure Layer or Google Map Satellite view are not included in analysis.			

Structure Locations



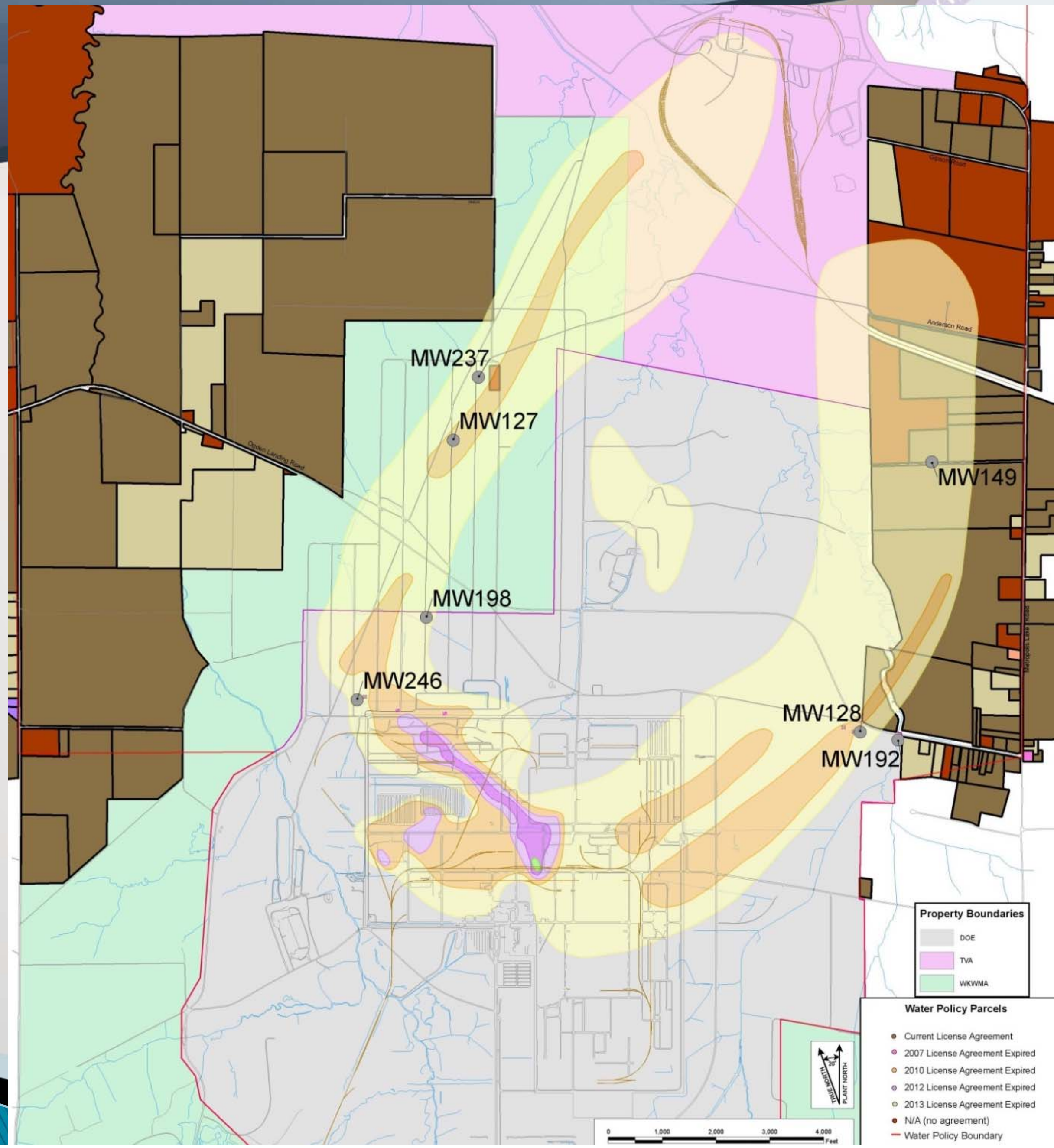
No Residential Wells Within Plume Footprint

Six wells total

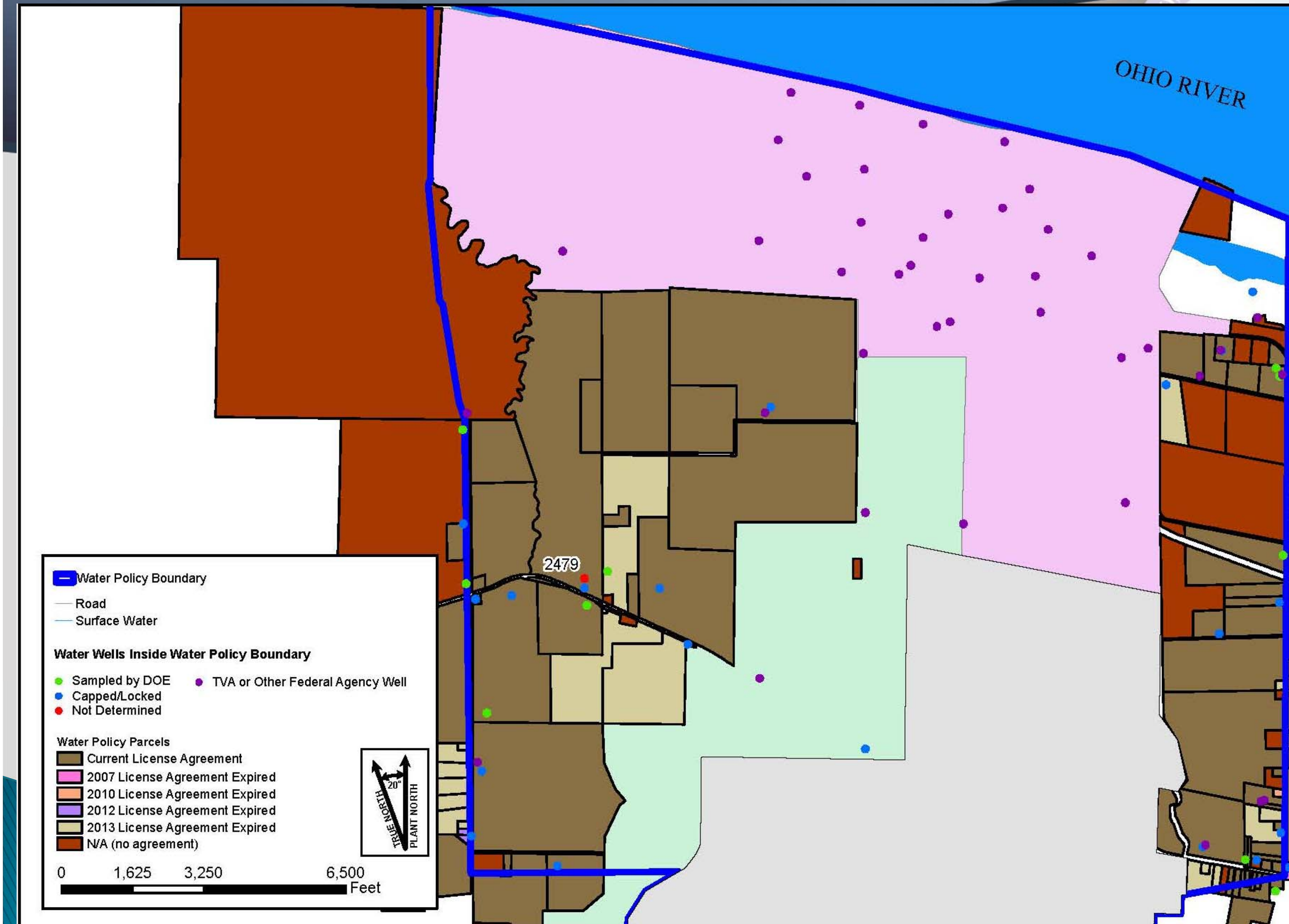


B-25

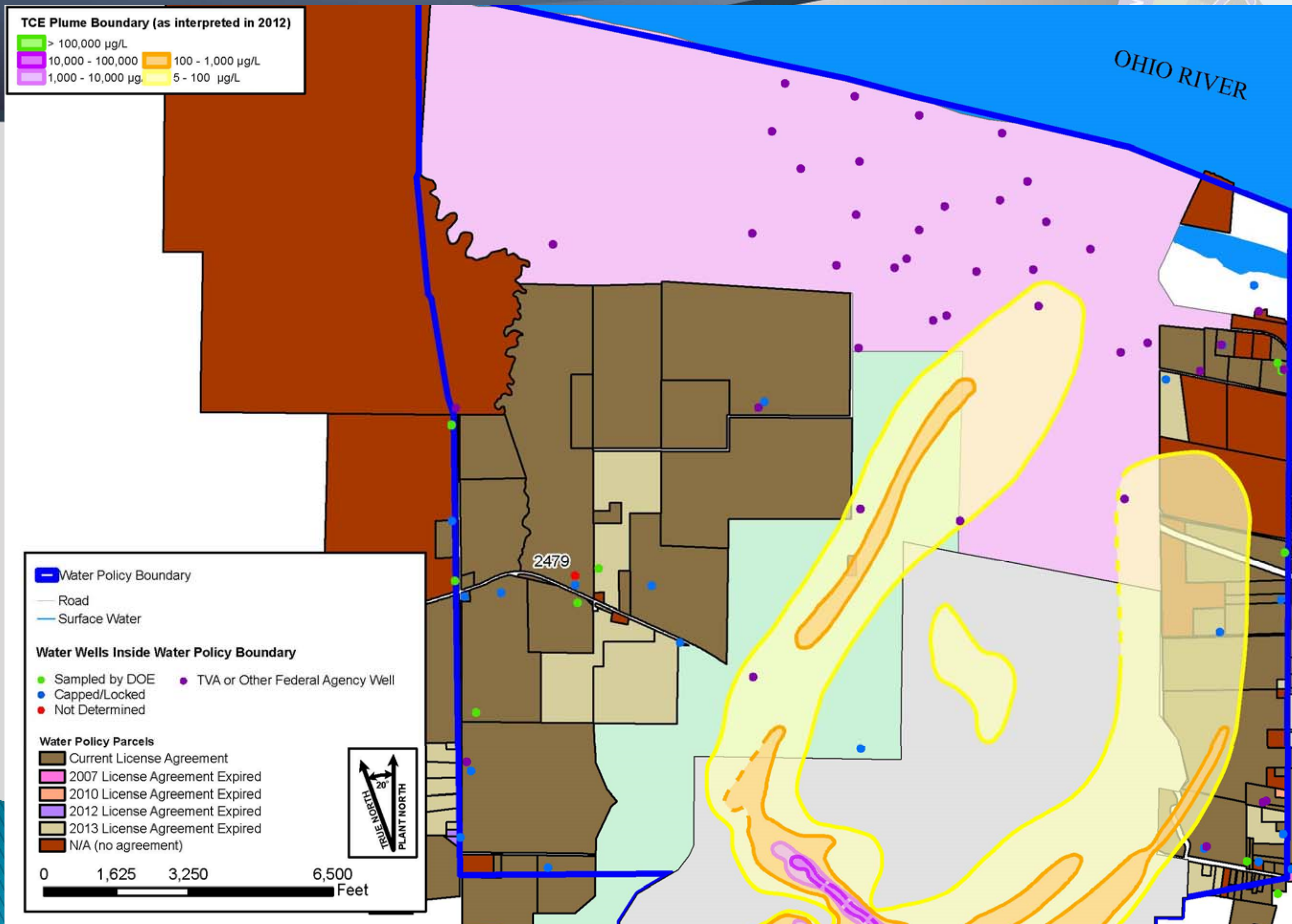
UCRS Monitoring Wells in Distal Plume



Summary of Water Policy Wells / Agreements



Map of Water Policy Area Wells vs. RGA Plume



Modeling

Johnson-Ettinger at C-720, SWMU 1 and SWMU 47

- Screening Model did NOT Screen out Potential Impact
  - When evaluated against future rural resident (adult/child)

- SWMU 47 immediately west of C-400

C-400: Six-Phase Heating Air Samples (2003)

Collected to evaluate impact on C-400 indoor air

- Gas indicator tube sampling in 4 locations
  - C-400 basement (1)
  - Tunnel adjacent to Six-Phase Site (3)

- No detections of either TCE or VC at detection limit of 2 ppmv TCE and 0.5 ppmv VC

- Ten weeks of weekly SUMMA samples at same 4 locations
  - 24-hour Integrated sample
  - Detection limit of 0.5 ppmv TCE and VC
  - Two detections (2.8 ppmv, 0.2 ppmv TCE) in 40 samples attributed to sump water outgassing

APPENDIX C

WATER POLICY VAPOR INTRUSION SCOPING MEETING PRESENTATION

FEBRUARY 24, 2015

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DRAFT

Preliminary Evaluation of Vapor Intrusion at the Paducah Gaseous Diffusion Plant (PGDP) Water Policy Area

Data Quality Objectives (DQO) Workshop

2/24/2015

Vapor Intrusion (VI) Evaluation

DQO Process Steps[1]

- **Step 1. State the Problem.** Define the problem that necessitates the study; identify the planning team, examine budget, schedule
- **Step 2. Identify the Goal of the Study.** State how environmental data will be used in meeting objectives and solving the problem, identify study questions, define alternative outcomes
- **Step 3. Identify Information Inputs.** Identify data & information needed to answer study questions
- **Step 4. Define the Boundaries of the Study.** Specify the target population & characteristics of interest, define spatial & temporal limits, scale of inference
- **Step 5. Develop the Analytic Approach.** Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings
- **Step 6. Specify Performance or Acceptance Criteria.** Specify probability limits for false rejection and false acceptance decision errors. Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use
- **Step 7. Develop the Plan for Obtaining Data.** Select the resource-effective sampling and analysis plan that meets the performance criteria

[1]EPA 1994, Guidance for the Data Quality Objectives Process, EPA QA/G-4, EPA/600/R-96/055

Vapor Intrusion Evaluation

DQO Step 1. State the Problem

1. State the Problem
- Give a concise description of the problem
- Identify leader and members of the planning team
- Develop a conceptual site model (CSM) of the environmental hazard to be investigated
- Determine resources—budget, personnel, and schedule

- Problem Statement:
  Determine whether groundwater (GW) data indicate a VI study is warranted.
  --Adapted from U.S. Environmental Protection Agency (EPA) letter, dated 9/30/2014: ". . . a vapor intrusion study is conducted if current groundwater data indicate a study is warranted."

  - Problem Description: Trichloroethene (TCE) is present in Regional Groundwater Aquifer (RGA) GW near residences. The planning team will review existing data; identify data gaps, if any; and, if necessary, determine what new data are needed to evaluate the potential for vapor intrusion into residences.
  - Planning Team: Federal Facility Agreement (FFA) Parties; Leader: U.S. Department of Energy (DOE)
  - Conceptual Model: Evaluate EPA VI conceptual site model, adapt to PGDP conditions. Evaluate VI driving factors against PGDP CSM conditions.
  - Determine Resources:
    - Schedule: within 18 months of 9/30/2014
    - Budget: Based upon scope
    - Personnel: LATAKY, Fluor Paducah

Statement: *Determine Whether GW Data Indicate VI Study is Warranted*

- Approach: compare VI driving factors against PGDP conditions, CSM
  - Review EPA VI guidance[2]
  - Review VI guidance CSM; adapt to PGDP conditions
  - Compare VI driving factors from guidance against PGDP conditions
  - Evaluate RGA TCE conc's in distal (outside source/fenced area) plume
  - Determine if UCRS hydrogeologic conditions at PGDP conducive to VI

[2]EPA 2013, OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)

Review EPA Draft 2013 VI Guidance[2]

CSM Development: Features needed for VI

C-7

Three features must exist for hazardous vapors to reach the interior of buildings from the subsurface environment underneath or near a building:

1. A source of hazardous vapors must be present in the soil or in groundwater underneath or near a building

2. Vapors must form and have a pathway along which to migrate toward the building

3. Entry routes must exist for the vapors to enter the building and driving forces must exist to draw the vapors into the building

[2]EPA 2013, OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)

Conceptual Site Model
from 2013 Draft EPA VI Guidance[2]

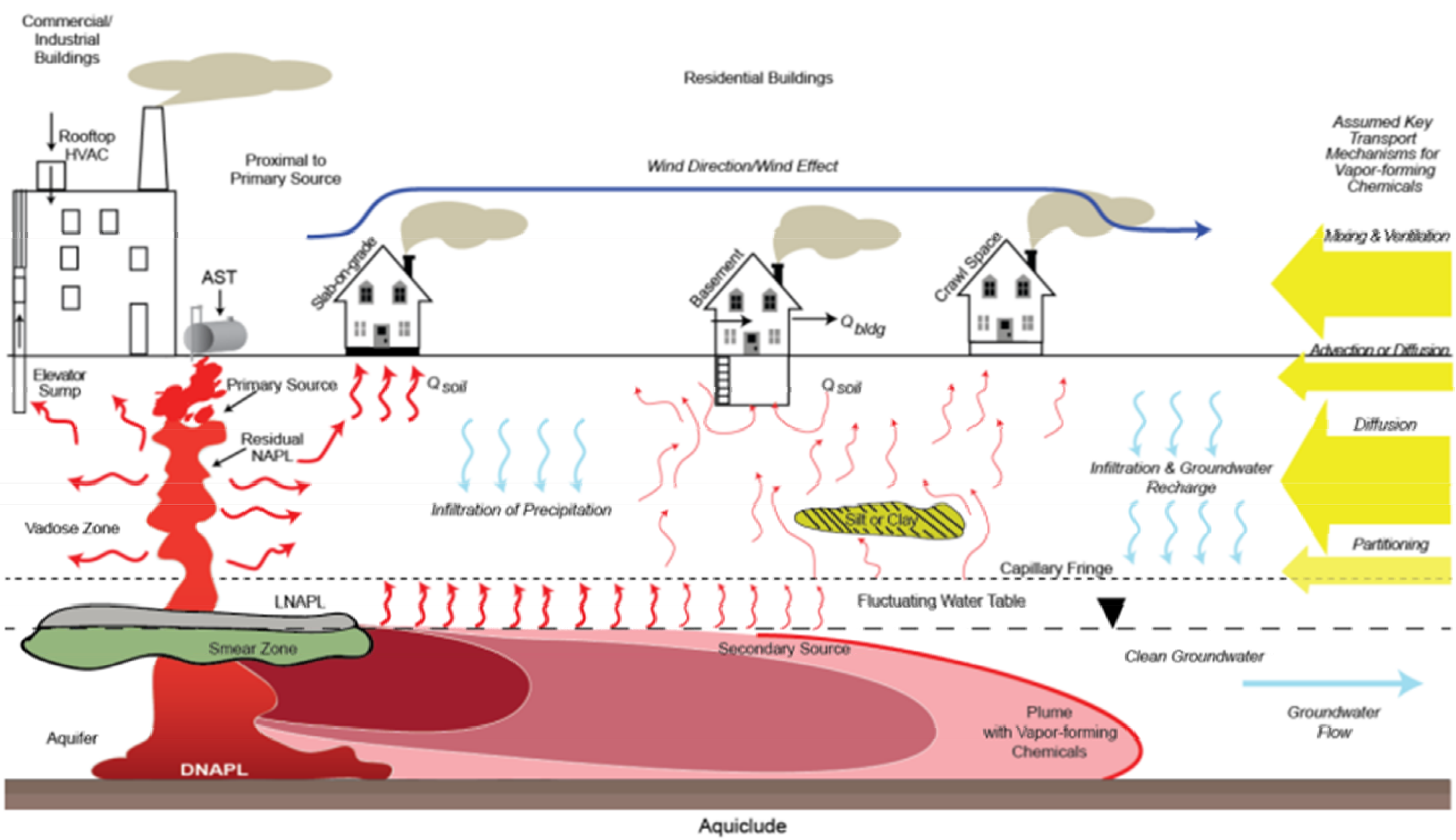


Figure 2-1 Illustration of Conceptual Model of Vapor Intrusion

Note: Q_{soil} represents soil gas entry; Q_{bldg} represents building ventilation.

PGDP CSM for VI
Adapted from Draft EPA VI Guidance[2]

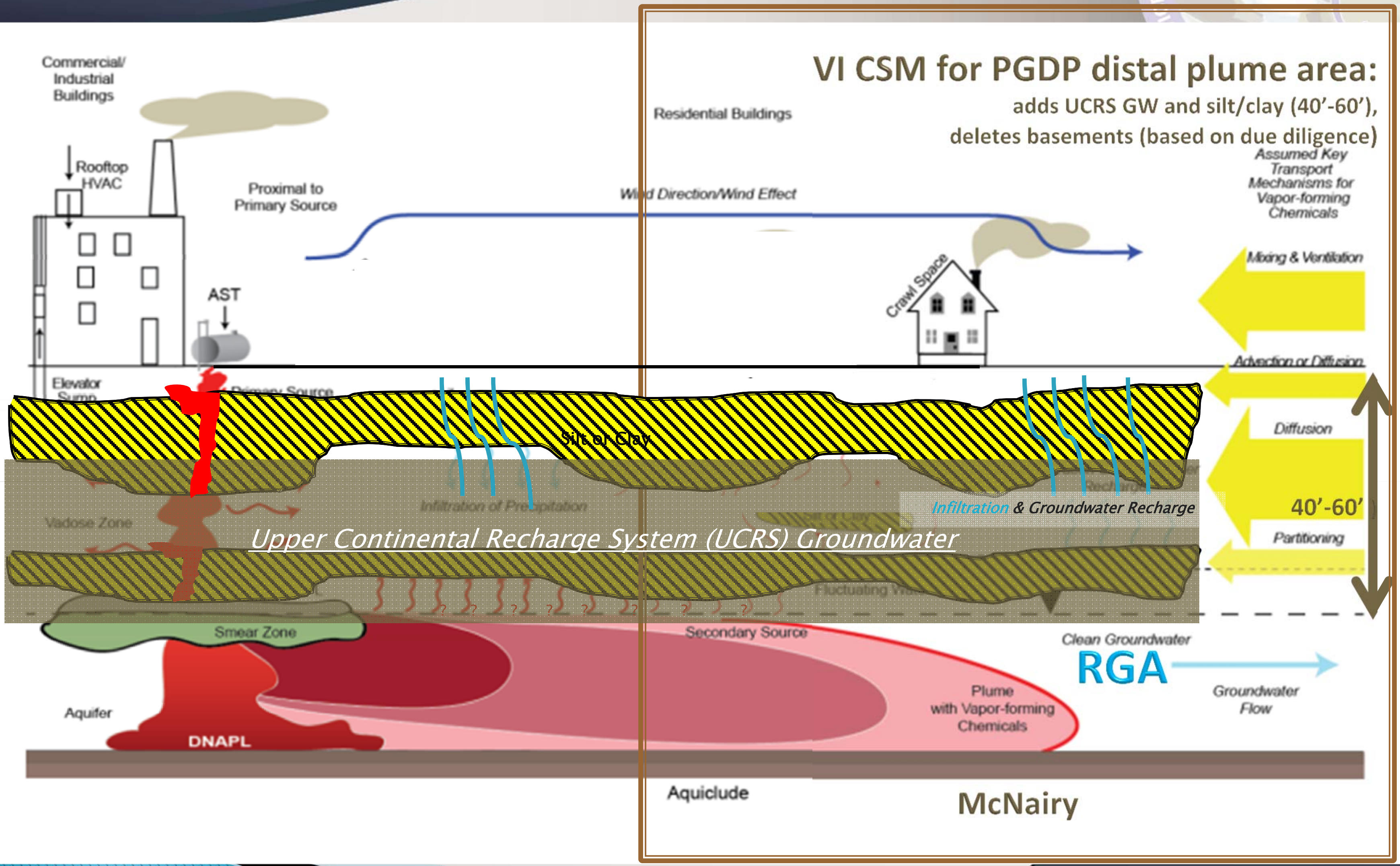


Figure 2-1 Illustration of Conceptual Model of Vapor Intrusion

Note: Q_{soil} represents soil gas entry; Q_{bldg} represents building ventilation.

CSM Development: Compare PGDP Conditions to VI Driving Factors

Five Factors Identified in VI Guidance Related to Vapor Intrusion Potential

- Vapor Source
- Vadose Zone Geology
- Vadose Zone Hydrogeology
- Vadose Zone Biochemistry
- Building Foundation

CSM Development: Factors Affecting VI from EPA VI Guidance[2]

Compare to PGDP Conditions

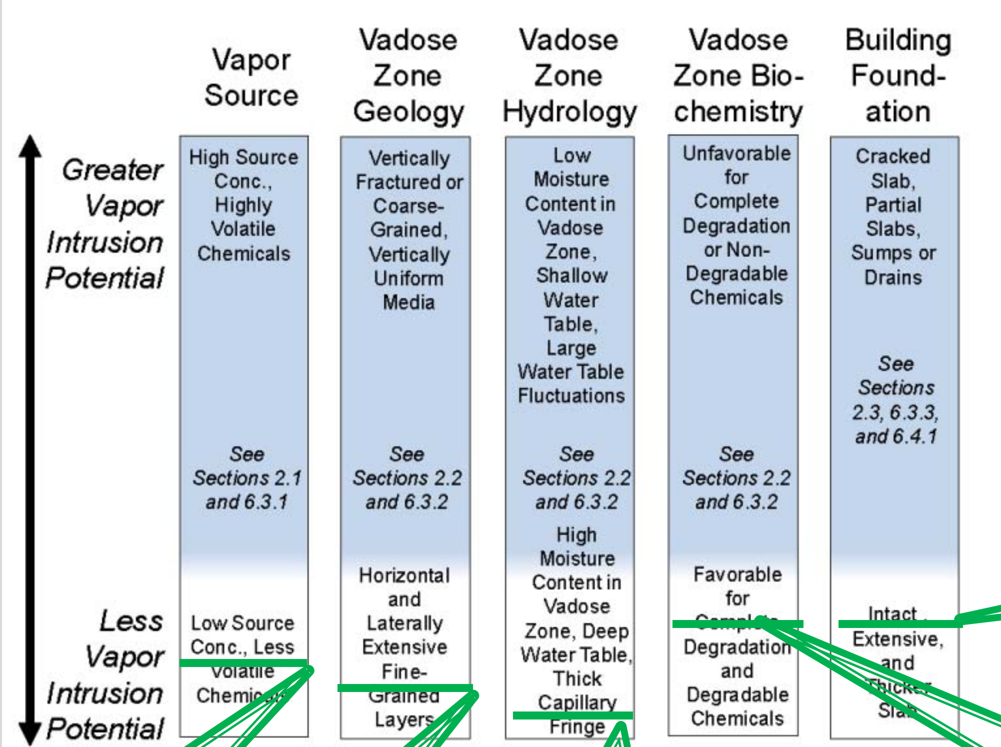


Figure 2-2 Some Factors that Affect Vapor Intrusion

UCRS at PGDP:
- ❑ Not vertically fractured
- ❑ Typically fine-grained with multiple layers
- ❑ Saturated/high moisture in vadose zone
- ❑ Has small water table fluctuations

RGA at PGDP:
- ❑ Low and decreasing TCE conc's
- ❑ Water table fluctuations irrelevant due to overlying UCRS

Few structures, no wells, no basements; few surface barriers, foundation conditions unknown

Low conc's of TCE; RGA aerobic degradation attacks daughters/lowers [TCE]; UCRS conditions favorable for localized reductive dechlorination

Low & decreasing concentrations

Fine-grained; not vertically fractured

Deep (contaminated) water table; intervening high moisture/saturated UCRS

Step 1

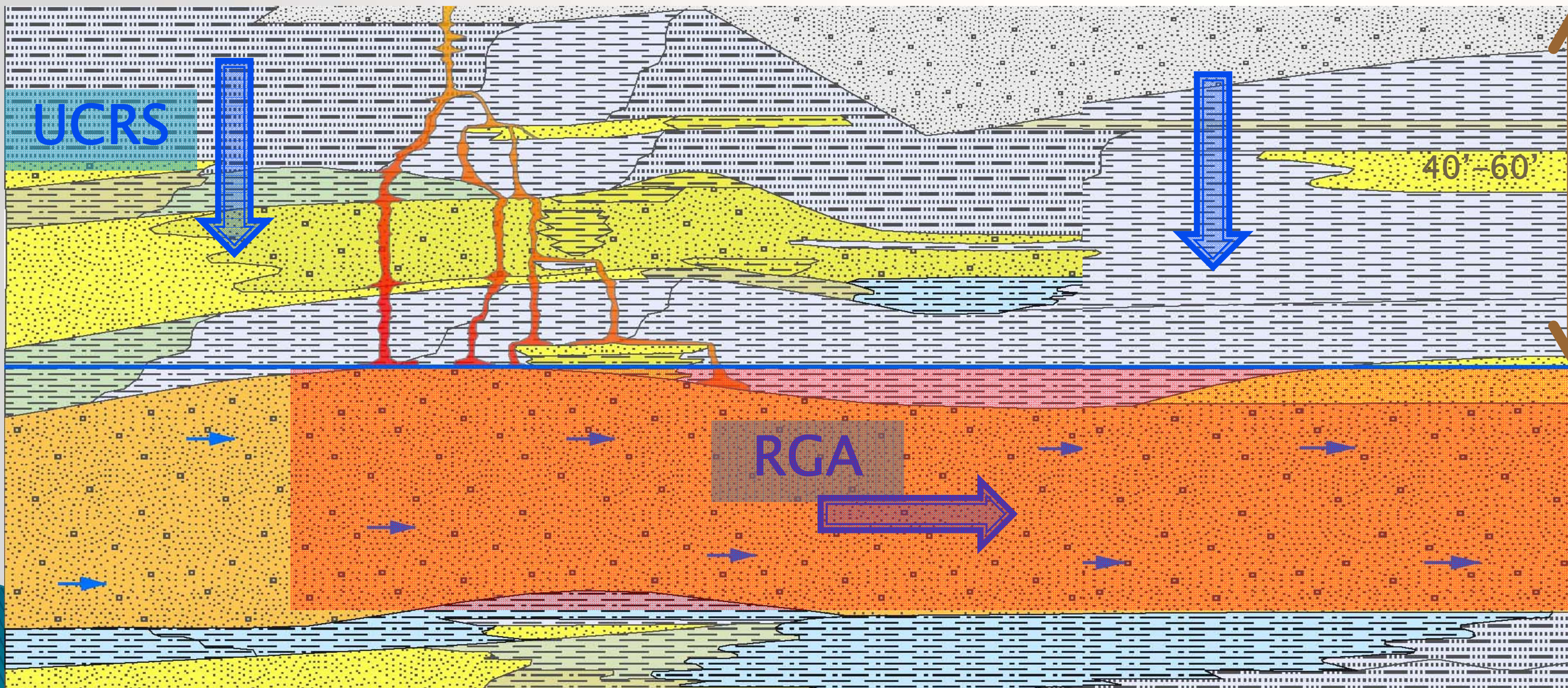
PGDP CSM Summary

- RGA TCE contamination is potential source, but
  - RGA distal plume conc's are low and decreasing
- For a VI issue, vapors from TCE in the RGA must move upward through UCRS against downward GW gradient and continue to migrate through UCRS vadose zone silt/clay; but
- UCRS has
  - Fine-grained soils; not vertically fractured (see cross-sections)
  - Deep (contaminated) RGA GW; but intervening saturated / high-moisture UCRS
  - Low TCE conc's; TCE recalcitrant but RGA aerobic degradation eliminates daughters and lowers TCE conc's
  - UCRS conditions favorable for reductive dechlorination
  - UCRS hydraulic gradient is nearly completely vertical
  - No wells in use, no basements, few residences
  - Although slab conditions unknown, few adjacent surface barriers to limit venting of vapors

Step 1. State the Problem Summary:
- ***Evaluation shows low potential for PGDP VI due to geologic conditions***
- ***UCRS GW between RGA and surface further limits VI migration potential***
- ***Additional PGDP information supplied to***
  - *Support CSM and evaluate PGDP conditions against VI driving factors*
  - *Present the historical record*

PGDP Dissolved Phase Conceptual Site Model Recap[3]

- GW flow vertical through UCRS (40'–60' thick) and horizontal (lateral) through RGA
- In distal areas of plume *(outside source areas)* RGA contamination would have to migrate against downward UCRS hydraulic gradient to reach vadose zone



Step 1

[3]Adapted from DOE 2011. Revised Proposed Plan for Volatile Organic Compound Contamination at the C-400 Building at the Paducah Gaseous Diffusion Plant

PGDP CSM: Additional PGDP Site Setting Information

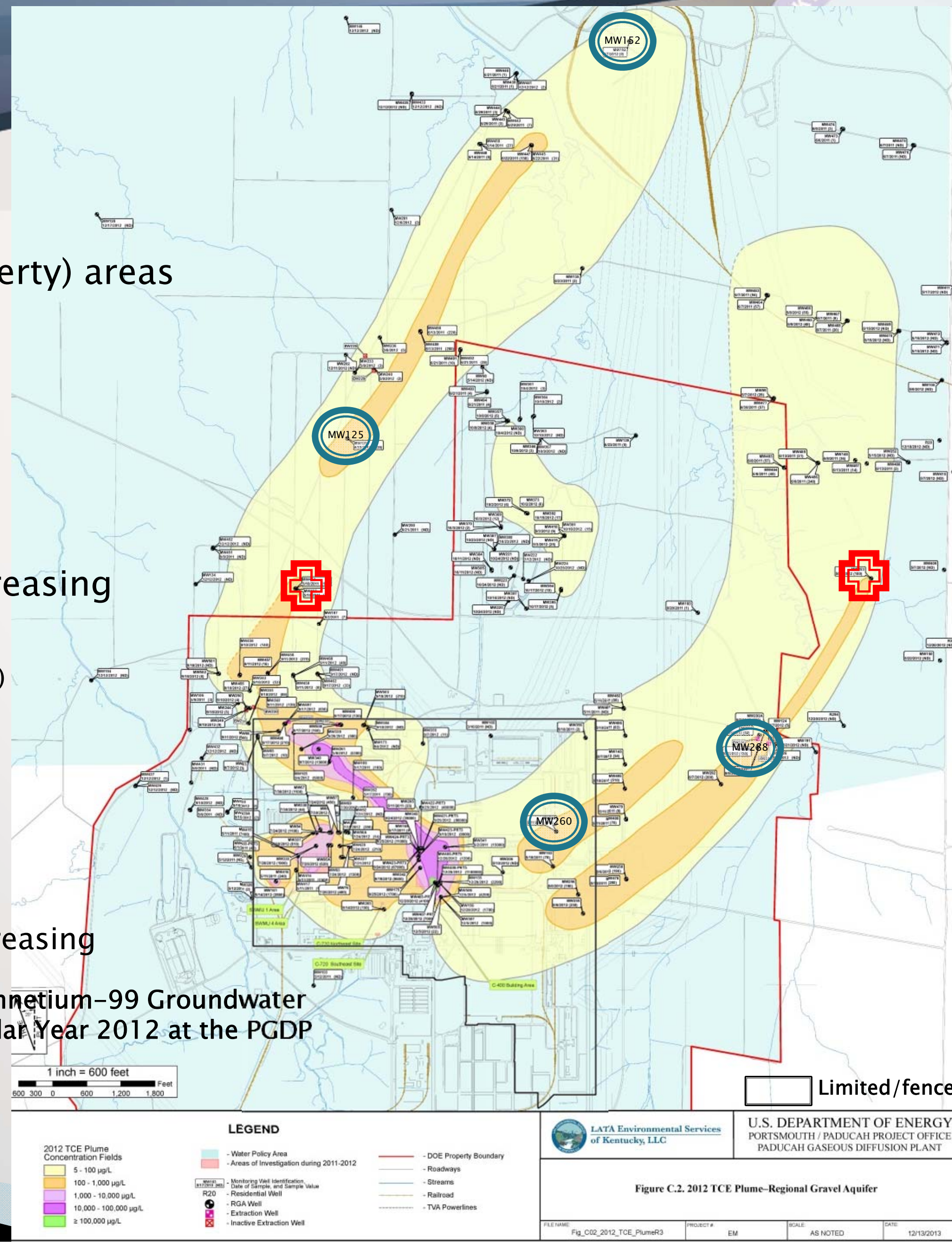
See List of References in Backup

- RGA TCE plume, 2012[4]
- RGA TCE plumes over time[4, 5, 6, 7, 8]: RGA TCE conc's low and decreasing
- Fine-grained soils; not vertically fractured (see cross-sections, Seismic[9], and Landfill Siting Studies)
- No wells, no basements, few residences, few surface barriers, slab/ foundation conditions unknown

[4]LATAKY2014. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2012 at the PGDP
[5]LATAKY 2011. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2010 at the PGDP
[6]PRS 2007. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2005 at the PGDP
[7]BJC 2001. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2000 at the PGDP
[8]Adapted from LMES 1997. Paducah Site Annual Report for 1995
[9]Seismic Issues for Consideration in Site Selection and Design of a Potential On-Site Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Waste Disposal Facility

PGDP CSM: 2012 RGA Plume Map[4]

- Focusing on distal plume (and off-property) areas
- 2012 RGA distal plume TCE conc's
  - NW Plume Area Range: ND (<1 µg/L) – 190 µg/L
    - Max at MW454
  - NE Plume Range: ND (<1 µg/L) – 100 µg/L
    - Max at MW253
- Intrawell comparisons show conc's decreasing
  - NW Plume Examples: MW125
    - MW125: 44% decrease (2012 from max. value)
    - MW152: 89% decrease
  - NE Plume Examples: MW260
    - MW260: 56% decrease
    - MW288: 93% decrease
- Bottom Line: RGA concentrations low and decreasing

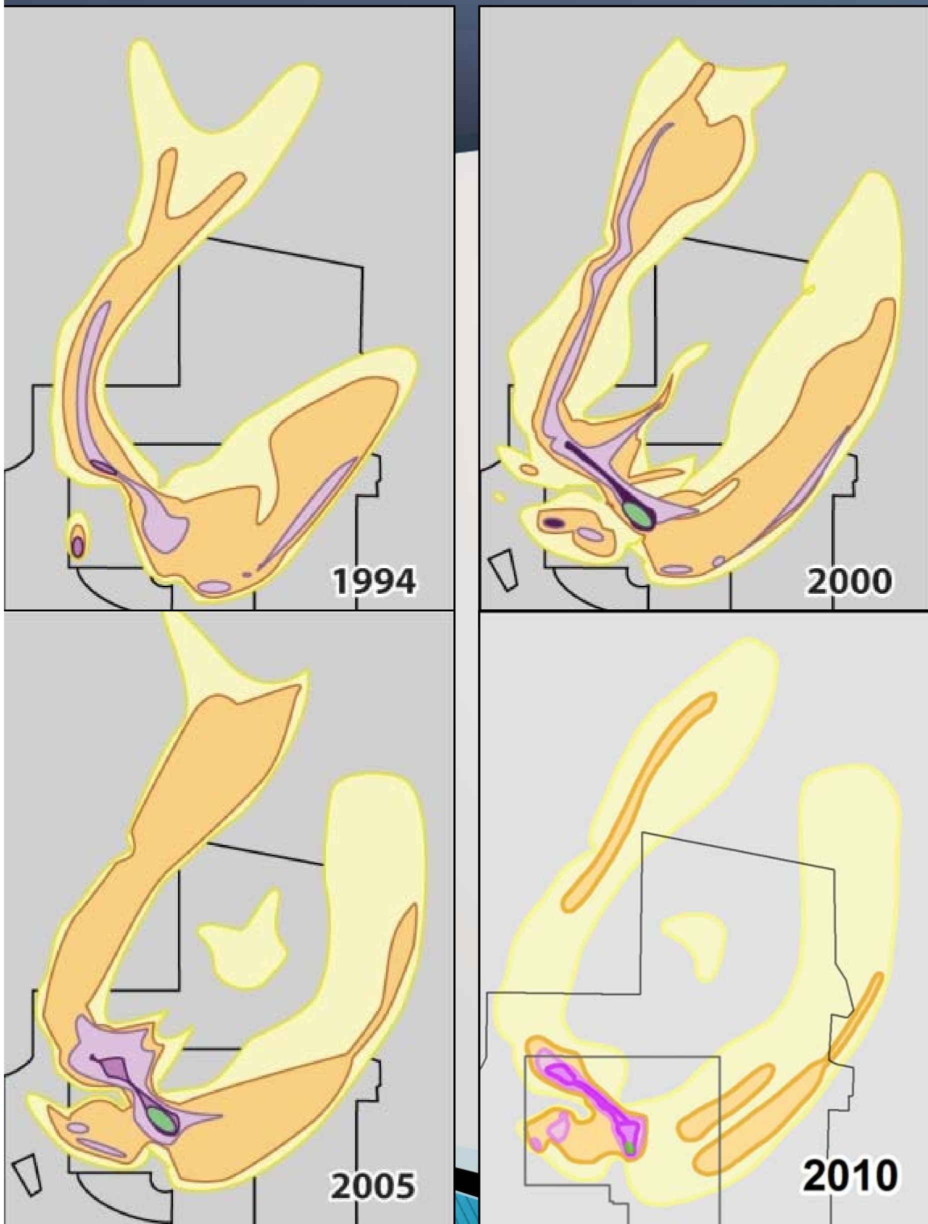


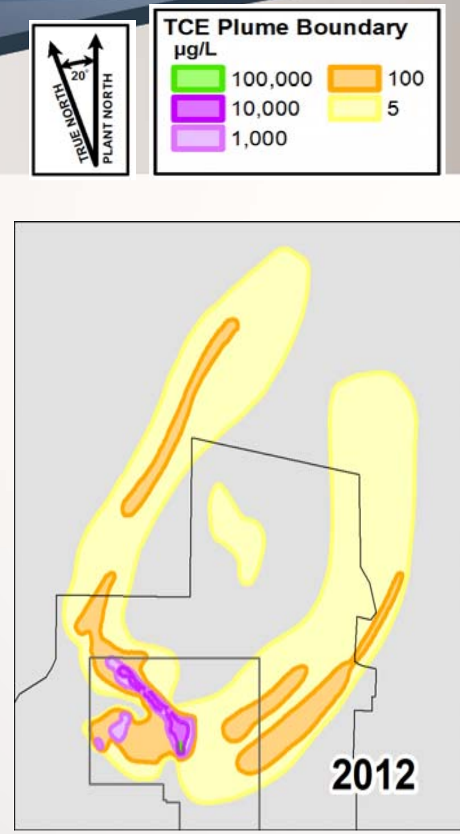
Limited/fenced area

[4]Adapted from LATA KY 2014. Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2012 at the PGDP

PGDP CSM: RGA TCE Plumes Over Time 1994-2012[4-8]

TCE Conc's and Areal Extent Decreasing





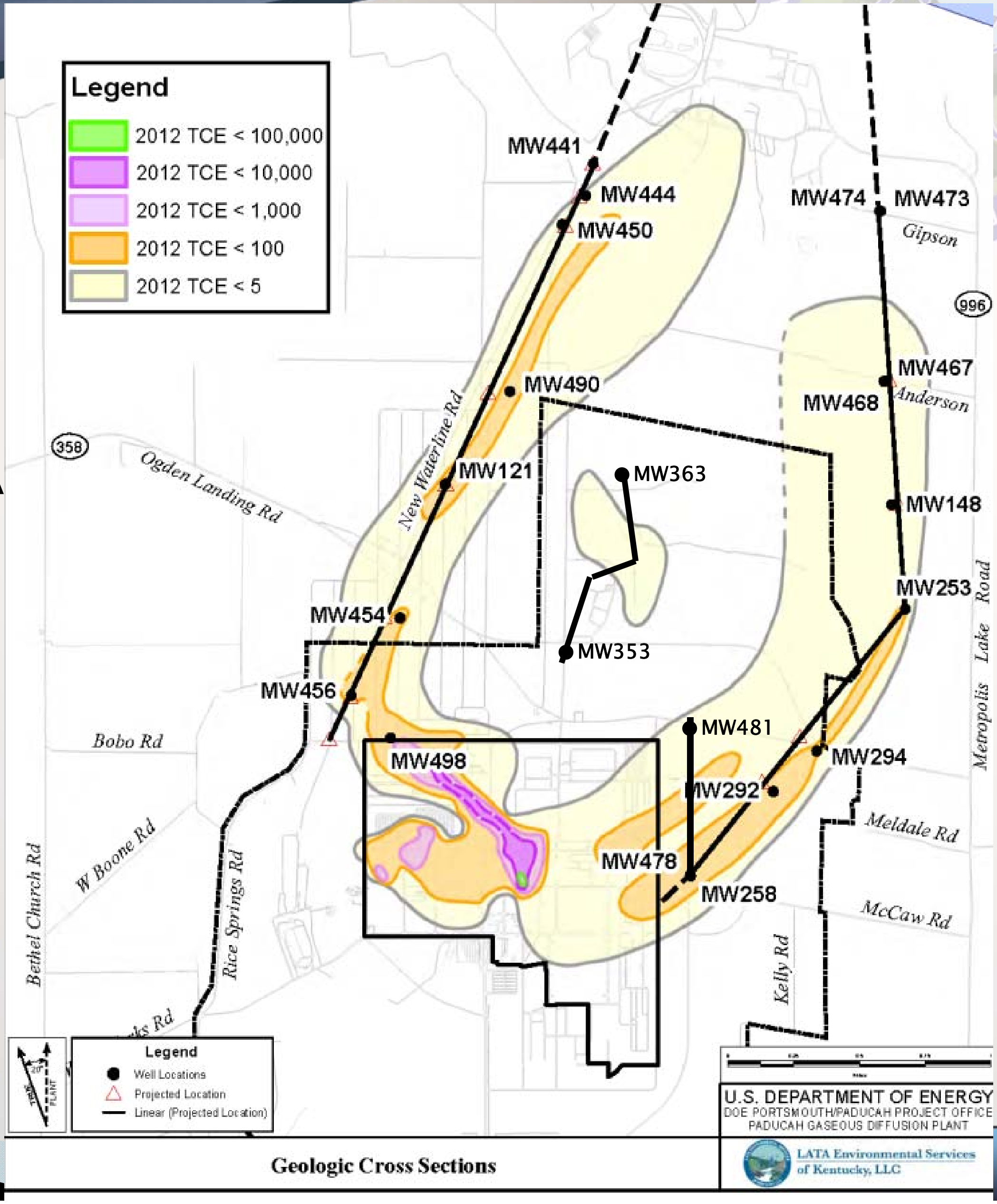
- Areal extent of 100 µg/L contour decreasing over time
- NOTE: TCE conc's in Upper RGA typically lower than in Lower RGA, as expected

Step 1

PGDP CSM: Geologic Cross Sections

Prepared from Well Logs for Wells Shown

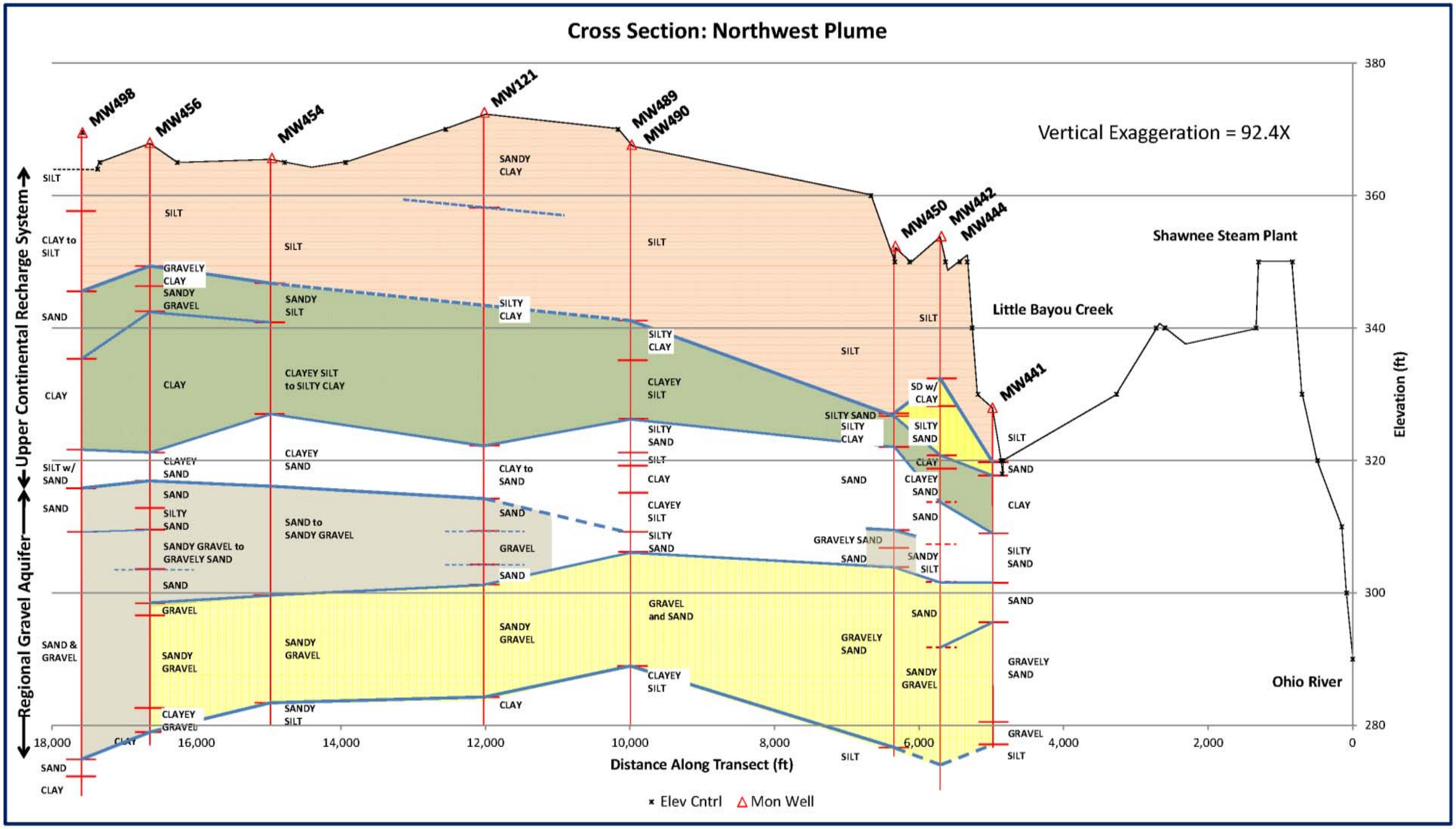
- Four recently prepared cross sections
  - NW Plume
  - NE Plume
  - Landfills
  - East Side
- Show UCRS silt and clay between RGA and vadose zone



Step 1

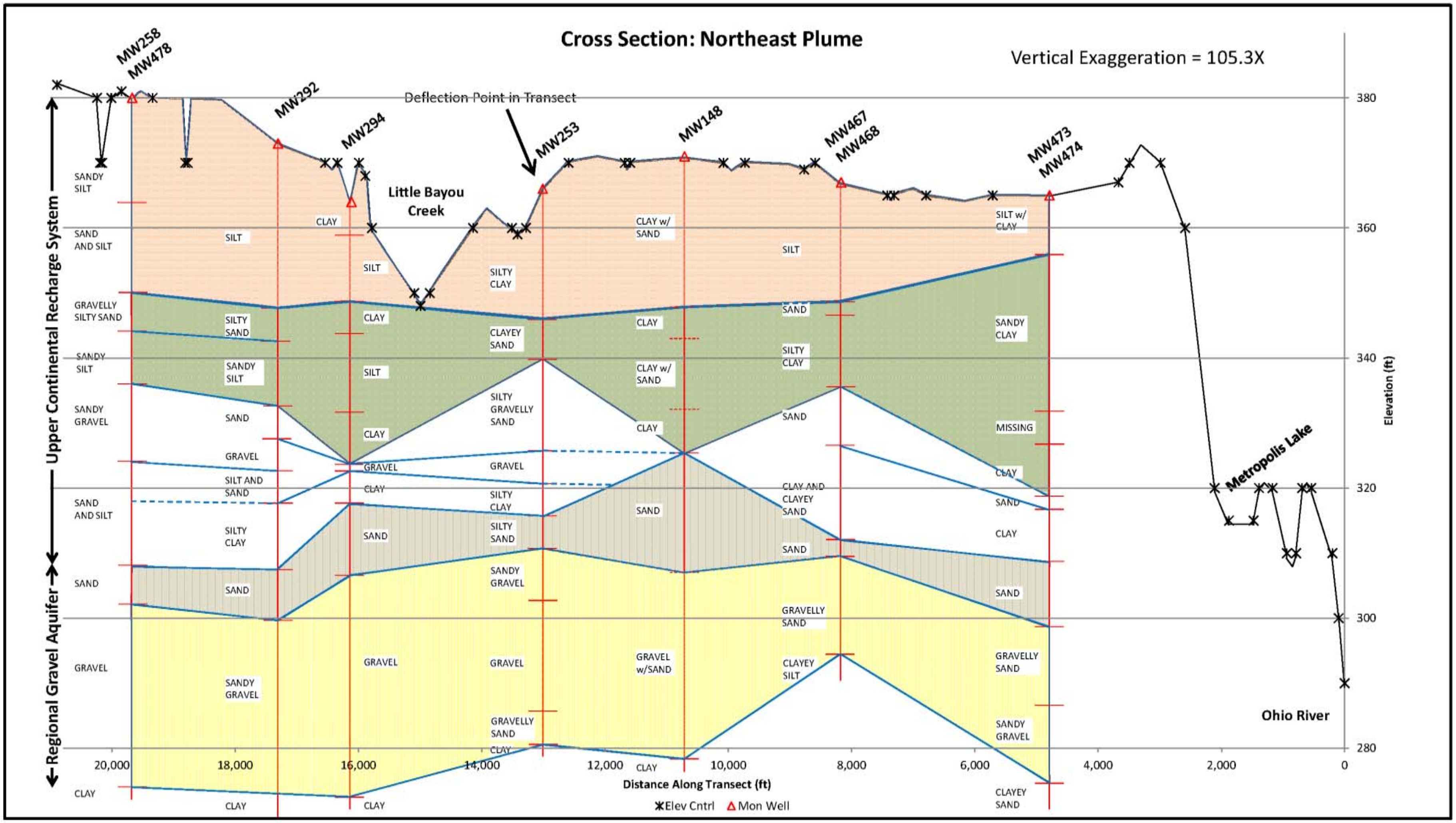
PGDP CSM: Northwest Plume Cross-Section

Clay/Silt Between Contaminated RGA and Surface



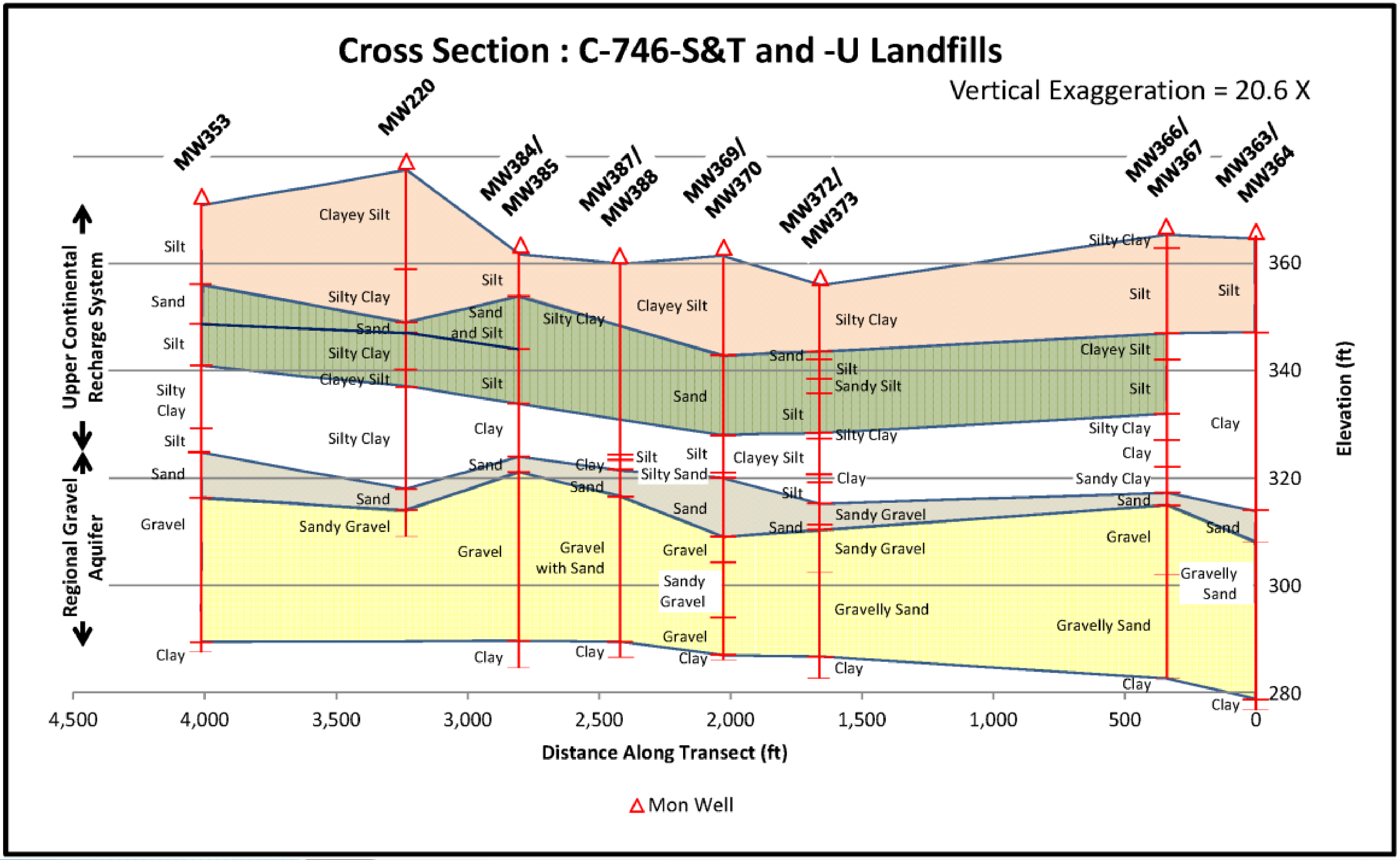
PGDP CSM: Northeast Plume Cross-Section

Clay/Silt Between Contaminated RGA and Surface



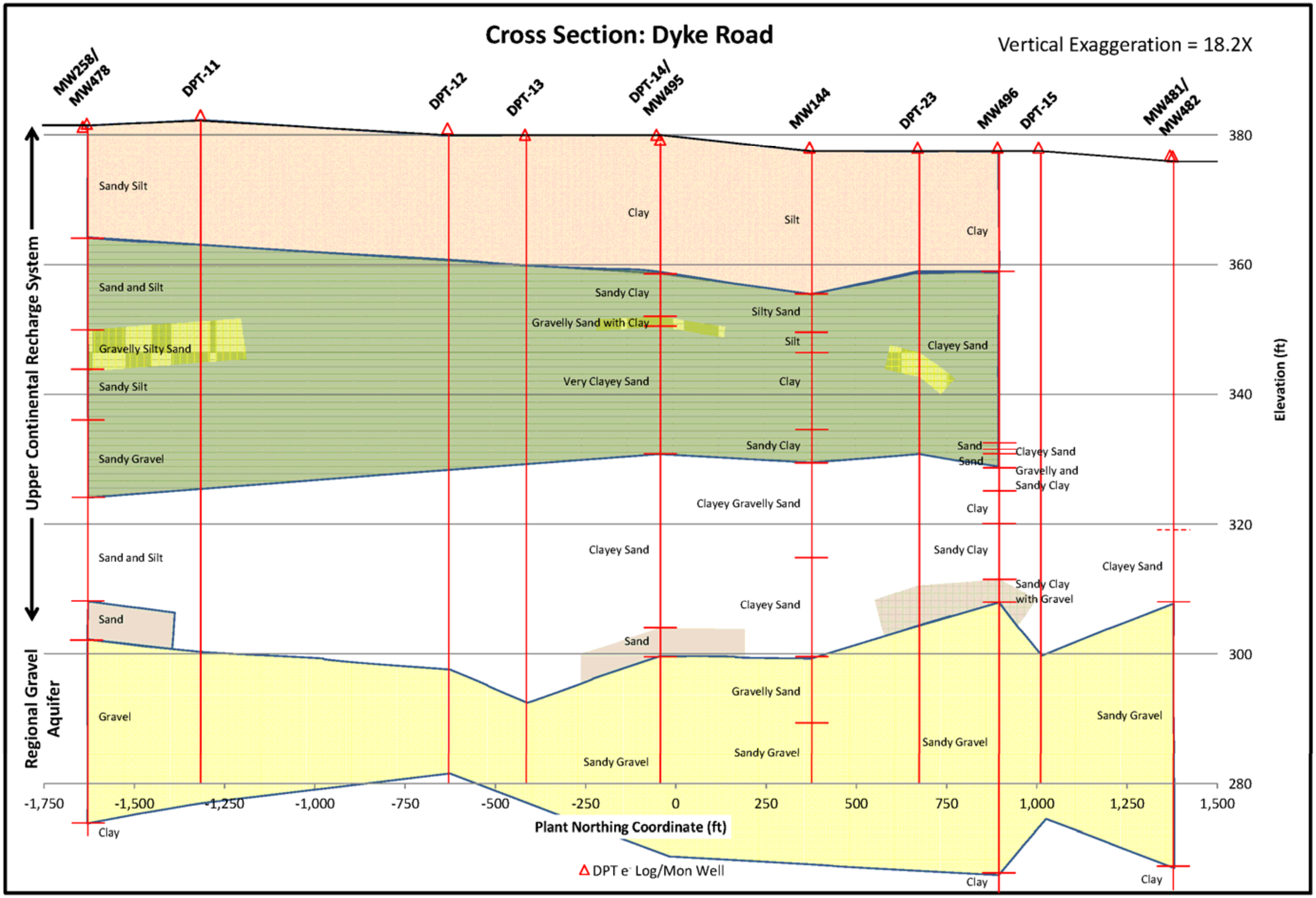
CSM Development: Landfill Area Cross-Section

Clay/Silt Between Contaminated RGA and Surface



CSM Development: East Side Cross-Section

Clay/Silt Between Contaminated RGA and Surface



Step 1

Step 1 Summary: PGDP Conditions Show Lower VI Potential

UCRS Groundwater and Silt/Clay Are Barriers to Vapor Migration

- The Regional Gravel Aquifer (RGA) contamination is a potential source of hazardous vapors in groundwater underneath or near a building
- However, TCE vapors must travel upward through the UCRS groundwater (against the hydraulic gradient) for vapors to reach the subsurface
- And, vapors must travel through low perm strata (silt/clay) to enter the building
- **Bottom Line Conclusion: RGA TCE conc's are low/decreasing and UCRS GW and soil matrix are barriers to VI**

Step 1 Summary: State the Problem:

- ***Determine whether groundwater (GW) data indicate a VI study is warranted***
- ***Propose evaluation to confirm UCRS GW data (when combined with other PGDP information) is sufficient to demonstrate VI not an issue***

Vapor Intrusion Evaluation

DQO Step 2. Identify the Goal of the Study

2. Identify the Goal of the Study
- Identify principal study question(s)
- Consider alternative outcomes or actions that can occur upon answering the question(s)
- For decision problems, develop decision statement(s), organize multiple decisions
- For estimation problems, state what needs to be estimated and key assumptions

Identify the Goal of the Study:

- Review UCRS GW conc's to determine if UCRS shallow water TCE conc's are < residential VI screening level (VISL[10]) of 1.2 μg/L for groundwater
  - Potential Outcomes
    - If UCRS TCE conc's below 1.2 μg/L in first-encountered GW in UCRS in Water Policy Area, inference is VI not a problem
    - If UCRS TCE conc's above 1.2 μg/L, verify if first-encountered water
    - If UCRS TCE conc's above 1.2 μg/L in first water, identify extent of condition; evaluate proximity of location to residences, and evaluate degree of exceedance
- If spatial extent is NOT limited and/or conc's exceed VISL benchmark, GW conditions may indicate a VI study is warranted and additional goals will be needed
- Current Hypothesis: UCRS GW conc's < residential VI screening levels

[10]Vapor Intrusion Screening Level (VISL) Calculator and VISL Users Guide, EPA 2013, http://www.epa.gov/oswer/vaporintrusion/documents/VISL-Calculator.xlsm

VI Evaluation

DQO Step 2. Identify the Goal of the Study

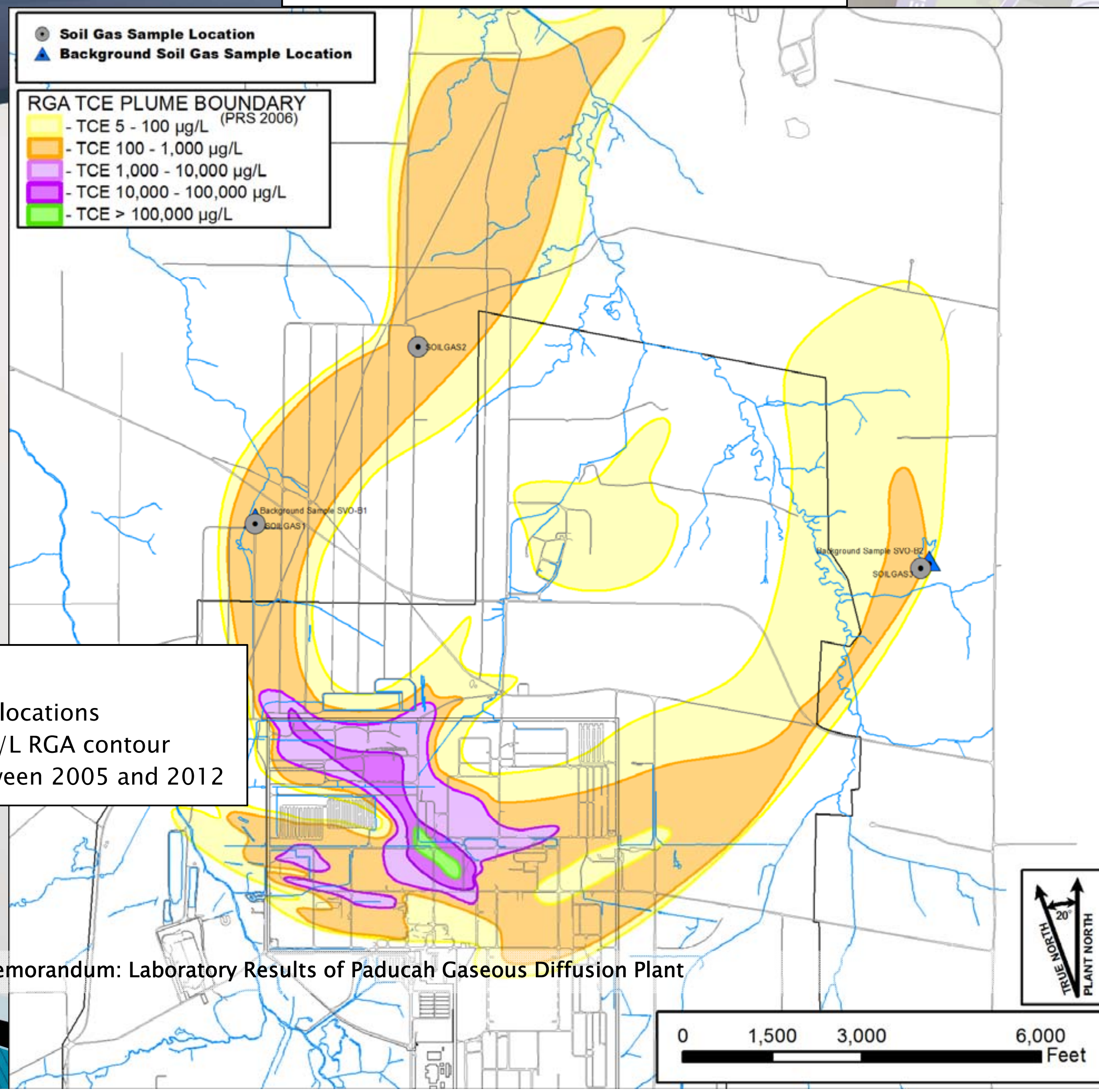
2. Identify the Goal of the Study
- Identify principal study question(s)
- Consider alternative outcomes or actions that can occur upon answering the question(s)
- For decision problems, develop decision statement(s), organize multiple decisions
- For estimation problems, state what needs to be estimated and key assumptions

Decision Statement Development

- If UCRS first water TCE conc's are < residential VISLs, inference is VI is not a problem
  - Inference appropriate because residential VISLs are more conservative than needed at PGDP because VISLs were:
    - Developed for 70-year exposure with groundwater use
      - Meeting VISL is more protective than necessary because of PGDP 5-year exposure with no current known GW use due to Water Policy
    - Developed for all matrices, including sand/gravel (not silt/clay like PGDP)
    - Developed for worst-case settings (basements, cracked foundations, sumps, nearby surface barriers, etc.)
  - Inference appropriate because vadose zone has high percentage silt and clay
    - TCE from RGA/UCRS GW doesn't migrate through UCRS GW then via soil gas through vadose zone
    - Historical studies show UCRS soils do not allow soil gas migration, even above RGA plume

PGDP 2005 EPA Soil Gas Sampling Results[11]

2005 RGA Plume



Soil Gas Had No TCE

- Tight soils provided no recovery in 2 locations
- Samples collected over 100–1000 µg/L RGA contour
- NOTE: 100 µg/L contour shrunk between 2005 and 2012

EPA 2005. Memorandum: Laboratory Results of Paducah Gaseous Diffusion Plant

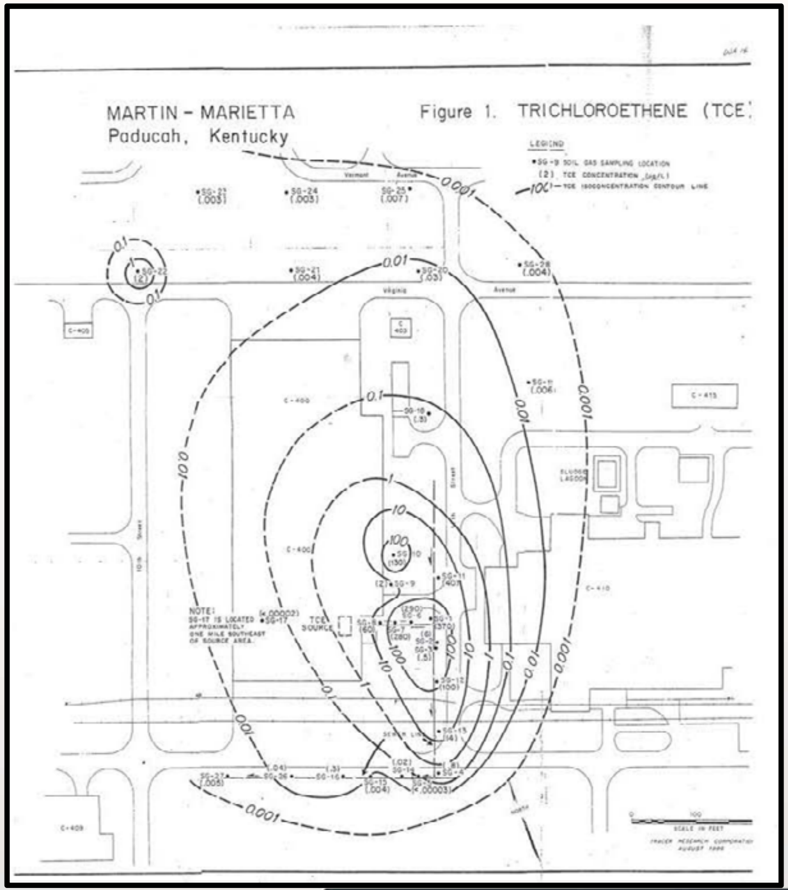
Step 2

Step 2. 1986 Tracer Soil Gas Survey[12]

Soil Gas found only in on-site major source areas

Vapor migration not evident even though high soil and GW conc's nearby

- 28 Samples; found TCE concentrated in SE corner of C-400
- Survey performed before degreaser use discontinued and the C-400 Tank and Line remediation (early 1990s)
- Results:
  - Data indicate TCE source at location where the sewer line leaves building C-400
  - TCE in soil as high as 7,000,000 "μg/L"
  - TCE soil gas conc's range: 0.003-370 μg/L
  - Eight of 28 samples >2 μg/L
  - Soil gas contour 0.01 μg/L ~500' from source



Inferences:

1. *If max soil gas of 370 μg/L in area with known TCE DNAPL in soil, matrix must be very tight*
2. *If 0.01 μg/L soil gas contour 500' from source, VI far from source unlikely*

[12]Shallow Soil Gas Survey at Martin Marietta Energy Systems Facility Paducah Kentucky, August 1986 Tracer Research Corporation

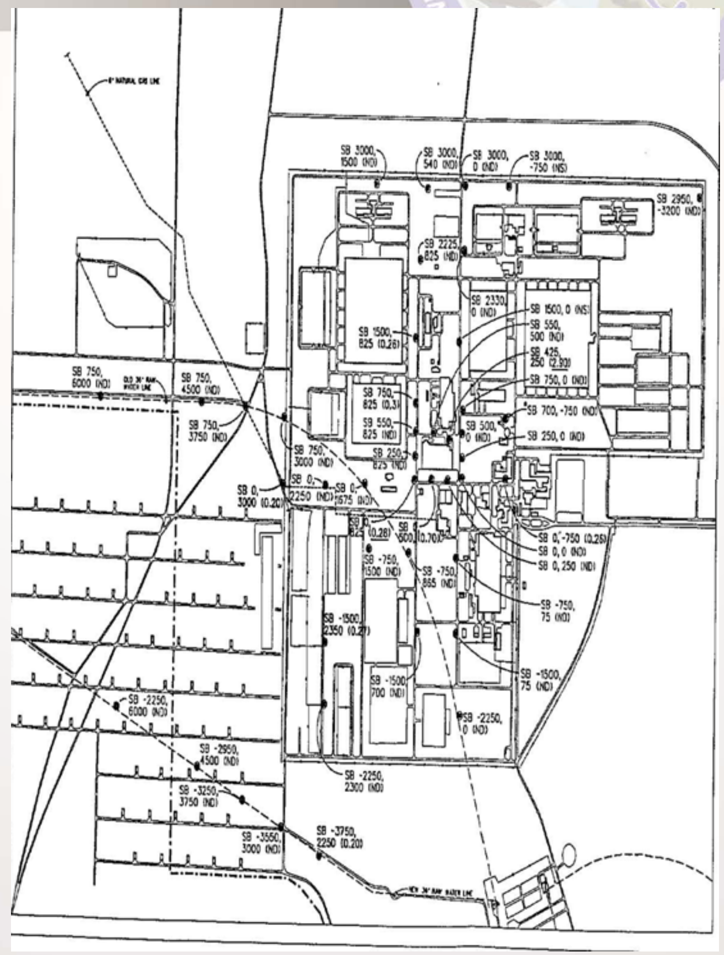
1990 Soil Gas Survey Phase I/II Site Investigation[13,14]

Soil Gas found only near largest on-site major source areas

Vapor migration not evident

- 250’ intervals near C400 plus other site buildings
  - 43 locations, 41 samples
  - *TCE only at two locations*
    - 2.9 ppmv at SE corner, C400, [former tank location]
    - 0.28 ppmv at NW corner, C400 [NW Plume centerline]

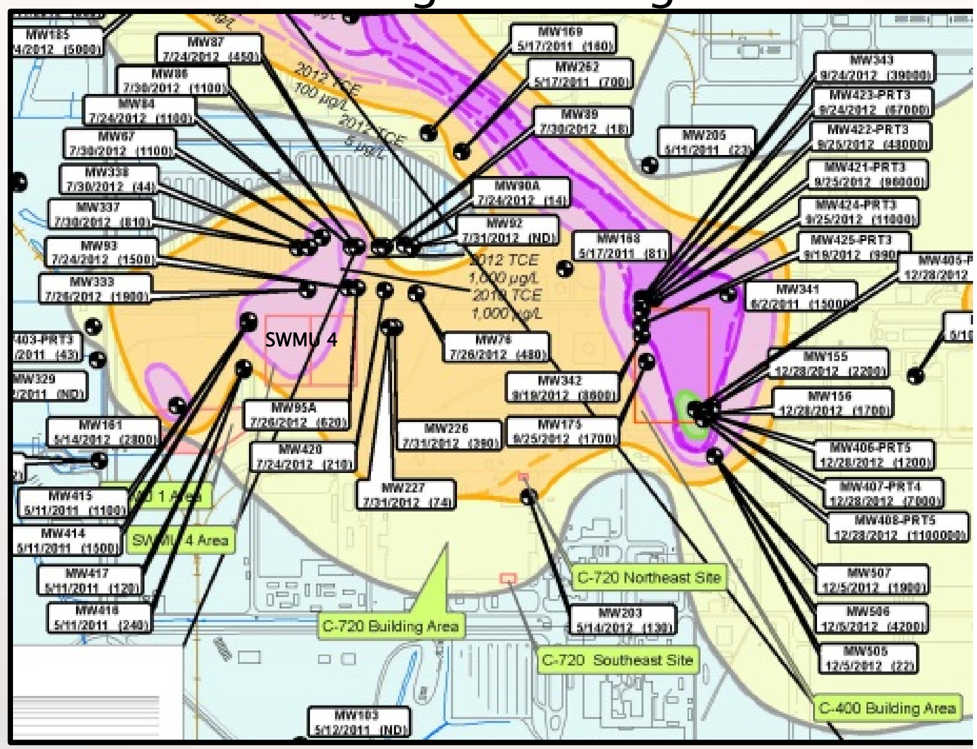
- ***“Sample collection at all locations was more difficult than expected due to the tightness of the soil formation being sampled.”***



[13]CH2M HILL 1991. Results of the Site Investigation, Phase I, at the Paducah Gaseous Diffusion Plant
[14]CH2M HILL 1992. Results of the Site Investigation, Phase II

2013 SWMU 4 Passive Vapor Study[15]

- Two (of 69 passive samples) had detectable TCE
  - 29 ng and 54 ng (detection limit of 25 ng)
- SWMU 4 overlies SW Plume with conc's an order of magnitude higher than in distal plumes off-site
- SWMU 4 clay cover expected to act as surface barrier
  - Would tend to trap vapors just below the cover and preserve vapors to be collected by passive samplers



[15]DOE 2012. Beacon Environmental Services Project 2480, Passive Soil Gas Survey

VI Evaluation

DQO Step 2. Identify the Goal of the Study

- Determine if UCRS first water TCE conc's are < residential VISLs
  - Inference is VI is not a problem because
    - Residential VISLs are more conservative than needed at PGDP
    - PGDP UCRS has high percentage of silt and clay that inhibit soil gas migration
    - Historical studies show soil gas migration low at PGDP

C-29

Step 2 Summary: Identify the Goal of the Study

- ***Determine if UCRS first water TCE conc's are < residential VISLs***
- ***Historical studies support inference derived from study goal***

Vapor Intrusion (VI) Evaluation

DQO Step 3. Identify Information Inputs

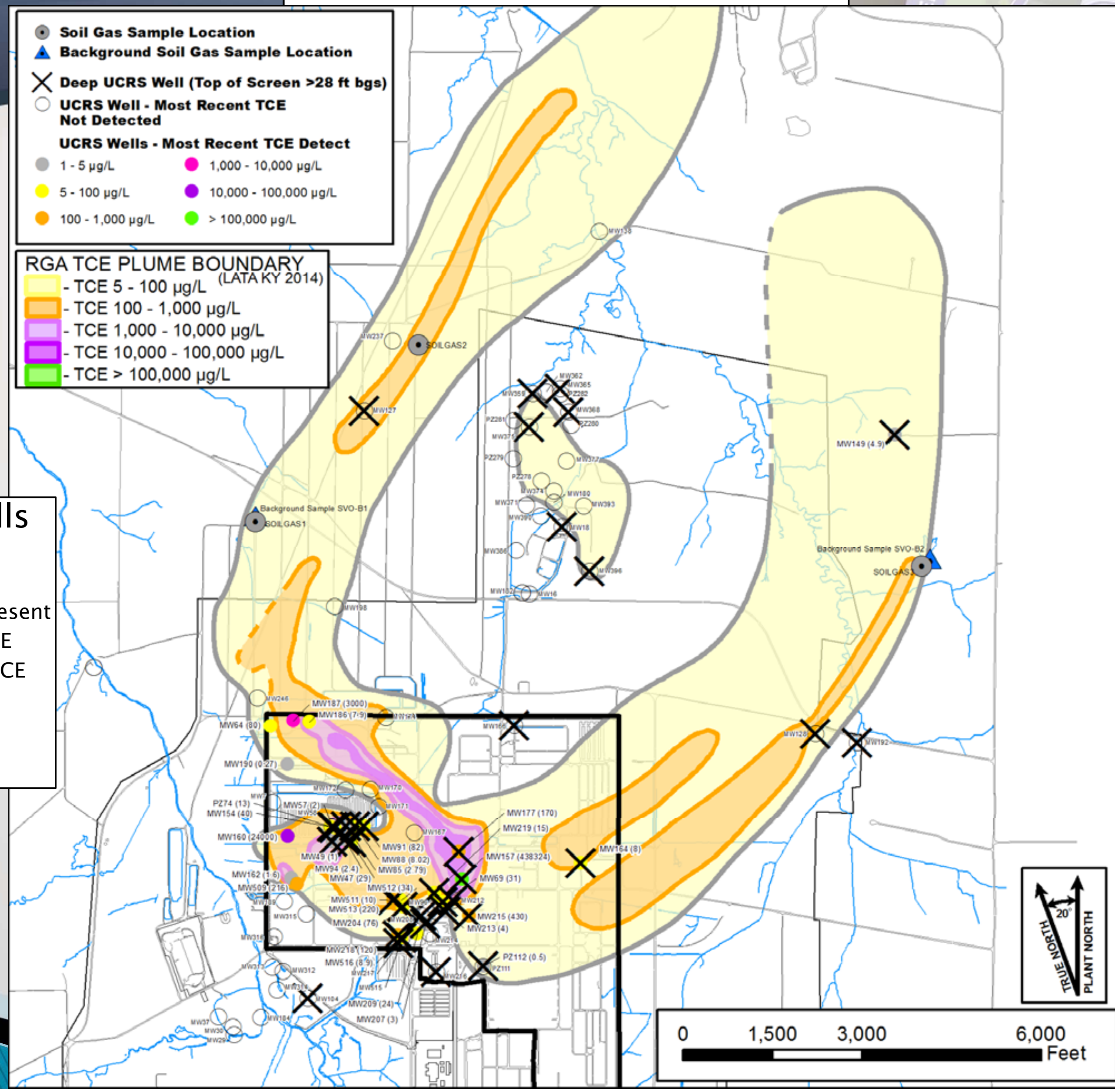
3. Identify Information Inputs
- Identify types and sources of information needed to resolve decisions or produce estimates.
- Identify the basis of information that will guide/support choices to be made in later steps of the DQO Process.
- Select appropriate sampling and analysis methods for generating the information.

- Identify Information Inputs (What Information Do We Need)
  - Most-recent conc's in UCRS wells w/top of screen at 28'bgs (or less) across PGDP
    - Standard GW sampling & analysis methods sufficient because detection limit < 1.2 µg/L
  - Review UCRS GW conc's to determine locations with TCE conc. > 1.2 µg/L
    - Evaluate location of UCRS well relative to potential sources
    - Evaluate if likely first-encountered water

Preliminary Study Results: What Information Do We Have

No TCE in Most-Recent UCRS Shallow GW Samples Outside Fence

2012 RGA Plume



Water Policy/Distal UCRS Wells

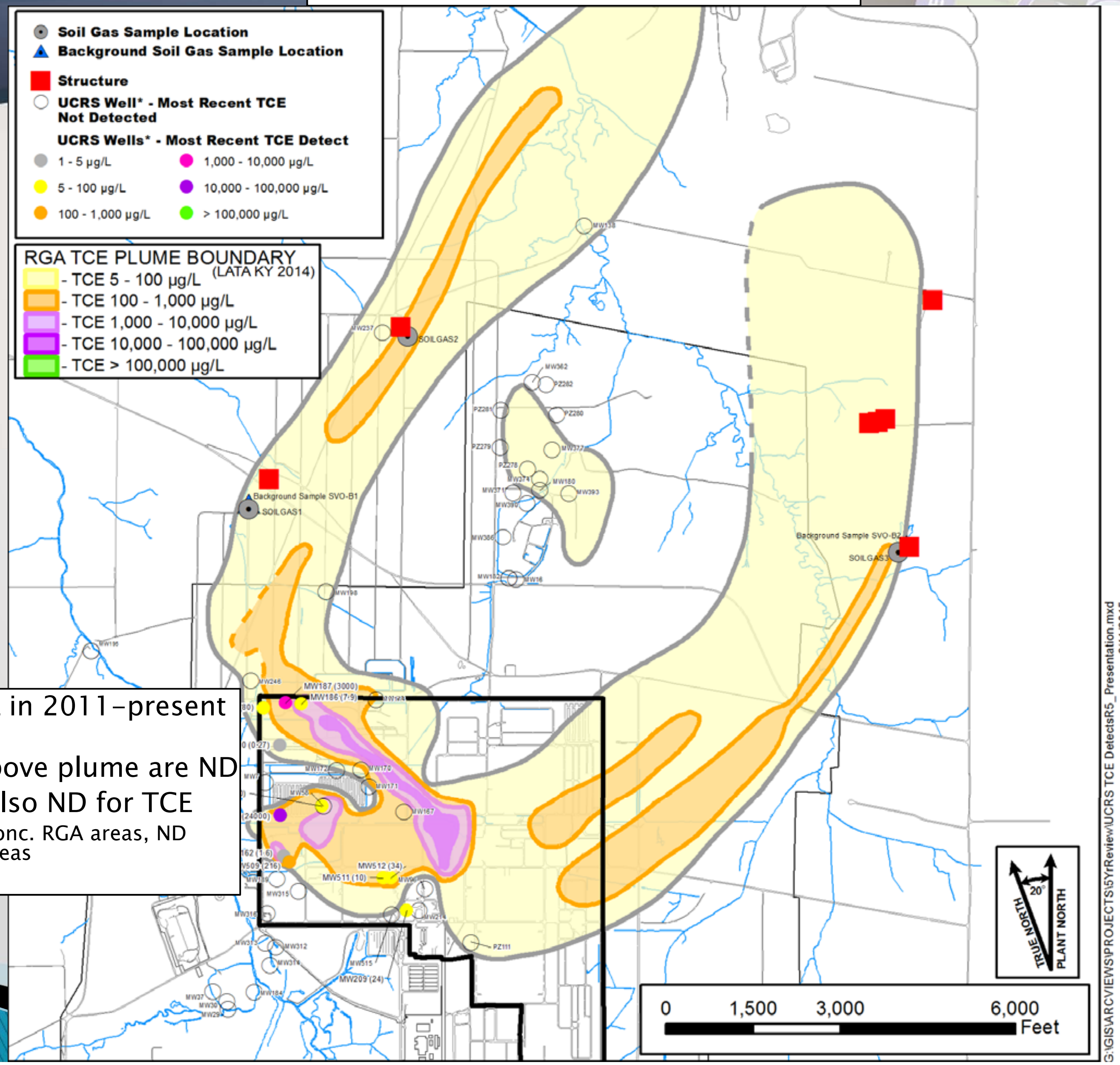
- Over 500 UCRS well analyses
- Most in Vicinity of S, T, & U Landfills
- No detections above 1 µg/L in 2011-present
- Even on-site, few shallow wells have TCE
- Many deeper "UCRS" wells also ND for TCE
- ND in distal plumes
  - Shallow: MW246, 198, 237, 138, 153
  - Deeper: MW127, 128, 192

Step 3

Preliminary Study Results: What Information Do We Have

Shallow (<28') Most-Recent UCRS TCE Results and Residence Locations

2012 RGA Plume, Shallow UCRS Wells Only



- No detections above 1 µg/L in 2011-present outside fence
- Many on-site UCRS wells above plume are ND
- Many deeper "UCRS" wells also ND for TCE
  - Inference: if ND above higher-conc. RGA areas, ND above lower-conc. RGA distal areas

Step 3

VI Evaluation

DQO Step 3. Identify Information Inputs

- Identify Information Inputs (What Information Do We Need)
  - Most-recent conc's in UCRS wells w/top of screen at 28'bgs (or less) across PGDP

- What Information Do We Have
  - Most-recent conc's in UCRS wells
  - Locations of existing UCRS wells

- What Information Do We Need
  - What are potential data gaps

Step 3 Summary: Identify Information Inputs
- ***UCRS most-recent first water TCE conc's above distal plume are < residential VISLs***
- ***Sample locations in spatial/temporal areas***

Vapor Intrusion (VI) Evaluation

DQO Step 4. Define the Boundaries of the Study

4. Define the Boundaries of the Study
- Define the target population of interest & relevant spatial boundaries
- Define what constitutes a sampling unit
- Specify temporal boundaries and other practical constraints associated with sample/data collection
- Specify the smallest unit on which decisions or estimates will be made

- The UCRS GW is the target to meet the Study Goal
  - Spatial limits: within Water Policy Area (incorporate other relevant UCRS information)
  - At UCRS GW table (deeper GW results would represent greater potential for VI)
- The UCRS TCE concentration is the characteristic of interest
- Sampling units are UCRS wells
  - Individual well results may be used for decision-making if first water and close to residence
  - Deeper GW results and results further from residences (closer to PGDP) would represent greater potential for VI
- Temporal Limits: Most-recent result
  - With RGA concentrations decreasing, most-recent result would best represent potential for VI
- Scale of Inference:
  - If TCE conc's below 1.2 μg/L in shallow UCRS wells, inference is VI not a problem in Water Policy Area
  - Given known PGDP geology, is there some alternative concentration level that is more appropriate?

Step 4 Summary: Define the boundaries of the study
- *First-encountered UCRS GW samples in distal areas of RGA plume*
- *Alternative screening level conc. for PGDP?*

VI Evaluation: DQO Process

Decision Point

- Do we have sufficient existing data
  - Most-recent shallow UCRS GW data outside fence <1.2 μg/L
  - 1.2 μg/L is lower than screening level needed for PGDP site geology
  - Samples collected from above higher RGA conc. areas and at greater depths than needed for VISL comparison

C-35

- What are potential data gaps

- Additional data collection activities required
  - Satisfied by data mining
  - Requires additional sample collection/analysis

Decision Point Preliminary Conclusion

- *Conc's in first UCRS GW samples in distal areas of RGA plume below VISLs*
- *VISLs are lower than needed to evaluate VI potential at PGDP ; thus,*
- *GW data show additional VI study not warranted; no additional data needed*

Vapor Intrusion (VI) Evaluation

DQO Step 5. Develop the Analytic Approach

5. Develop the Analytic Approach
- Specify appropriate population parameters for making decisions or estimates
- For decision problems choose a workable Action Level and generate an "If…then…else" decision rule
- For estimation problems, specify the estimator and the estimation procedure

- Compare most-recent result of UCRS GW samples from wells located outside fence to VISL of 1.2 µg/L
  - If any result exceeds 1.2 µg/L TCE, then
    - Determine proximity to residence
    - Determine if another UCRS well closer to residence
    - Determine if wells with exceedance representative of first water
    - Determine if additional well/sample point needed to fill spatial gap (closer to residence/shallower)
  - Most-recent results of UCRS shallow wells outside fence are ND and RGA conc's are decreasing
    - Determine if temporal issues exist
- Determine if spatial/temporal data gaps exist; as necessary, collect UCRS GW samples and analyze for volatile organic compounds (VOCs)

Step 5 Summary: Develop the Analytic Approach
- ***First-encountered UCRS GW samples in distal areas of RGA plume***

Vapor Intrusion (VI) Evaluation

DQO Step 6. Specify Performance or Acceptance Criteria

> 6. Specify Performance or Acceptance Criteria
> - For decision problems, specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions and place acceptable limits on the likelihood of making decision errors
> - For estimation problems, specify acceptable limits on estimation uncertainty

- Confirm add'l UCRS GW results from distal plume areas have TCE <1.2 μg/L
  - Additional samples to fill spatial and temporal data gaps
    - If samples in Water Policy <1.2 μg/L, inference is VI not an issue
    - If samples in Water Policy >1.2 μg/L, add'l evaluation/sampling may be required
    - For UCRS GW sample results with TCE >1.2 μg/L, confirm they are collected from first UCRS GW
    - If first water, confirm results from within 5 years
- If recent, first UCRS [TCE] > 1.2 μg/L and wells located near residence, evaluate additional work
  - Determine if results consistently above 1.2 μg/L to allow VI through silt/clay to residences
  - Determine additional study needed to confirm

> ***Step 6 Summary: Specify Performance or Acceptance Criteria***
> - ***Verify UCRS GW results in distal areas of RGA plume are <1.2 μg/L***
> - ***If not, hypothesis not confirmed***

Vapor Intrusion (VI) Evaluation

DQO Step 7. Develop the Detailed Plan for Obtaining Data

7. Develop the Detailed Plan for Obtaining Data
- Compile information and outputs from Steps 1–6
- Use information to identify alternative sampling and analysis designs are appropriate for intended use
- Select/document a design that will yield data that will best achieve your performance or acceptance criteria

- Review Existing Data and Identify Data Gaps
  - Assembled UCRS GW results from wells screened <28'bgs show no detectable TCE above distal plume areas
  - Determine whether additional GW locations are needed. Considerations:
    - UCRS GW has TCE conc. > 1.2 μg/L, the VISL residential screening level. With PGDP geology, the VISL levels are lower than a screening level that would represent a potential for VI at PGDP.
    - UCRS GW with TCE conc. > 1.2 μg/L from deeper wells represents a greater potential for VI than at first water.
    - Existing wells tend to be closer to plume/source and farther from residences, representing greater potential for VI.
    - With RGA TCE concentrations decreasing, the older results represent the greater potential for VI.
  - ***Results below VISLs even though collected from locations with greater potential for VI .***

- Develop Plan for Obtaining Data Needed to Fill Gaps
  - Evaluate round of UCRS GW samples from wells without data within past five years
  - Evaluate need for additional UCRS water locations
    - At first water
    - Closer to residences
    - Over higher distal plume concentration areas

Step 7 Summary: Develop the Detailed Plan for Obtaining Data
- ***Collect additional UCRS GW data to fill spatial/temporal data gaps***

DQO Process Summary

1. Problem Statement: Determine whether GW data indicate a VI study is warranted.
2. Identify Study Goal: Review UCRS GW Conc's to see if <VISL of 1.2 μg/L. Historical studies confirm VISLs lower than needed for VI protection at PGDP.
3. Identify Information Inputs: Most-recent shallow UCRS conc's in distal plume are <1.2 μg/L.
4. Define Study Boundaries: Most-recent TCE in UCRS GW within Water Policy and above VISL. Sample locations are conservative in both spatial and temporal terms.
5. Develop Analytic Approach: Review existing data, identify data gaps, determine if additional data required to fill spatial/temporal gaps.
6. Specify Performance/Acceptance Criteria: If UCRS GW results <VISL, VI not an issue.
7. Develop the Detailed Plan for Obtaining Data to fill data gaps, if identified. No data gaps identified because spatial and temporal locations of existing results are from areas with greater VI potential than areas nearer residences.

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APPENDIX D

WATER POLICY VAPOR INTRUSION SCOPING MEETING PRESENTATION

APRIL 22, 2015

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Second Sampling and Analysis Plan Scoping Meeting:
Evaluation of Vapor Intrusion (VI) at the Paducah Gaseous Diffusion Plant (PGDP) Water Policy Area

Recap of VI Guidance as Adapted to PGDP Site

Summary of Sampling and Analysis Plan Outline from Scoping Meeting 1

Additional Discussion/Backup/Evaluation

Evaluation of Proposed Changes to Plan

Monitoring Program Details

4/22/2015

VI Scoping Meeting 2 Agenda

- Recap VI guidance, VI Conceptual Site Model (CSM), and evaluation against PGDP conditions
- Summarize results from 1st Scoping Meeting including sampling plan outline
- Address issues raised during 1st scoping meeting
- Address comments on plan outline (notes/subsequent comments)
- Detail sampling, including planned methodology and form of deliverable(s)
- Summarize agreement: next step prepare Sampling and Analysis Plan (SAP)?

Recap: EPA Draft 2013 VI Guidance[2]

CSM Development: Features needed for VI

Three features must exist for hazardous vapors to reach the interior of buildings from the subsurface environment underneath or near a building:

1. A source of hazardous vapors must be present in the soil or in groundwater underneath or near a building

2. Vapors must form and have a pathway along which to migrate toward the building

3. Entry routes must exist for the vapors to enter the building and driving forces must exist to draw the vapors into the building

- *Guidance supplemented with VI Screening Level (VISL) calculator providing default screening levels for default site conditions*

[2]EPA 2013, OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)

Recap: VI Conceptual Site Model

from 2013 Draft EPA VI Guidance[2]

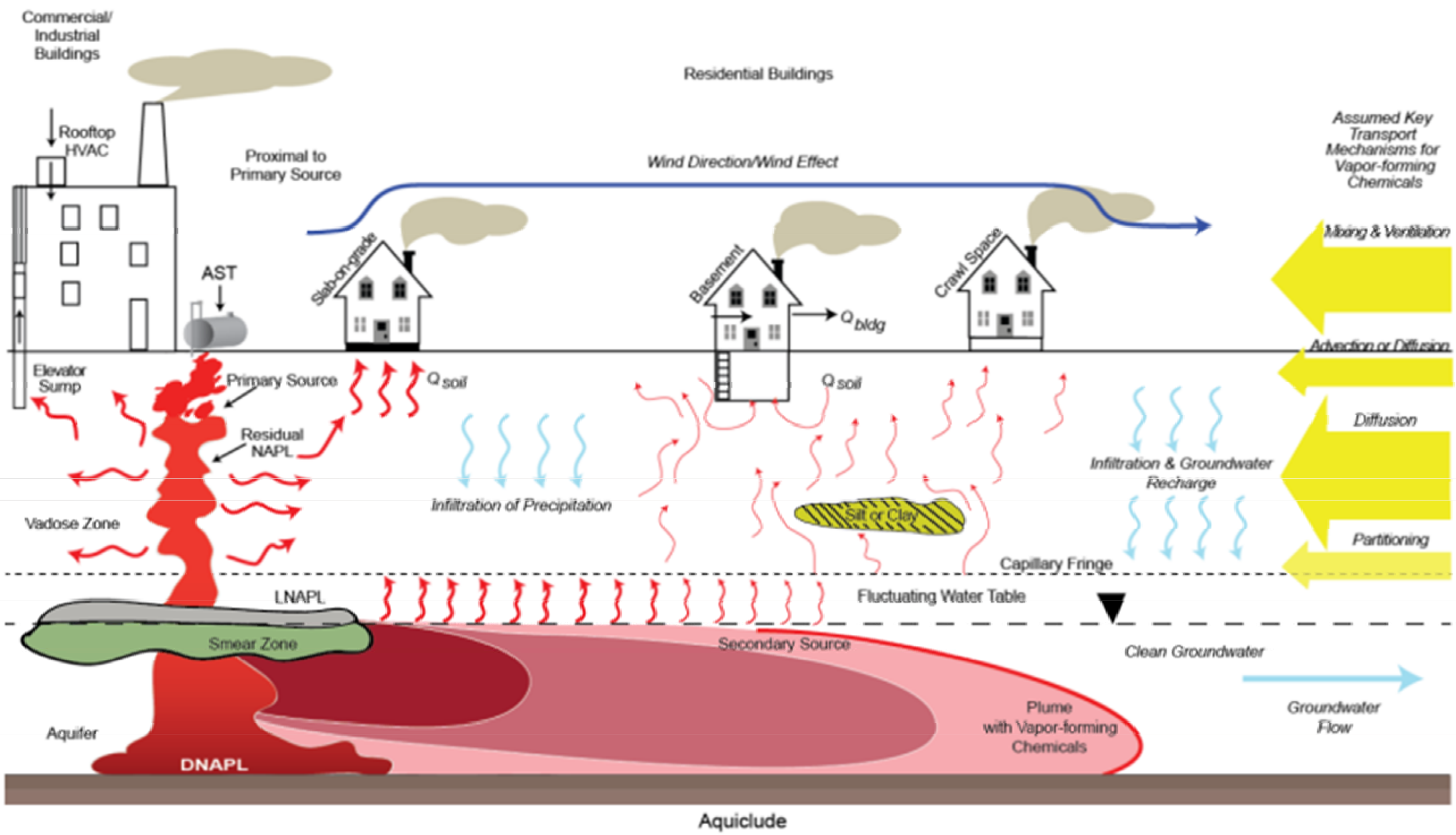


Figure 2-1 Illustration of Conceptual Model of Vapor Intrusion

Note: Q_{soil} represents soil gas entry; Q_{bldg} represents building ventilation.

[2]EPA 2013, OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)

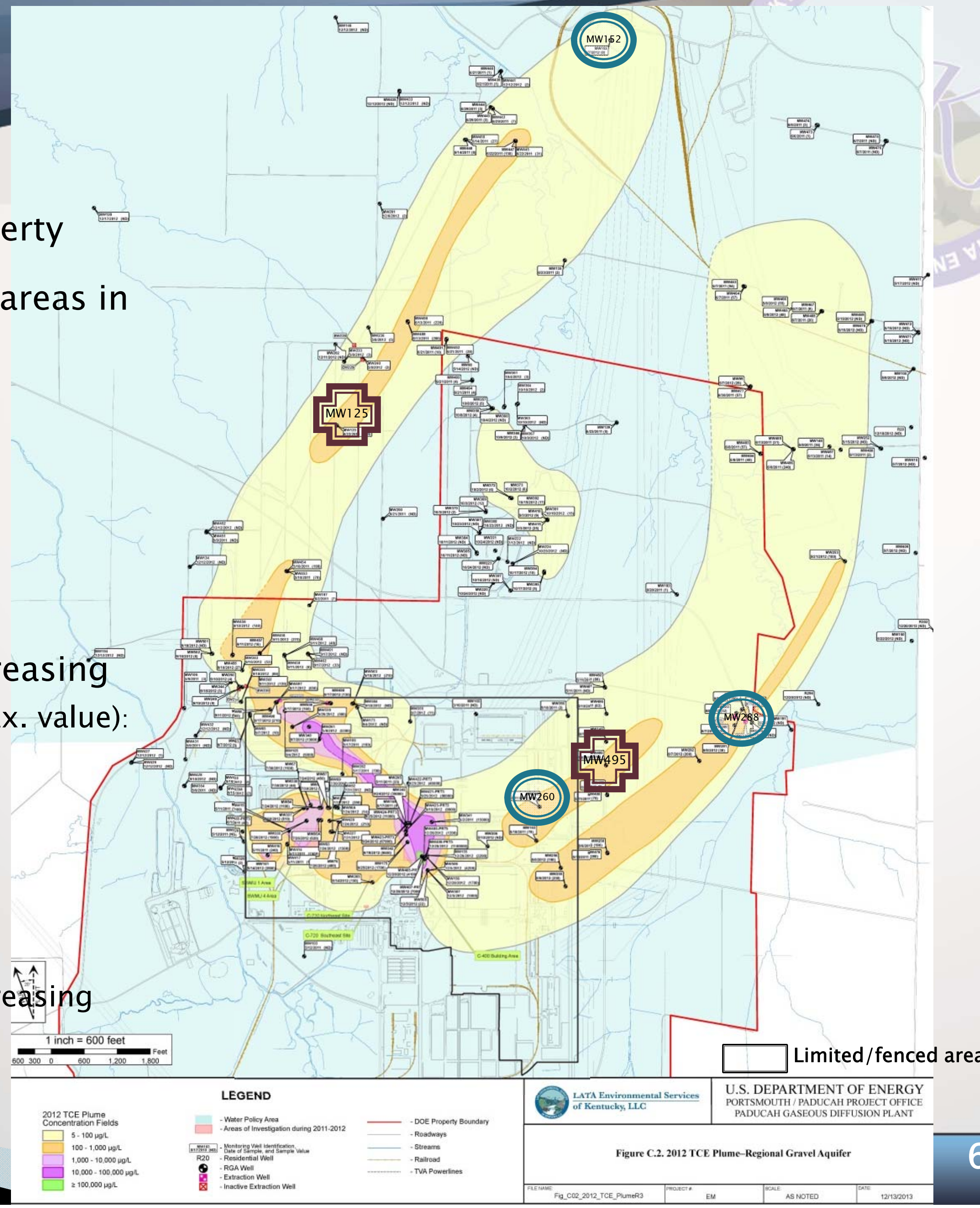
Recap: VI Default CSM Summary and Guidance

- CSM includes soil/vadose zone and groundwater sources
  - CSM shows proximity to higher conc's has higher VI potential
- CSM shows differential migration due to geology (silt/clay)
  - Less potential for migration through silt/clay
- CSM shows differential migration due to hydrogeology
  - Less potential with greater depth to contaminated water
  - Groundwater infiltration of clean water in distal plume areas
  - Plume orientation (less migration in distal areas w/lower plume conc.)
- Guidance includes potential for attenuation via biological processes
- Guidance includes differential potential related to building foundation type and condition and adjacent near-surface soil/cover composition

Recap: PGDP CSM: 2012 Plume Map

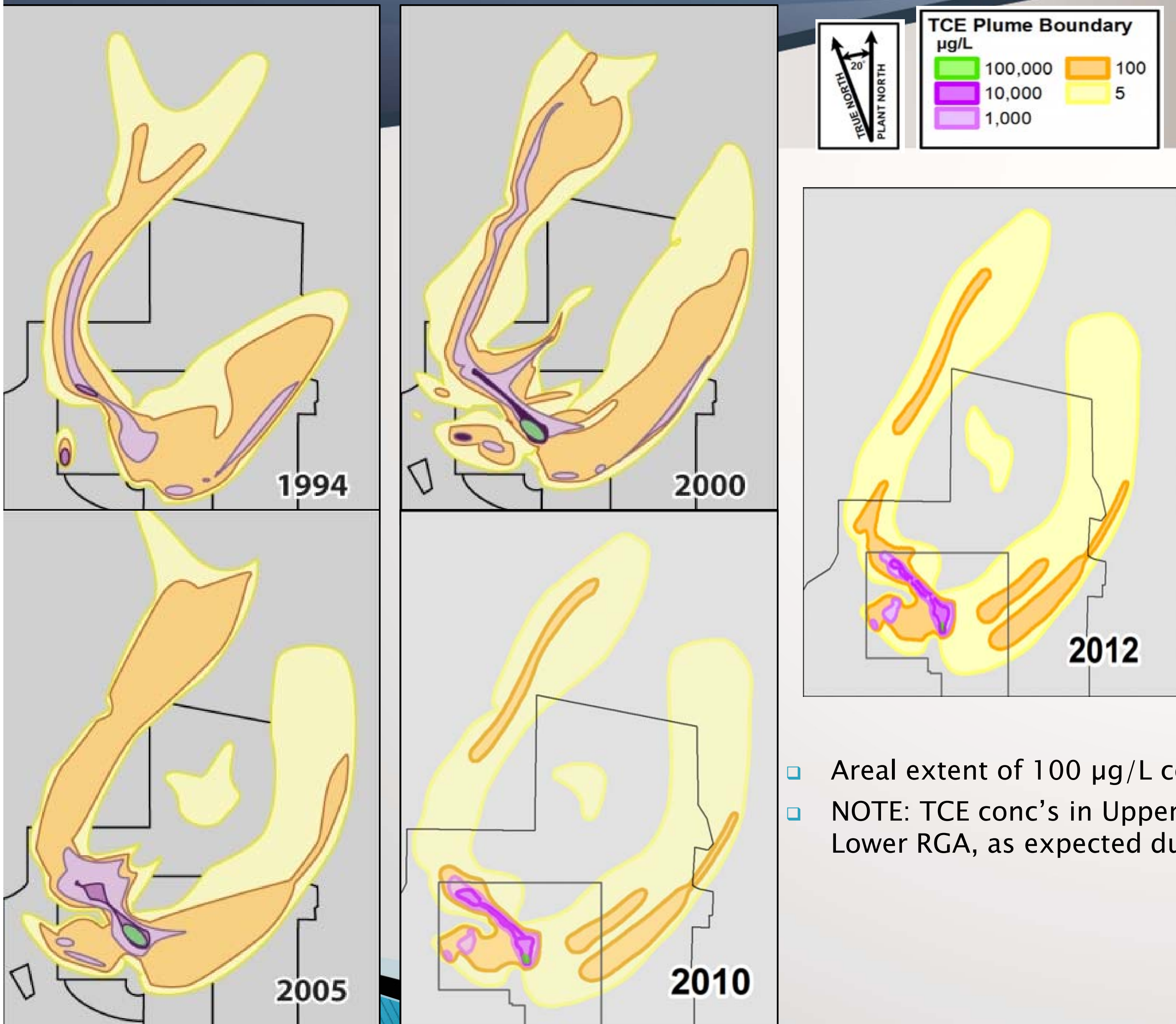
Trichloroethene (TCE) in Regional Gravel Aquifer (RGA)

- PGDP RGA TCE Plume extends off-property
- VI focus on distal (off-property) plume areas in the Water Policy Area (shaded in blue)
  - 7 residences above/near plume
- 2012 RGA *distal* plume TCE conc's
  - NW Plume Area Range: ND (<1 µg/L) – 420 µg/L
    - Max at MW125
  - NE Plume Range: ND (<1 µg/L) – 510 µg/L
    - Max at MW495
- Intrawell comparisons show conc's decreasing
  - NW Plume Examples (2012% decrease fr. max. value):
    - MW125: 44% decrease since 2005
    - MW152: 89% decrease since 2011
  - NE Plume Examples:
    - MW260: 56% decrease since 1997
    - MW288: 93% decrease since 1996
- Bottom Line: RGA concentrations low and decreasing



Recap: PGDP CSM: RGA TCE Plumes Over Time 1994-2012

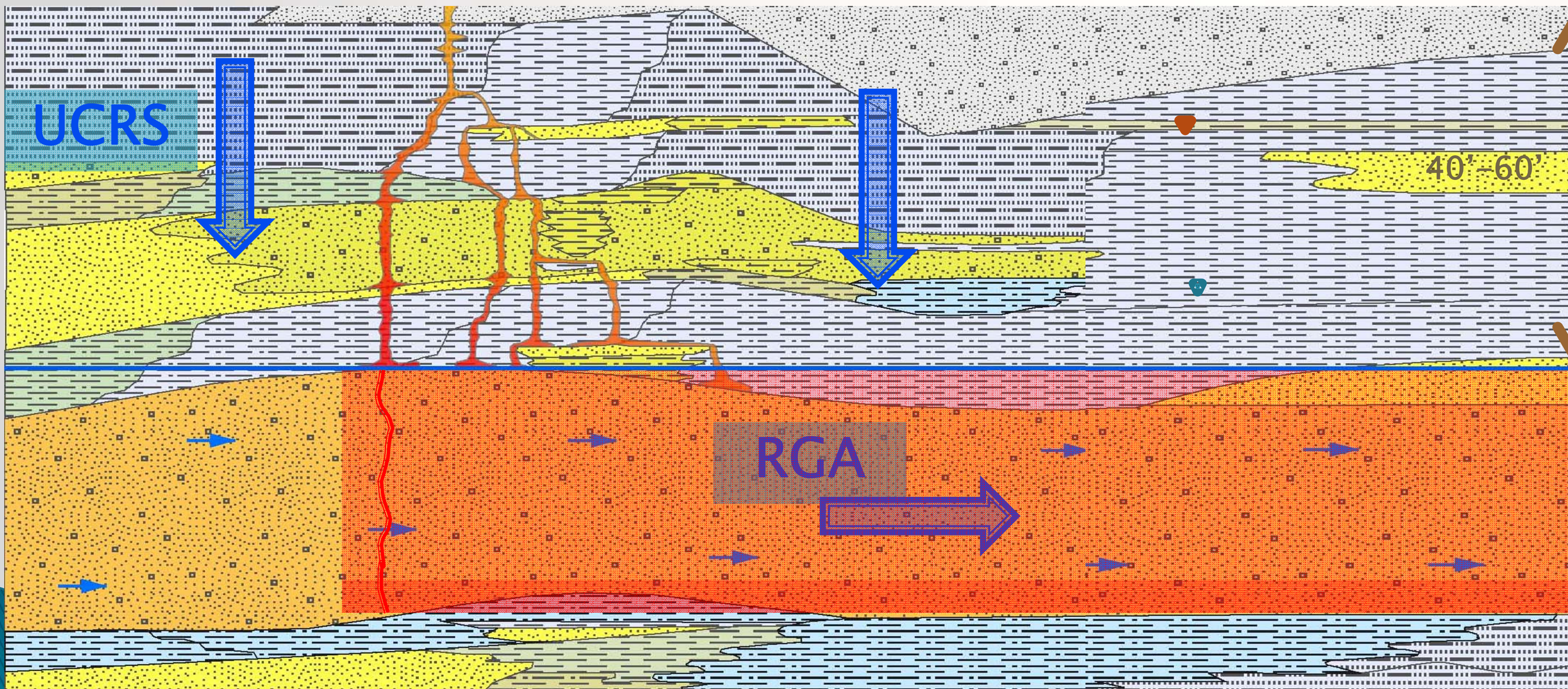
TCE Conc's and Areal Extent Decreasing



- Areal extent of 100 µg/L contour decreasing over time
- NOTE: TCE conc's in Upper RGA typically lower than in Lower RGA, as expected due to PGDP CSM

Recap: PGDP Dissolved Phase Conceptual Site Model[3]

- GW flow vertical through UCRS (40'–60' thick) and horizontal (lateral) through RGA
- In distal areas of plume *(outside source areas)* RGA contamination would have to migrate upward against clean downward UCRS GW gradient to reach vadose zone



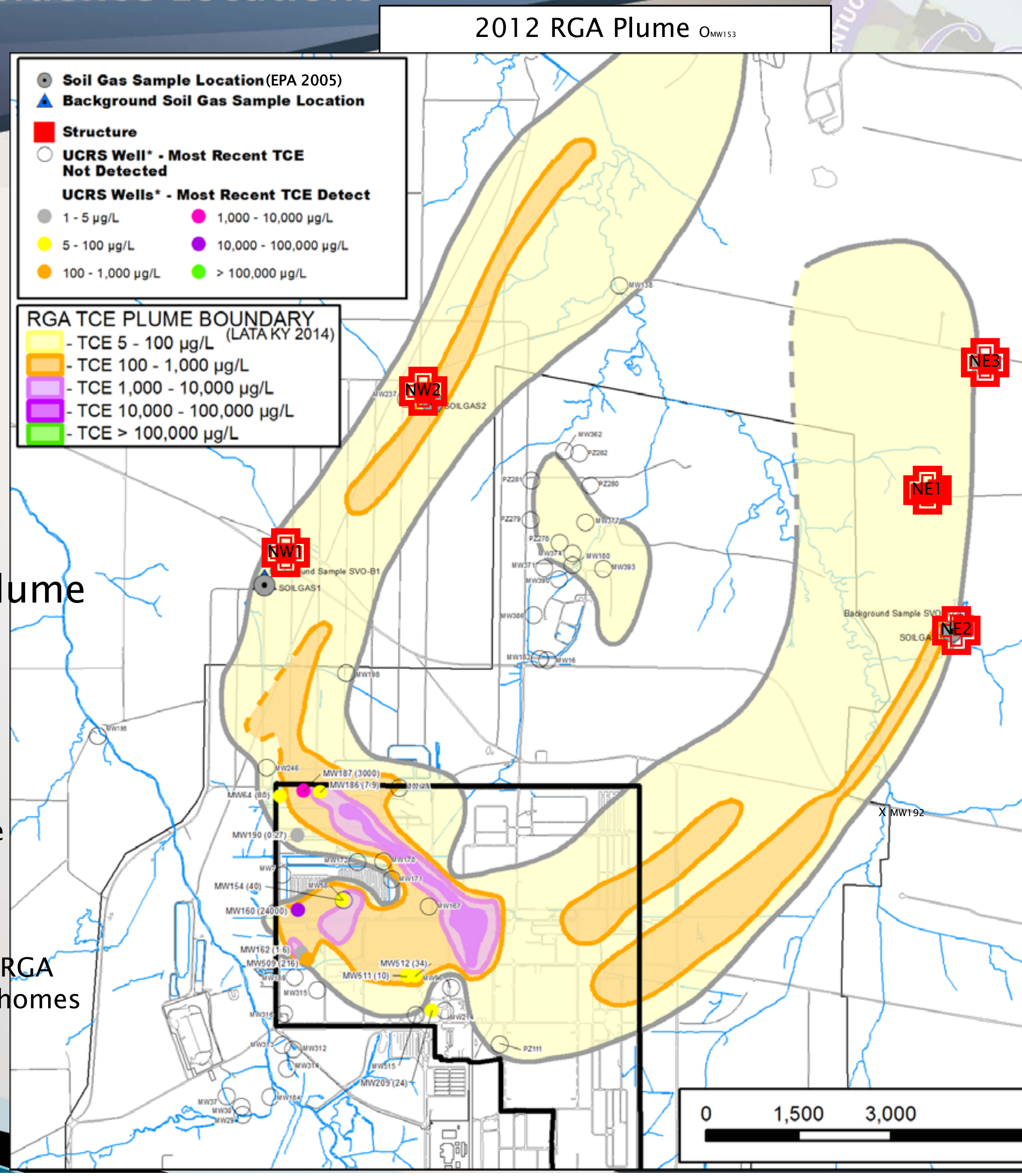
[3]Adapted from DOE 2011. Revised Proposed Plan for Volatile Organic Compound Contamination at the C-400 Building at the Paducah Gaseous Diffusion Plant

First water in UCRS (typ.)   RGA potentiometric surface (typ.)

Recap: PGDP CSM

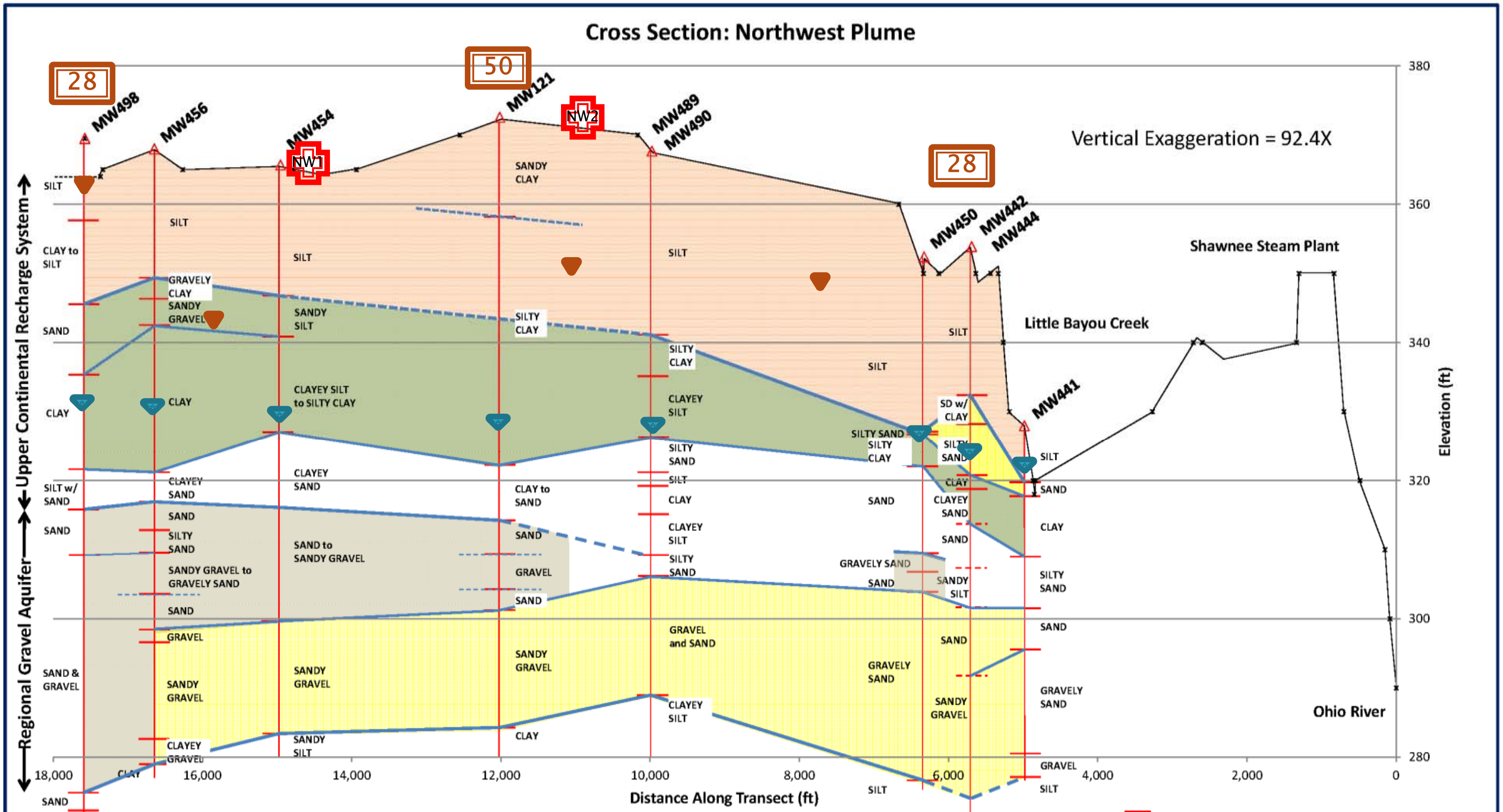
Scoping Meeting 1: Residence Locations

- 2 residences in NW Plume
  - NW1 along edge of current RGA plume
  - NW1 does not have nearby UCRS well
  - Other UCRS wells in better locations:
    - Over higher concentrations in plume
    - Some closer to plant source
  - NW2 over 100+ ug/L plume
  - NW2 has UCRS well nearby
- 5 residences above/near NE Plume
  - NE1 has 3 clustered residences
  - NE1 has no UCRS well nearby
  - NE2 has no UCRS well nearby
  - Closest UCRS well located south and not over plume
  - NE3 is not over 1 ug/L RGA [TCE] plume
- PGDP VI CSM
  - VOCs must migrate from contaminated RGA up through UCRS silt/clay/GW to reach homes



Recap: PGDP CSM: Northwest Plume Cross-Section

~25-50' Clay/Silt Between Contaminated RGA and Surface



NW2 Projected residence location

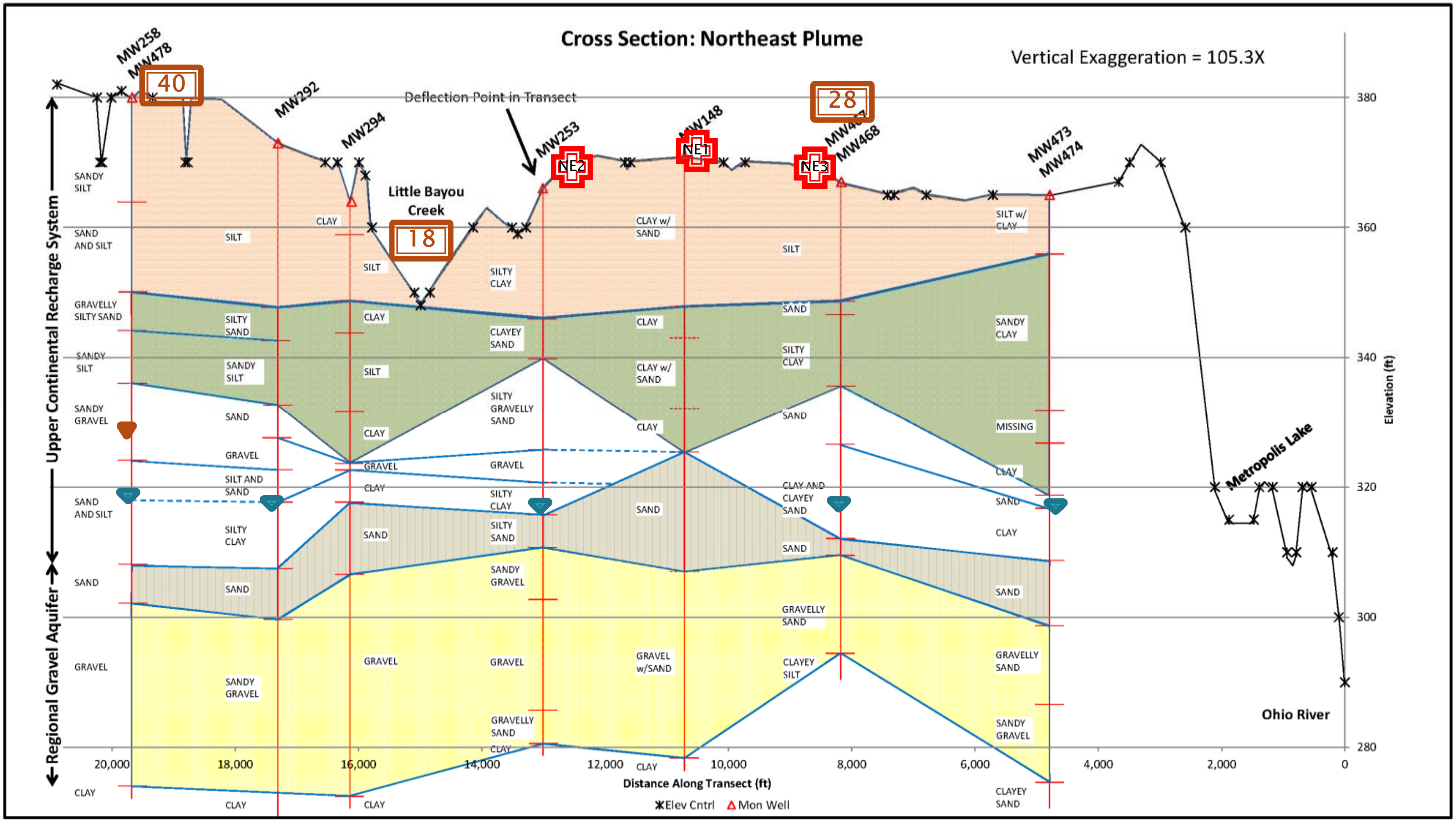
Approximate UCRS first water

Approximate RGA potentiometric surface

50 Approximate clay/silt thickness

PGDP CSM: Northeast Plume Cross-Section

Clay/Silt Between Contaminated RGA and Surface



Projected residence location

Approximate UCRS first water

Approximate RGA potentiometric surface

Approximate clay/silt thickness

Recap of VI Default CSM Summary and Guidance
Compare Against *PGDP Conditions*

- Vapor Source: *RGA GW source at PGDP deep*
  - *Only one potential pathway from single deep RGA (plume) source to residences*
  - *RGA PGDP plume GW source concentrations low and decreasing*

- Vadose Zone Geology: *40-60' soil [incl. >25' silt/clay] between source and residences*

- Vadose Zone Hydrology : *UCRS high moisture/saturated, contaminated water deep, overlying clean UCRS water. Downward hydraulic gradient of clean infiltrating water through UCRS*

- Vadose Zone Biochemistry: *potential for attenuation in UCRS , no additional PGDP TCE sources, UCRS moisture/saturation*

- Building Foundation: *no basements in 7 residences over/near plume*

Recap: CSM Factors Affecting VI and Screening Levels Compare to PGDP Conditions

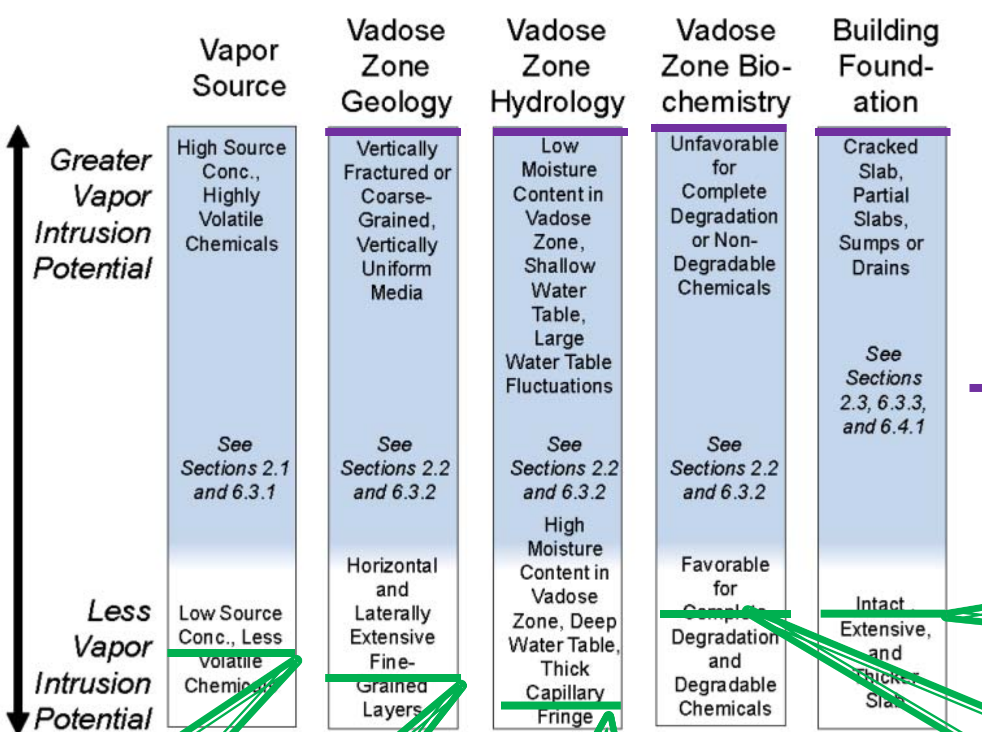


Figure 2-2 Some Factors that Affect Vapor Intrusion

UCRS at PGDP:

- ❑ Not vertically fractured
- ❑ Typically fine-grained with multiple layers
- ❑ Saturated/high moisture in vadose zone
- ❑ Has small water table fluctuations

RGA at PGDP:

- ❑ Low and decreasing TCE conc's
- ❑ Water table fluctuations irrelevant due to overlying UCRS

Default VI screening levels protective even under much greater vapor intrusion potential than PGDP

Few structures, no wells, no basements; few surface barriers, foundation conditions unknown

Low & decreasing concentrations

Fine-grained; not vertically fractured

Deep (contaminated) water table; intervening high moisture/saturated UCRS

Low conc's of TCE; RGA aerobic degradation attacks daughters/lowers [TCE]; UCRS conditions favorable for localized reductive dechlorination

Step 1

Recap: EPA Draft 2013 VI Guidance, 1

Against *PGDP Conditions*

Three features must exist for hazardous vapors to reach the interior of buildings from the subsurface environment underneath or near a building:

1. A source of hazardous vapors must be present in the soil or in groundwater underneath or near a building *(RGA plume at 40–60' bgs)*

2. Vapors must form and have a pathway along which to migrate toward the building *(overlying UCRS silt/clay/soil and groundwater; pathway not likely complete)*

3. Entry routes must exist for the vapors to enter the building and driving forces must exist to draw the vapors into the building *(limited apparent entry routes [i.e., no basements]; no surface barriers to outgassing, limited surface soil permeability)*

Recap: PGDP CSM for VI: Adapted from Draft EPA VI Guidance[1]

Silt, clay, and water between RGA contamination and residences

UCRS depth to water and lithology varies across the site

VI CSM for PGDP distal plume area:

adds UCRS GW and silt/clay (40'-60'), deletes basements (based on due diligence)

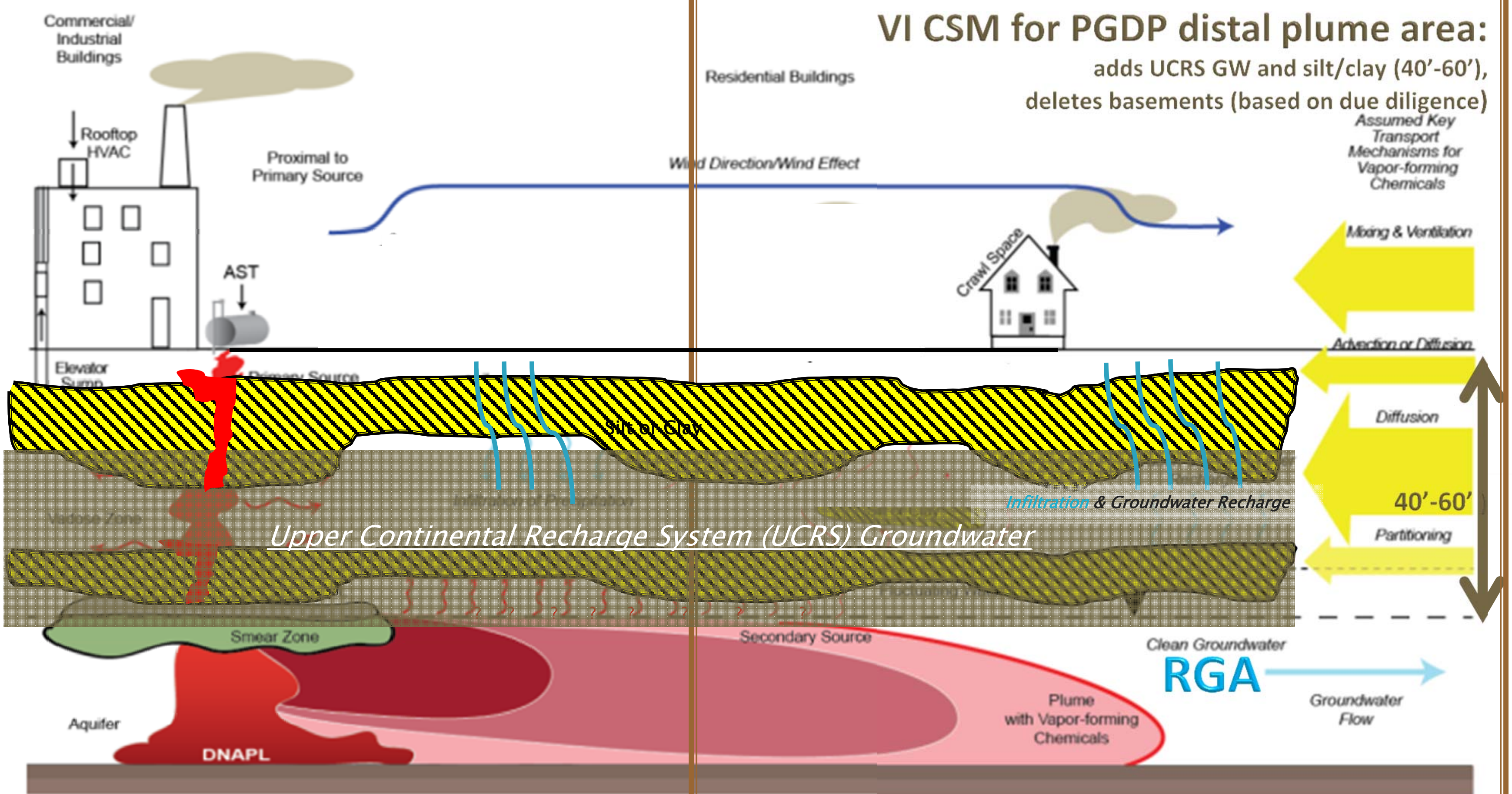


Figure 2-1 Illustration of Conceptual Model of Vapor Intrusion

Note: Q_{soil} represents soil gas entry; Q_{bldg} represents building ventilation.

[1]EPA 2013, OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air (External Review Draft)

Recap: CSM Summary of VI Potential at PGDP

- VI potential from RGA low (see VI factors discussion)
  - Intervening UCRS GW/silt/clay impede migration of VOCs from RGA upward through UCRS
  - VI potential limited because:
    - Affected GW won't significantly migrate upward against clean UCRS water w/downward hydraulic gradient
    - Including through >25' of silt/clay and through ~25' more soil
    - Then outgas into vadose zone, migrate through low perm. Loess, and then preferentially into residences without basements when soil gas can freely exchange with ambient air adjacent to residences

- PGDP VISL will be much higher than default VISL
  - Default VISL designed to be protective for shallow water contamination in sand unit
  - PGDP has deep contamination at low concentrations with intervening UCRS

- Few residences (7) near/above RGA plume
  - Plume at 1.2 ug/L TCE does not add residences to study area

- CSM shows VI potential low
  - Plan to address spatial/temporal gaps in evidence as necessary

Summary Scoping Meeting 1: SAP Outline

Developed Using the DQO Process

Problem Statement: *Determine whether multiple lines of evidence (e.g., groundwater (GW) data, soil gas data, site specific geology) indicate that Vapor Intrusion (VI) is occurring in the water policy area.*

--Adapted from U.S. Environmental Protection Agency (EPA) letter, dated 9/30/2014: ". . . a vapor intrusion study is conducted if current groundwater data indicate a study is warranted."

Investigation SAP Outline from Scoping Meeting 1:

- Review VI screening level for default site; estimate VISLs for site-specific PGDP
- Measure VOC concentrations in first *available* water
  - Compare concentrations to default VISLs
  - Identify TCE, cis/trans-1,2-DCE, VC that exceed default VISLs in first available water
  - Determine follow-on sampling / evaluation needed for those locations with results > default VISL concentrations

Summary Scoping Meeting 1: Water Policy Area

Sampling Details

- NW1: Collect 5 UCRS samples from NW Plume wells (including more-contaminated areas)
  - If all UCRS well [VOC]s < default VISLs, VI pathway considered incomplete
  - UCRS water/soil gas sample nearer residence may be needed
  - NOTE: R2 [TCE] (residential) RGA > 1.2 ug/L but < estimated PGDP VISL
- NW2: RGA well has [TCE] > 1.2 ug/L; collect UCRS sample from nearby well
  - If UCRS well [VOC] < default VISL, VI pathway considered incomplete
  - NOTE: Confirm distance from well to residence
- NE1: Collect RGA sample from R31 (residential well). Alternate location MW149
  - Compare concentrations to default VISLs and PGDP VISLs
  - If [VOC] < default VISL, VI pathway considered incomplete
  - If [VOC] > default VISL but < PGDP VISLs, evaluate need for additional sample(s); possible resolution: new first water (and soil gas if practical) sample
- NE2: Collect DPT first water sample; may collect soil gas sample
  - Use DPT first water result; compare against default VISL
  - If exceed default VISL, identify needed additional samples
  - NOTE: Nearest RGA well (MW253) has ~100 ug/L TCE; value > default VISL but < PGDP VISL estimate
- NE3: No additional sampling
  - Nearby RGA well results < VISL default screening levels

Summary of Issues Raised During 1st Scoping Meeting

- Sample type preference hierarchy
- Difficulty getting UCRS DPT/grab GW and/or soil gas sample
- Extent of UCRS GW/silt/clay
- Impact of UCRS GW/silt/clay on PGDP site specific VISL
- Plume at 1.2 ug/L does not add residences to study area

Summary of Issues Raised After 1st Scoping Meeting

Clarifications

- Expressed preference for sampling close to residences
- Attempt soil gas sampling from DPT?
- Clarify decision rules relative to VOCs vs TCE

Summary of Issues Raised After 1st Scoping Meeting

Comments for Further Discussion

- Propose modify NW1 sampling to collect water/soil gas near house
- Improve decision-rule clarity
- Confirm NW2 UCRS well distance to R17 residence
- Identify how to collect soil gas from DPT
- Sampling and Analysis Plan to use VISL Calculator 3.3.1 May 2014 values
- EPA Region 4's practice of response actions due to indoor air
- Develop decision rules for soil gas sample results
- Discuss sequencing of data collection and review, i.e. groundwater, soil gas, sub-slab, indoor air, ambient air
- DPT results are "grab" samples
- Soil gas results at PGDP not representative of VI potential due to tight soil
- DPT vs. new well for UCRS water samples

Discussion of Issues Raised During 1st Scoping Meeting

Preliminary Responses

- Sample type preference hierarchy
  - *UCRS well first water samples above higher concentration areas of plume and nearer PGDP*
- Difficulty getting UCRS grab/DPT GW and/or soil gas sample
  - *For DPTs, propose multi-depth installation: collect water from shallowest with water*
  - *Soil gas from shallow DPT?*
    - *Soil gas not representative of VI potential due to inability to get good sample at PGDP*
    - *No reasonable soil gas benchmark*
- Extent of UCRS GW/silt/clay
  - *Confirmed UCRS GW expressed in most wells*
  - *UCRS GW/silt/clay present near residences*
- Impact of UCRS GW/silt/clay on PGDP VISL
  - *Default VISL appropriate for contaminated shallow GW in sandy soils with basements*
  - *PGDP VISL should be >120 ug/L (estimated) due to UCRS GW/clay/silt*
- Plume at 1.2 ug/L does not add residences to study area
  - *See NE3*

Sample Type Preference Hierarchy at PGDP

1. UCRS well water samples from first water over RGA plume
   - *Reproducible, best evidence, indicative of degree of migration of <u>PGDP-related source</u>*
2. UCRS well samples from deeper water w/[VOC] < default VISL
   - *Reproducible, indicative of degree of migration from PGDP RGA plume*
   - *VI potential from deeper samples lower than from shallower samples with same [VOC]*
3. RGA well samples w/[VOC] < default VISL
   - *Reproducible, related to migration potential from plume, but lower potential (deeper)*
   - *If [TCE] > default VISL, additional evaluation needed*
4. If [VOC] at depth > default VISL (+no UCRS well), DPT from first water
   - *Not reproducible; potential for false positive by dragging VOC down;*
   - *Other non-PGDP plume source(s)?*
5. If 1-4 above have [VOC] > default VISL, soil gas
   - *Difficult to get representative sample at PGDP; gas sample not representative of VI potential*
     - *Multiple attempts over decades*
     - *Typically no TCE in soil gas except within 500' of DNAPL in UCRS soil*
     - *VISL benchmarks for subslab soil not appropriate for UCRS soil gas*

Discussion of Issues Raised After1st Scoping Meeting

Clarifications

Clarifications

- Sampling location preference close to residences
  - *Distances will be in SAP*
  - *Residence location preference to be balanced against first water over plume centroid*
  - *With single PGDP-related pathway from plume, first-water over centroid more important*

- Attempt soil gas sampling from DPT?
  - *Tentatively propose 3-depth DPTs, collect water from shallowest expressed*
  - *No soil gas (due to questions about representativeness of soil gas results from PGDP)*
  - *No reasonable soil gas benchmark for PGDP UCRS*
  - *Even if soil gas sample can be collected using low flow/high vacuum, results would not reflect VI potential through actual PGDP UCRS soil/GW*

- Clarify decision rules relative to VOCs vs TCE
  - *Acknowledged. Will refine in Scoping Meeting 2*

Discussion of Issues Raised After1st Scoping Meeting, 1

Further Discussion

- Modify NW1 sampling to collect water/soil gas near house?
  - *No: residence location preference balanced against first water over plume centroid*
  - *No: value of soil gas sample questionable due to questions about representativen*ess
- Improve decision-rule clarity
  - *Acknowledged. Meeting 2 to resolve*
- Confirm NW2 UCRS well distance to R17 residence (300')
  - *UCRS well near NW Plume centroid, adjacent to RGA well*
- How to collect soil gas from DPT
  - *Propose no soil gas from DPT due to tight soils*
  - *Unlikely to get sample under normal protocol*
  - *Low flow sample may be possible but conc's won't reflect VI/gas migration potential*
    - *If no sample at -100" wc vacuum, no significant migration in absence of vacuum*
- SAP to use VISL Calculator 3.3.1 (May 2014) default values
  - *No 1,2-DCE values*
  - *Default VISL values for only TCE and vinyl chloride*

Discussion of Issues Raised After1st Scoping Meeting, 2

Further Discussion

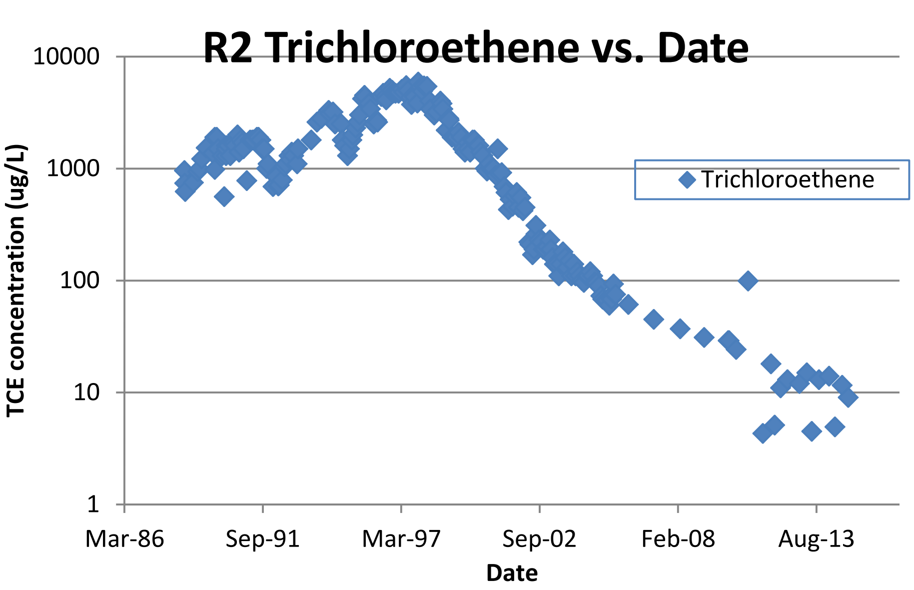
- EPA Region 4's practice of response actions due to indoor air
  - *Have not received*
- Develop decision rules for soil gas sample results
  - *Due to tight soils, value of soil gas results at PGDP questionable*
- Discuss sequencing of data collection and review, i.e. groundwater, soil gas, sub-slab, indoor air, ambient air
  - *Groundwater, soil gas if collected*
- DPT results are "grab" samples
  - *Agreed*
- Soil gas results at PGDP not representative of VI potential due to tight soil
  - *Soil gas value not representative of actual VI potential; no benchmark for soil gas*
- DPT vs. new well for UCRS water samples
  - *First water UCRS sample superior to DPT*

Summary of Scoping Meeting 1

Location NW1: WKWMA House (near R2 well)

Location NW1

- At current edge of NW Plume
- R2 [TCE] decreased to ~10 ug/L (RGA)
  - Level below estimated PGDP VISL
- Study question: RGA conc's < PGDP VISL
- UCRS wells over higher distal conc. area
  - 198, 246, 153, 237, 138 provide lines of evidence
  - 198: most recent ND
  - 246: all results ND
  - 153: all results ND
  - 237: most ND; max 4 ug/L
  - 138; all ND
  - NOTE: Although NE Plume UCRS well 192 has all results ND, well not above plume / deeper UCRS well
- Identified potential need for new sample closer to residence



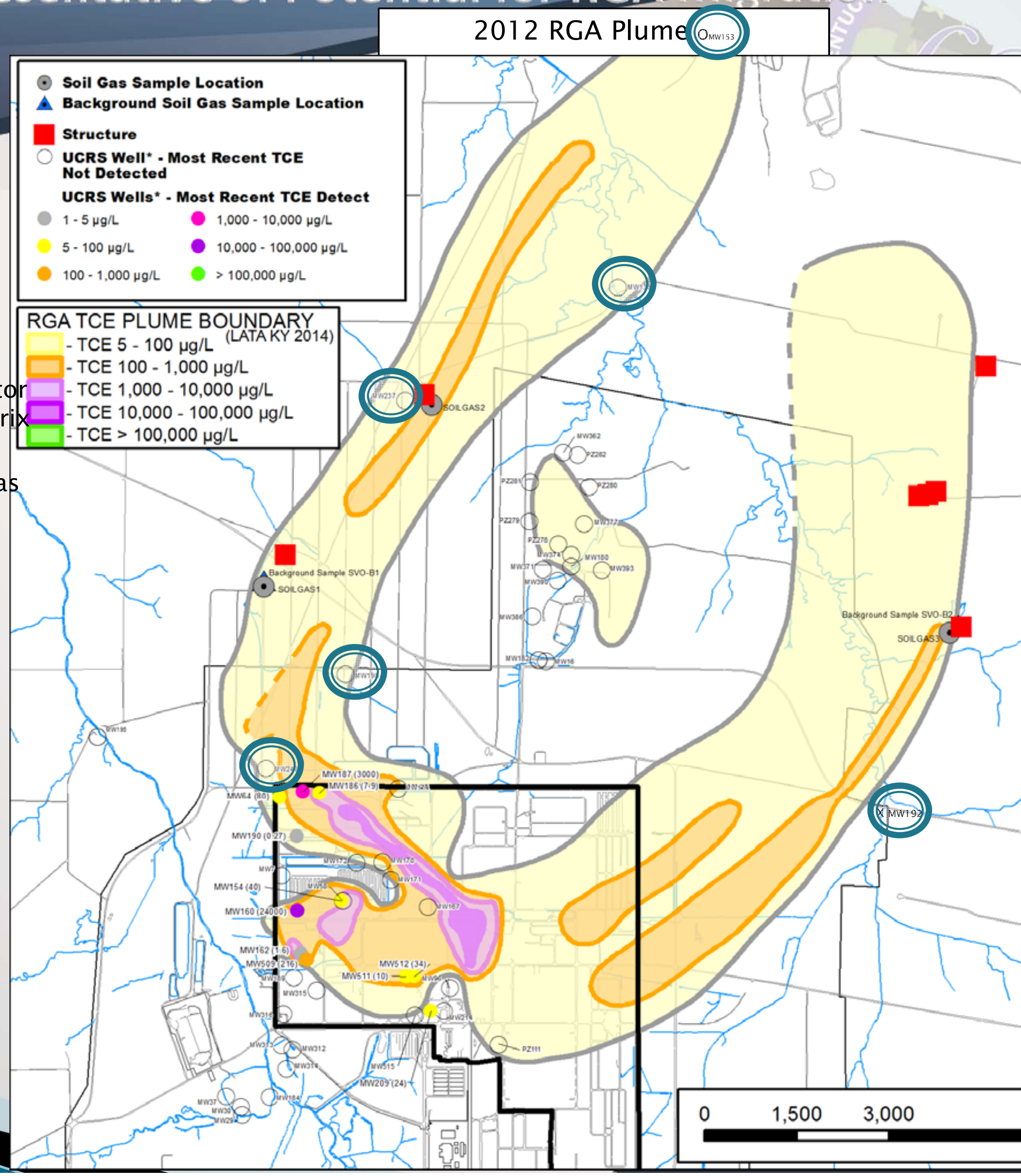
Summary of Scoping Meeting 1

UCRS Wells More Representative of Potential for RGA Migration

- UCRS wells above more-concentrated areas of plume
  - MWs: 198, 246, 153, 237, 138
  - If [VOC] in UCRS wells < default VISLs, VI pathway (from PDGP plume) incomplete
  - [VOC] in UCRS may confirm attenuation factor 2 orders of magnitude higher for UCRS matrix (silt/clay)
  - NOTE: Although NE Plume UCRS well 192 has results ND, well not above plume

- Compare recent results with historical UCRS results

- NOTE: Historical NW Plume RGA [VOC] higher
  - Demonstrates single PGDP TCE migration mechanism not a VI issue
  - Superior to *new* first-water sample near residence
    - *Because over higher concentration areas*
    - *Existing wells allow historical data comparability*



Summary of Scoping Meeting 1

Location NW2: R17 Residence

- NW2: RGA well has [TCE] > 1.2 ug/L but < PGDP VISL (recently 6–46 ug/L)
  - Historical RGA results as high as 1,800 ug/L
- Collect UCRS sample from MW237 (adjacent to 4 RGA wells)
- Distance from residence to MW237 = 300'
- Compare new UCRS results with historical values and default VISLs
  - If below default VISL, VI pathway considered incomplete

Summary of Scoping Meeting 1

Location NE1: R31 Residence

- NE1: Collect RGA sample from R31 (alternate MW149)
  - Historical R31 results typically < VISL
- Compare RGA result to default VISL (and estimated PGDP VISL)
  - If result >default VISL evaluate need for additional sample
  - Possible resolution: DPT water/soil gas or new UCRS well

Summary of Scoping Meeting 1

Location NE2: Residence

- No wells with shallow UCRS sample above plume and nearby
- NE2: New water/soil gas sample
  - DPT vs new well?
- Compare UCRS water result to default VISL
- Discuss value of soil gas sample / decision rule development / benchmark

Summary of Scoping Meeting 1

Location NE3: Residence

- NE3: Recent (and historical) RGA [TCE] < VISL
- No additional samples required; document in SAP

Sampling Considerations
UCRS Well/DPT, First Groundwater

- UCRS well samples at locations above distal RGA Plume including new wells, if any
  - Using Standard Operating Procedure for collecting UCRS well sample
- DPT grab sample
  - Open-ended DPT rods or Geoprobe SPT16/SP22 sampler (0.65” ID screen)
  - Three depths: 10’, 20’, 30’
  - Leave overnight
  - Next day: Identify shallowest boring with water
  - Sample water
  - May sample shallower boring for soil gas, if available
- Use bailer or discrete depth sampler (see SAP)
- Fix-based Laboratory
- Abandonment via coated bentonite pellets (1/4-inch diameter pellets)
- Location via GPS

Sampling Considerations

DPT Sampling, Soil Gas

- General rule: 3 to 10 "pore volumes" are used as a criterion for purging
  - Pore volume includes:
    - The open volume of the sample chamber
    - Pore space of the sand pack,
    - Dry bentonite seal of the vapor implant system, and
    - Inside volume of tubing used for sampling
  - Pore volumes are specific to each sampling effort and a major factor in the time required for purging

- Equilibration time before sampling
  - DPT: at least two hours
  - Hollow stem or hand auger: at least 48 hours
  - Rotosonic or air rotary: varies from a few days to a few weeks

- Flow conditions
  - Sustain 100 mL/min with a vacuum of 100" (or less) water column for 3-10 pore volumes
  - If cannot maintain 100 mL/min flow, sample not representative of VI potential

Updated Sampling Plan Outline as Adjusted for 2nd Scoping Meeting

After Update, Go to Sampling Plan Development?

- Update Sampling and Analysis Plan for 5 Areas:
  - NW 1
  - NW2
  - NE1
  - NE2
  - NE3: Document rationale for sampling/no sampling in SAP

- Confirm tentative sampling approach
  - Existing UCRS wells
  - New UCRS wells?
  - New DPTs?
  - DPT soil gas?

- Update decision rules

- Sampling plan development schedule
  - Use existing SOPs

BACKUP to

Second Sampling and Analysis Plan Scoping Meeting:

Evaluation of Vapor Intrusion (VI) at the Paducah Gaseous Diffusion Plant (PGDP) Water Policy Area

Recap of VI Guidance as Adapted to PGDP Site
Summary of Sampling and Analysis Plan Outline from Scoping Meeting 1
Additional Discussion/Backup/Evaluation
Evaluation of Proposed Changes to Plan
Monitoring Program Details

4/22/2015

Step 1 Summary: PGDP Conditions Show Lower VI Potential

UCRS Groundwater and Silt/Clay Are Barriers to Vapor Migration

- The Regional Gravel Aquifer (RGA) contamination is a potential source of hazardous vapors in groundwater underneath or near a building
- However, TCE vapors must travel upward through the UCRS groundwater (against the hydraulic gradient of clean infiltrating water) for vapors to reach the subsurface
- And, vapors must travel through low perm strata (silt/clay) to enter the building even though there is no surface barrier to outgassing to ambient air
- **Bottom Line Conclusion: RGA TCE conc's are low/decreasing and UCRS GW and soil matrix are barriers to VI with little potential for migration to few residences**

Step 1 Summary: State the Problem:

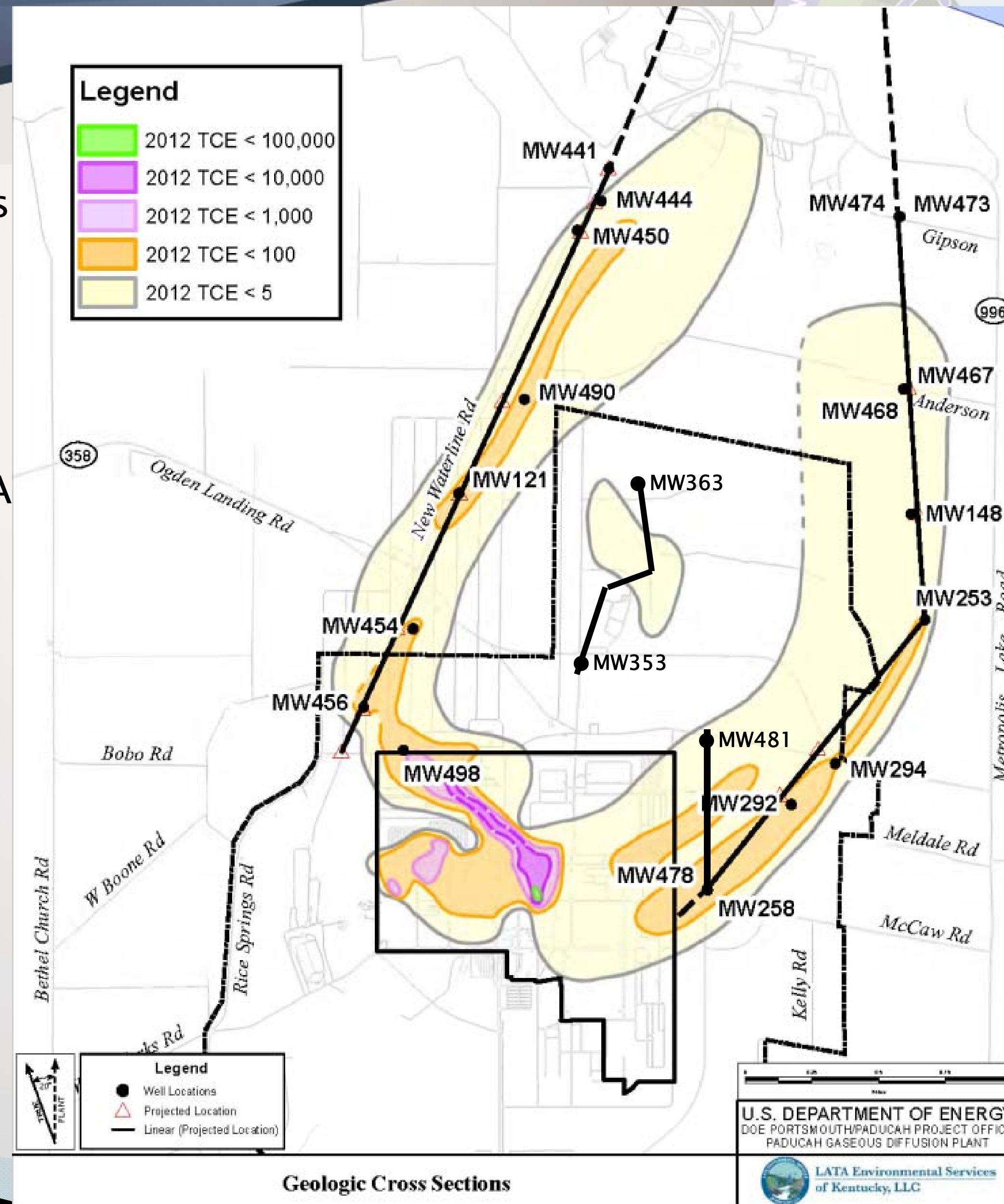
- *Determine whether groundwater (GW) data indicate a VI study is warranted*
- *Propose evaluation to confirm UCRS GW data (when combined with other PGDP information) is sufficient to demonstrate VI not an issue*

PGDP CSM: Geologic Cross Sections

Prepared from Well Logs for Wells Shown

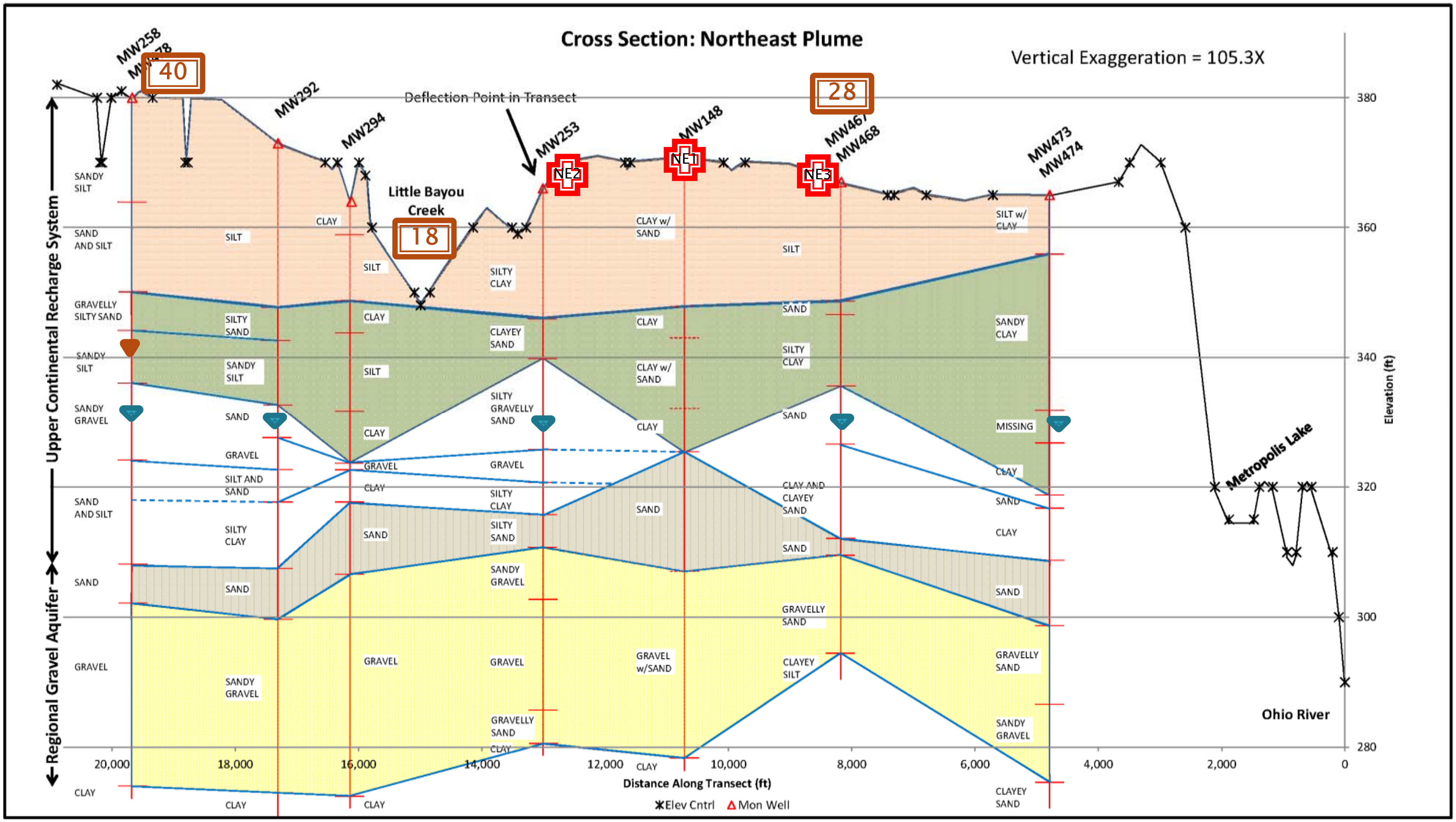
- Four recently prepared cross sections
  - NW Plume
  - NE Plume
  - Landfills
  - East Side

- Show UCRS silt and clay between RGA and vadose zone



PGDP CSM: Northeast Plume Cross-Section

Clay/Silt Between Contaminated RGA and Surface

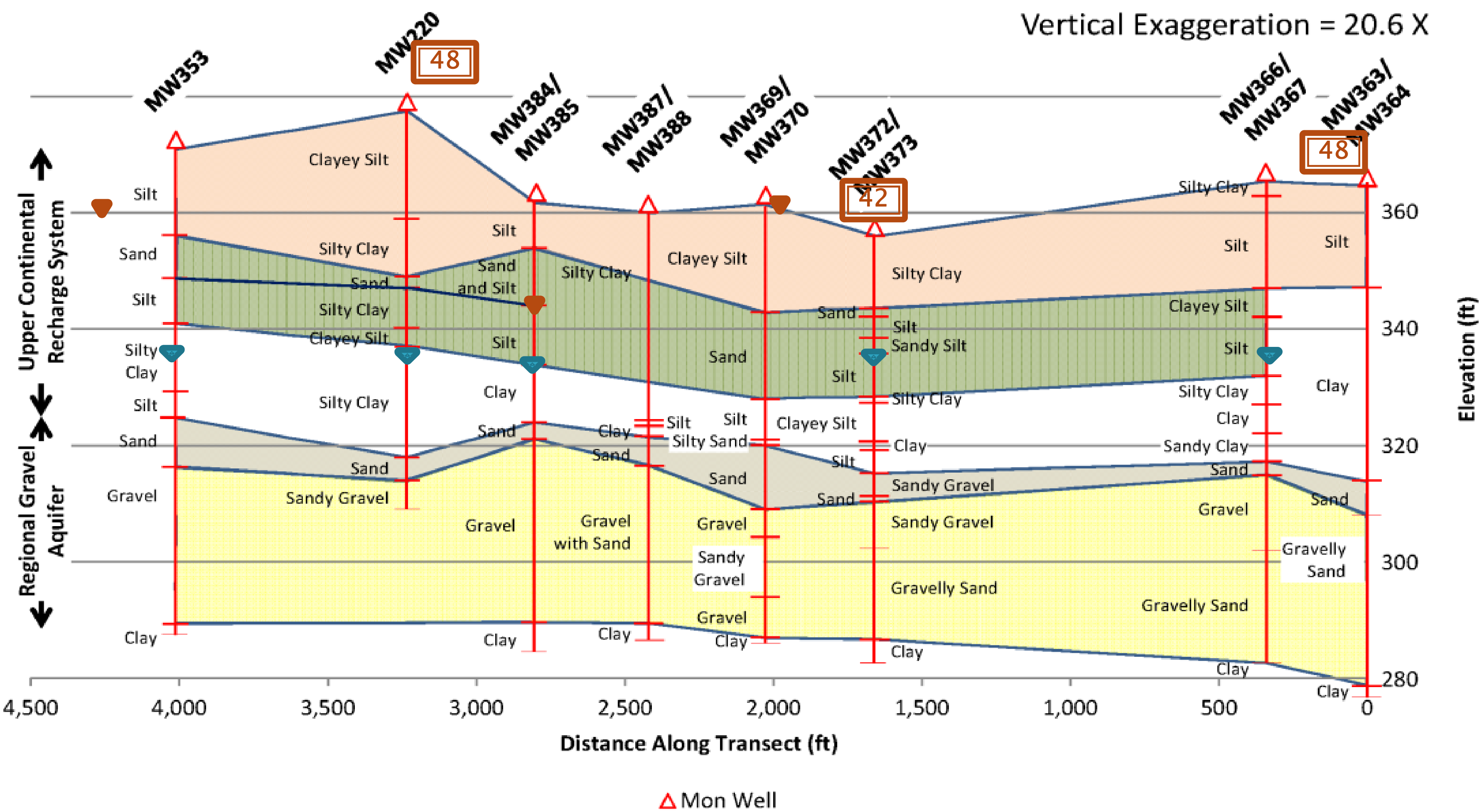


Approximate UCRS depth to water Approximate RGA potentiometric surface 28 Approximate clay/silt thickness

CSM Development: Landfill Area Cross-Section

Clay/Silt Between Contaminated RGA and Surface

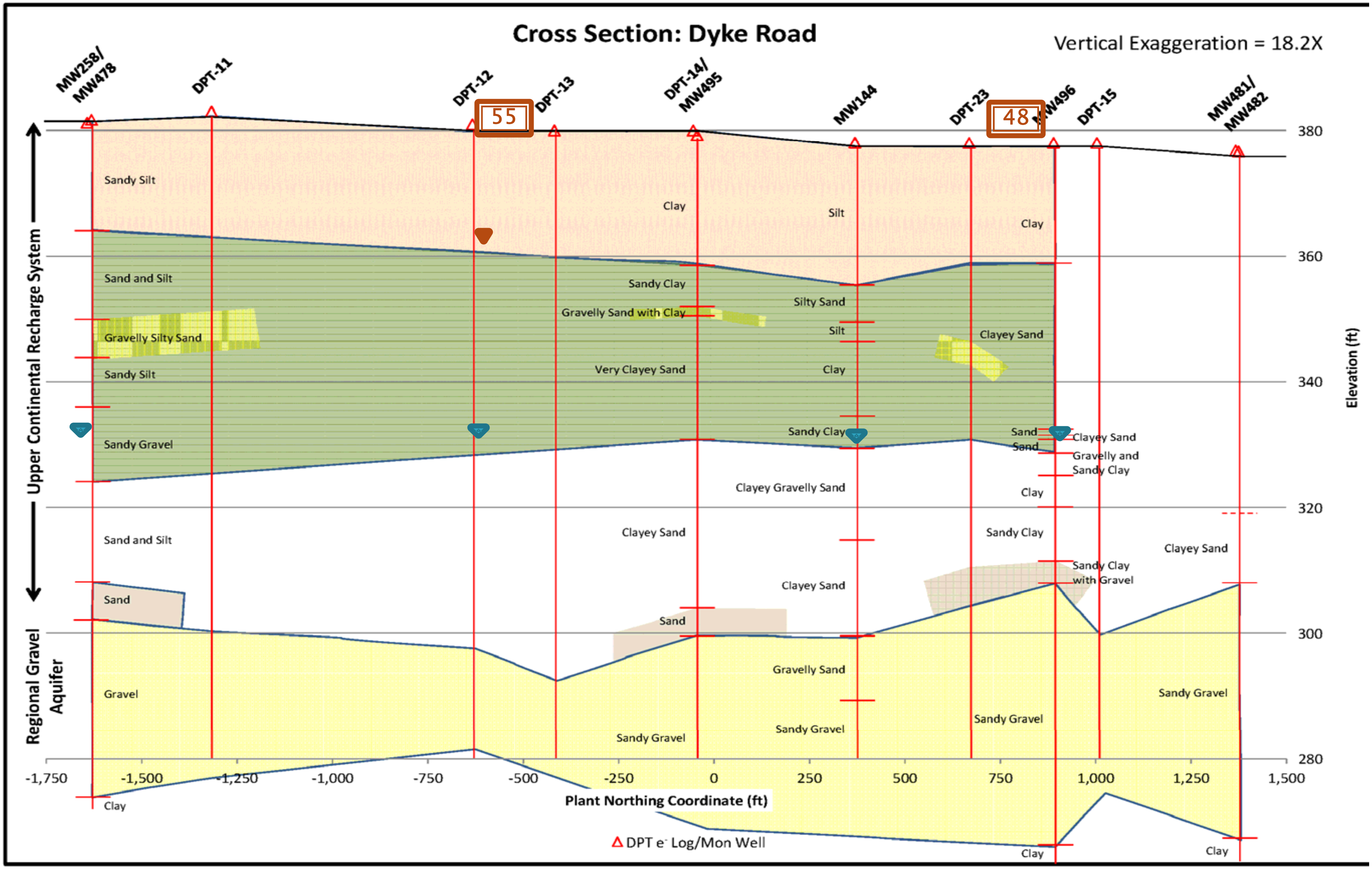
Cross Section : C-746-S&T and -U Landfills



Approximate UCRS depth to water Approximate RGA potentiometric surface 48 Approximate clay/silt thickness

CSM Development: East Side Cross-Section

Clay/Silt Between Contaminated RGA and Surface



Approximate UCRS depth to water | Approximate RGA potentiometric surface | 48 Approximate clay/silt thickness

PGDP CSM Summary

- RGA TCE contamination is potential source, but
  - RGA distal plume conc's are low and decreasing
- For a VI issue, contaminated water/vapors from TCE in the RGA must move upward through UCRS against downward clean GW gradient and continue to migrate through UCRS vadose zone silt/clay; but
- UCRS has
  - Fine-grained soils; not vertically fractured (see cross-sections)
  - Deep (contaminated) RGA GW; but intervening saturated / high-moisture UCRS
  - Low TCE conc's; TCE recalcitrant but RGA aerobic degradation eliminates daughters and lowers TCE conc's
  - UCRS conditions favorable for reductive dechlorination
  - UCRS hydraulic gradient of clean water is nearly completely vertical
  - No wells in use, no basements, few residences
  - Although slab conditions unknown, few adjacent surface barriers to limit venting of vapors

Step 1. State the Problem Summary:

- ***Evaluation shows low potential for PGDP VI due to geologic conditions***
- ***UCRS GW between RGA and surface further limits VI migration potential***
- ***Additional PGDP information supplied to***
  - *Support CSM and evaluate PGDP conditions against VI driving factors*
  - *Present the historical record*

BACKUP: Variability in Amounts of
Intervening UCRS Water/Silt/Clay

- Confirmed UCRS GW (at > 333.3') at all UCRS well locations except
  - In the vicinity of the landfills
  - Near C-400
  - Near creeks where UCRS is incised

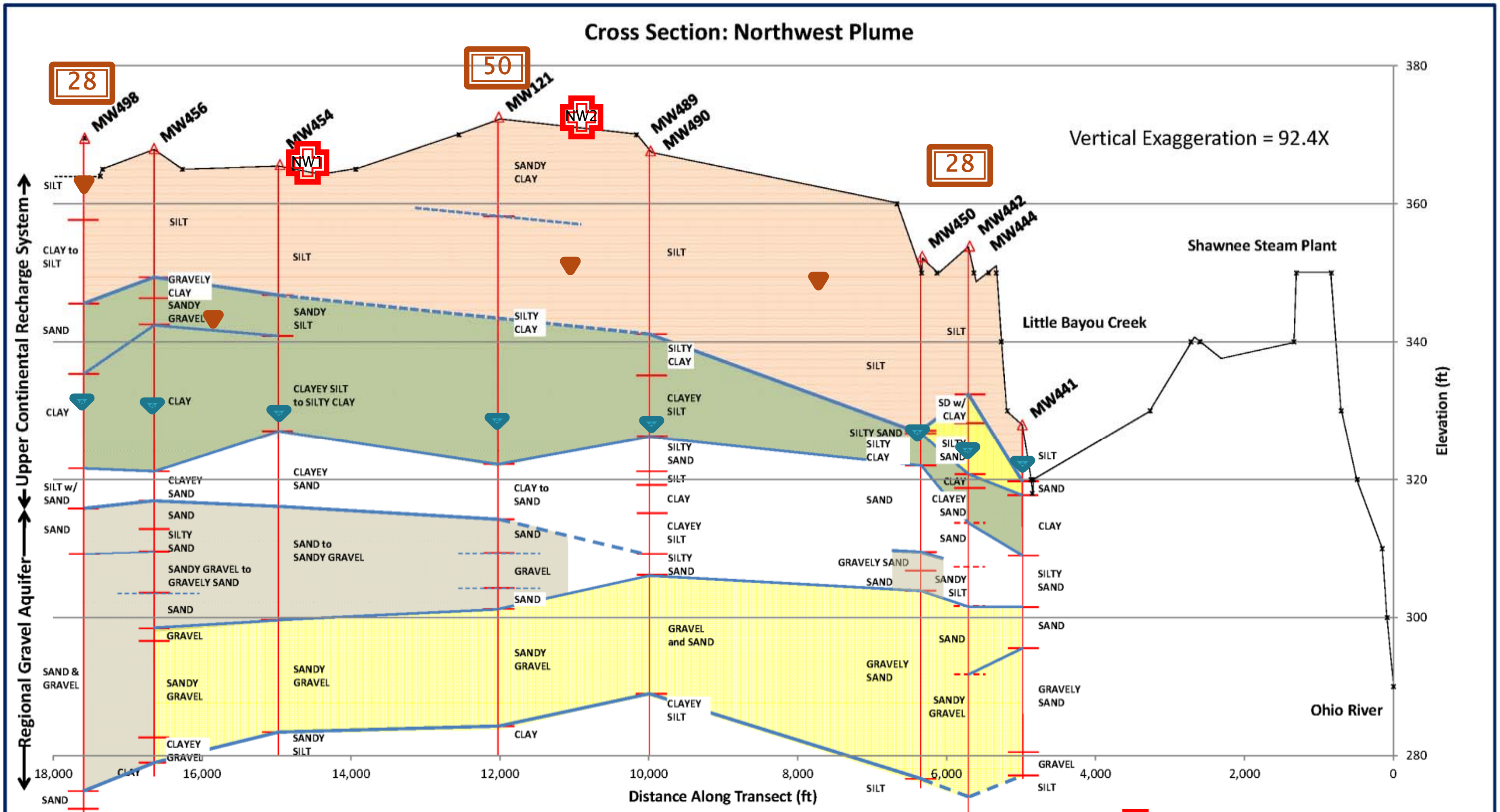
- GW below 333.3' may be UCRS or RGA. Confirmed UCRS GW expressed except
  - When near-surface soils impermeable/lateral UCRS water not present (near landfills)
  - When UCRS is sandy, infiltration limited, and water percolates to RGA easily (near C-400)
  - When UCRS is incised by surface water (near creeks)

- UCRS silt/clay present across site
  - See cross-sections for depiction of ~thickness of UCRS silt/clay
  - See cross-sections for depiction of ~RGA and UCRS water levels

- Intervening GW and silt/clay adds attenuation of VOCs
  - PGDP RGA TCE VISL estimated at > 120 ug/L

Recap: PGDP CSM: Northwest Plume Cross-Section

~25-50' Clay/Silt Between Contaminated RGA and Surface



Projected residence location

Approximate UCRS first water

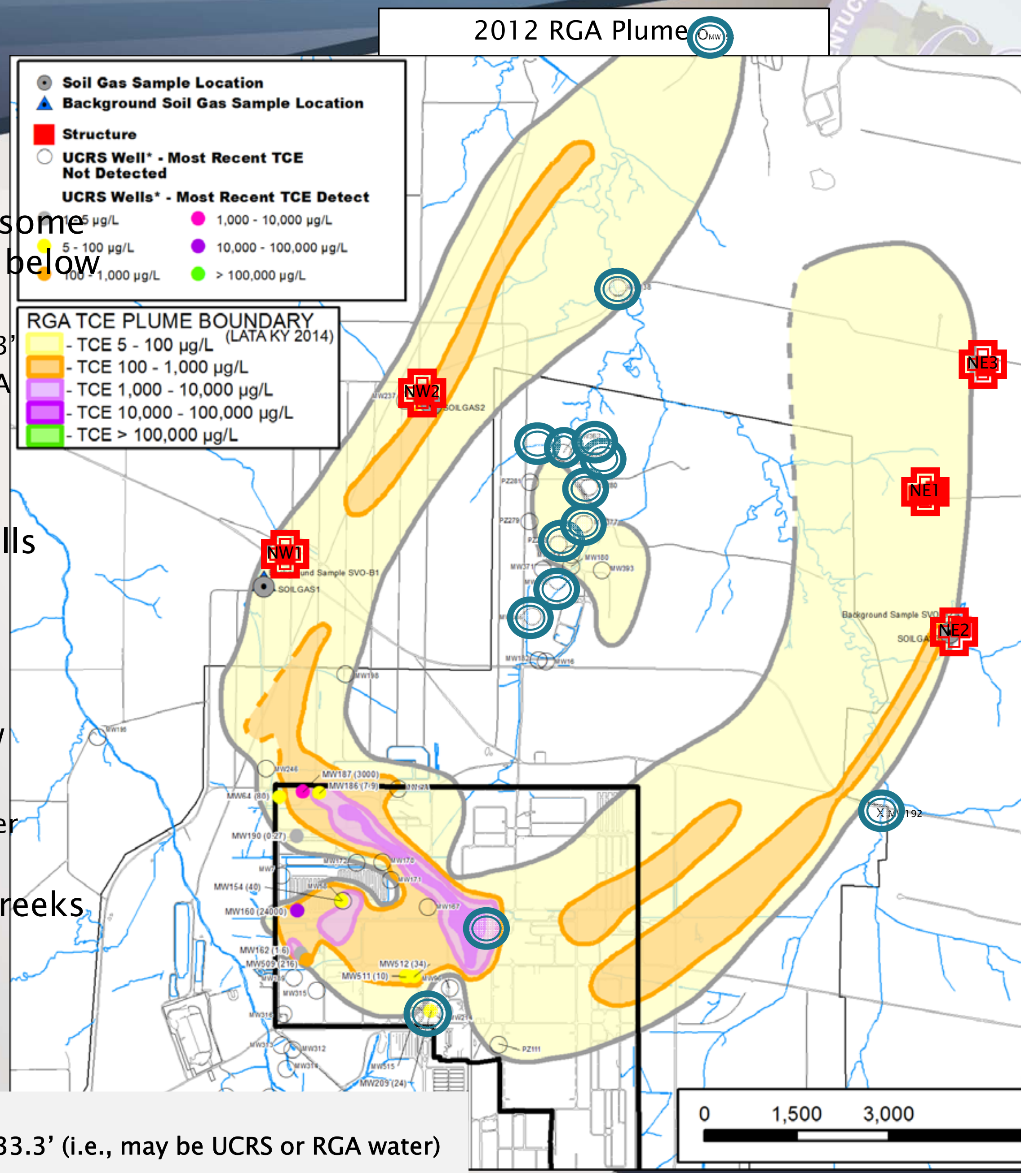
Approximate RGA potentiometric surface

Approximate clay/silt thickness

UCRS Groundwater Expressed Except as Shown

Confirmed UCRS GW Not Expressed Near Landfills, C-400, Near Creeks

- All UCRS wells have had water but some wells have first water at elevations below 333.3’
  - Confirmed UCRS GW has elevation > 333.3’
  - Deeper water may be either UCRS or RGA
  - 153, 390, 192, 368, 138, 365, 69, 377, 359, 376, 389, 362, 374, 177
- Lack of confirmed UCRS GW, landfills
  - Disturbed native soils
  - Additional clay
  - No horizontal UCRS communication
- Lack of C-400 confirmed UCRS GW
  - Sandier UCRS allows GW to drain to RGA
  - Overlying buildings limit infiltration water
- Lack of confirmed UCRS GW near creeks
  - Deeply incised UCRS
  - Adjacent lands should include UCRS GW



NW1 Residence Location

Location of UCRS wells with first water below 333.3’ (i.e., may be UCRS or RGA water)

Collect Soil Gas from UCRS DPT/Wells?

- UCRS wells typically have water above screen above plumes
- General rule: 3 to 10 "pore volumes" are used as a criterion for purging
  - Pore volume includes:
    - the open volume of the sample chamber
    - pore space of the sand pack,
    - dry bentonite seal of the vapor implant system, and
    - inside volume of tubing used for sampling
  - Pore volumes are specific to each sampling effort and a major factor in the time required for purging
- Equilibration time before sampling
  - DPT: at least two hours
  - Hollow stem or hand auger: at least 48 hours
  - Rotosonic or air rotary: varies from a few days to a few weeks
- Flow conditions
  - Sustain 100 mL/min with a vacuum of 100" (or less) water column for 3-10 pore volumes
  - If cannot maintain 100 mL/min flow, sample not representative of VI potential

Location NE1: R31 Residence

STA_NAME	CHEMICAL_NAME	D_COLLECTED	RESULTS	UNITS	RSLTQUAL
R31	Trichloroethene	8/13/1988	1	ug/L	U
R31	Trichloroethene	12/15/1988	1	ug/L	U
R31	Trichloroethene	1/26/1989	1	ug/L	U
R31	Trichloroethene	3/21/1989	1	ug/L	U
R31	Trichloroethene	5/18/1989	1	ug/L	U
R31	Trichloroethene	7/18/1989	1	ug/L	U
R31	Trichloroethene	9/20/1989	1	ug/L	U
R31	Trichloroethene	11/27/1989	1	ug/L	U
R31	Trichloroethene	1/4/1990	1	ug/L	U
R31	Trichloroethene	3/2/1990	1	ug/L	U
R31	Trichloroethene	3/2/1990	5	ug/L	U
R31	Trichloroethene	6/21/1990	1	ug/L	U
R31	Trichloroethene	7/17/1990	1	ug/L	U
R31	Trichloroethene	9/6/1990	1	ug/L	U
R31	Trichloroethene	9/19/1990	1	ug/L	U
R31	Trichloroethene	9/24/1990	1	ug/L	U
R31	Trichloroethene	10/1/1990	1	ug/L	U
R31	Trichloroethene	10/8/1990	1	ug/L	U
R31	Trichloroethene	10/15/1990	1	ug/L	U
R31	Trichloroethene	10/22/1990	1	ug/L	U
R31	Trichloroethene	10/29/1990	1	ug/L	U
R31	Trichloroethene	11/5/1990	1	ug/L	U
R31	Trichloroethene	11/12/1990	1	ug/L	U
R31	Trichloroethene	11/19/1990	1	ug/L	U
R31	Trichloroethene	11/26/1990	1	ug/L	U
R31	Trichloroethene	12/3/1990	1	ug/L	U
R31	Trichloroethene	12/10/1990	1	ug/L	U
R31	Trichloroethene	12/17/1990	1	ug/L	U
R31	Trichloroethene	12/26/1990	1	ug/L	U
R31	Trichloroethene	1/7/1991	1	ug/L	U
R31	Trichloroethene	1/14/1991	1	ug/L	U
R31	Trichloroethene	1/21/1991	1	ug/L	U
R31	Trichloroethene	1/28/1991	1	ug/L	U
R31	Trichloroethene	2/4/1991	1	ug/L	U
R31	Trichloroethene	2/11/1991	1	ug/L	U
R31	Trichloroethene	2/19/1991	1	ug/L	U
R31	Trichloroethene	2/25/1991	1	ug/L	U
R31	Trichloroethene	3/4/1991	1	ug/L	U
R31	Trichloroethene	3/11/1991	1	ug/L	U
R31	Trichloroethene	3/18/1991	1	ug/L	U
R31	Trichloroethene	3/25/1991	1	ug/L	U
R31	Trichloroethene	4/1/1991	1	ug/L	U
R31	Trichloroethene	4/8/1991	1	ug/L	U
R31	Trichloroethene	4/15/1991	1	ug/L	U
R31	Trichloroethene	4/22/1991	1	ug/L	U
R31	Trichloroethene	4/29/1991	1	ug/L	U
R31	Trichloroethene	5/6/1991	1	ug/L	U
R31	Trichloroethene	5/13/1991	2	ug/L	
R31	Trichloroethene	5/20/1991	1	ug/L	U
R31	Trichloroethene	6/3/1991	1	ug/L	U
R31	Trichloroethene	6/10/1991	1	ug/L	U
R31	Trichloroethene	7/18/1995	1	ug/L	U

- NE1: Collect RGA sample from R31 (alternate MW149)
- Compare RGA result to default VISL (and estimated PGDP VISL)
  - If result >default VISL evaluate need for additional sample
  - Possible resolution: DPT water/soil gas or new UCRS well

Location NE3: Residence

- NE3: Recent (and historical) RGA [TCE] < VISL
- No additional samples required

STA_ NAME	CHEMICAL_NAME	D_COLLECTED	RESULTS	UNITS	RSLT QUAL
MW469	Trichloroethene	3/31/2010	1	ug/L	U
MW469	Trichloroethene	6/15/2010	1	ug/L	U?
MW469	Trichloroethene	3/30/2011	1	ug/L	U
MW469	Trichloroethene	5/18/2011	1	ug/L	U
MW469	Trichloroethene	10/5/2011	1	ug/L	U
MW469	Trichloroethene	12/8/2011	1	ug/L	U
MW469	Trichloroethene	2/28/2012	1	ug/L	U
MW469	Trichloroethene	5/15/2012	1	ug/L	U
MW469	Trichloroethene	5/15/2012	1	ug/L	U
MW469	Trichloroethene	10/16/2012	1	ug/L	U
MW469	Trichloroethene	12/18/2012	1	ug/L	U
MW469	Trichloroethene	5/8/2013	1	ug/L	U
MW469	Trichloroethene	5/20/2014	0.38	ug/L	J

STA_ NAME	CHEMICAL_NAME	D_COLLECTED	RESULTS	UNITS	RSLT QUAL
MW470	Trichloroethene	3/31/2010	1	ug/L	U
MW470	Trichloroethene	6/15/2010	1	ug/L	U?
MW470	Trichloroethene	3/30/2011	0.41	ug/L	J
MW470	Trichloroethene	5/18/2011	1	ug/L	U
MW470	Trichloroethene	10/5/2011	1	ug/L	U
MW470	Trichloroethene	12/8/2011	1	ug/L	U
MW470	Trichloroethene	2/28/2012	1	ug/L	U
MW470	Trichloroethene	5/15/2012	1	ug/L	U
MW470	Trichloroethene	5/15/2012	1	ug/L	U
MW470	Trichloroethene	10/16/2012	1	ug/L	U
MW470	Trichloroethene	12/18/2012	1	ug/L	U
MW470	Trichloroethene	5/8/2013	1	ug/L	UJ
MW470	Trichloroethene	10/14/2013	1	ug/L	U
MW470	Trichloroethene	5/20/2014	0.47	ug/L	J

Adjust VISL for PGDP

- The equation for the target groundwater concentration (Cgw) is:

$$Cgw = \frac{Cia,target}{AFgw \times (1000\ L/m^3) \times HLC}$$

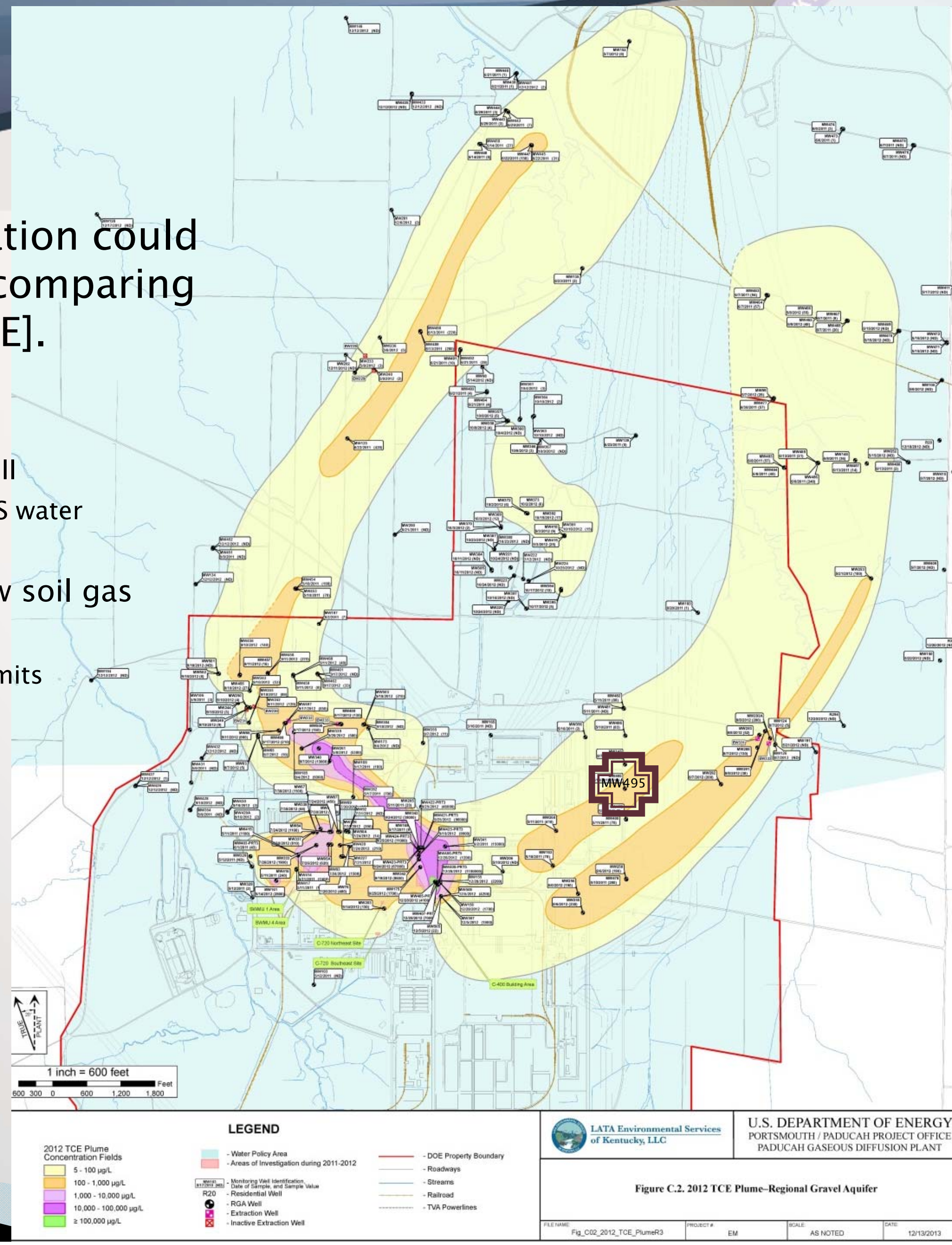
where Cia is the target indoor air concentration, AFgw is the generic attenuation factor for groundwater (default value = 0.001) and HLC is Henry's Law Constant

- Adjust VISL for PGDP by changing attenuation factor from 0.001 to 0.00001 to account for PGDP silt/clay and PGDP UCRS clean water

- Estimated PGDP VISL of >120 ug/L

Estimate PGDP VISL

- The degree of additional attenuation could be more precisely estimated by comparing RGA [TCE] to overlying UCRS [TCE].
  - Potential location: near MW495
  - Install new UCRS well at first water
    - Measure concentration in MW495 vs new well
    - Estimate attenuation between RGA and UCRS water
  - Could theoretically also measure shallow soil gas
    - Soil gas samples not representative
    - Attenuation estimate limited by detection limits



D-52

VISL Default Parameters

Carcinogen averaging time	70 years
Exposure Duration	26 years
Exposure Frequency	350 days/year
Exposure Time	24 hours/day
Target ELCR	1E-6
Default Attenuation Factor	For sandy matrix, shallow soil/GW contamination

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APPENDIX E

DISCRETE DEPTH SAMPLER PROCESS

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Groundwater Sampling Steps for Vapor Intrusion Investigation—Discrete Depth Sampler

A discrete interval sample system, such as the Solinst Model 425 Discrete Interval Sampler, will be used to collect a grab groundwater sample. The following sampling steps may be modified based on brand, model, and/or field conditions at the discretion of the sampling team. Any deviations will be documented in the report. The discrete interval sample system consists of a stainless steel sampler with tubing. Water enters the sampler through a check-ball valve at the base of the sampler. A pressure attachment and pressure/vent switch (mounted on the reel for the sampler tubing) are used to apply and release pressure on the sampler. A compressed nitrogen cylinder is used to pressurize the sample system to avoid cross contamination from the air pumps and to minimize volatilization of contaminants in the groundwater sample within the discrete depth sampler.

Step 1: Begin the sampling process by measuring the depth to water using a water-level meter.

Step 2: Determine the operating pressure for the sampling system. The operating pressure [in pounds per square inch (psi)] is calculated as 10 plus the product of 0.43 and the submerged depth of the direct push technology (DPT) sample rods, in feet:

$$\text{Operating pressure (psi)} = [10 + (0.43 \text{ x submerged depth})]$$

Step 3: After pressurizing the discrete depth sample system to the operating pressure, lower the discrete depth sampler to the base of the DPT rods.

Step 4: Release the gas pressure on the discrete depth sampler (via the pressure/vent switch). Hydrostatic pressure will fill the sampler with water directly from the base of the DPT sample rods.

Step 5: After water has entered the sampler, repressurize the discrete depth sampler to the operating pressure to ensure the bottom valve is closed and retrieve the discrete depth sampler.

Step 6: Fill the VOC sample vials first by releasing pressure on the sampling system and then by using a sample release device to decant the sample through the bottom valve of the discrete depth sampler.

Step 7: Collect remaining water in a beaker and measure and record the sample water temperature. (The temperature measurement will be used in later calculations of the applicable Vapor Intrusion Screening Level.)

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