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March 30, 2015

Mr. Daniel Burke
US Department of Energy
Portsmouth/Paducah Project Site Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513

RE: Transmittal of the 2013 Commonwealth of Kentucky Environmental Oversight Report
Paducah Gaseous Diffusion Plant
Paducah, McCracken County, Kentucky
KY8-890-008-982

Mr. Burke:

Please find an attached copy of the above-referenced annual technical progress report. This report was prepared by the Kentucky Division of Waste Management (Division) and the Kentucky Cabinet for Health Services to report activities under the DOE grants #DE-FG30-07CC40003 and DE-FG30-07CC40004 for calendar year 2013.

If you have any questions or require additional information, please contact Todd Mullins at (502) 564-6716, or e-mail todd.mullins@ky.gov.

Sincerely,

April J. Webb, P.E., Manager
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DWM File: #490, Graybar ARM20080013 (Annual Environmental Oversight Rpt)

Commonwealth of Kentucky

Environmental Oversight Report 2013
Paducah Gaseous Diffusion Plant

Kentucky Division of Waste Management
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502-564-6716

This 2013 Environmental Oversight Report, finalized in July 2014, was prepared by the Kentucky Division of Waste Management to report activities under the U.S. Department of Energy Federal Facility Agreement (FFA) and Agreement in Principle (AIP) grants covering the period from Jan. 1, 2013, to Dec. 31, 2013. This report summarizes activities undertaken by the Commonwealth of Kentucky (Kentucky) to oversee environmental restoration activities at the Paducah Gaseous Diffusion Plant (PGDP). Copies of the report are available from the Hazardous Waste Branch, Division of Waste Management, 200 Fair Oaks Lane, 2nd Floor, Frankfort, Kentucky 40601, phone 502-564-6716.

Acknowledgment: This material is based upon work supported by the Department of Energy under Award Number DE-EM0001946.

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ACRONYM and ABBREVIATION LIST

Agreement in Principle	**AIP**
Applicable or Relevant and Appropriate Requirements	**ARAR**
Area of Concern	**AOC**
Burial Ground Operable Unit	**BGOU**
Cabinet for Health and Family Services	**CHFS**
Citizens Advisory Board	**CAB**
Comprehensive Environmental Response, Compensation, and Liability Act	**CERCLA**
Decontamination and Decommissioning	**D&D**
Dense Non-Aqueous Phase Liquid	**DNAPL**
Department of Energy (US)	**DOE**
Engineering Evaluation/Cost Analysis	**EE/CA**
Environmental Indicators	**EI**
Environmental Management	**EM**
Environmental Protection Agency (US)	**EPA**
Environmental Restoration	**ER**
Feasibility Study	**FS**
Federal Facilities Agreement	**FFA**

Gallons Per Minute	**gpm**
Groundwater Operable Unit	**GWOU**
In Situ Object Counting System	**ISOC**
Kentucky Department for Environmental Protection	**KDEP**
Kentucky Division of Waste Management	**KDWM**
Kentucky Ordnance Works	**KOW**
Kentucky Pollutant Discharge Elimination System	**KPDES**
Land Use Control Implementation Plan	**LUCIP**
Maximum Concentration Level	**MCL**
Memorandum of Agreement	**MOA**
Monitoring Well	**MW**
National Priorities List	**NPL**
Nevada Test Site	**NTS**
Non-Detect	**ND**
North-South Diversion Ditch	**NSDD**
Northeast Plume Containment System	**NEPCS**
Northwest Plume Groundwater System	**NWPGS**
Not Applicable	**NA**
Paducah Gaseous Diffusion Plant	**PGDP**

Paducah Remediation Services	**PRS**
Parts Per Billion	**ppb**
Parts Per Million	**ppm**
Polychlorinated Biphenyl	**PCB**
Principal Threat Waste	**PTW**
Proposed Remedial Action Plan	**PRAP**
Radiation Health Branch	**RHB**
Rapid Bioassessment Protocol	**RBP**
RCRA Facility Investigation	**RFI**
Record of Decision	**ROD**
Regional Groundwater Aquifer	**RGA**
Remedial Design/Site Investigation	**RD/SI**
Remedial Design Work Plan	**RDWP**
Remedial Investigations/Feasibility Study	**RI/FS**
Resource Conservation and Recovery Act	**RCRA**
Sampling and Analysis Plan	**SAP**
Scrap Metal Removal Project	**SRMP**
Site Management Plan	**SMP**
Soils Operable Unit	**SOU**

Solid Waste Management Unit	**SWMU**
Solid Waste Management Unit Assessment Report	**SAR**
Surface Water Operable Unit	**SWOU**
Technetium-99	**Tc-99**
To Be Considered	**TBC**
Total Suspended Solids	**TSS**
Trichloroethene	**TCE**
University of Kentucky	**UK**
Upper Continental Recharge System	**UCRS**
United States Enrichment Corporation	**USEC**
United States Geological Survey	**USGS**
Uranium Hexafluoride	**UF_6**
Uranium Tetraflouride	**UF_4**
Volatile Organic Compound	**VOC**
Waste Acceptance Criteria	**WAC**
West Kentucky Wildlife Management Area	**WKWMA**

Introduction

In July 2013, the Paducah Gaseous Diffusion Plant (PGDP) ended over 60 years of continuous production of enriched uranium. The PGDP is located on a 3,556-acre federal reservation in northwestern McCracken County. Most of the operations at the PGDP occurred inside a fenced security area of approximately 750 acres, surrounded and bounded by the West Kentucky Wildlife Management Area (WKWMA). Since construction, the PGDP has been owned by the United States Department of Energy (DOE) or its predecessor US government agencies. The United States Enrichment Corporation (USEC) assumed responsibility for operation and maintenance of the PGDP production facilities in July 1993. Although DOE retains ultimate responsibility for environmental restoration and waste management, DOE has retained a series of support contractor teams to assist the implementation of various activities at the site. LATA Kentucky was the PGDP general support contractor to DOE throughout the period covered by this report.

A variety of environmental concerns have been identified at the site since 1988. Historical PGDP activities have adversely affected soil, sediment, surface water, and groundwater. Groundwater sampling and analysis has detected concentrations of both trichloroethene (TCE) and Tc-99, a radioactive byproduct of historic PGDP process operations. Soils and sediment sampling and analysis have detected the presence polychlorinated biphenyls (PCBs) and uranium. In addition, surface water studies have documented PCB concentrations in fish collected from both Bayou Creek (west of the site) and Little Bayou Creek (east of the site).

Site cleanup activities at the PGDP occur in a sequenced approach consisting of pre-shutdown and post-shutdown activities. The pre-shutdown scope is associated with media-specific Operable Units (OUs). An OU is grouping of areas or sources that share common attributes such contaminated media type (groundwater surface water, soil) and associated exposure pathways (ingestion, inhalation, dermal exposure). Post-shutdown activities will focus on D&D of the remaining PGDP as well as upon potentially contaminated media that is presently unknown or currently inaccessible.

At the PGDP, media-specific OUs were established by developing a site conceptual risk model for each solid waste management unit (SWMU) and Areas of Concern (AOC). This process

included a qualitative evaluation of contaminant types and concentration, release mechanisms, likely exposure pathways, estimated points of exposure, and potential receptors. Current and reasonably foreseeable future land assumptions were also included in the evaluation.

The media-specific OUs identified for the PGDP are:

Pre-GDP Shutdown

- Surface Water OU
- Groundwater OU
- Burial Grounds OU
- Soils OU
- Decontamination and Decommissioning (D&D) OU

Post- GDP Shutdown

- GDP Lagoons and Ditches OU
- GDP Groundwater Sources OU
- Additional Burial Grounds Sources OU
- Soils and Slabs OU
- GDP D&D OU

A Final Comprehensive Site OU evaluation will occur following completion of D&D of the PGDP and completion of clean-up of the media-specific OUs.

Public Participation

Citizens Advisory Board (CAB)

The Paducah Citizens Advisory Board (CAB) is a stakeholders' board that provides advice and recommendations to DOE regarding environmental management programs at the PGDP.

KDWM and CHFS are non-voting, ex-officio members who serve as advisors and inform the CAB on their agencies' policies and views

Kentucky's Oversight Program

The Commonwealth of Kentucky (hereafter Kentucky) is responsible for overseeing the environmental cleanup of the PGDP. Kentucky's Energy and Environment Cabinet (EEC) has designated the Hazardous Waste Branch within the Division of Waste Management to serve as the lead agency to coordinate this oversight and to implement both the Agreement in Principle (AIP) and the Federal Facility Agreement (FFA) programs for Kentucky. The CHFS Radiation Health Branch (RHB) also serves a critical role in implementing these two oversight programs. State agencies and other organizations assisting the Hazardous Waste Branch and RHB with oversight responsibilities include:

- Division of Waste Management (DWM)
- Division of Water (DOW)
- Division for Air Quality (DAQ)
- Kentucky Department of Fish and Wildlife Resources (KDFWR)
- University of Kentucky KRCEE

In addition to intra-state governmental coordination, coordination with both federal agencies and citizens groups is necessary and expected. Kentucky regularly cooperates and interacts with DOE, the U.S. Environmental Protection Agency (EPA), the Paducah CAB and other DOE-facility host states.

Agreement in Principle (AIP)

Under the AIP program, Kentucky[1] conducts independent environmental monitoring activities and oversees monitoring activities conducted by DOE. Additionally, the program serves to disseminate information relevant to ongoing site cleanup activities to concerned citizens and the public in general. The fundamental goal of the AIP program is to allow Kentucky to conduct independent and impartial assessments of the potential environmental impacts of past, present and future DOE activities at the PGDP. Since 1991, the AIP has been periodically renegotiated and extended.

Federal Facility Agreement / Site Management Plan

The FFA is a three-party agreement between DOE, EPA and Kentucky. It was developed to ensure compliance with and to avoid duplication between the corrective action provisions of the Resource Conservation and Recovery Act (RCRA) permitting program and the corrective action requirements of CERCLA. Moreover, the FFA outlines regulatory structure and guides interactions between the three parties. The FFA allows Kentucky and EPA to address contaminated areas at the PGDP that are not subject to permitting but nonetheless require remediation and provides a framework for project management, investigation and remediation.

The Site Management Plan (SMP) is an appendix to the FFA that serves to document those operable units (OUs) and their associated SWMUs requiring remediation along with the

[1] For the purposes of this report, all references to activities conducted by the Paducah Gaseous Diffusion Plant Section of the Division of **Waste** Management (KDWM) of the Department for Environmental Protection (KDEP), in Energy and Environment Cabinet (EEC) will be referred to as Kentucky. References to activities by other state government agencies that are not part of the ECC (and in some cases, not part of KDWM) will be specified as appropriate.

enforceable milestones that drive this work. These milestones are set for the current FY as well as for the following two years and include submittal dates for regulatory documents, dates for the initiation of project field work and dates for completion of all work within a particular operable unit known as out-year enforceable milestones. The SMP also documents the prioritization strategy for remediation of the PGDP as agreed to by the FFA parties. It is a living document that is renegotiated by the parties on an annual basis. The FFA parties typically scope revisions for the document in the summer months leading up to the document's formal submittal in November.

The FY 2013 SMP represented a dramatic shift in both out-year enforceable milestones and the milestones associated with the three-year window. During the summer of 2012, the FFA Senior Managers (DOE Paducah/Portsmouth Manager, EPA Region 4 Superfund Director & Kentucky Division of Waste Management Director) agreed to extend many of the existing out-year enforceable milestones. The parties recognized that the existing dates were unrealistic and noted that attempts to demonstrate compliance with those dates came at the expense of diminished work quality. Subsequently a five-year schedule consistent with the new out-year dates was developed and memorialized in the FY 2013 SMP. The FY 2013 SMP established new out-year enforceable milestone dates for the following operable units:

- Soils OU – Sept. 30, 2030
- Groundwater OU – Sept. 30, 2032
- Surface Water OU – Sept. 30, 2032
- Burial Grounds OU – Sept. 30, 2031

The FY 2013 annual revision was approved by Kentucky in late in 2012 and by EPA in January of 2013.

Site Management Plan Documents Reviewed In 2013

12/5/2013 – *2014 Site Management Plan* (1292&D1). Comments issued 1/3/14.

Kentucky AIP Program Elements for 2013

One of the primary goals of the Agreement in Principle (AIP) is to monitor current site activities through sampling and observation to identify possible threats to human health and the environment. Another goal is to ensure that DOE's environmental data is accurate and that interpretations made from the data reflect the actual environmental conditions at the areas evaluated.

To achieve these goals, AIP staff routinely inspects facilities and observes DOE operations to identify any environmental issues or concerns. Any resulting environmentally significant conditions or practices are then brought to DOE's attention.

AIP staff also collects independent environmental (e.g., surface water and groundwater) samples, splits environmental samples with DOE, and occasionally works with various independent research organizations. For some projects, these research organizations also collect independent environmental samples. Environmental samples are routinely sent to an independent laboratory under contract to the AIP program. AIP sampling includes the collection of groundwater samples at the request of nearby property owners from private residential wells as a means to inform the public of current groundwater conditions near the PGDP boundaries. Split environmental samples are also obtained to independently validate DOE's sampling results. In additional split tissue samples are opportunistically collected from animals living near the PGDP to monitor the health of the local animal population.

For 2013, the primary AIP independent contract laboratory for non-radiochemical analysis was TestAmerica Laboratories (TAL) located in Earth City, Missouri. TAL is an accredited, independent laboratory that meets or exceeds the requirements set forth by governing EPA standards.

All radiochemical analysis was performed by CHFS RHB. In addition to serving as the primary AIP radiochemical lab, the RHB routinely collects airborne and surface water samples using automated monitoring equipment. RHB also routinely obtains surface water grab samples from predetermined locations about the plant site.

HWB staff receives all analytical data directly from TAL and CHFS. The results are interpreted and shared formally with DOE and other appropriate parties.

Other activities undertaken by Kentucky AIP in 2013 included a water level measurement campaign to assess the potential effects of plant shutdown on the local hydraulic gradient and a spot check of DOE's latest TCE plume map using both AIP and DOE groundwater data. Synoptic water level measurements were also recorded using wells located near the Northwest Plume pump-and-treat extraction wells in order to better gage the effectiveness of the pump-and-treat system.

AIP Groundwater Investigations

During 2013, AIP staff collected groundwater samples from seven different residential wells and 48 different monitoring wells. Some of these wells were sampled more than once. The seven residential wells were sampled independently by AIP staff. Figures 1 and 3 depict all wells sampled during the 2013 reporting period. The vast majority of the wells sampled are located near mapped groundwater contaminant plume boundaries and/or less than two miles from the PGDP.

In general, the monitoring well and residential well sampling conducted by AIP staff has produced results that are consistent with those obtained by DOE. This can be viewed as evidence to support the general accuracy of DOE data collection and analysis for samples collected during the reporting period. AIP independent oversight of DOE's groundwater sampling program helps to ensure that results obtained by DOE are accurate, reproducible and verifiable.

Residential Wells Sampled by Kentucky AIP

In 1988, when TCE and Tc-99 were detected in off-site wells, nearby residents relying upon groundwater for domestic use were provided alternative water sources by DOE. Subsequently, DOE created a Water Policy that provides a permanent alternative water source at no costs to residents impacted or potentially impacted by the contamination. To

participate in this DOE funded program, among other requirements residents must agree to refrain from using the groundwater.

Due to the proximity of the Northeast Plume to the eastern edge of the Water Policy boundary, residential groundwater wells located east of this boundary are an important focus of the AIP independent residential sampling program. Residents to the east of Metropolis Lake Road were not covered by the Water Policy until 1997. Some of the residents located in close proximity to this road still use their wells as sources of potable water. AIP staff sampled seven wells in this area (Figure 1) in order to detect any evidence that the Northeast Plume may be migrating further to the east. Each of these wells was sampled twice during the reporting period. Based upon 2013 AIP sampling results, the plume does not appear to have migrated east of the road.

All residential wells sampled by AIP staff were located outside of the known outer extent of the contaminant plumes (as determined from plume maps compiled by DOE) with the exception of R2 which is located within the West Kentucky Wildlife Management Area. During this reporting period, with the exception of R2, AIP independently confirmed that those residential wells sampled had not been impacted by the plumes. For all residential wells sampled, the results and a discussion of the results were sent directly to the residents.

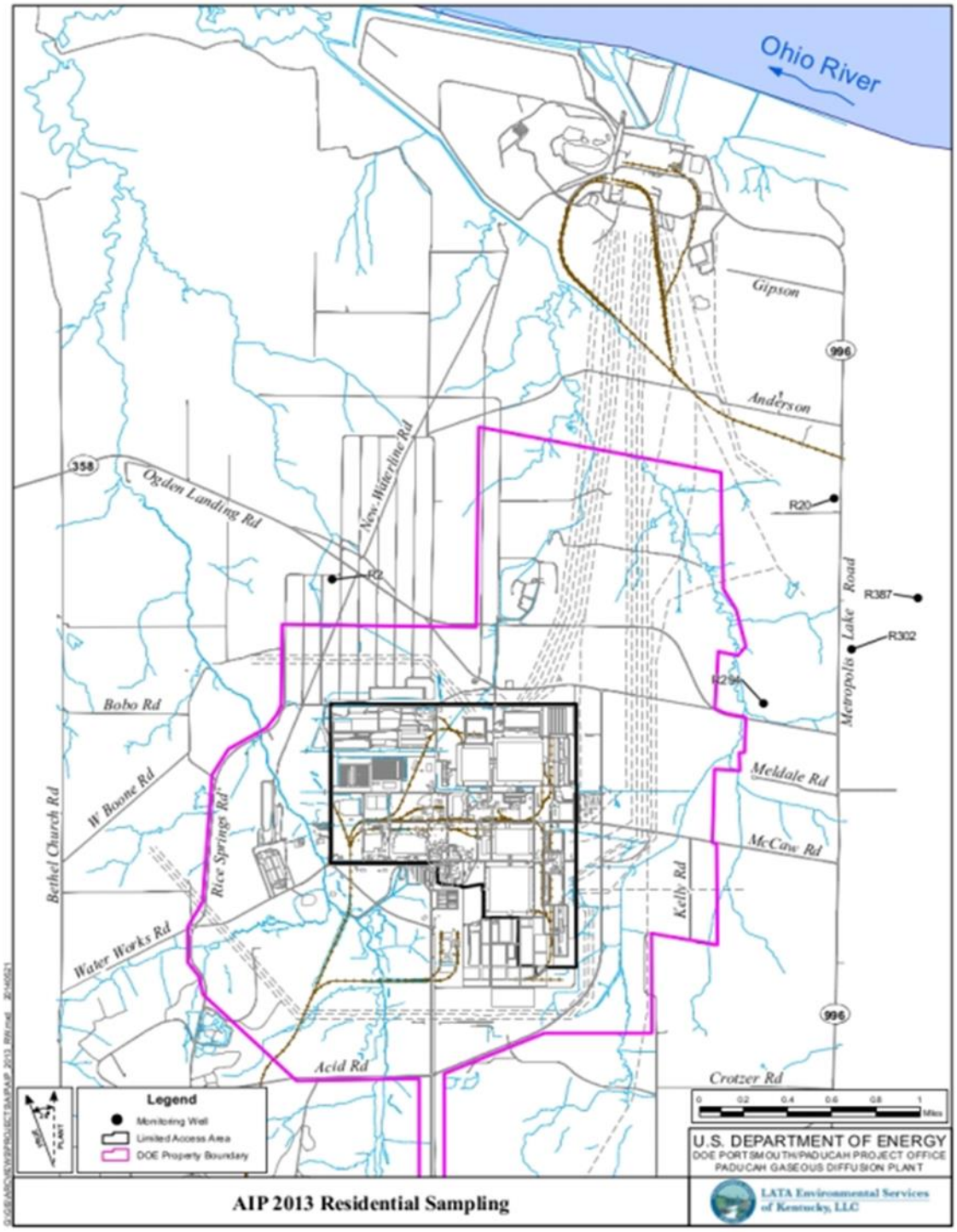

Figure 1. AIP 2013 Residential Wells Sampled

Monitoring Wells Sampled by Kentucky AIP

The objectives of the AIP monitoring well sampling program are significantly different from those for residential well sampling program. Sampling of residential wells is targeted toward determining whether the plumes have negatively affected local resident's wells. Conversely, monitoring well sampling events are conducted primarily to evaluate and substantiate DOE's sampling procedures and to verify the accuracy of its laboratory analysis. In addition, these results can be used to analyze contaminant trends in particular wells. If present, trends can be used to determine whether continued sampling of a well is justified or as a means of monitoring plume expansion or contraction. Detections by DOE of TCE and Tc-99 at various monitoring well locations are used in part to determine the nature and extent of contaminant plumes at PGDP as presented on DOE site plume maps. AIP monitoring well sampling can also be used to validate these maps as necessary.

In 2013, 48 monitoring wells were sampled. Each of the wells sampled are located either within the known plumes or in close proximity to the plumes. AIP staff split samples with DOE on five of the wells sampled. In most cases, AIP staff arranged to split samples with DOE during its regularly scheduled sampling activities.

MW100 was of special concern due to its close proximity to the eastern edge of the Northeast Plume. This particular well exhibited minor levels TCE two of the three times it was sampled in 2010 and 2011 (Figure 2). These levels were below the laboratory reporting limit of 1.0 µg/l and EPA's maximum contaminant limit (MCL) of 5 µg/l. More recent analytical results have been non-detect for TCE. Given its proximity to residential areas, AIP staff will continue to closely evaluate MW100 over time.

On Aug. 13, 2013, Kentucky conducted split sampling at selected wells associated with the C-404 Hazardous Waste Landfill (Table 1). These wells are located both upgradient and downgradient of the landfill and inside the fenced portion of the PGDP facility. TCE was detected by both parties with results agreeing to within approximately 20 per cent RPD. Of the five monitoring well samples split by Kentucky and DOE and analyzed for Tc-99, two had similarly lowTc-99 concentrations. On one occasion, neither Kentucky nor DOE detected Tc-99. In another sample, Kentucky detected Tc-99 at a very low concentration in a sample obtained

from MW 90A while DOE did not. During this split sampling event Kentucky monitored DOE's sampling procedures to verify this work was performed in compliance with EPA Standard Operating Procedures for field measurements and sampling methods. No problems were noted.

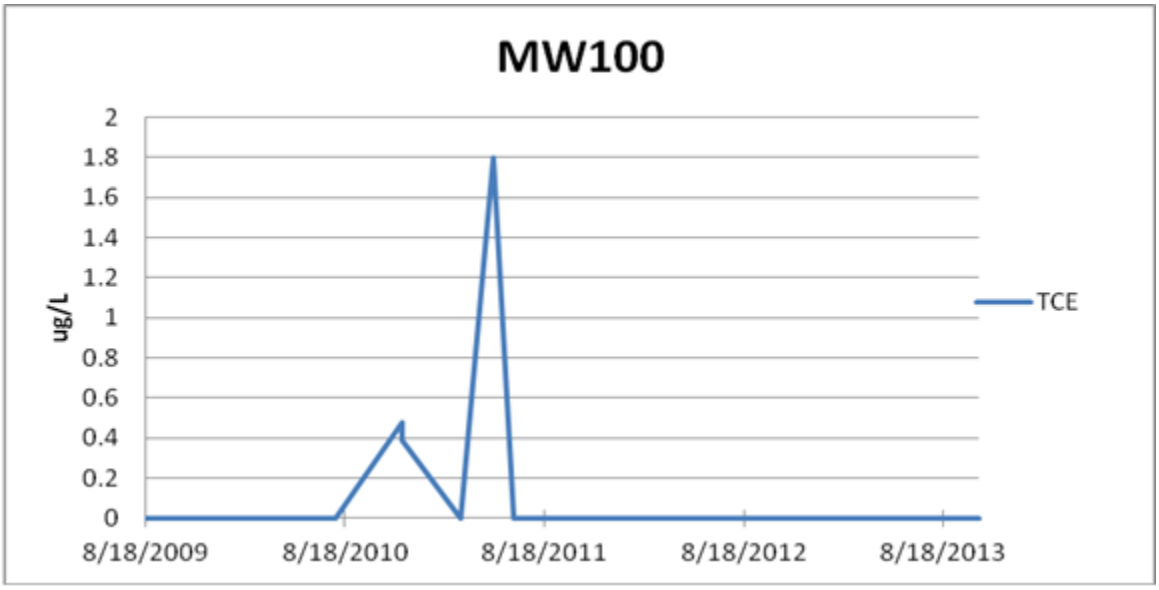

Figure 2. Monitoring Well 100 Sampling Results

Well #	Date	AIP TCE (µg/L)	DOE TCE (µg/L)	Relative % Diff	AIP Tc-99 (pCi/L)	DOE Tc-99 (pCi/L)	Relative % Diff
MW90 A	8/13/13	37 RL 1.0	35	5.5	12.05 +/-1.37	U	NA
MW93	8/13/13	2600 RL 100	2200 D	16.7	NA	U	NA
MW84	8/13/13	1400 RL 50	1300 D	7.4	8.94 +/-1.35	18.8 J +/-11.4	NA
MW87	8/13/13	970 RL 25	760 D	24.3	U	U	NA
MW420	8/13/13	250 RL 10	230 D	8.3	7.98 +/-1.35	17.9 J +/-11.3	NA

RL = reporting limit, D = dilution, NA = not applicable or available, U = undetected, J = result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value

Table 1. AIP/DOE Data Comparison

Anthropogenic Recharge Monitoring

Water level measurements were taken monthly on four wells in the central portion of the plant to monitor for changes in water levels due to the USEC shutdown. The data is so far inconclusive. The project is continuing in 2014.

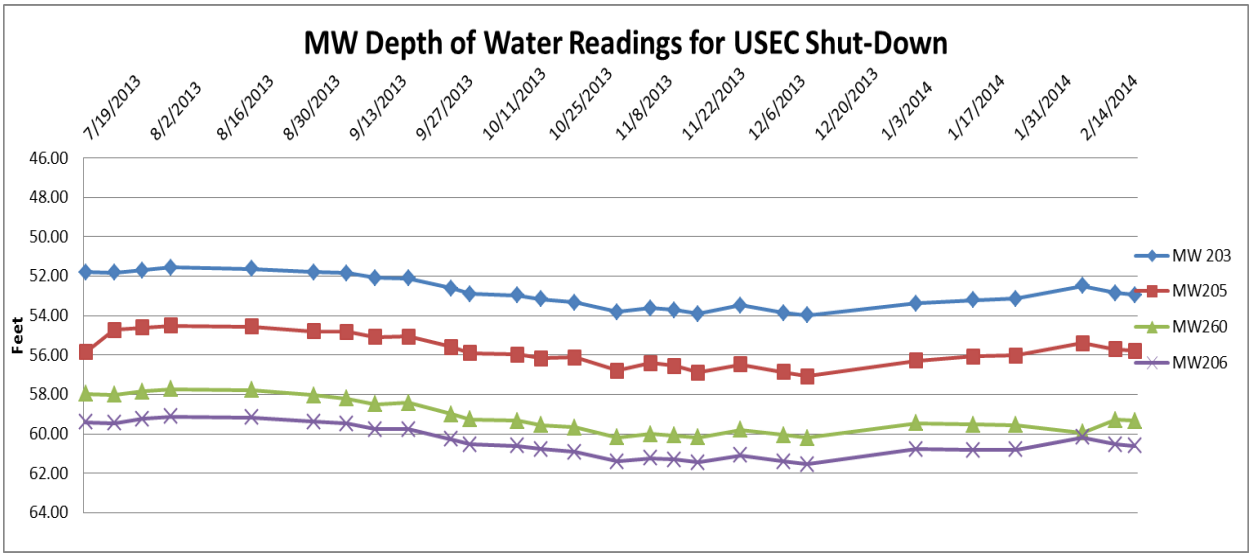

Figure 3. Anthropogenic Recharge Monitoring

Northeast and Northwest Plume TCE Data Assessment

In late 2009 DOE installed 68 new monitoring wells within the northwest and northeast plumes. Many of these wells were installed as transects across the plumes. During the period from 2010 to 2012 Kentucky AIP obtained samples from these wells in an effort to establish TCE and Tc-99 concentration baselines, or starting points, against which to assess future changes within the plumes.

In 2013, AIP personnel compared the TCE data gathered during the prior three years to data used to prepare the 2010 and 2012 DOE plume maps as presented in the documents *2010 Northwest and Northeast Portions of the TCE Plume in the Regional Gravel Aquifer* and *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer*

for Calendar Year 2012 at the PGDP. The purpose of this exercise was to validate DOE's maps by determining how well DOE's data corresponded with similar AIP data obtained throughout the plumes.

Initially AIP sample data was compared to the values depicted on DOE's 2010 series maps. In the Northwest Plume (Table 2), AIP and DOE values were generally consistent with the exception of those for MW445, MW498 and MW499. Based upon this comparison, a plume map constructed using AIP data would appear very similar to DOE's map.

For the Northeast Plume, 2010 AIP data for monitoring wells MW483, MW484, MW485, MW486, MW487 and MW488 can be used to delineate the more distant portions of that plume. AIP samples from MW 485 and MW 486 exhibited TCE concentrations of 102 µg/l and 330 µg/l, respectively. Assuming that the AIP data is more indicative of the actual concentrations, the distant portion of the >100µg/l lobe as depicted on DOE's 2010 plume map should likely extend beyond those wells. DOE's 2010 data indicates that levels of TCE in these two wells did not exceed 100µg/l. Therefore DOE's 2010 map interpretation is consistent with these results.

MW No.	AIP2010 (µg/l)	DOE2010 (µg/l)	AIP2011 (µg/l)	DOE2011 (µg/l)	AIP2012 (µg/l)	DOE2012 (µg/l)
445	135	66	37	37	32	32
447	227	150	170	170	95	91
491	20	13	160	160	120	110
492	47	28	130	130	140	140
454	58	67	240	240	340	340
501	NS	27	0.98J	1.1	0.45J	U
502	NS	25	6.8	6.9	6.7	7.1
458	26	13	270	350	430	430
461	23	6	1.1	1.1	0.74J	U
497	11.4	3	68	72	590	260
498	1220 D	6800	4100	2300	180	220
499	19.2	150	170	200	140	170
500	17.2	65	230	280	210	200
503	18.7	29	310	370	390	350

Table 2. Northwest Plume Well Data

For monitoring wells located in the Northeast Plume, AIP and DOE data are consistent over 2011 and 2012. As mentioned above AIP and DOE TCE results for MWs 485 and 486 were not consistent in 2010; however, the two wells have returned to consistency in 2011 and 2012. The inconsistency was probably due to single samples being taken on different dates. The newer DOE and AIP data also suggest that the core of the 100µg/l lobe should extend at least out to the location of these two wells.

MW No.	AIP2011 (µg/l)	DOE2011 (µg/l)	AIP2012 (µg/l)	DOE2012 (µg/l)
485	72	72	72	68
486	200	240	230	220

Table 3. Northeast Plume Well Data

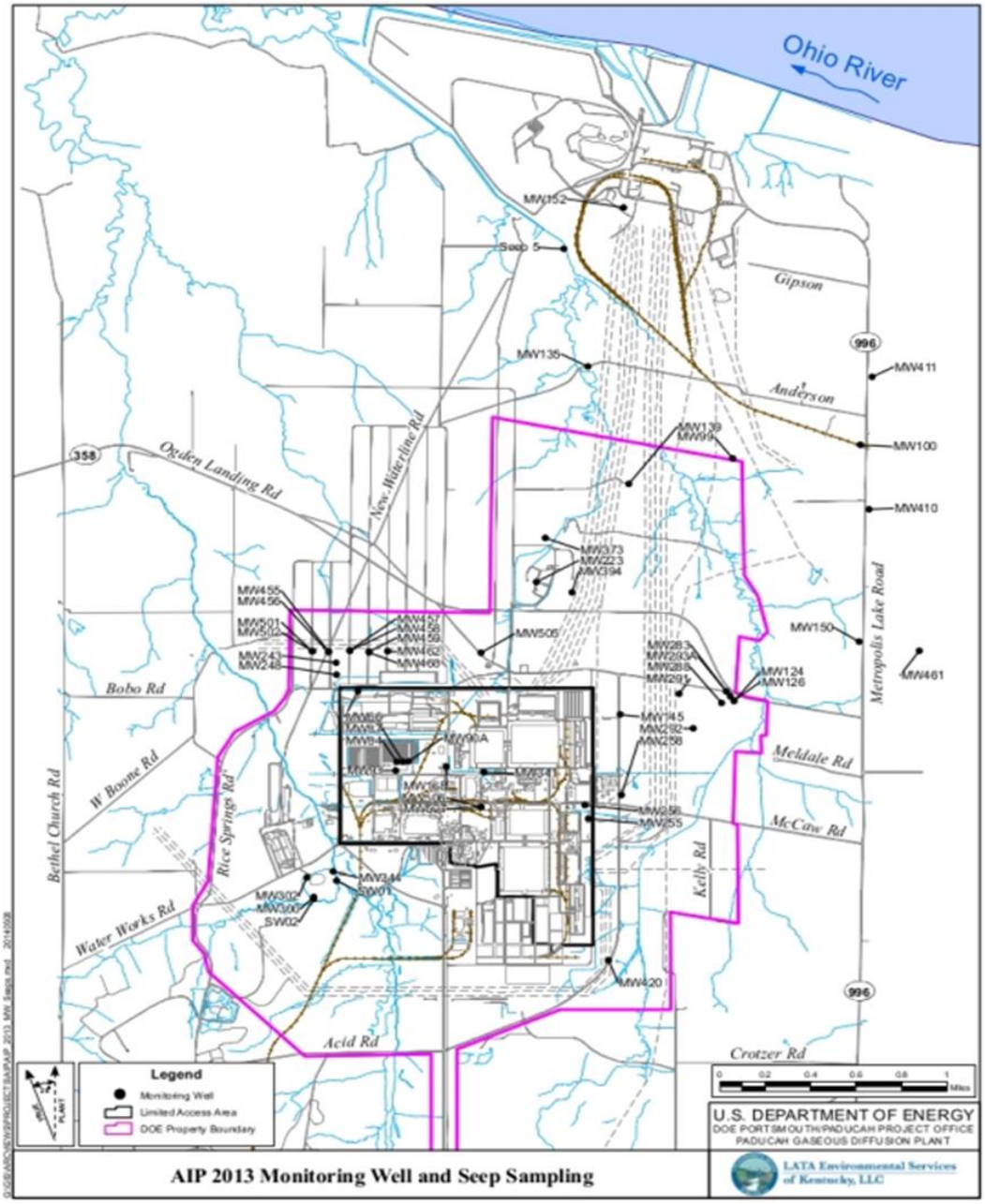

Figure 4. AIP 2013 Monitoring Well and Seep Sampling

NW Plume Pumping Well Area of Influence/Cone of Depression Assessments

During 2013, the AIP program obtained quarterly synoptic water level measurements (Figure 5) from 34 wells located in the vicinity of the Northwest Plume withdrawal wells. For each quarter's data, water level drawdown contours were superimposed on a Northwest Plume map to illustrate the cone of depression and capture zone of the pumping wells. The drawings show that the distal end of the high concentration portion of the plume lies within the cone of depression laterally. Vertical capture of the plume is more difficult to assess. In 2014 the study area will be enlarged to include 14 additional wells in order to further assess the extent and stability of the capture zone. The monitoring wells used in the assessment are shown on Figure 6.

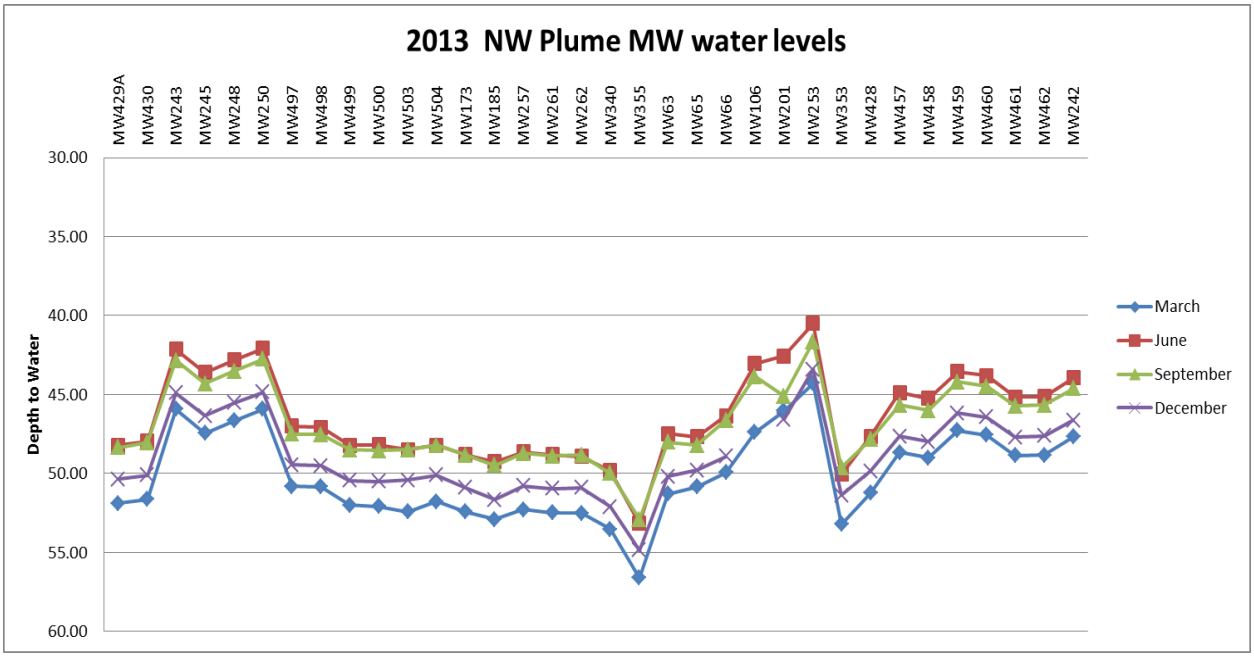

Figure 5. 2013 Northwest Plume Water Levels

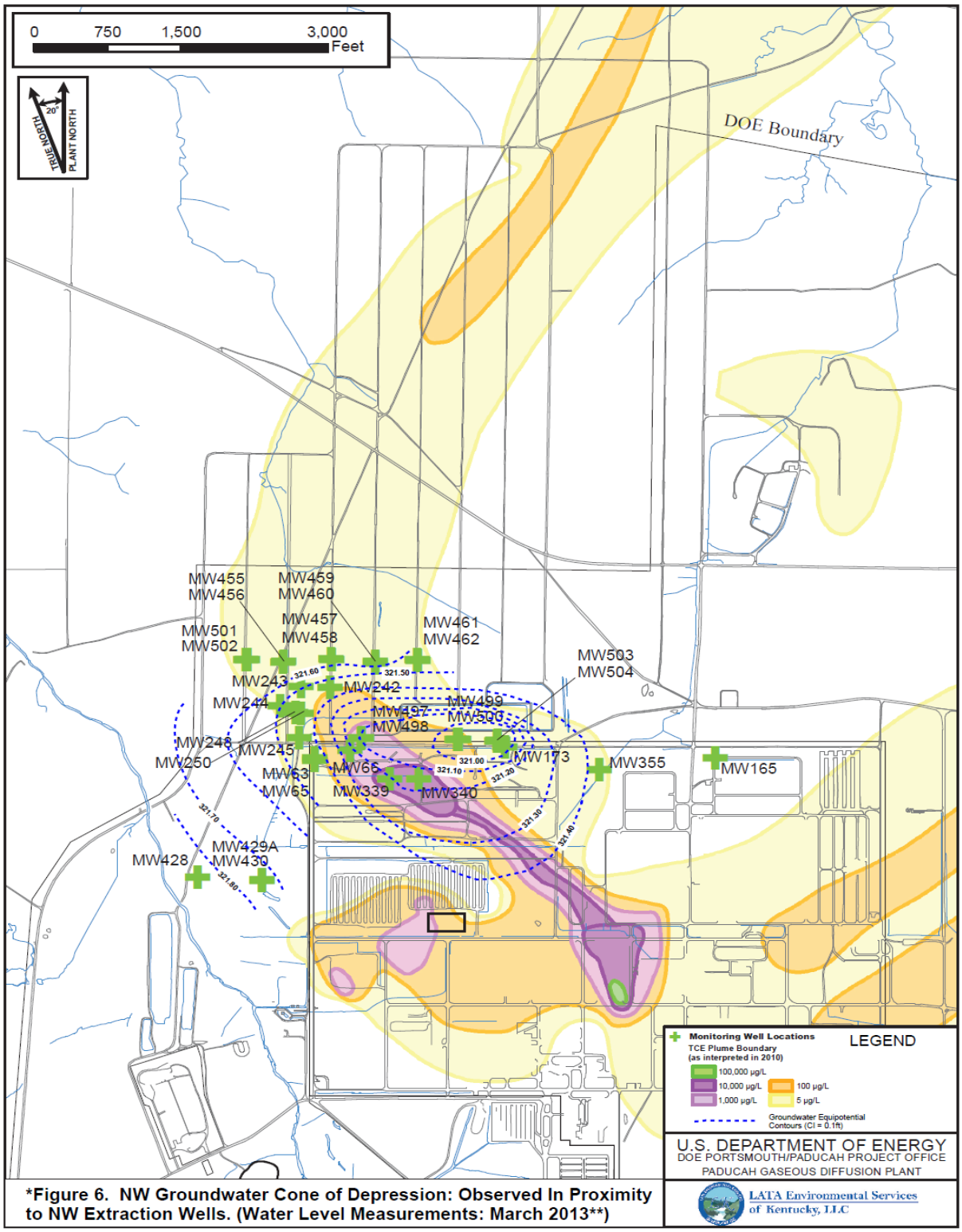

***Figure 6. NW Groundwater Cone of Depression: Observed In Proximity to NW Extraction Wells. (Water Level Measurements: March 2013**)**

**This figure is modified from DOE Document PAD-ENM-0055/R3 Environmental Monitoring Plan Fiscal Year 2014: Figure C.6 (Page C-29)*
*** March 2013 water level measurements also presented graphically on Figure 5 as blue line.*

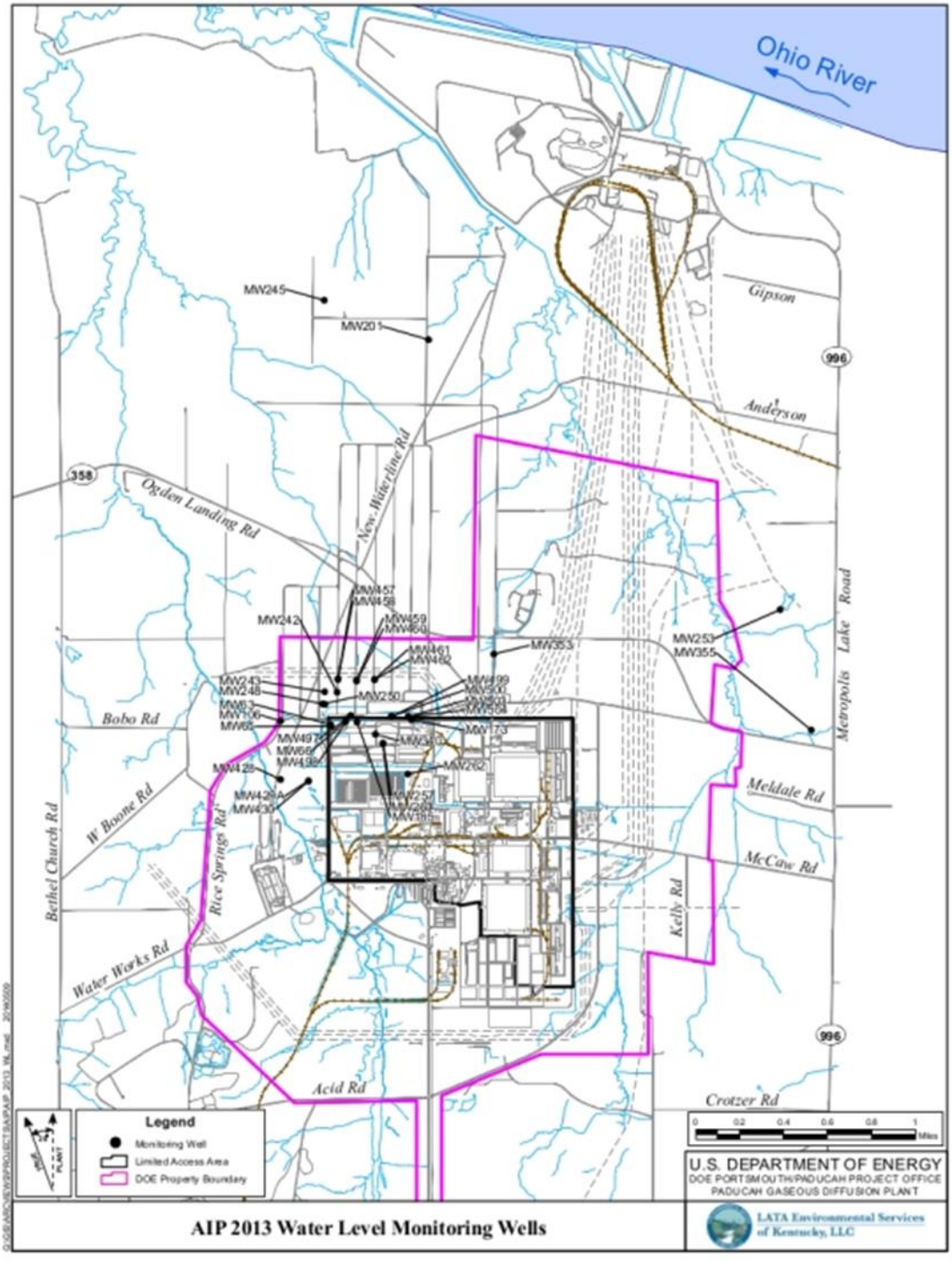

Figure 7. AIP 2013 Water Level Monitoring Wells

AIP Surface Water Investigations

Seeps Sampled by Kentucky AIP

During the late 1990s, six seeps were identified north of the PGDP along Little Bayou Creek (LBC). These seeps were subsequently added to Kentucky's surface-water sampling program in 2002; a seventh seep was discovered and added in June 2007. The seeps represent locations where contaminated groundwater containing TCE and Tc-99 is upwelling into a channelized (artificially straightened) portion of the creek. The seeps are not static and can migrate after major storm events, when high flow causes changes in depositional features and in the banks of the creek. The seeps are located downstream of the Paducah plant site, approximately halfway between the plant and the Ohio River.

Two AIP independent surface water samples were collected during April and June of 2013 from seep location LBCSP5 and analyzed for volatile organic compounds and Tc-99. Location LBCSP5 can be seen on the 2013 AIP Monitoring Well and Seep Sampling locations map (Figure 3). Both AIP seep samples exhibited similar levels of TCE (34 µg/l and 32 µg/l). TCE concentrations at this location have decreased over time from levels that were once in the hundreds of parts per billion. Tc-99 levels detected in 2013 at LBCSP5 were 15.02 pCi/L (+/- 1.45) and 19.62 pCi/L (+/- 1.39). These levels are also low compared to historical levels. The cause of the apparently decreasing levels of contamination is unknown at present but could represent the influence of the Northwest Plume pump-and-treat system which has been in operation since 1995.

Other Surface Water Sampling

On Nov 19, 2013, AIP independently sampled two additional surface-water locations located in the Unnamed Tributary of Bayou Creek. The Unnamed Tributary flows along the southern edge of the C-746-K Landfill, one of the first landfills constructed at the PGDP. The samples were analyzed for TCE. No TCE was detected in either of the two samples.

AIP Inspection Activities

During 2013 AIP staff inspected portions of the PGDP reservation on a weekly basis. These inspections took place in areas of the plant located both within and outside of the security fence. Locations within the security fence that were routinely inspected included areas adjacent to the process buildings (C-310, C-331, C-333, C-335, C-337), the C-340 Metals Plant, the C-400 Maintenance Facility and ERH unit, the C-410 Feed Plant, the C-600 Steam plant, former scrap metal yards, cylinder yards, process and sanitary wastewater treatment facilities, the C-404 Landfill, and classified burial grounds. Those areas beyond the security fence that were inspected weekly included wastewater lagoons, the Northeast and Northwest plume pump-and-treat units, the C-613 Sedimentation Basin, the closed K-Landfill, the water treatment plant and lagoons, and plant outfalls (001, 015, 008, 016, 006, 009, 017, 013, 012, 011, 010, 002). No significant issues requiring DOE's attention were noted during any of the inspections. The following is a short list of inspection activities that were completed in 2013:

- From January through July, 57 site visits were completed during construction of the C-400 ERH Phase IIb project.

- During demolition of the C340 Metals Plant, 56 site visits were completed.

- Approximately 6,875 nickel ingots are stored on-site near the C-746-A Warehouse. About 50 of the ingots contain trace amounts of asbestos. These nickel ingots were inspected on a quarterly basis to ensure that they are completely covered with the required tarps.

- The C-746-U Landfill was inspected on a weekly basis during the year. The specific areas of the landfill that were inspected included the landfill working face, the leachate collection building, the sedimentation basin, Outfalls 019 and 020, and the closed S & T Landfill. In addition, Outfall 020 was sampled 13 times during the latter part of the year.

- A total of 341 monitoring well inspections were completed. The well components inspected included the well padlock, outer casing condition, protective bollards and the concrete pad.

Sediment Basin Sampling Methodology

The C-613 Northwest Storm Water Control Facility (a.k.a. the C-613 Sediment Basin) was completed in March 2003 as part of the first phase of the scrap metal removal project. The sediment basin began operation in March 2003, has a capacity of 4.5 million gallons and was designed to collect surface water runoff from the 27-acre former scrap yard area. The sediment basin collects storm water runoff and allows the associated sediment a period of time to settle, after which the storm water is discharged through the Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001 into Bayou Creek. The Kentucky Division of Water (DOW) permit for Outfall 001 specifies that total suspended solids (TSS) will not exceed 30 mg/L averaged over a 30-day period and that pH shall not exceed a range of 6 to 9 standard units.

The sediment basin sampling regimen has been modified since the basin became operational and sampling began. Samples collected during 2003 to 2007 provided baseline analyte concentrations, allowed the determination of trends and identified specific contaminants of concern. After sufficient information was collected, the sample regimen was both reduced and standardized beginning in 2008. This standardized quarterly regimen was performed during 2008 to 2011. Due to stabilization of reported analyte concentrations as well as budgetary constraints, the sampling regimen was again modified in 2012. The frequency of sample collection was reduced from quarterly to semi-annually. The semi-annual sampling regimen was continued through 2013 and still contains one non-discharge sampling event per year to continue assessment of possible changes in contaminant concentrations that sediment basin releases may have on Bayou Creek.

The standardized semi-annual sampling regimen for 2013 is as follows:

First Semi-Annual Sampling Event:

Part 1) Sediment Basin, KPDES Outfall 001 and Iron Bridge Sampling Points

Purpose: The purpose of the first semi-annual event is to obtain samples from the basin inlet, outlet (Outfall 001) and at a point where WKWMA recreators can be exposed to Bayou creek water (Iron Bridge). These three samples are collected during a Sediment Basin discharge event.

Part 2) C-612 Northwest Pump & Treat Discharge Sampling Point

Purpose: This annual sample of the Northwest Pump & Treat discharge water provides an indication of the effect this discharge may have on downgradient locations shared with the C-613 Sediment Basin and provides a verification of the NW Pump & Treat system effectiveness. The sample is collected at the same time as Part 1 sampling.

Second Semi-Annual Sampling Event:

Part 1) Sediment Basin, KPDES Outfall 001 and Iron Bridge Sampling Points

Purpose: The purpose of the second semi-annual event is to obtain samples from the basin inlet, outlet (Outfall 001) and at a point where WKWMA recreators can be exposed to Bayou creek water (Iron Bridge). These samples are collected during a Sediment Basin discharge event.

Part 2) KPDES Outfall 001 and Iron Bridge Sample Points (Annual)

Purpose: This annual sample is collected to determine analyte concentrations when there is no active discharge from the Sediment Basin. This sample is referred to as a non-discharge event. The sample is collected during the second semi-annual event as this has historically been a period of both steady rainfall and stream flow. The sampling event was designed to be representative of a WKWMA recreator's average possible contaminant exposure during normal stream flow conditions.

All samples are analyzed for the following analytes:

Total Suspended Solids (TSS)

Metals, including Uranium and Mercury

Gross Alpha/Beta activity

Isotopic Uranium (U-234, U-235 and U-238)

Results: TSS and pH

During the 2013 reporting period, neither the TSS concentrations nor the pH limits exceeded DOW KPDES Outfall 001 permit requirements. Flocculent, a material used to enhance particulate precipitation, was not used during 2013. The Scrap Metal Removal Project was completed in early March of 2007. In the spring of 2008 the entire area was hydro-seeded. Since that time the grass cover has become well-established, which has resulted in lower Sediment Basin turbidity results. Based on a comparison of these sample results and the Outfall 001 discharge requirements, it was concluded that the Sediment Basin continues to perform its primary design function, which is to help ensure compliance with Kentucky Division of Water KPDES requirements for Outfall 001.

Results: Uranium Metal, Uranium Radionuclides and Alpha and Beta

Concentrations of total uranium, uranium isotopes U-234, U-235 & U-238 and gross alpha/beta readings were consistently lower at Outfall 001 than in the Sediment Basin during both semi-annual sampling events. The following is a 2013 data comparison presentation of the C-613 Sediment Basin sampling point (Inlet) results to the KPDES Outfall 001 sampling point (Outlet) results and results associated with the "Iron Bridge" sampling point.

2013 First Semi-Annual Sampling Event:

Part 1) Sampling Performed on Jan. 15, 2013:

U) Inlet: 100.0 µg/L	Outlet: 66.0 µg/L	Iron Bridge: 30.0 µg/L
α) Inlet: 27.6 pCi/L	Outlet: 17.5 pCi/L	Iron Bridge: 7.66 pCi/L
β) Inlet: 38.5 pCi/L	Outlet: 27.0 pCi/L	Iron Bridge: 18.3 pCi/L
U-234) Inlet: 18.0 pCi/L	Outlet: 11.5 pCi/L	Iron Bridge: 5.14 pCi/L
U-235) Inlet: 1.05 pCi/L	Outlet: 1.14 pCi/L	Iron Bridge: 0.30 pCi/L
U-238) Inlet: 31.5 pCi/L	Outlet: 21.9 pCi/L	Iron Bridge: 8.9 pCi/L

Part 2) Sampling Performed on Jan. 15, 2013:

U) C-612 Discharge Point: 1.1 µg/L

α) C-612 Discharge Point: 1.83 pCi/L

β) C-612 Discharge Point: 15.9 pCi/L

U-234) C-612 Discharge Point: 0.33 pCi/L
U-235) C-612 Discharge Point: < 1.0 pCi/L
U-238) C-612 Discharge Point: 0.57 pCi/L

2013 Second Semi-Annual Sampling Event:

Part 1) Samples Collected on Nov. 18, 2013:

U) Inlet: 57.0 µg/L	Outlet: 49.0 µg/L	Iron Bridge: 16.0 µg/L
α) Inlet: 23.0 pCi/L	Outlet: 15.7 pCi/L	Iron Bridge: 8.29 pCi/L
β) Inlet: 43.3 pCi/L	Outlet: 38.5 pCi/L	Iron Bridge: 16.7 pCi/L
U-234) Inlet: 12.3 pCi/L	Outlet: 9.6 pCi/L	Iron Bridge: 3.6 pCi/L
U-235) Inlet: 0.74 pCi/L	Outlet: 0.85 pCi/L	Iron Bridge: 0.36 pCi/L
U-238) Inlet: 20.3 pCi/L	Outlet: 17.6 pCi/L	Iron Bridge: 5.37 pCi/L

Part 2) Samples Collected on Dec. 11, 2013:

The non-discharge sample is collected when the Sediment Basin is not being actively discharged. This sample point is considered to be representative of a WKWMA recreator's average possible contaminant exposure.

U) Outlet: 6.3 µg/L	Iron Bridge: 3.7 µg/L
α) Outlet: 1.61 pCi/L	Iron Bridge: 1.65 pCi/L
β) Outlet: 11.3 pCi/L	Iron Bridge: 5.15 pCi/L
U-234) Outlet: 0.89 pCi/L	Iron Bridge: 0.63 pCi/L
U-235) Outlet: 0.11 pCi/L	Iron Bridge: 0.05 pCi/L
U-238) Outlet: 2.53 pCi/L	Iron Bridge: 1.07 pCi/L

Sediment Basin sampling has been performed regularly since the basin became operational. The following data were compiled from 2003 to 2013 concerning average uranium concentrations (averaged from all results available for a given year) and the annual discharge through the Sediment Basin (in gallons). The average yearly rainfall in the Paducah, Kentucky area is 49.3 inches.

Average Uranium (total) concentrations, Sediment Basin discharge volume, annual rainfall and percentage of annual rainfall for each year from 2003 through 2013 are as follows:

2003: Inlet: 346.0 µg/L Outlet: 156.0 µg/L
Annual Discharge: Not Applicable Rainfall: 47.84 inches (97 per cent of Average)

2004: Inlet: 371.0 µg/L Outlet: 206.0 µg/L
Annual Discharge: Partial Year Only Rainfall: 40.66 inches (82 per cent of Average)

2005: Inlet: 458.0 µg/L Outlet: 193.0 µg/L
Annual Discharge: 57,800,000 Gallons Rainfall: 37.45 inches (76 per cent of Average)

2006: Inlet: 454.0 µg/L Outlet: 244.0 µg/L
Annual Discharge: 101,100,000 Gallons Rainfall: 67.11 inches (136 per cent of Average)

2007: Inlet: 276.0 µg/L Outlet: 36.0 µg/L
Annual Discharge: 34,000,000 Gallons Rainfall: 43.33 inches (88 per cent of Average)

2008: Inlet: 338.0 µg/L Outlet: 110.0 µg/L
Annual Discharge: 51,000,000 Gallons Rainfall: 53.69 inches (109 per cent of Average)

2009: Inlet: 439.0 µg/L Outlet: 46.0 µg/L
Annual Discharge: 45,000,000 Gallons Rainfall: 55.60 inches (113 per cent of Average)

2010: Inlet: 176.7 µg/L Outlet: 93.3 µg/L
Annual Discharge: 32,550,000 Gallons Rainfall: 36.67 inches (74 per cent of Average)

2011: Inlet: 188.0 µg/L Outlet: 75.7 µg/L
Annual Discharge: 51,012,000 Gallons Rainfall: 74.85 inches (152 per cent of Average)

2012: Inlet: 196.0 µg/L Outlet: 31.3 µg/L
Annual Discharge: 2,820,000 Gallons Rainfall: 30.06 inches (61 per cent of Average)

2013: Inlet: 78.5 µg/L Outlet: 57.5 µg/L
Annual Discharge: 24,439,000 Gallons Rainfall: 60.3 inches (122 per cent of Average)

Based on an analysis of the data, Kentucky concludes that the concentration of elemental uranium received from the northwest corner drainage basin and discharged at Outfall 001 is roughly proportional to the volume of rainfall and subsequent runoff. The data also show that the concentration of uranium decreases by roughly one-half to greater than one half between the inlet and Outfall 001 during the evaluation period. Although average inlet concentrations have varied during the 10-year reporting period, outlet concentrations at Outfall 001 (2007 to 2012) continue to trend downwards. The highest reported average inlet concentration was 458.0 µg/L in 2005 and the lowest was 78.5 µg/L in 2013. The highest reported average outlet (Outfall 001) concentration was 244.0 µg/L in 2006 and the lowest was 31.3 µg/L in 2012. The 2013 average outlet concentration of 57.5 µg/L was the fourth lowest and was also less than the previous 11-year running average of (113.5 µg/L).

Based on continuing data analysis and field observations, it was concluded that former scrap yard storm water runoff continues to contribute to the off-site migration of metals and low-level radionuclides. Data shows that the operation of the sediment basin has a pronounced effect on the reduction of uranium concentration and turbidity. Therefore, Kentucky believes that operation of the C-613 sediment basin should continue.

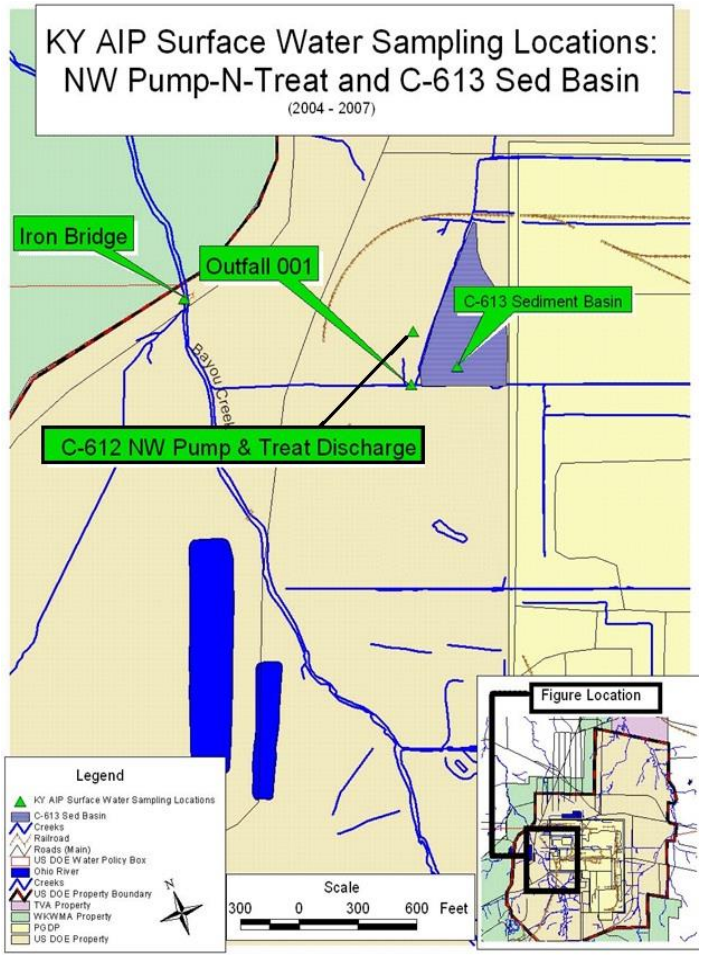

Figure 8. AIP Surface Water Sampling Locations: NW Pump and Treat and C-613 Sed Basin

Radiation Health Branch AIP Sampling

The Radiation Health Branch (RHB) has a robust environmental monitoring program, funded by the AIP, designed to ensure that there is no danger to public health from PGDP's radionuclide releases to groundwater, surface water, or air. In 2013, RHB collected 1,636 samples and performed 1,145 analyses on both those samples and the additional 85 samples collected by EEC.

Groundwater

RHB monitors groundwater by collecting quarterly samples at 10 wells surrounding the site (Figure 9). Gross alpha/beta analysis is performed on the samples. Additional isotope specific analyses may be performed based on the results of the gross measurement.

The majority of the locations sampled are private drinking water wells that are potentially impacted by the TCE/Tc-99 plume travelling away from the site. These wells are no longer used for drinking water. RHB continually evaluates the results from this activity, along with results from third party activities and other activities at the site, to determine the need for additional monitoring locations or modification of current locations.

In 2013, there were no abnormal measurements from RHB groundwater monitoring efforts.

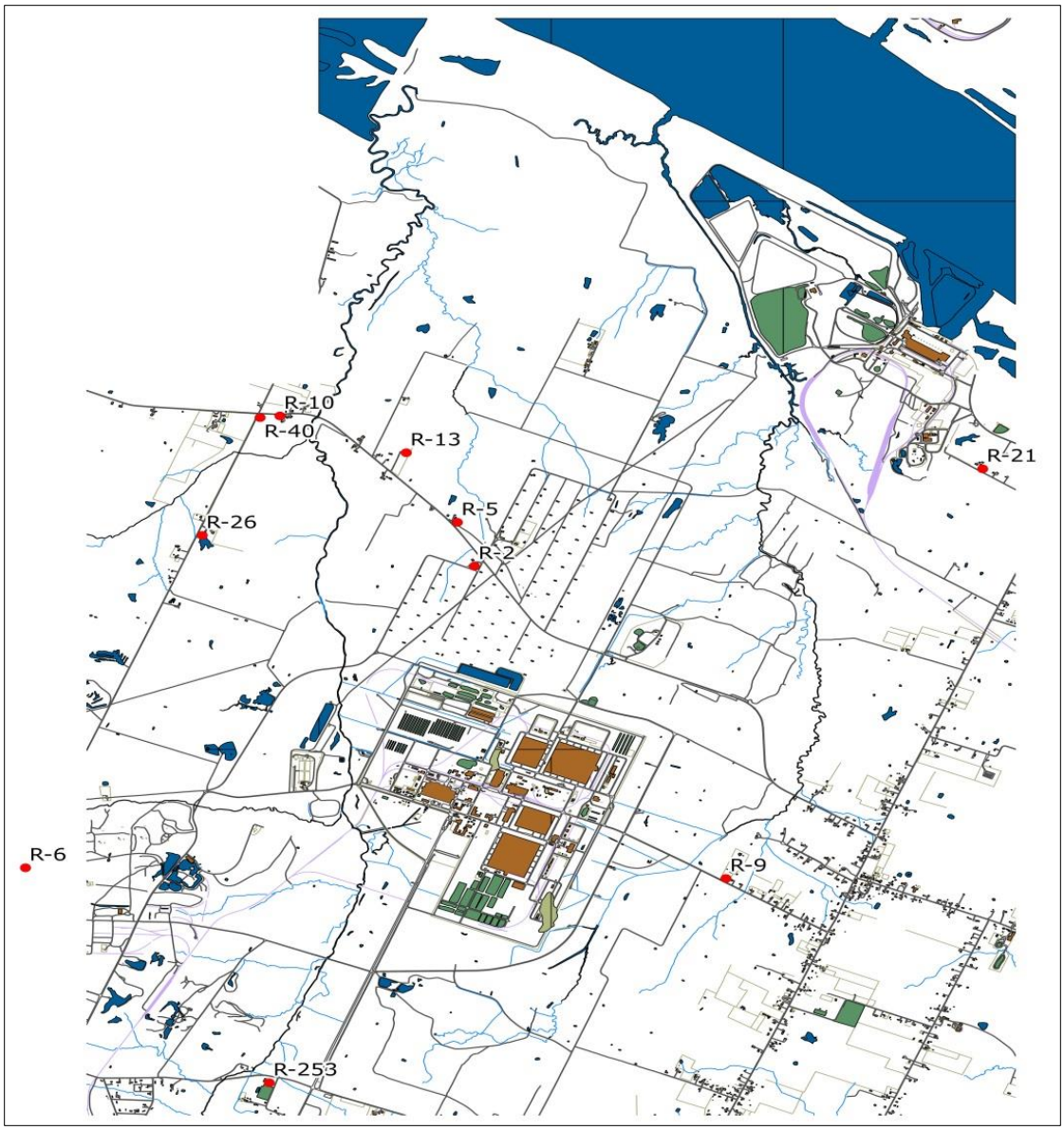

Figure 9. RHB Groundwater Monitoring Locations

Surface Water

RHB monitors surface water by taking quarterly samples at 32 locations surrounding the site (Figure 10) and through continuous sampling (ISCO) at an additional four locations (Figure 11). Gross alpha/beta analysis and isotope specific analyses are performed on the samples, with the ISCO samples being collected and composited over 21 day periods.

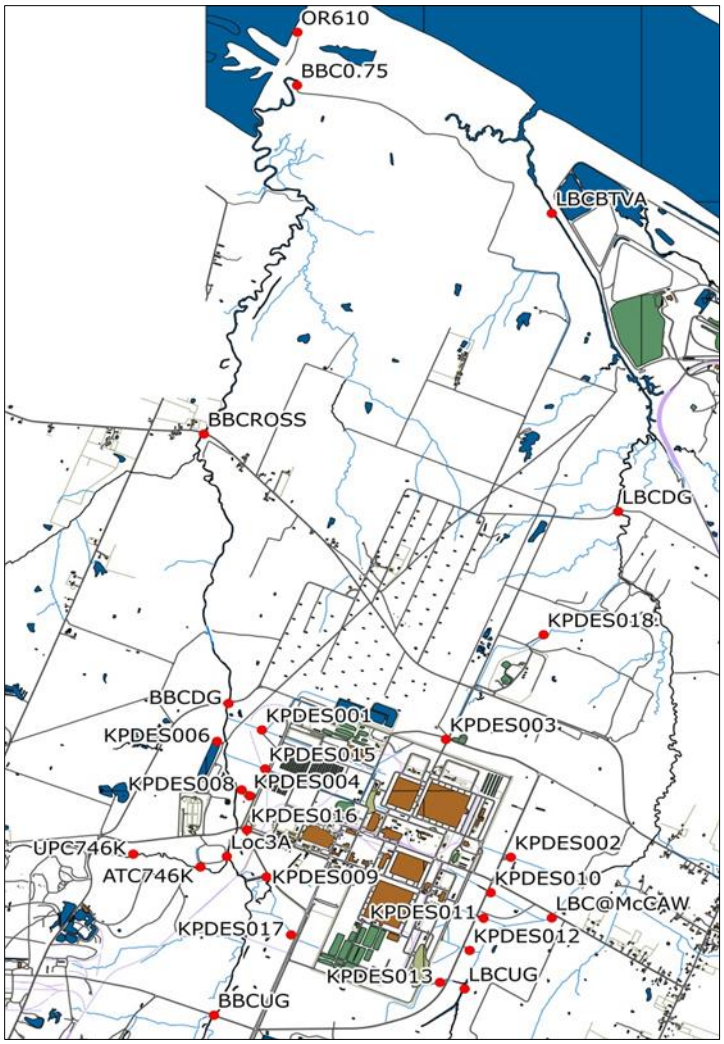

Figure 10. RHB Quarterly Surface Water Sampling Locations

Locations selected for surface water monitoring were focus on outfalls from the site, locations of known runoff from contaminated areas, and historical sampling locations. Background monitoring sites are located upstream in Bayou Creek (ISCO B and BBCUG), upstream in Little Bayou Creek (LBCUG), upstream of the C-746-K Landfill (UPC746K), and approximately five miles to the southeast on Massac Creek (a known unimpacted local waterway, not shown on map).

In 2013, elevated levels of uranium were found leaving the C-746-U solid waste landfill in surface water. This contamination was likely sourced from disposed transite paneling recently

removed from the C-340 Building that exhibited high levels of mobile uranium surface contamination (likely UO_2F_2, uranyl fluoride). In response, RHB began monitoring points in the discharge path from C-746-U, beginning in August, in order to ensure that effluent release limits were not exceeded. During 2013 the cumulative releases did not exceed the effluent release limits, and the uranium levels are slowly returning to normal.

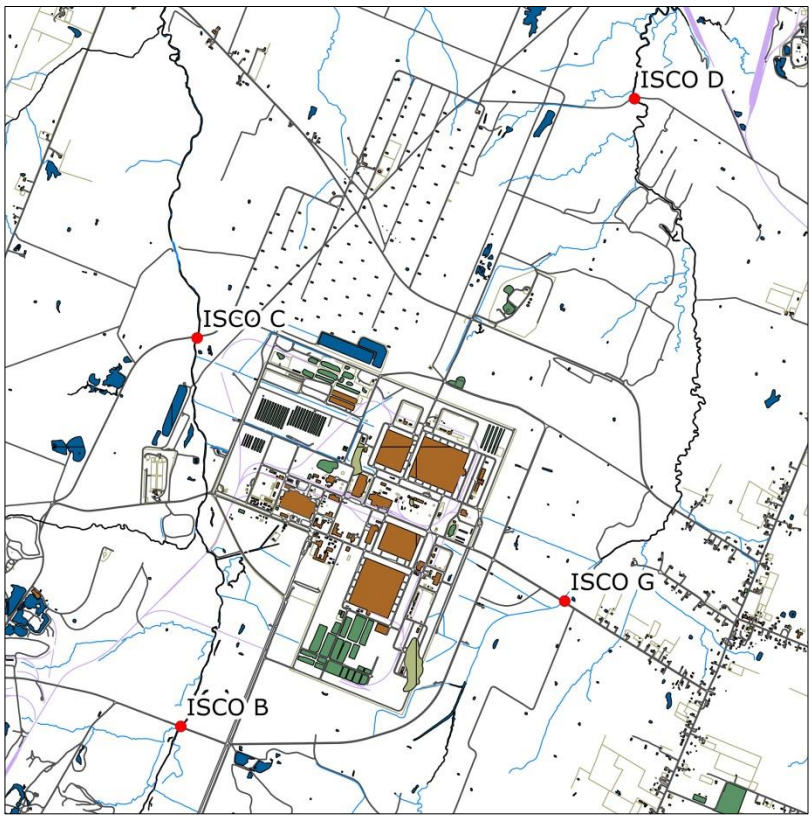

Figure 11. RHB ISCO Sampling Locations

In 2013, there were no abnormal or unexpected measurements from RHB surface water monitoring efforts aside from the elevated C-746-U samples.

Air

RHB monitors air by taking continuous samples at 10 locations surrounding the site (Figure 12) over 21 day periods. Samples are collected on small paper filters. A gross alpha/beta analysis is performed on each filter, and the filters are composited quarterly for isotope specific analyses.

Air monitoring locations were selected based on prevailing wind direction and expected release points/types from the plant. The background monitor is located approximately three miles southeast of the plant at the Barkley Regional Airport (not shown on map) and is > 90 degrees offset from prevailing winds. RHB continually evaluates the results from this activity, along with results from third party activities and other activities at the site, to determine the need for additional monitoring locations or modification of current locations.

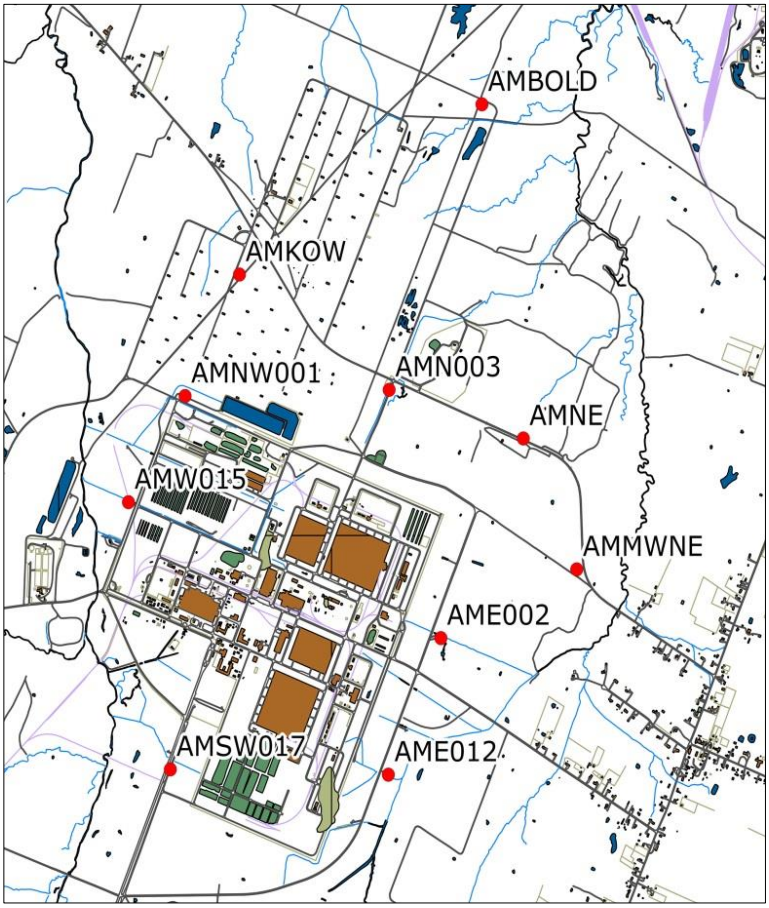

Figure 12. RHB Air Monitoring Locations

In January of 2012, due to reductions in the federal budget, the frequency of filter collection was reduced from weekly to once per 21 days. The potential consequences of this reduction are that there is an increased probability of overloading the filters in drier months due to increased dust and greater sampled volume, and a 200% increase in potential response time following a release. Both have yet to be an issue.

In 2013, there were no abnormal measurements from RHB air monitoring efforts.

Kentucky FFA Program Elements for 2013

Surface Water Operable Unit

The Remedial Investigation Report for the Surface Water OU is scheduled for completion in 2029. The Surface Water OU team did not meet in 2013.

Surface Water OU Documents reviewed in 2012:

No Surface Water OU documents were submitted by DOE or reviewed by Kentucky during 2013.

Groundwater Operable Unit

Northeast Plume Containment System (Pump-and-Treat)

A Record of Decision (ROD) was signed in 1995 which documented the requirements to operate a pump-and-treat system for the purpose of containing higher concentrations within the Northeast Plume. The system that carries out this decision is known as the Northeast Plume Containment System (NEPCS). The NEPCS extracts contaminated groundwater from two extraction wells (EWs) transmitting it to a cooling tower where air stripping transfers the TCE into the atmosphere. The water that remains is then released through a regulated outfall into Bayou Creek. The extraction wells (EW331 and EW332) pump at a combined average rate of 170 gpm. This rate was designed to diminish the growth of the plume's centroid (i.e., highest

concentration zone). Both extraction wells are located approximately 3,000 feet northeast of the PGDP facility, near the crossing of Bayou Creek and Ogden Landing Road.

In 2013 a total of five gallons of TCE was extracted from 63,277,091 gallons of groundwater treated by the NEPCS. The total amount of groundwater extracted by the NEPCS since inception (Feb. 28, 1997) totals 1,427,983,977 gallons. The total amount of TCE extracted since inception is 284 gallons. Table 4 breaks down the operational status for each month in 2013.

Two separate events hindered operational performance in 2013. On June 28, 2013 USEC ceased operation of the cooling towers, forcing a shut-down of the system. During July and August, DOE installed temporary piping to bypass the cooling towers so that treatment could be carried out by a new air stripper unit to be located in close proximity to the future location of an optimized extraction well. This temporary configuration of the TCE treatment system became operational in September 2013. System delays also occurred in December when the system had to be shut down for a few weeks due to a pump failure.

2013 NEPCS		
Month	**% Operational**	**Gallons Pumped**
January	100	7,544,650
February	100	6,997,200
March	100	8,007,850
April	89	6,343,700
May	69	6,343,700
June	76	5,493,400
July	0	0
August	0	0
September	88	6,943,600
October	98	8,221,895
November	94	6,923,514
December	13	457,582

Table 4. 2013 Northeast Plume Containment System Data

In 2010 an Environmental Monitoring System upgrade took place site wide which included the installation of approximately 60 new monitoring wells. Some of these new wells were placed within the known footprint of the Northeast Plume. Subsequently, groundwater level measurements taken from these wells were compared with analytical data and used in conjunction with the most recent site specific groundwater flow model (2008) to reveal a previously unknown bifurcation within the Northeast Plume.

In 2011, the United States Enrichment Corporation (USEC) notified DOE that it would shut down the cooling towers once uranium enrichment ceased at PGDP, forcing DOE to develop an alternative strategy to treat TCE-contaminated water. This lead to a decision on the part of the FFA parties to develop a Remedial Action Work Plan for the purpose of optimizing the NEPCS.

Several meetings were held between the FFA parties to reach consensus on the best strategy to optimize the NEPCS. Design of an optimized NEPCS focused on capturing both cores of the northeast plume, as well as exploring an alternative way to replace the USEC cooling towers. The site specific groundwater model was utilized to examine the best configuration, number, and location of extraction wells, along with optimizing pumping rates to achieve maximum mass capture. Technical discussions and meetings occurred between regulators and DOE in a collaborative effort to stream-line the necessary CERCLA documentation required for optimizing the NEPCS and modifying the 1995 ROD.

Documents submitted in 2013 included two versions of the Remedial Action Work Plan (submitted on April 1 and August 19), two versions of an Operation and Maintenance Plan (submitted on May 7 and August 23), and an Explanation of Significant Differences to the 1995 Record of Decision (submitted on June 21 and August 2). Shortly after the initial versions of these three documents were transmitted, DOE verbally informed regulators on June 25, 2013 that the USEC cooling towers would officially cease operation on June 28, 2013. A Notification of Intent to Temporarily Cease Operation of the Northeast Plume Extraction System was transmitted to regulators in a letter dated July 3, 2013.

Two versions of the Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action for the NE Plume were submitted in June and August 2013. Kentucky submitted comments on the D1 and approved the D2 version of the ESD (Aug. 20, 2013). Approval of the D2 ESD was eventually retracted on Nov. 13, 2013, after Kentucky regulators discovered that ‘release criteria’ language in the RAWP, while consistent with stated ARARs, was inconsistent with the ongoing effluent standard of treatment (goal) for Tc-99 of 900pCi/L at the Northwest Plume Groundwater System (NWPGS). Kentucky initiated several conference calls with EPA and DOE to discuss this matter; however, Kentucky’s technical staff was unsuccessful in convincing DOE to treat extracted groundwater from the northeast plume

extraction wells to the same goals adopted for the NWPGS. This impass escalated into DOE invoking informal dispute on Nov. 12, 2013.

The May 2013 D3/R3 revision to the NEPCS's Operation and Maintenance Plan document was submitted primarily address the imminent shut-down of the USEC cooling towers. The revised O&M plan was intended by DOE to only address a portion of the NEPCS optimization strategy; however, regulators reviewing the plan were initially unaware of the limited intent. As a result, regulators issued deficiency letters along with comments outlining concerns that the O&M plan was incomplete. After a clarification meeting with regulators, DOE explained the limited intent of the O&M plan and made revisions which were captured in the D3/R4 revision, officially transmitted on Aug. 23, 2013. Kentucky approved the D3/R3 revision on September 23. The approved D3/R4 version of the NEPCS O&M plan addressed installation of an alternate treatment unit (ATU) for treating TCE from groundwater as well as necessary infrastructure changes to transmit extracted groundwater from the existing extraction wells to the proposed ATU. A further revision of the O&M plan will be provided to regulators prior to both optimized extraction wells being placed into service.

As part of the optimized groundwater extraction system design process, various groundwater modeling scenarios were run in an effort to optimally locate the new extraction wells. This was done in part to avoid disrupting the existing flow patterns, since a shift in the current groundwater divide could impact the capture zone efficiency of the recently optimized NWPGS. In fact, computer-based models predicted that an additional extraction well may be necessary near the C-400 Building (the primary source area of the Northwest Plume) to ensure that contamination from that flow system does not bypass or cross over into the capture zone of the optimized NEPCS. DOE will address the overall extraction system optimization, well locations, and proposed pumping rates in the revised Remedial Action Work Plan.

The April 2013 D1 version of the Remedial Action Work Plan (RAWP) was submitted by DOE. Kentucky and EPA submitted comments and the D2 version of the RAWP was submitted in August 2013; however it did not satisfactorily resolve Kentucky and EPAs Tc-99 effluent concerns. As a result, the disputed RAWP was integrated into the ongoing ESD dispute process.

Figure 13. PGDP East Side Cooling Towers

Northeast Plume Optimization Documents Reviewed In 2013:

D1 Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action DOE/LX/07-1280&D1 – (Kentucky Submitted Comments 05-29-2013)

D1 Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume DOE/LX/07-1291&D1 – (Kentucky Submitted Comments 07-09-2013)

D3/R3 Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action DOE/OR/07-1535&D3/R3 – (Kentucky Submitted Comments 07-24-2013)

D2 Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action DOE/LX/07-1280&D2 – (Kentucky Conditionally Concurred 09-18-2013) **In Dispute*

D3R4 Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action DOE/OR/07-1535&D3/R4 – (Kentucky Approved 09-23-2013)

D2 Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume DOE/LX/07-1291&D1 – (Kentucky Approved 08-30-2013, Revoked Approval 11-13-13)

*D2 Notification of Invocation of Informal Dispute Resolution for the Retraction of Approval and Conditional Concurrence of the Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume DOE/LX/07-1291&D2 – *In Dispute since 11-12-13*

Figure 14. Northeast Plume Groundwater Treatment Trailer

Northwest Plume Optimization

The NWPGS consists of the C-612 wastewater treatment facility located at the plant's northwest corner and two extraction wells. As of Dec. 31, 2013, the Northwest Plume Groundwater System (NWPGS) system has removed 3,250 gallons of TCE since it became operational on Aug. 28, 1995. The total amount of TCE removed in 2013 was 137 gallons. The total amount of contaminated groundwater treated in 2013 was 113,114,257 gallons and since inception that amount is approaching two billion gallons (1,935,166,287).

In 2009 DOE, Kentucky and the U.S. EPA began to investigate whether the original four well pump-and-treat system might perform more efficiently if pumping were to be concentrated near the northeast corner of the plant. Subsequently, a computer modeling simulation performed by DOE's contractor indicated that two new extraction wells (pumping rate of 110 gallons each) placed near the northern fence line and east of the existing south well field would effectively capture much of the contaminated groundwater feeding the large plume. Based on the computer model, the FFA parties agreed to optimize pumping rates and locations for the two new extraction wells. An Explanation of Significant Differences (ESD) served to memorialize the overall change to the ROD. It was also agreed that the north well field would be deactivated and that the existing south extraction well field would be placed in standby mode, in case it were to be needed in the future. Fieldwork for this project began in March 2010 and the system became fully operational in August of that same year.

The optimized pump-and-treat system is performing as designed. Data is available that suggest much of the contaminated groundwater being captured for treatment is being pulled in the direction of the easternmost extraction well (EW233). Contaminant levels have risen in EW233 but have decreased somewhat in EW 232, the westernmost extraction well. Contaminant levels may have also decreased in MW 456 which appears to be located directly downgradient of the plume's high concentration core.

The table below breaks down the NWPGS operational production and status for each month in 2013.

2013 NWPGS		
Month	**% Operational**	**Gallons Pumped**
January	100	9,781,782
February	100	8,782,520
March	99	9,711,960
April	100	9,550,310
May	100	9,901,665
June	100	9,536,164
July	100	9,949,661
August	96	9,438,286
September	100	9,591,804
October	99	9,613,208
November	89	8,151,618
December	98	9,105,279

Table 5. 2013 Northwest Plume Groundwater System Data

Northwest Plume Optimization Documents Reviewed In 2013:

No documents were submitted for review in 2013.

Southwest Plume Sources

The Southwest Plume was discovered in 1998 during the Waste Area Grouping (WAG) 27 remedial investigation (RI) and further investigated in 2004. It is the smallest of the three plumes originating from the PGDP and the only plume that has not migrated beyond the DOE property boundary. The 2004 investigation focused on four source areas suspected to be potential contributors of contamination to the plume. The areas in question were the C-747-A Oil Landfarm (SWMU 1), the northeast and southeast corners of the C-720 Building (SWMUs 211-A and 211-B, respectively), and a section of the plant's storm sewer system (SWMU 102). The SWMU 4 Burial Ground is also believed to be a significant contributor to the Southwest Plume; however, it is being addressed under a separate Burial Grounds Operable Unit.

A Focused Feasibility Study (FFS) for this project was issued in 2011 which described four remedial action objectives. Among these are objectives to treat and remove Principal Threat Waste (PTW), reduce VOC migration and to prevent MCL exceedances in the regional gravel aquifer (RGA) at the SWMU boundary due to impacted subsurface soils. PTW is defined by EPA as those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained.

The first draft (D1) of the Record of Decision (ROD) for the Southwest Plume sources remedial action was intentionally issued out of sequence on July 22, 2011 in order to maintain an agreed upon schedule for document submittals. After several review and revision cycles the D2/R1 ROD was approved by Kentucky on March 20, 2012. The ROD firmly establishes the treatment approach for SMWU 1 (deep soil mixing) but permits one of two different treatment options for the C-720 Building source areas (long-term monitoring with land-use controls or enhanced bioremediation with monitoring and land-use controls) depending upon the outcome of a Remedial Design Support Investigation (RDSI). SWMU 1 was also included as part of the RDSI in an effort to further refine the area within the SMWU that would require treatment.

DOE presented a Remedial Design Support Investigation (RDSI) Characterization Plan to regulators on Feb. 8, 2012. The RDSI field work occurred July through September 2012 and the results were initially summarized in a Remedial Design Report (RDR) for SWMU 1. Results

of the investigation conducted at SWMU-211-A and SWMU 211-B were presented in a D1 Final Characterization Report submitted on June 27, 2013.

SWMU 1 C-747-C Oil Landfarm

The Remedial Design Report (RDR) for SWMU 1 was preceded by a series of documents each representing a different stage in the design process (i.e. 30 percent, 60 per cent). The 30 per cent and 60 per cent interim designs were submitted prior to and without the benefit of the additional RDSI supplemental data (collected in late 2012). DOE subsequently requested an extension of the date to submit the 90 per cent RDR. DOE indicated that the extension was needed to allow the FFA parties time to assess a revised TCE mass/volume estimate generated by its contractors suggesting that only 8 gallons of TCE was present in the subsurface, instead of the previously suspected 49 gallons. Due to the timing of the alternate estimate, both Kentucky and EPA requested that DOE proceed with the 90 per cent RDR submittal as planned while each regulatory agency independently evaluated DOE's new estimate.

The D1 90 per cent Remedial Design Report was submitted in February 2013 and incorporated data collected at 22 locations. This data was used to further refine the SWMU 1 treatment area. After several productive and collaborative meetings, the three parties collaboratively explored differing interpretations of the SWMU 1 data. This exercise ultimately resulted in a range of TCE mass/volume estimates for SWMU 1.

On May 22, 2013, Kentucky issued a conditional concurrence to the D1 90 per cent RDR and on June 21, 2013 DOE revised the document to address Kentucky and EPA concerns. A D2 RDR 100 per cent version of the document outlined four different approaches to calculating TCE mass/volume estimates. The interpolation methods used to calculate the TCE mass/volume estimates were kriging, kriging using the 90 per cent confidence interval (CI), inverse distance weighting (IDW) and nearest neighbor. The mass estimate table presented in the D2 RDR is reproduced below. The table shows how the four different interpolation methods were used to develop a possible range of TCE volume estimates for SWMU 1.

	Kriging	90% CI Kriging	IDW	Nearest Neighbor
Isoconcentration Level µg/kg	**Volume of TCE (gal)**			
73	8.9	29.3	1.4	24.8
1,000	8.0	28.1	0.5	23.7
10,000	4.2	19.8	0.1	18.0

Table 6. SWMU 1 TCE Mass/Volume Calculations

Of these four methods, the report noted that "both the 90% CI kriging and the nearest neighbor interpolation indicate that 96% of the estimated mass is located within the greater than 1,000 µg/kg isocontour area." Based on this interpretation the FFA parties agreed to define the SWMU 1 treatment area as all soils containing greater than 1,000 µg/kg TCE. Additional meetings and discussions expanded the isocontour area to areas less than 1,000 µg/kg. In addition, several additional soil mixing area treatment cells were added to account for sparse characterization data in the northeast and southeast portions of the treatment area.

Several versions of the RDR and the RAWP for SMWU 1 were submitted to regulators in 2013. The deficiencies and/or conditions identified by Kentucky and EPA were rooted in the overall uncertainty surrounding historical operations and lack of evidence to support precisely where the oil landfarm plots were physically located. Additional deficiencies were addressed concerning how information was compiled and presented in the document. Kentucky and DOE independently investigated the uncertainty surrounding the operation and physical location of the oil landfarm. Additional information was identified but persistent uncertainty associated with the actual location of the oil landfarm plots necessitated the need for additional soil borings. The rationale for installing four additional soil borings (documented in Appendix C of the D2/A1/R1 RAWP) is supported by several lines of evidence including the apparent lack of land

scarring observed in historical aerial photographs in the areas where characterization efforts were focused. Results of the four additional SWMU 1 borings are expected in October 2014.

SWMU 211-A & 211-B (C-720 sites)

Two versions of the Final Characterization Report for SWMUs 211-A and 211-B were reviewed by regulators in the latter half of 2013. The reports were submitted to present and evaluate the hydrologic and analytical results obtained during the 2012 Remedial Design Support Investigation (RDSI). The RDSI data augmented historical data in order to better define the vertical and lateral extent of volatile organic compounds that exist in each of the SWMUs to provide "sufficient information as a basis to select a remedial alternative." Estimated volumes of TCE were calculated for each of the two SWMUs. The TCE volume estimated to be present at SWMU 211-A over an areal extent of approximately 34,000 square feet was 2.2 gallons. The TCE volume estimated to be present at SWMU 211-B was 0.8 gal; however, this estimate does account for TCE that may be present in currently inaccessible areas underneath the C-720 Building. Per the ROD, the two possible remedies for SWMUs 211-A and 211-B are interim land-use controls (LUCs) with either long-term monitoring (Alternative 2) or enhanced in situ bioremediation (Alternative 8).

Based upon the assessment of the RDSI data, DOE formally recommended long-term monitoring (Alternative 2) with institutional controls as the remedy for SWMUs 211-A and 211-B. On Dec. 17, 2013, Kentucky formally accepted DOE's recommendation. Shortly thereafter, EPA recommended that "DOE should install the RGA monitoring wells that will be necessary for groundwater monitoring as part of the Alternative 2 remedy or the Alternative 8 remedy." EPA noted that VOC "sources may be underestimated by sampling only soils without supplemental groundwater samples that reflect current conditions down-gradient of the source areas." DOE is currently considering EPA's recommendation.

Southwest Plume Sources Documents Reviewed in 2013:

D1 90% Remedial Design Report In Situ Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil

Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1276&D1 – (Kentucky Submitted Comments 05-22-2013)

D1 Supplemental Information to the 90% Remedial Design Report In Situ Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1276&D1 – (Kentucky Submitted Comments 05-22-2013)

D2 100% Remedial Design Report In Situ Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1276&D2 – (Kentucky Conditionally Concurred 08-23-2013)

D1 Remedial Action Work Plan for In Situ Source Treatment by Deep Soil Mixing of the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1287&D1 – (Kentucky Submitted Comments 09-20-2013)

D1 Final Characterization Report for Solid Waste Management Units 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume DOE/LX/07-1288&D1 – (Kentucky Submitted Comments 9-25-2013)

D2/R1 100% Remedial Design Report In Situ Source Treatment Using Deep Soil Mixing for the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1276&D2R1 – (Kentucky Approved 10-21-2013)

D2 Final Characterization Report for Solid Waste Management Units 211-A and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume DOE/LX/07-1288&D2 – (Kentucky Approved 12-17-2013)

D2 Remedial Action Work Plan for In Situ Source Treatment by Deep Soil Mixing of the Southwest Groundwater Plume Volatile Organic Compound Source at the C-747-C Oil

Landfarm (Solid Waste Management Unit 1) DOE/LX/07-1287&D2 – (Kentucky Approved 01-08-2014)

Groundwater Remedial Action – C-400 Building

The C-400 Building was constructed early in the PGDP's history to serve as the primary parts cleaning facility for the plant. Soil and groundwater near the building are contaminated with trichloroethene (TCE), a solvent that for years was used to remove oil and grease from parts. The physical properties of this contaminant (e.g., it is denser than water) make it difficult to remove it from the environment.

Figure 15. C-400 ERH System

Electrical Resistance Heating (ERH) was selected in an August 2005 ROD as the technology best suited to remediate subsurface TCE contamination at C-400. ERH relies upon electrical current and vapor extraction wells to heat and then removal volatile contaminants such as TCE from the subsurface. During Phase I of the C-400 remediation project, ERH proved to be well suited to remediating near surface contaminated soils; however, the technology was found to be ineffective within the deeper portions of the contaminated Regional Gravel Aquifer (RGA). When it became clear that another approach was needed to address TCE present in the RGA a decision was made to divide Phase II of the C-400 remedial action into two parts. Phase IIa would again use ERH to effectively treat near-surface contaminated soils. Phase IIb would focus upon removing TCE from the RGA using an alternative approach.

As an alternative to using ERH in the RGA, DOE submitted a Revised Proposed Plan in late 2011 which promoted using In-Situ Chemical Oxidation (ISCO) in concert with emulsified zero valent iron to break down the TCE. ISCO requires that chemicals capable of reacting with and destroying TCE molecules be injected into the aquifer in areas where residual TCE is concentrated. Kentucky and EPA expressed some concern that this technology might prove inadequate to address the large quantities of TCE believed to be present in the RGA and suggested that DOE also evaluate Steam Enhanced Extraction (SEE) as an alternative technology. SEE would use high pressure steam injected into the aquifer to volatilize and break down the TCE. Preliminary evaluations of SEE's potential effectiveness in the RGA were performed by a well-known SEE vendor and by Dr. Ron Falta of Clemson University. After having reviewed results generated by both parties, EPA formally rejected DOE's preferred alternative and stated its preference for using SEE to remediate TCE contamination in the RGA.

Phase IIa

Given the successful implementation of ERH during Phase I, the FFA parties chose to again employ the technology near the C-400 Building's more highly contaminated southeastern corner. Installation of the ERH system began during September 2012 and was still underway at the beginning of 2013. Kentucky AIP program staff completed numerous site inspections in 2013 to oversee the construction which was completed in May. In July, following system testing, the ERH system began actively remediating the shallow soils near the southeastern corner of C-400. While there have been some technical issues arise during the course of

treatment, the system has performed well overall and was continuing to remove significant quantities of TCE from the ground at the end of 2013.

During the course of construction, DOE requested that Kentucky and EPA allow it to modify the project's approved Remedial Action Work Plan to permit greater flexability in the way that wastewater could be treated. DOE submitted its requested page changes in late July 2013 for Kentucky's review. Kentucky submitted its review comments in August. In its comments, Kentucky requested that DOE correct an error in the text that cited an outdated health-based level applying to wastewater containing small amounts of TCE. The level was somewhat higher than the permissible amount. These corrections were made and Kentucky approved the revised RAWP on Nov. 4, 2013.

Phase IIb

In Jan 2013 DOE submitted Dr. Ron Falta's formal analysis on the potential implementation of SEE at Paducah titled *Numerical Simulations of Steam Injection in the Regional Gravel Aquifer at the C-400 Area, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. Several conclusions were drawn in the report. For instance, Dr. Falta's modeling indicated that SEE would be unlikely to work in the lower RGA if the horizontal hydraulic conductivity were high and the anisotropy low, even if the steam injection pressure was high. It also demonstrated that there was no synergistic effect observed when steam injection was modeled at the top and bottom of the RGA simultaneously as had been seen in the SEE vendors modeling results. A primary conclusion of the report was that a need exists to gain a better understanding of the ratio of hydraulic conductivity to anisotropy prior to implementing any full-scale application of SEE at C-400.

In late January Kentucky formally proposed that the FFA parties consider evaluating SEE's effectiveness by implementing a treatability study near C-400. DOE expressed some willingness to perform the study so in early April the FFA parties met in Atlanta to discuss a path forward. Later that month the parties began preliminary Data Quality Objectives and conceptual design scoping activities in support of a treatability study. This work continued through May and June 2013. In August the parties completed the review of a draft treatability study work plan outline and began to finalize an agreement on the treatability study schedule. This schedule

was eventually finalized in a memorandum of understanding that set enforceable milestone dates to insure that the study would be completed in a timely manner. Once the study was completed, DOE agreed to submit a D2 Proposed Plan for C-400 that would include the preferred alternative for Phase IIb of the remedial action. In accordance with the approved schedule DOE submitted a D1 Treatability Study Work Plan (TSWP) on Oct 21. The memorandum of understanding was signed ten days later.

Kentucky reviewed the TSWP and submitted comments on Nov. 27, 2013. Early in the scoping process DOE had indicated that it would attempt during the study to use temperature decay as a means of refining estimates of groundwater flow velocity in the vicinity of C-400. It was speculated that groundwater velocity could have a significant impact in determining whether SEE could be successfully implemented at C-400. Kentucky questioned how effective these measurements would be if the axis of monitoring wells installed as part of the treatability study was significantly skewed with respect to the groundwater flow direction. Kentucky was concerned that DOE might not have enough information to accurately orient these wells with respect to the flow direction. DOE later indicated that flow velocity was not as critical to the success of the study or SEE implementation in general as had originally been believed and that the proposed approach would be adequate to allow for an estimation of groundwater velocity. Approval of the TSWP was pending at the end of 2013.

C-400 IRA Documents Reviewed In 2013:

D2/R2 *Remedial Action Work Plan for Phase IIa of the Interim Remedial Action for the Volatile Organic Compound Contamination at the C-400 Cleaning Building DOE/LX/07-1271&D2/R2* – (Kentucky Approved 11-4-2013)

D1 Treatability Study Work Plan for Steam Injection, Groundwater Operable Unit DOE/LX/07-1294&D1 – (Kentucky Submitted Comments 11-27-2013)

Figure 16. SE Corner of C-400 Building

Burial Grounds Operable Unit

The historic generation of various types of waste materials at the PGDP led to the on-site subsurface disposal of some of these wastes in areas referred to as Burial Grounds. The Burial Grounds Operable Unit is comprised of 10 such areas that are designated by their respective SWMU numbers listed below:

SWMU 2 C-749 Uranium Burial Ground

SWMU 3 C-404 Low-Level Radioactive Waste Burial Grounds

SWMU 4 C-747 Contaminated Burial Yard and C-748-B Burial Area

SWMU 5 C-746-F Burial Yard

SWMU 6 C747-B Burial Grounds

SWMU 7 C-747-A Burial Grounds and Burn Area

SWMU 9 C-746-S Landfill

SWMU 10 C-746-T Landfill

SWMU 30 C-747-A Burial Grounds and Burn Area

SWMU 145 P Landfill

SWMUs 5 and 6 are grouped together in a separate FS. SWMUs 2, 3, 7 and 30 are grouped together in an FS. SWMU 4 is following a separate path as it undergoes further sampling and investigation. SWMUs 9, 10 and 145 are deferred until 2026.

SWMUs 5 and 6

The FFA parties reached agreement on the informal dispute on the Feasibility Study (FS) for SWMUs 5 and 6 in January 2013. The regulatory agencies received the D2/R3 FS on Feb. 8, 2013. Shortly thereafter Kentucky issued its letter of concurrence.

DOE issued the D1 Proposed Plan for SWMUs 5 and 6 on May 2nd. In it they proposed Alternative 5, a Kentucky Subtitle D Cap with Land Use Controls and Monitoring as the preferred alternative for both SWMUs. Kentucky provided comments and DOE issued the D2 Proposed Plan on July 17 that addressed Kentucky's concerns.

In their July board meeting the Paducah Citizen's Advisory Board passed a recommendation to delay implementation of the preferred remedial action in the Proposed Plan for SWMUs 5 and 6 until the waste disposition study regarding use and location of an on-site CERCLA cell landfill was completed, until the community has had time to provide input to DOE relative to site redevelopment, until DOE and the community have had time to solicit and evaluate development proposals from interested parties and until uncertainties in funding relative to plant shutdown, demolition and remediation are resolved. In deference to the CABs request and in recognition of the CAB's argument that an apparent conflict existed between the CERCLA WDA

and SWMUs 5 and 6 projects, Kentucky delayed submittal of its final comments on the D2 Proposed Plan by 165 days.

SWMUs 2, 3, 7 and 30

Kentucky issued a letter with additional comments on the D1 Feasibility Study for SWMUs 2, 3, 7 and 30 on Feb. 21st. These comments stemmed from the resolution of the informal dispute on the SWMUs 5 and 6 FS.

Given that the first Proposed Plan for SWMUs 2 and 3 will not be issued until 2022, DOE was granted an extension until March 30, 2014 to issue the D2 FS. Ten conference calls were held over the remainder of the year for comment resolution.

SWMU 4

SWMU 4 is being investigated using a phased approach to sample collection with each subsequent phase being informed by the preceding one. The twenty-two Phase 2 shallow subsurface (0-20 ft) borings were completed within SWMU 4 in March and April 2013. Kentucky split two of samples obtained by DOE during Phase 2 for QA/QC purposes. Four meetings were held among the FFA parties to discuss the results of the Phase 2 sampling and to plan locations for Phase 3 (20-58 ft) borings. Eleven borings were located toward the southern portion of SWMU 4. These borings were completed in May 2013. Four conference calls were held in the last four months of the year to discuss the results of the Phase 3 sampling and to plan locations for the Phase 4 deep borings.

BGOU Documents Reviewed in 2013:

Feasibility Study for SWMUs 5 and 6 of the Burial Grounds Operable Unit, DOE/LX/07-0130a&D2R3 – (KY Approved 2-14-13)

Proposed Plan for the Burial Grounds Operable Unit Source Areas SWMUs 5 and 6, DOE/LX/07-1275&D1 – (KY Submitted Comments 6-14-13)

Proposed Plan for the Burial Grounds Operable Unit Source Areas SWMUs 5 and 6, DOE/LX/07-1275&D2 – (KY Comments Pending)

Feasibility Study for SWMUs 2, 3, 7 and 30 of the Burial Grounds Operable Unit, DOE/LX/07-1274&D1 – (Additional Comments Issued 2-21-13).

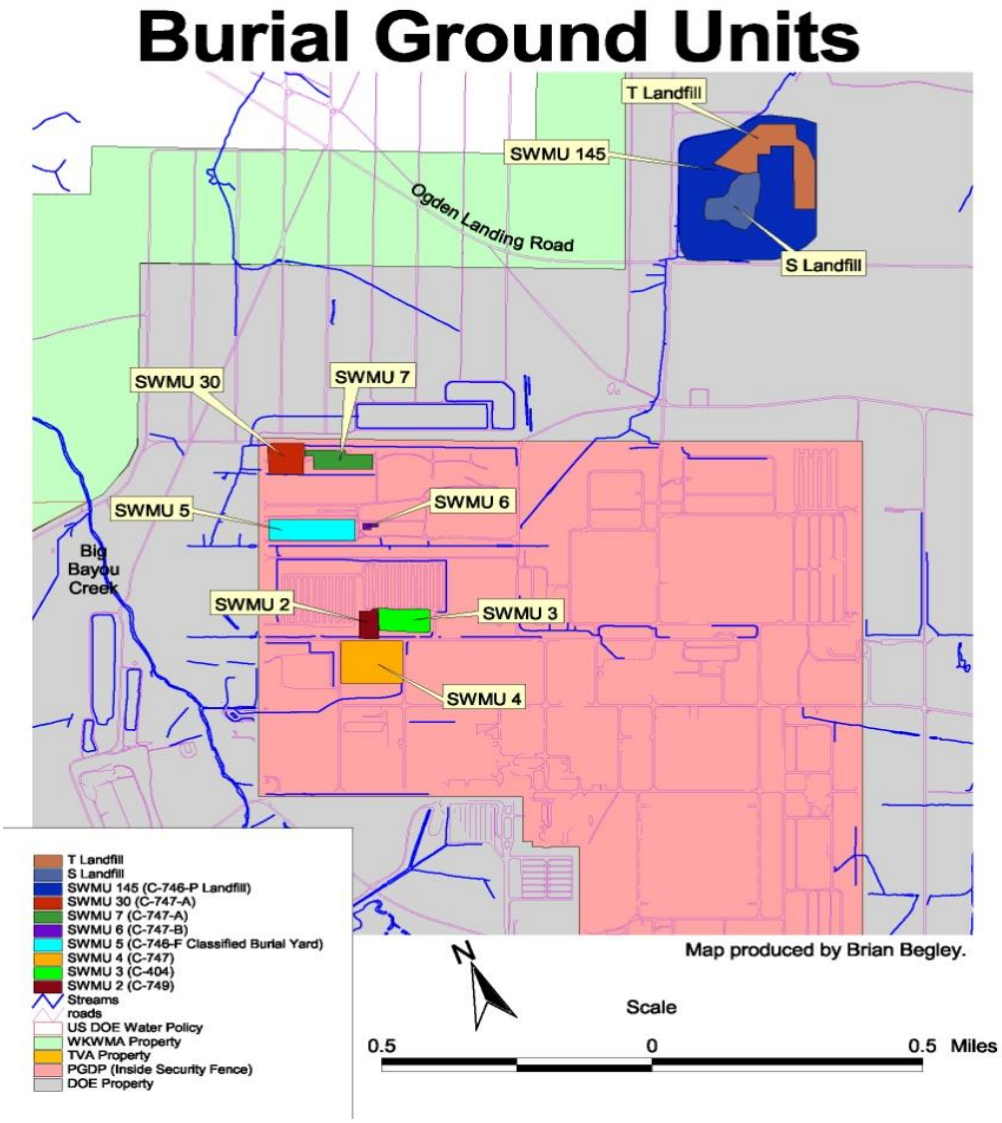

Figure 17. Burial Ground SWMUs

Soils Operable Unit

The Soils OU includes SWMUs and AOCs of that contain various types of shallow soil contamination. This contamination is generally associated with spills, scrap yards, soil or rubble piles, PCB release sites, and impacts from a range of other discrete activities. The prevalent contaminants are polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) [benzo(a)pyrene equivalents], Tc-99 and uranium. As a general rule, soil depths investigated as part of the Soils OU are limited to 0-10 feet below ground surface and up to 16 feet below ground surface in areas containing subsurface pipelines. Any contamination identified below these depths would be addressed by the Groundwater OU since it would be considered to be too deep for direct contact to occur.

Three meetings were held in January to address the remaining issues and comments on the D2 Remedial Investigation Report (RIR). A D2/R1 revision consisting of replacement pages was issued on Feb. 7, 2013. Kentucky and EPA concurred with the D2/R1 version of the RI Report on Feb. 25, 2013. The approved report presents results of the remedial investigation for 50 of the 86 SWMUs included in the remedial investigation work plan. Of the 37 SWMUs not included in the RIR, 20 were moved to the Soils and Slabs OU, 16 were determined to need further investigation and will be included in a second subsequent RI and SWMU 12, which is part of SWMU 7, was determined to require no further action. SWMU 99 was divided into A and B sections with SWMU 99A being moved to the Soils and Slabs OU and SWMU 99B remaining in the Soils OU. Per agreement by the FFA parties, a feasibility study for the Soils OU will not be submitted until 2023.

Soils Operable Unit Documents Reviewed in 2013:

Soils Operable Unit Remedial Investigation Report at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/LX/07-0358&D2R1 – (Kentucky Approved on 2-25-13)

Decontamination and Decommissioning Operable Unit

Across the country, aging DOE facilities contain structures that are contaminated and no longer serve a useful purpose. Many of these structures no longer have an active mission, are in a state of disrepair and contain radioactive and other contaminants. The process of addressing these structures is referred to as Decontamination and Decommissioning (D&D). The PGDP has numerous structures that will eventually be subject to the D&D process. At present, only inactive structures under DOE management are being addressed under the D&D program. The D&D activities conducted in 2013 were associated with the abandoned C-410/420 Complex.

Figure 18. C-410/420 Exterior

C-410/420 Complex Infrastructure D&D

Final work on the interior of the C-410/420 Complex concluded in 2013, rendering the structures amenable for demolition in 2014.

CY 2013 work focused on preparing the C-410 Feed Plant for full-scale demolition and included:

- Completion of removal of fluorine piping
- Completion of accessible interior asbestos abatement
- Completion of removal and packaging of 20 Cold Traps
- Placement of 20 Cold Traps in storage, pending future uranium recovery/reprocessing

The approved decision documents for the C-410/420 complex envisioned that all material from the project would be either recycled or disposed of as waste. However, due to the value of the uranium contained within them and economies of scale that may be realized by addressing them during D&D of the remaining PGDP, the FFA parties reached agreement on placing the cold traps in temporary storage.

Waste Management

Waste Disposition Alternatives (WDA) Project

During the next several decades large quantities of waste will be generated at the PGDP. Much of this waste will be in the form of concrete, structural steel and decommissioned equipment that will require disposal following decontamination and decommissioning of large process buildings. Lesser volumes of waste will be created as contaminated soils and burial grounds are remediated. As much as 3.7 million cubic yards of waste are projected to be generated at the PGDP during the course of site cleanup. The question as to where all of this waste will eventually be disposed is the subject of a DOE generated CERCLA waste disposal alternatives feasibility study currently under review by Kentucky and U.S. EPA.

The feasibility study evaluates two general disposal options, on-site disposal versus off-site disposal. Since it is somewhat uncertain how much waste will actually require disposal, both the on-site and off-site alternatives are further broken down into subcategories based upon certain assumptions. The base case subcategory assumes that some of the waste generated

will go to an existing on-site solid waste landfill. The high volume subcategory assumes that this landfill will not be available for use and that all waste will require disposal in a new on-site cell or transport and subsequent disposition in an off-site landfill. An on-site repository would allow the site to safely dispose of non-hazardous, hazardous, TSCA, low-level radioactive and low-level radioactive mixed wastes on-site, thereby avoiding more costly off-site disposal. However, the option to ship all or a portion of the waste off-site to a DOE owned or commercial waste facility still exists.

If on-site disposal is ultimately selected as the best waste disposal option for the PGDP then it's likely that one of five potential locations will be chosen as the site for the new landfill. These five sites are similar in size (110 acres) but differ in other respects. For instance, some of the sites are located south of the PGDP in uncontaminated areas and therefore are upgradient of existing groundwater contamination. These sites would have the advantage of being easier to monitor in the event that the landfill were to leak at some distant point in the future. Other sites are located above existing groundwater contaminant plumes but are further away from public view. Some of these sites also offer greater potential for expansion relative to other sites. In the feasibility study, a representative site has been selected from each of these two zones (uncontaminated and contaminated). These two sites are then compared in lieu of comparing each of the five sites individually.

Following submittal of its initial feasibility study comments to DOE in late 2012, Kentucky received a revised draft of the document along with DOE's individual responses to Kentucky's comments in late July 2013. As required under the Federal Facility Agreement (FFA), Kentucky then identified specific conditions that would need to be met prior to its granting final approval of the document. These were transmitted to DOE on Oct. 23, 2013.

In its conditions, Kentucky reasserted its position that DOE cite certain regulations as being relevant and appropriate to construction of an on-site CERCLA landfill. In particular, Kentucky reiterated its position that 902 KAR 100:022 § 19 is relevant and appropriate to the design, operation and closure of an on-site CERCLA landfill. This regulation pertains to the need to ensure that low level radioactive waste landfills protect against future inadvertent intrusion into buried waste. Kentucky also continued to assert that the point of compliance for any future on-site CERCLA waste landfill is dictated by 401 KAR 34:60 which states that this point is "a

vertical surface located at the hydraulically downgradient limit of the waste management area." In addition, Kentucky again noted that it views certain prescriptive solid waste regulations applicable to construction of solid waste landfills as minimum standards for construction of a CERCLA landfill and again required that these regulations be cited as relevant and appropriate in the feasibility study.

While many of Kentucky's conditions focused on regulations, a few of conditions also sought to elicit a response or commitment from DOE with respect to matters of importance to the Commonwealth. For instance, Kentucky had requested some time ago that DOE to perform a radon flux analysis for a potential on-site CERCLA landfill. This analysis would determine with some level of certainty whether a landfill containing those wastes projected to require disposal would be capable of releasing radon from its cap at flux rates in excess of 20 pCi/L/s, an emission limit required for capped uranium mill tailing piles. DOE disagreed that a commitment was ever made to conduct this modeling. Nevertheless, Kentucky reasserted its position that the modeling must be performed.

In a matter unrelated to the review of the feasibility study but pertinent to siting of a CERCLA landfill, Kentucky transmitted a letter to DOE on December 19, 2013 in part requesting that the FFA parties consider the merits and complexities of Site 9 as a potential landfill location. Site 9, while one of the five sites selected for further consideration, was ranked last in terms of its overall ability to meet certain predefined acceptance criteria. The site's greatest advantage is also potentially its greatest disadvantage. Site 9 is located at the northwest corner of the PGDP where a significant quantity of waste is buried. Construction of a landfill in this area would require that much of this waste be removed and staged while the landfill was being built. Presumably the waste would then be placed inside the landfill. This would be a positive outcome given that waste once buried in unlined pits would be newly interred in a structure specifically designed to contain it. The site is also attractive due to the fact that it is a brownfield site whereas some of the other sites under consideration are more attractive candidates for future redevelopment. One unattractive attribute is that landfill construction at the site would take much longer than in other areas – due to the presence of buried waste -- thereby delaying eventual D&D of the PGDP.

At the end of 2013, members of the Paducah Citizens Advisory Board (CAB) favored Site 9 as a potential landfill location and requested that Kentucky investigate its use. The CAB also objected to any near-term action being taken at Site 9 that would run counter to its potential use as a future landfill location. Specifically, it requested that SWMUs 5&6, two burial grounds located in the middle of Site 9, not be capped in advance of a decision being finalized with regards to landfill siting. Kentucky supported the CAB's position.

Following eventual approval of the feasibility study, DOE will issue a Proposed Plan that will include a description of its preferred alternative. The public will then be asked to provide input regarding this alternative. A decision as to whether the on-site option is selected is expected sometime in 2015.

Waste Disposition Options Documents Reviewed in 2013:

Remedial Investigation/Feasibility Study for CERCLA Waste Alternatives Evaluation DOE/LX/07-0244&D2 – (Kentucky Conditionally Concurred 10-23-13)

Solid Waste Management Units (SWMUs)

During the reporting period from January 1 to Dec. 31, 2013, Kentucky did not receive any Solid Waste Management Unit Reports (SARs) for newly discovered SWMUs or Revised SARs. There are currently no SWMUs listed in either Appendix A-4(a) (DOE Material Storage Areas for which the permittee has submitted SARs and are under review by the Cabinet) or in Appendix A-4(b) (SWMUs Under Review by the Cabinet) in the PGDP Permit.

SWMU Documents Reviewed In 2013:

There were no SWMU related documents received in 2013.