Commonwealth of Kentucky

Environmental Oversight Report 2015
Paducah Gaseous Diffusion Plant

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This 2015 Environmental Oversight Report, finalized in April 2016, 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, 2015, to Dec. 31, 2015. 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.

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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 Investigation/Feasibility Study	**RI/FS**
Resource Conservation and Recovery Act	**RCRA**
Sampling and Analysis Plan	**SAP**
Scrap Metal Removal Project	**SMRP**
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 enriched uranium production. Today, The United States Department of Energy (DOE) oversees environmental cleanup activities at the site, including environmental management, waste management, depleted uranium hexafluoride conversion, and decontamination and decommissioning. The PGDP is located on a 3,556-acre federal reservation in northwestern McCracken County, Kentucky. Most of the operations at the PGDP occurred inside a fenced secured 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 DOE or its predecessor U.S. government agencies. The United States Enrichment Corp. (USEC) was responsible for the operation and maintenance of the PGDP production facilities from July 1993 to October 2014. Although DOE retains ultimate responsibility for environmental restoration and waste management, DOE has employed a series of support contractor teams to assist the implementation of various activities at the site. LATA Kentucky was the PGDP environmental remediation contractor to DOE from 2012 through the first half of 2015. Fluor Federal Services, the deactivation contractor, assumed the environmental remediation contract for the second half of 2015, during the remaining time period covered (CY 2015) 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 trichloroethylene (TCE) and Tc-99, a radioactive by-product of historic PGDP process operations. Soil and sediment sampling and analysis have detected the presence of polychlorinated biphenyls (PCBs) and uranium. In addition, historic 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 a grouping of areas or sources that share common attributes such as a 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 Area 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 Cabinet for Health and Family Services (CHFS) are non-voting, ex-officio members who serve as advisors and inform the CAB on their respective agencies' policies and views.

Kentucky's Oversight Program

The Commonwealth of Kentucky is responsible for overseeing the environmental cleanup of the PGDP. Kentucky's Energy and Environment Cabinet (EEC) has designated the Hazardous Waste Branch (HWB) within the Division of Waste Management (DWM) 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 HWB 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 Research Consortium Energy and Environment (KRCEE)

In addition to intra-state governmental coordination, coordination with federal agencies and citizens groups is necessary and expected. Kentucky regularly cooperates and interacts with U.S. DOE, the U.S. Environmental Protection Agency (EPA), and the Paducah CAB. Kentucky is an active participant in the National Governor's Association Federal Facilities Task Force, State and Tribal Working Group and the Environmental Council of the States.

Federal Facility Agreement / Site Management Plan

The FFA is a three-party agreement between DOE-Paducah, EPA Region 4 and the Kentucky Energy and Environment Cabinet. It was developed to ensure compliance with and to avoid duplication between the cleanup provisions of the Resource Conservation and Recovery Act (RCRA) and those 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 define and document operable units (OUs) requiring investigation and cleanup. The SMP is revised annually and provides enforceable milestones for the investigation and cleanup of the site. Milestones are set for the current fiscal year (FY) and the following two years. Longer term out-year milestones are set for completion of the larger media-type OUs. The SMP also documents the three-party prioritization strategy for the complete remediation of the PGDP. The FFA parties meet to scope revisions for the document in the months leading up to the document's annual revision on Nov. 15.

The FY 2015 annual revision was approved by Kentucky on April 30, 2015 and by EPA on May 5, 2015.

Site Management Plan Documents Reviewed In 2015

FY 2016 Annual Revision to Site Management Plan (2400&D1). Comments issued 12/15/15.

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. During 2015 the AIP wrote and distributed 5 issues of the *Oversight News,* its newsletter detailing activities at the PGDP. AIP also completed and distributed its 2013 and 2014 Annual Reports.

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.

Kentucky AIP Program Elements for 2015

One of the primary goals of the Agreement in Principle (AIP) is to monitor current site activities through sampling and observation in order 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.

[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.

To achieve these goals, AIP staff routinely observes DOE facilities and 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 collect independent environmental (soil, surface water and groundwater) samples, split environmental samples with DOE, and work with various independent research organizations, such as the University of Kentucky, under a Memorandum of Agreement (MOA) for the AIP program. For some projects, these research organizations also collect independent environmental samples. These 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; AIP also splits environmental samples to independently validate DOE's sampling results; and historically have split tissue samples collected from animals living near the PGDP to monitor the biota.

For 2015, the primary AIP independent contract laboratory 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. The CHFS analyzes groundwater samples as well as airborne and surface water samples collected using continuous monitoring equipment for gross alpha and gross beta concentrations. If trigger levels for gross alpha and gross beta are exceeded, then CHFS will analyze the sample for isotopic radionuclides. AIP staff directly receives all analytical data from TAL and CHFS. The results are verified, interpreted and shared formally with the appropriate parties.

AIP Groundwater Investigations

Residential Wells Sampled in 2015

During 2015, AIP staff collected samples from five different residential wells and 91 different monitoring wells. In all, AIP staff sampled some wells more than once for a total of 124 sampling events during 2015. All five residential wells were sampled twice; the first sampling

event AIP collected samples independent of DOE and the second time AIP split samples with DOE contractors in November. The 2015 AIP Groundwater Sampling Locations maps show all wells sampled during the 2015 reporting period. The vast majority of the wells sampled were less than two miles from PGDP plumes and/or less than two miles from the PGDP.

The residential wells sampled by AIP staff were located outside of the plumes. During this reporting period, AIP independently confirmed that, of the 5 residential wells sampled in 2015, none were impacted by the plumes. The fact that the wells were sampled independently of DOE, that the samples were analyzed by an independent lab and that the results were independently reviewed and interpreted by AIP staff, provided the residents a higher level of assurance that their well water has not been impacted by the PGDP groundwater plumes. For all residential wells sampled, the laboratory report and a discussion of the results were sent directly to the residents.

In 1988, when TCE and Tc-99 were discovered at off-site water wells, nearby residents using groundwater wells for domestic use were provided an alternative water supply. In response, DOE created a water policy area that provides alternative water sources at no costs to residents who may be affected by contaminated groundwater. In exchange, residents must agree to refrain from using the groundwater. This policy is used, in part, to protect the public from potential exposure to contaminants. In 2015 AIP staff focused on sampling residential wells in the area (to monitor for any evidence that the plume had not expanded east toward Metropolis Lake Road). Based upon the sampling results, the plume does not appear to have migrated east towards Metropolis Lake Road. During 2016 the wells on the west side boundary of the water policy will be sampled.

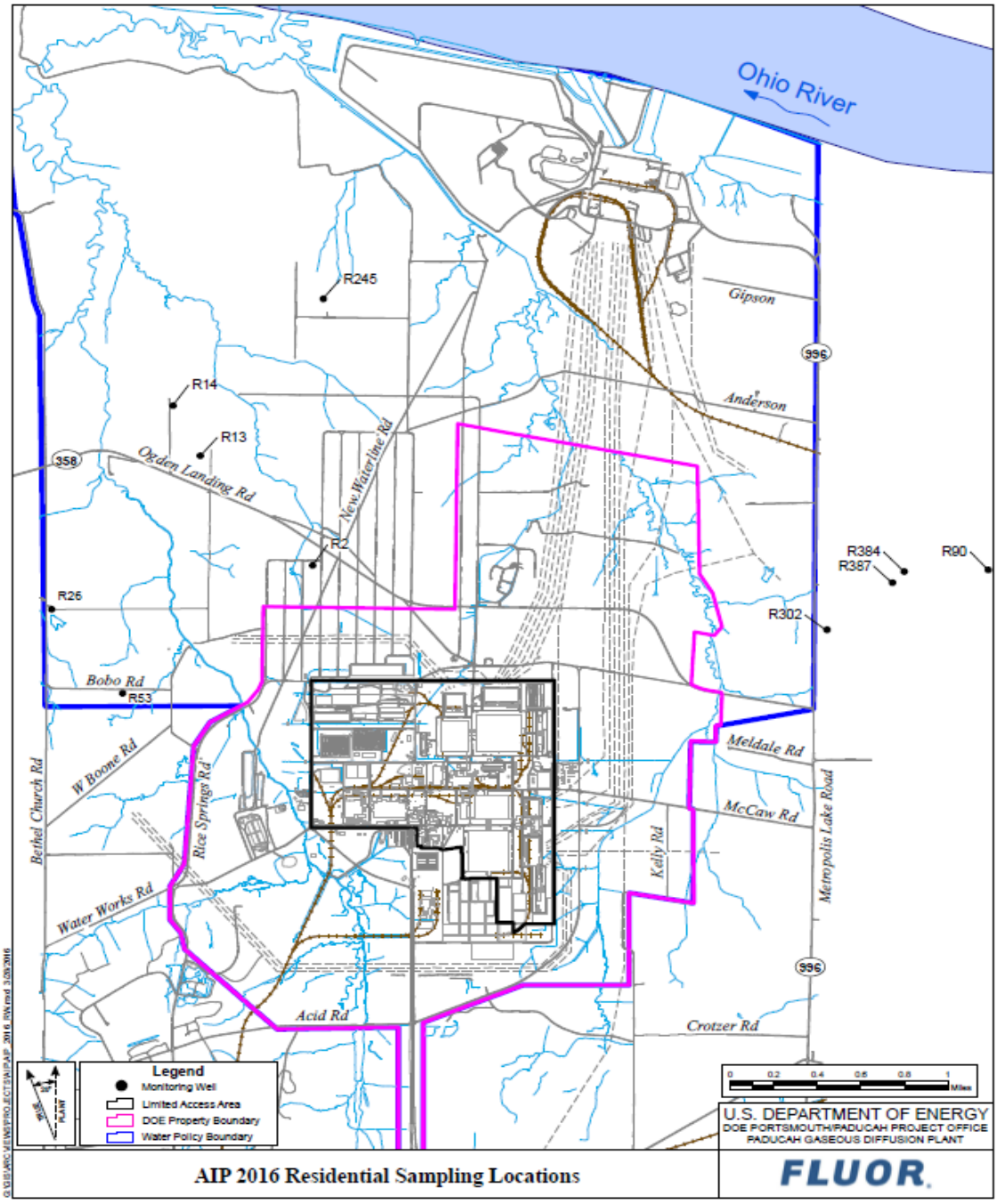


Figure 1. AIP 2015 Residential Wells Sampled

Monitoring Wells Sampled by Kentucky AIP

The objectives of the AIP sampling activities for monitoring wells were significantly different from the objectives of the residential well sampling. Sampling of residential wells was targeted toward determining whether PGDP plumes had negatively affected nearby drinking water resources. The 94 monitoring wells sampled involved 114 sampling events in 2015. Each of these sampling events was located either within the known plume footprint or in close proximity to the plumes. These sampling events were conducted to evaluate and substantiate DOE's sampling procedures and to verify the quality of their laboratory analysis. AIP staff split samples with DOE on 11 of the 114 sampling events conducted in 2015. The concentrations detected by DOE for TCE and Tc-99 at various monitoring well locations are used to determine the nature and extent of contaminant plumes at PGDP, as presented in DOE site plume maps.

In most cases, AIP staff arranged to split samples with DOE during their scheduled sampling activities. A total of 108 of the 114 sampling events involved single samples collected from monitoring wells during 2015. One well was sampled twice and one monitoring well was sampled four times, (quarterly) by AIP staff.

Split sampling activities demonstrated a general similarity between those samples collected and analyzed by Kentucky and those collected and analyzed by DOE. During the split sampling events, 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.

Of the 11 monitoring well samples split by Kentucky and DOE and analyzed for Tc-99, two had similar Tc-99 concentrations. On five occasions, neither Kentucky nor DOE detected Tc-99. During the January 6 and 13, 2015 sampling event for MW-370 and MW-395, Kentucky had the higher reading while DOE had the non-detect reading. The wells are located at the C-746 S & T Landfills. During the July 15, 2015 sampling event for MW-90A and MW-84, Kentucky had the higher reading while DOE had the non-detect reading. The wells are located at the C-404 Landfill inside the fenced PGDP facility.

Well #	Date	AIP TCE ug/L	DOE TCE ug/L	Relative % Difference	AIP Tc-99 pCi/L	DOE Tc-99 pCi/L	Relative % Difference
MW369	1/13/15	1.3 RL 1	1.46 RL 1	11.6	50.8 +/-1.58	45.2 +/-13.3	11.6
MW370	1/13/15	0.89 J RL 1	1.04 J RL 1	15.5	24.3 +/-1.42	U	23.4
MW222	1/6/15	0.33 J RL 1	0.64 J RL 1	63.9	U	U	NA
MW395	1/6/15	2.9 RL 1	3.99 RL 1	31.6	10.8 +/-1.34	U	56.5
MW360	1/13/15	ND	U	NA	U	U	NA
MW361	1/13/15	3.3 RL 1	3.88 J RL 1	14.1	58.4 +/-1.62	40.7 +/-12.7	35.7
MW84	7/15/15	1300 RL 100	1530 DL 20	16.2	4.47 +/-1.30	U	131.4
MW87	7/15/15	1100 RL 100	1250 DL 20	12.7	U	U	NA
MW90A	7/15/15	33 RL 2	37.9 DL 1	13.8	14.6 +/-1.36	U	41.3
MW93	7/15/15	2300 RL 100	2520 DL 50	9.1	U	U	NA
MW420	7/15/15	180 RL 10	191 DL 5	5.9	U	U	NA

Table 1. AIP/DOE DATA Comparison

RL = reporting limit, ND = Non detect at the reporting limit, NA = not applicable, U = not detected above laboratory reporting limit DL = Laboratory detection limit

AIP staff conducted split sampling at select wells associated with the C-404 Hazardous Waste Landfill. Split samples were collected to help verify the accuracy of DOE's environmental data by comparing it to AIP's independently collected, analyzed and verified data.

As illustrated on the 2015 AIP Monitoring Well and Seep Sampling Locations map (Figure 3), many of the monitoring wells sampled were clustered in an area near the S, T and U-Landfills. This area has been of special concern because of the uncertainty surrounding the source of groundwater contamination found in this area. Sampling in this area has been focused on determining whether or not there are separate primary or secondary source areas in the vicinity of the solid waste landfills (and the associated old NSDD), or if the contamination is associated with the sources located within the main PGDP central complex (such as the C-400 Building).

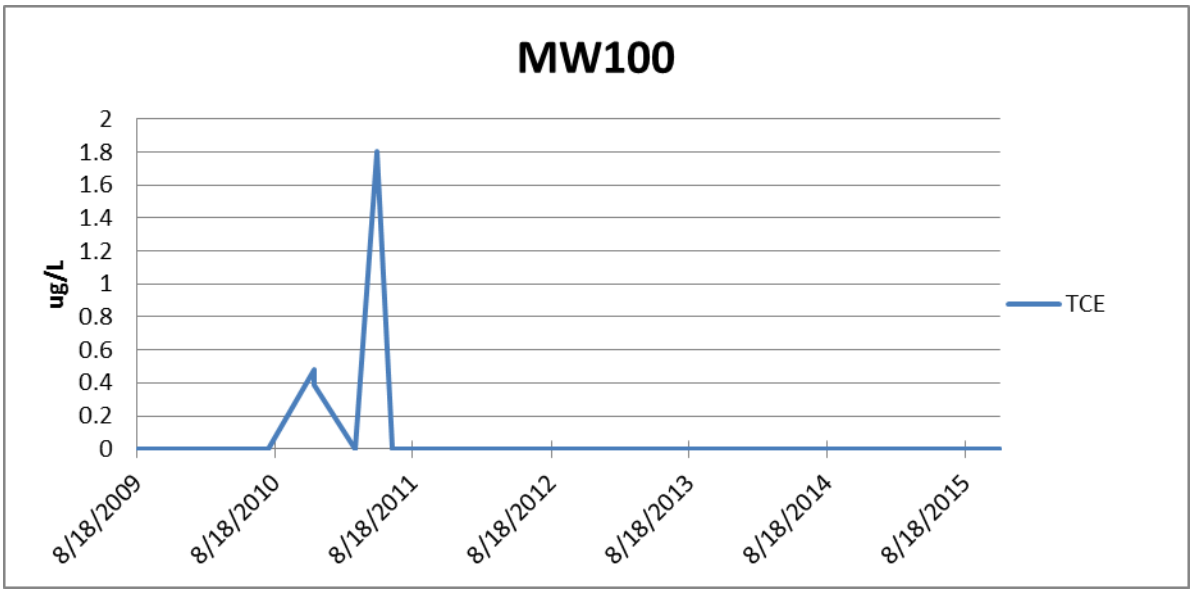


Figure 2. Monitoring Well 100 Sampling Results

MW100 was of special concern due to its close proximity to the eastern edge of the Northeast Plume. MW100 had detections of TCE two of the three times it was sampled in 2010 and 2011. The detections were below the laboratory reporting limit of 1.0 ug/L and the EPA's maximum contaminant limit (MCL) of 5 ug/L, respectively. AIP staff will continue to closely evaluate this particular well over time. 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 a line of evidence to support the general validity of DOE data collection and analysis of contaminant plumes at PGDP 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. Furthermore, AIP independent oversight helps to ensure that isoconcentration contours generated in maps produced by DOE can be verified and relied upon by regulators and the public.

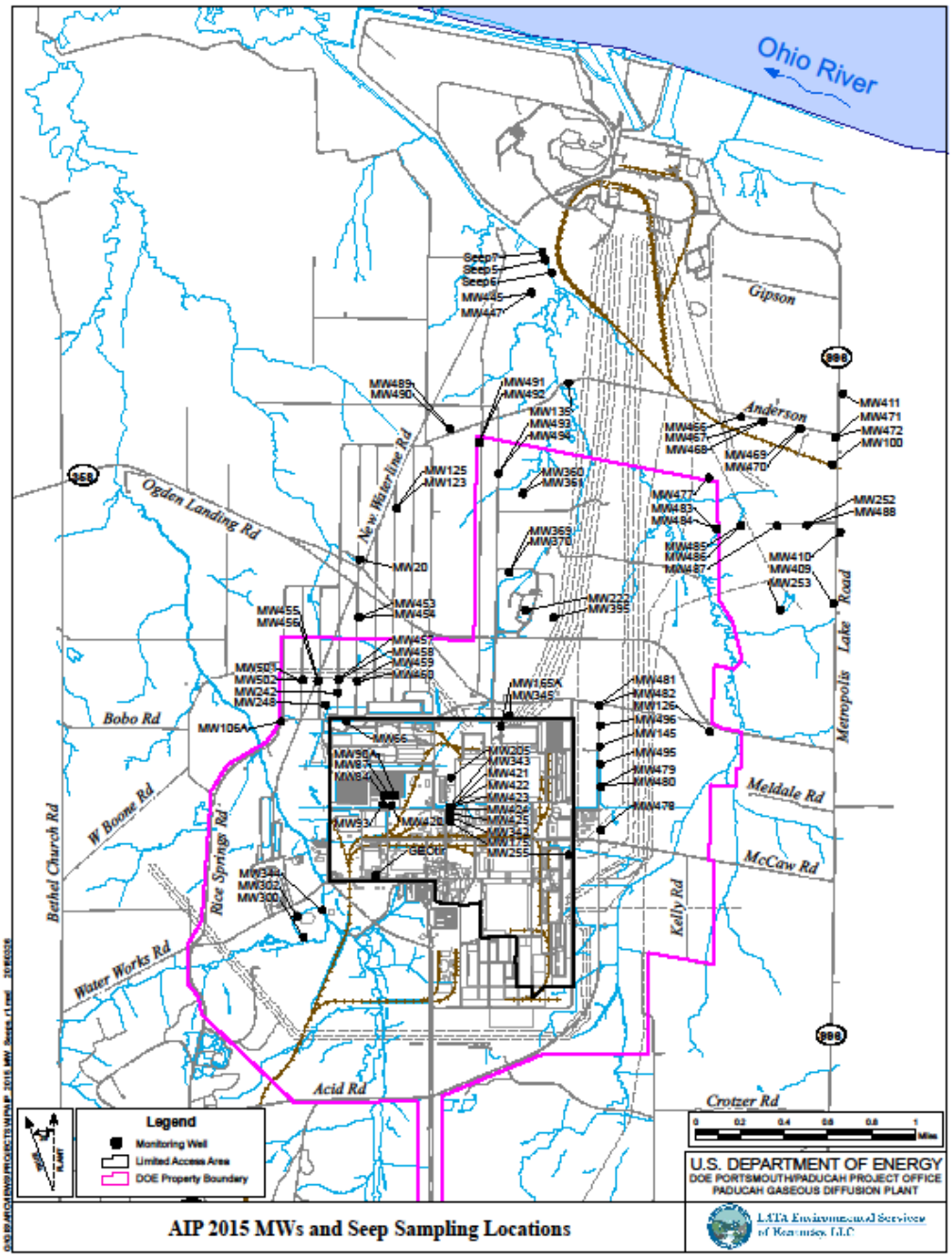


Figure 3. AIP 2015 Monitoring Well and Seep Sampling

Seeps Sampled by Kentucky AIP

Six seeps in Little Bayou Creek (LBC) were added to Kentucky's sampling program in 2002; a seventh seep was discovered and added in June 2007. These seeps are located where groundwater is upwelling in a channelized portion of LBC, along a Porter's Creek Clay exposure. The locations of the seeps can change by several feet after major storm events, when high flow causes changes in depositional features (sand bar shifting) and in the banks of the creek (sloughing). The base flow in LBC is comprised primarily of discharges from plant outfalls. These seeps are located downstream of the Paducah site, 2 miles from the plant and 2 miles from the confluence of LBC and the Ohio River.

Two AIP independent water (seep) samples were collected during 2015 from LBCSP5 for volatile organic compounds. The location can be seen on the 2015 AIP Monitoring Well and Seep Sampling Locations map (Figure 3). Both events had detectable levels of TCE: June 17, 2015, LBCSP5 32 ug/L RL 1.0 and LBCSP7 11 ug/L RL 1.0. A water sample was collected on December 21, 2015 from LBCSP5 at 23 ug/L RL 1.0. Seep 6 was not sampled in 2015.

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

Water levels in wells in the northwest portion of the plant were measured quarterly in 2015. March and September water level studies indicate that the high concentration portion of the plume is captured laterally within the cone of depression of EW 232 and EW 233. The June study was conducted during a time when the pump and treat system had been shut down for several days for modernization and is not representative of normal operating conditions. Water levels were not measured in December because the pump and treat system was again down for modernization.

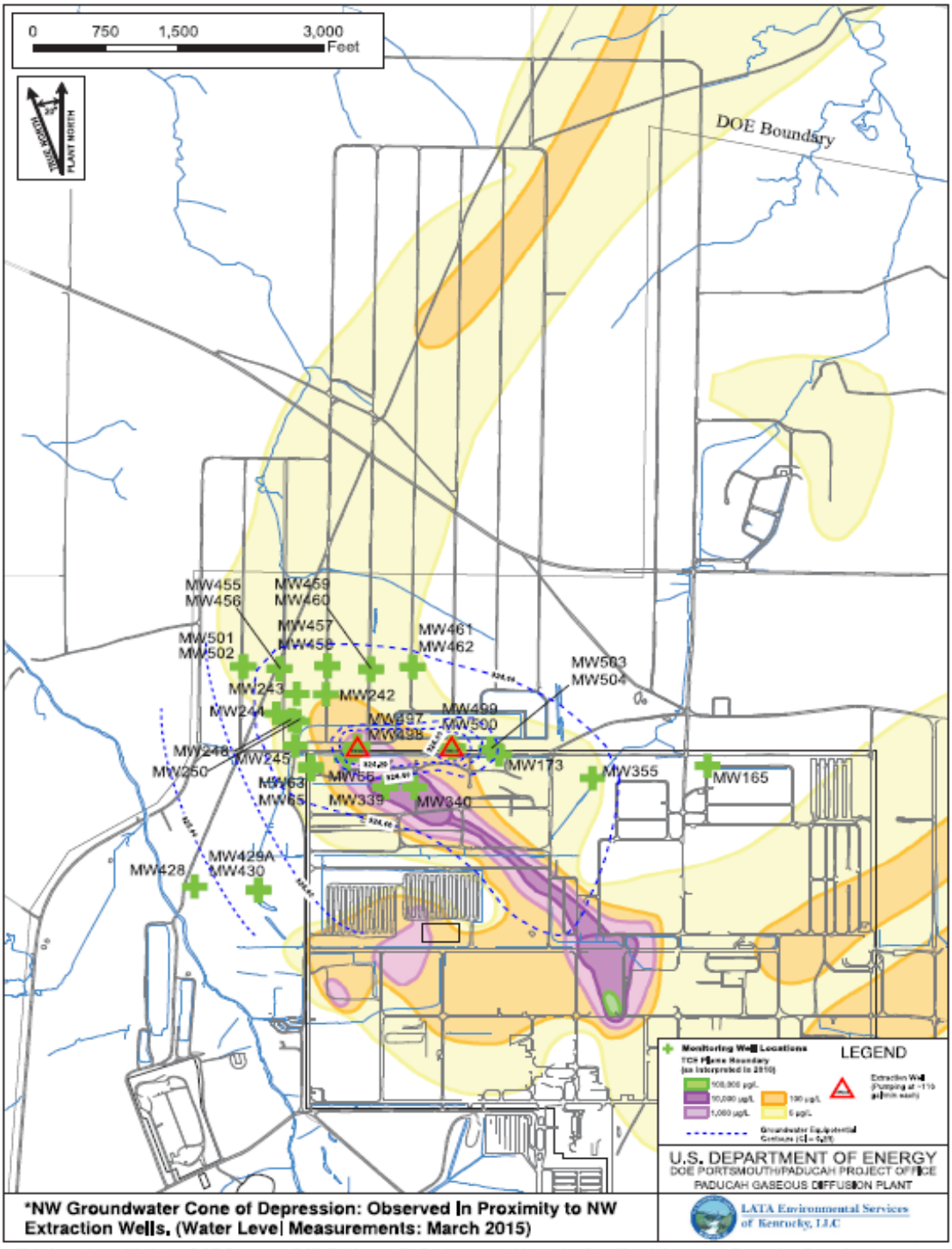
In order to assess whether the high concentration portion of the northwest plume is captured vertically, TCE levels in middle and deep RGA wells proximal to the pump and treat system were compared from 2009 through 2015. The new extraction wells EW 232 and EW 233 went online in August 2010. These wells are located further east of the original EW 230 and EW 231.

The new extraction wells were optimally placed to account for the eastward shifting of the high concentration portion of the plume. The new extraction wells are screened in the upper and middle portions of the RGA.

From 2009 through 2015, lower RGA wells MW 339 and MW 261, located upgradient of the extraction wells, have decreased in TCE concentrations by two and one orders of magnitude, respectively. MW 498, located immediately adjacent to EW 232 has also decreased TCE concentration by two orders of magnitude. During this time MW 456, on the western edge of the plume, downgradient of the extraction wells, decreased TCE concentrations by one order of magnitude. Furthermore, MW 458, MW 460 and MW 454 downgradient of the extraction wells in the centroid of the plume all increased TCE concentrations by an order of magnitude. During the same time period, middle RGA wells MW 243, MW 248 and MW 250, located on the western side of the plume showed concentrations of TCE decreased by one to two orders of magnitude. MW 242, located closer to the centroid of the plume remained unchanged.

MW 66, a shallow RGA well upgradient of the extraction wells decreased in TCE concentration by one order of magnitude. The other proximal shallow RGA wells showed little change in TCE concentrations from 2009 through 2015.

Over the past five years, the concentration of TCE in deep RGA wells upgradient of the extraction wells has decreased rather dramatically. Over the same time period, TCE concentrations in proximal deep downgradient wells have increased. This appears to indicate that the new extraction wells are not entirely capturing the TCE contamination in the deep RGA, resulting in by-pass.



*This figure is modified from DOE Document PAD-ENM-0055/R3 Environmental Monitoring Plan Fiscal Year 2014: Figure C.6 (Page C-29)

Figure 4. March 2015 NW GW Cone of Depression

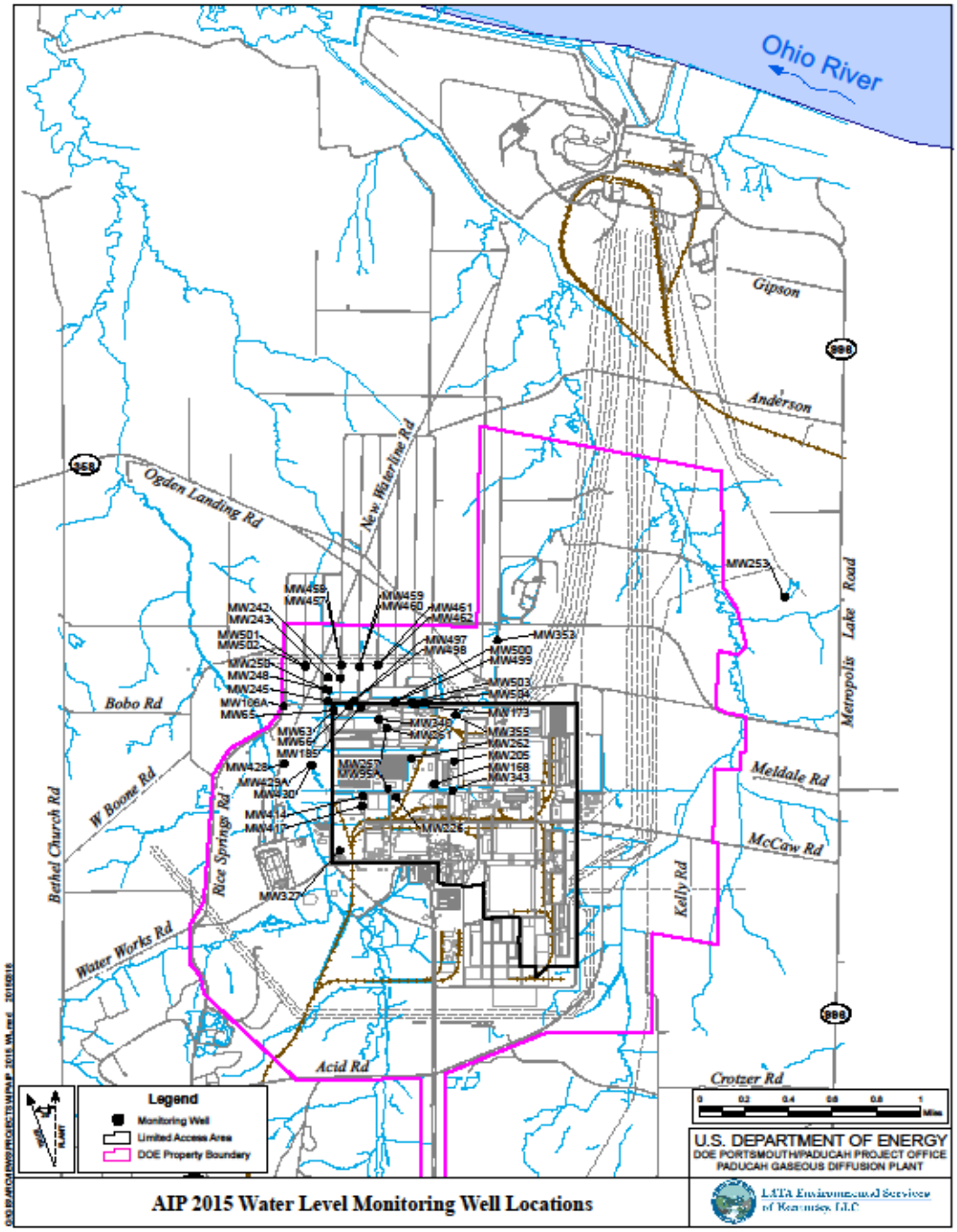


Figure 5. AIP 2015 Water Level Monitoring Wells

AIP Oversight Activities

During 2015 AIP staff observed portions of the PGDP reservation on a weekly basis. Locations within the security fence that were routinely observed included areas adjacent to the process buildings (C-310, C-331, C-333, C-335, C-337), the C-400 Maintenance Facility and ERH unit, the C-410/420 Feed Plant, the C-600 Steam plant and natural gas boilers, 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 observed 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 oversight activity. The following is a short list of oversight activities that were completed in 2015:

- The deep soil mixing project at SWMU 1 was completed in 2015. From March through October AIP conducted 38 visits to the project.

- During demolition of the C410-420 Feed Plant, 53 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 observed two times in 2015 to ensure that they are completely covered with the required tarps.

- The C-746-U Landfill was visited on a weekly basis during the year. The specific areas of the landfill that were observed 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 12 times this year for CHFS.

- A total of 406 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

The C-613 Northwest Storm Water Control Facility (a.k.a. the C-613 Sediment Basin) was constructed 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 Outfall 001 regulatory discharge limits are defined in the Division of Water (DOW) Permit as: Total Suspended Solids (TSS) will not exceed 30 mg/L averaged over a 30-day period, and shall not exceed a pH range of six to nine standard units.

Since sediment basin sampling began in 2003, the sampling regimen has been significantly modified twice. Frequent, non-periodic samples were collected from 2003 to 2007. These sample results identified specific contaminants of concern, provided baseline analyte concentrations and allowed for the determination of trends. After sufficient information was collected, a quarterly sampling regimen was established at the beginning of 2008. This quarterly regimen was performed from 2008 to 2011. Due to the stabilization of reported analyte concentrations as well as budgetary constraints, the sampling regimen was again modified at the beginning of 2012 when the frequency of sample collection was reduced from quarterly to semi-annually. The semi-annual sampling regimen was continued through 2015 and includes one non-discharge sampling event per year to continue assessment of possible changes in contaminant concentrations that sediment basin releases may have on West Kentucky Wildlife Management Area (WKWMA) receptors.

The semi-annual sampling regimen for 2015 is as follows:

First Semi-Annual Sampling Event:

Sediment Basin Inlet, KPDES Outfall 001 and Iron Bridge Sampling Points

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

Second Semi-Annual Sampling Event:

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

Purpose: The second semi-annual event collects samples from the basin inlet (Sediment Basin), outlet (Outfall 001) and at a point (Iron Bridge) where WKWMA recreators can be exposed to Bayou creek water. Samples are always 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 not an active discharge from the Sediment Basin. This sample is referred to as a non-discharge event. This sample is collected during the second semi-annual event as it has historically been a period of both steady rainfall and stream flow. This sampling event was designed to be representative of an average WKWMA recreator's possible contaminant exposure during normal stream flow.

Each sample is analyzed for the following analytes:

Total Suspended Solids (TSS)

Metals, including Uranium and Mercury

Gross Alpha and Beta activity

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

Results: TSS and pH

During the 2015 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 2015. Since completion of the (former) scrap metal removal project, the facility continues to cultivate and maintain a well-developed grass cover. It has been observed that there is a greater absorption of rainfall into the soil due to the vegetative cover and increased soil stability. This effect continues to result in lower sediment

basin turbidity measurements and TSS sample results. Based on a comparison of these sample results and the Outfall 001 discharge requirements, Kentucky concludes that the sediment basin continues to perform its primary design function, which is to comply with DOW KPDES requirements.

Results: Uranium Metal, Uranium radionuclides and alpha and beta

Concentrations of total uranium, uranium isotopes (U-234, U-235 & U-238) and gross alpha and beta readings have been historically and consistently lower at Outfall 001 than in the Sediment Basin. For the first time in the history of sampling the Sediment Basin, the November 24, 2014 discharge sampling event reported that concentrations of uranium metal and the alpha reading were higher at the outlet (Outfall 001) than in the inlet. The concentration of uranium metal was 7% greater and the alpha reading was 26% higher. As the cause of this was unknown, a special sampling event was performed in March of 2015 in an attempt to verify or refute these phenomena. This sampling was also performed to determine if D&D activities at the C-410/420 buildings, completed in June of 2015, contributed to the off-site release of uranium.

The following is a presentation of the 2015 analytical results for the C-613 Sediment Basin:

2015 Special Sampling Event:

Non-Discharge Event Samples Collected on March 24, 2015:

Results for Bayou Creek (upstream sample) and Iron Bridge (downstream sample)

Analyte	Bayou Creek Result	MDL/MDC	Total Uncertainty	Iron Bridge Result	MDL/MDC	Total Uncertainty
Uranium Metal (ug/L)	<1.0	0.23		6.4	0.23	
Gross Alpha (pCi/L)	0.53 (U)	2.20	1.20	5.09	2.31	1.77
Gross Beta (pCi/L)	2.10	0.46	0.424	7.66	0.467	1.04
Uranium-234 (pCi/L)	0.08	0.0738	0.0653	1.70	0.0573	0.301
Uranium-235 (pCi/L)	0.01 (U)	0.0374	0.249	0.08	0.0387	0.0635
Uranium-238 (pCi/L)	0.04	0.0300	0.0401	1.81	0.0572	0.0572

Results for Outfall 001 and Outfall 008 samples:

Analyte	Outfall 001 Result	MDL/MDC	Total Uncertainty	Outfall 008 Result	MDL/MDC	Total Uncertainty
Uranium Metal (ug/L)	10	0.23		8.4	0.23	
Gross Alpha (pCi/L)	7.32	2.09	1.94	4.6	2.15	1.64
Gross Beta (pCi/L)	14.8	0.613	1.78	7.39	0.525	1.03
Uranium-234 (pCi/L)	2.93	0.0306	0.424	2.33	0.0576	0.369
Uranium-235 (pCi/L)	0.228	0.0381	0.109	0.168	0.112	0.104
Uranium-238 (pCi/L)	3.78	0.0751	0.506	2.47	0.0684	0.382

2015 First Semi-Annual Sampling Event:

Discharge Event Samples Collected on May 14, 2015:

Analyte	Inlet Result	MDL/ MDC	Total Uncert	Outlet Result	MDL/ MDC	Total Uncert	Iron Bridge Result	MDL/ MDC	Total Uncert
Uranium Metal (ug/L)	250	0.23		170	0.23		88	0.23	
Gross Alpha (pCi/L)	129	12.4	23.9	85.8	8.80	16.0	61.9	7.20	12.0
Gross Beta (pCi/L)	58.8	2.11	6.7	33.5	1.77	4.09	18.1	1.50	2.53
Uranium-234 (pCi/L)	41.3	0.184	4.35	26.9	0.218	2.99	14.4	0.138	1.73
Uranium-235 (pCi/L)	3.3	0.262	0.864	2.21	0.202	0.654	1.41	0.150	0.448
Uranium-238 (pCi/L)	77.8	0.121	7.44	49.4	0.107	4.92	26.7	0.150	2.80

2015 Second Semi-Annual Sampling Event:

Part 1 Discharge Event Samples Collected on November 17, 2015:

Analyte	Inlet Result	MDL/ MDC	Total Uncert	Outlet Result	MDL/ MDC	Total Uncert	Iron Bridge Result	MDL/ MDC	Total Uncert
Uranium Metal (ug/L)	84	0.23		34	0.23		9.7	0.23	
Gross Alpha (pCi/L)	32.5	2.20	5.46	11.3	2.14	2.88	6.63	1.95	2.18
Gross Beta (pCi/L)	53.4	0.959	5.76	19.3	1.25	2.55	11.7	1.09	1.75
Uranium-234 (pCi/L)	15.2	0.202	1.75	6.68	0.191	0.978	2.13	0.188	0.486
Uranium-235 (pCi/L)	1.24	0.215	0.402	0.503	0.0887	0.247	0.191	0.161	0.156
Uranium-238 (pCi/L)	28.2	0.129	2.87	10.0	0.0711	1.29	2.84	0.0699	0.567

Part 2 Non-Discharge Event Samples Collected on November 24, 2015:

The non-discharge sample was collected when the Sediment Basin was not being actively discharged. Samples were collected at KPDES Outfall 001 (Outlet) and at the “Iron Bridge” sample point, which is considered to be representative of the possible contaminant exposure to an average WKWMA recreator.

Analyte	Outlet (001) Result	MDL/MDC	Total Uncertainty	Iron Bridge Result	MDL/MDC	Total Uncertainty
Uranium Metal (ug/L)	3.9	0.23		2.5	0.23	
Gross Alpha (pCi/L)	1.82	1.77	1.18	1.53	1.44	0.989
Gross Beta (pCi/L)	5.66	1.17	1.17	4.08	1.11	1.02
Uranium-234 (pCi/L)	1.12	0.0691	0.227	0.613	0.0993	0.169
Uranium-235 (pCi/L)	0.0767	0.0644	0.0627	0.0923	0.0673	0.0700
Uranium-238 (pCi/L)	1.25	0.0614	0.217	0.818	0.0720	0.193

Sediment Basin sampling has been performed regularly since the Sediment Basin became operational. The following data was compiled from 2003 to 2015 concerning average uranium concentrations (averaged from all results available for a given year) as well as the annual discharge through the Sediment Basin (in gallons). The average yearly rainfall in the Paducah, Kentucky area is 49.1 inches. Average Uranium (total) concentrations, Sediment Basin discharge volume, annual rainfall and percentage of annual rainfall for each year from 2003 through 2015 are as follows:

2003: Inlet: 346.0 µg/L Outlet: 156.0 µg/L

Annual Discharge: Not Applicable Rainfall: 47.84 inches (97% of Average)

2004: Inlet: 371.0 µg/L Outlet: 206.0 µg/L

Annual Discharge: Partial Year Only Rainfall: 40.66 inches (82% of Average)

2005: Inlet: 458.0 µg/L Outlet: 193.0 µg/L

Annual Discharge: 57,800,000 Gallons Rainfall: 37.45 inches (76% of Average)

2006: Inlet: 454.0 µg/L Outlet: 244.0 µg/L

Annual Discharge: 101,100,000 Gallons Rainfall: 67.11 inches (136% of Average)

2007: Inlet: 276.0 µg/L Outlet: 36.0 µg/L

Annual Discharge: 34,000,000 Gallons Rainfall: 43.33 inches (88% of Average)

2008: Inlet: 338.0 µg/L Outlet: 110.0 µg/L

Annual Discharge: 51,000,000 Gallons Rainfall: 53.69 inches (109% of Average)

2009: Inlet: 439.0 µg/L Outlet: 46.0 µg/L

Annual Discharge: 45,000,000 Gallons Rainfall: 55.60 inches (113% of Average)

2010: Inlet: 176.7 µg/L Outlet: 93.3 µg/L

Annual Discharge: 32,550,000 Gallons Rainfall: 36.67 inches (74% of Average)

2011: Inlet: 188.0 µg/L Outlet: 75.7 µg/L

Annual Discharge: 51,012,000 Gallons Rainfall: 74.85 inches (152% of Average)

2012: Inlet: 196.0 µg/L Outlet: 31.3 µg/L

Annual Discharge: 2,820,000 Gallons Rainfall: 30.06 inches (61% of Average)

2013: Inlet: 78.5 µg/L Outlet: 57.5 µg/L

Annual Discharge: 24,439,000 gallons Rainfall: 60.3 inches (122% of Average)

2014: Inlet: 93.0 µg/L Outlet: 100.0 µg/L

Annual Discharge: 30,663,000 gallons Rainfall: 46.84 inches (95% of Average)

2015: Inlet: 167.0 µg/L Outlet: 71.3 µg/L

Annual Discharge: 42,399,000 gallons Rainfall: 51.77 inches (105% of Average)

Observations:

The data reports that the concentration of uranium metal has historically decreased by roughly two-thirds between the inlet and Outfall 001. The average reduction in the concentrations of uranium for 2015 was approximately half. The decrease in radionuclide activity has historically reported reductions of two-thirds to three-fourths between the inlet and Outfall 001. The average reduction in radionuclide readings for 2015 was approximately half, which is less than historical reductions. Although average inlet concentrations have varied during the thirteen-year reporting period, concentrations of metals and radionuclides at Outfall 001 from 2009 to 2014 generally trended downwards. 2015 reported an 80% increase in outlet concentrations, diverging from this trend. The concentration of uranium during the first semi-annual sampling

event at the Iron Bridge (88.0 µg/L) was the second-highest ever recorded, the highest being (125.0 µg/L) in the fourth quarter of 2008.

The highest reported average inlet concentration was 458.0 µg/L in 2005 and the lowest was 31.3 µg/L in 2012. The highest reported average outlet (Outfall 001) concentration was 244.0 µg/L in 2006, which was at the end of the scrap metal removal project and before the growth of a vegetative cover. The lowest concentration, 31.3 µg/L in 2012, occurred in the driest of the thirteen years of data collection. The average outlet concentration of 71.3 µg/L for 2015 was the fourth-lowest and was also less than the thirteen-year running average of 106.8 µg/L.

Conclusions:

The phenomena of a higher concentration of uranium at the outfall as opposed to the inlet was not repeated in any of the sampling events in 2015, leading to the conclusion that it was a unique event and does not represent a trend. Low concentrations of uranium were reported during the special sampling event at Outfalls 001 (10.0 µg/L) and Outfall 008 (8.4 µg/L), which is the expected norm for the Paducah Site. The increase in the concentration of uranium and radionuclide activity during the first semi-annual sampling event corresponded with the completion of D&D activities at the C-410/420 buildings and heavy rainfall received in March and April of 2015. Based on these results, greater care to reduce exposure of buildings being demolished to rainfall as well as storm water containment should be implemented in future D&D activities.

Based on data analysis and field observations, Kentucky concludes that former Scrap Yard storm water runoff, as well as runoff from D&D activities, continues to contribute to the off-site migration of metals and low-level radionuclides. Data shows that operation of the Sediment Basin has a pronounced effect by reducing concentrations of metals, turbidity and radionuclide activity that leave the site. Therefore, Kentucky believes that operation of the C-613 Sediment Basin should continue.

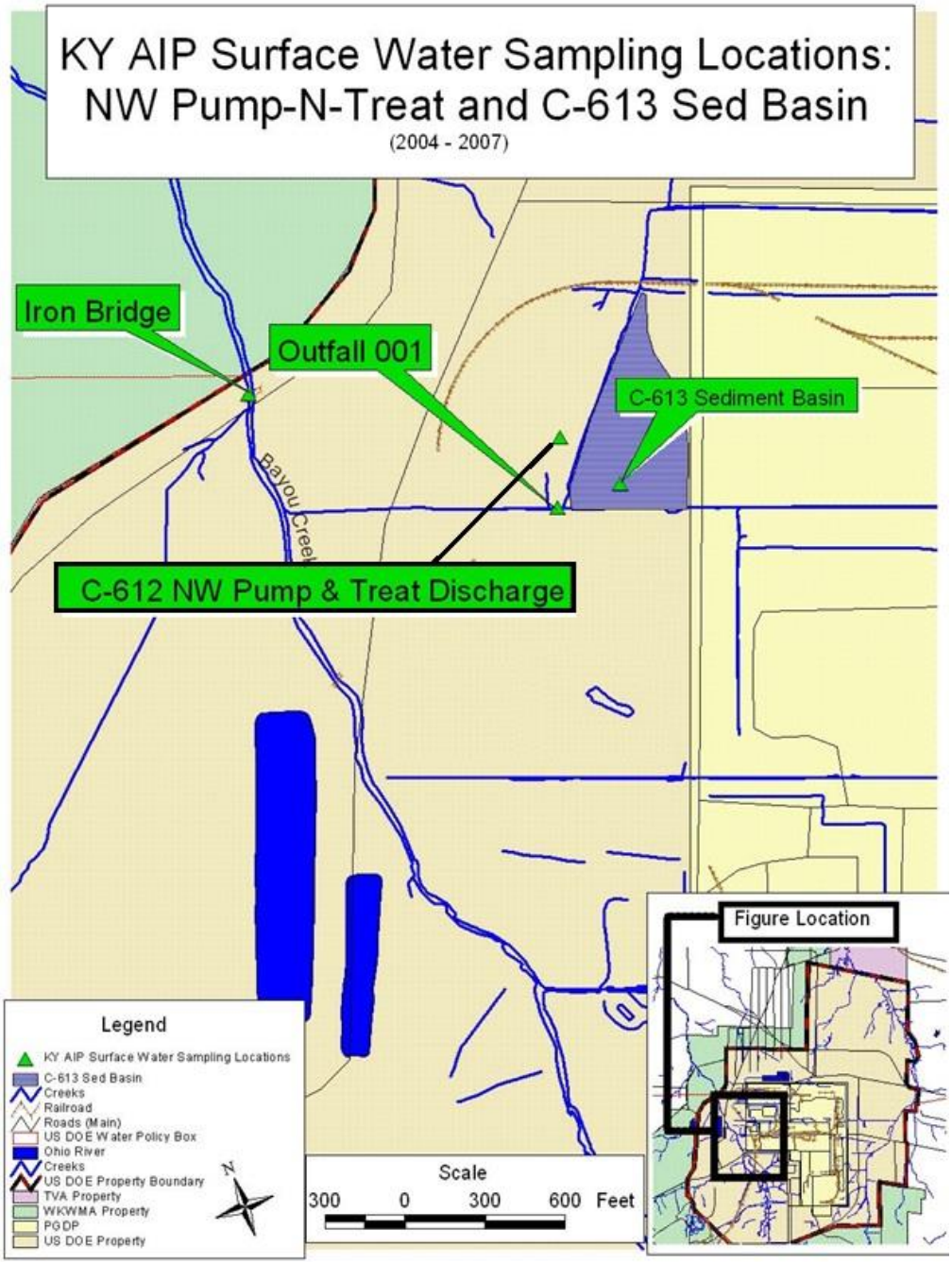


Figure 6. AIP Surface Water Sampling Locations: NW Pump and Treat and C-613 Sed Basin

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 2015, RHB collected 1,704 samples and performed 1606 analyses on those samples. In addition to analyzing samples collected by RHB AIP, an additional 100 samples were analyzed for EEC AIP.

Groundwater

RHB monitors residential groundwater quality (specifically for radionuclides) by collecting quarterly samples at 10 wells surrounding the site (Figure 7). Gross alpha/beta analysis is performed on all the samples, at a minimum. 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 routinely evaluates the results from this activity, along with results from other activities at the site, to determine the need for additional monitoring locations or if any changes in current locations need to occur.

In 2015, there were no abnormal measurements from RHB groundwater monitoring efforts.

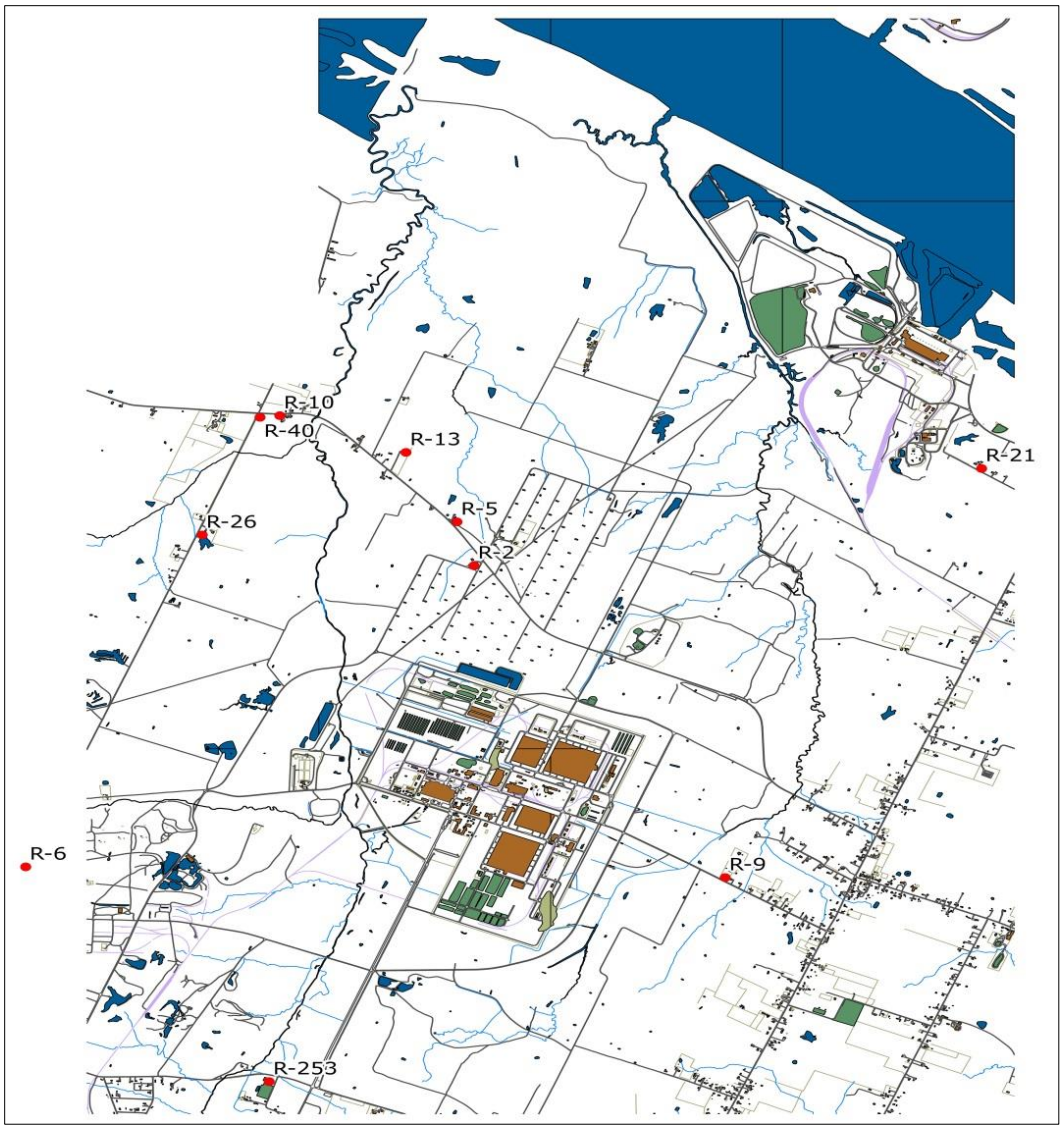


Figure 7. RHB Groundwater Monitoring Locations

Surface Water

RHB monitors surface water by taking quarterly samples at 28 locations surrounding the site (Figure 8) and through continuous sampling (e.g. ISCO) at an additional 4 locations (Figure 9). 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, all year long.

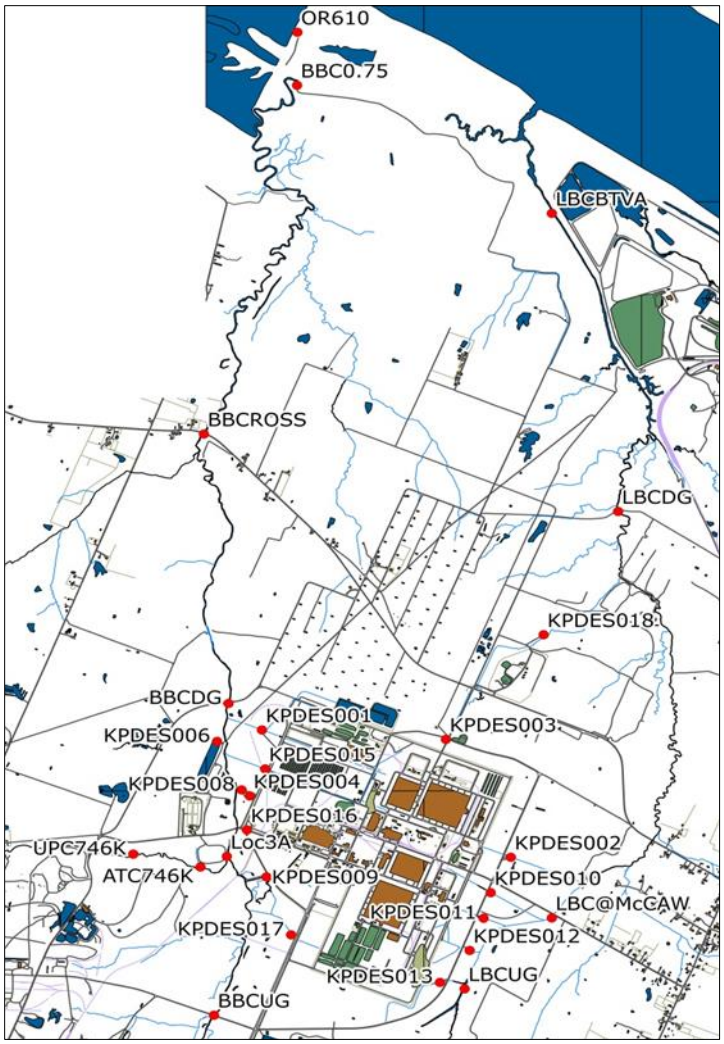


Figure 8. RHB Quarterly Surface Water Sampling Locations

The locations for surface water monitoring were selected based on outfalls from the site, locations of known runoff from contaminated areas, and historical sampling locations. The background monitoring locations 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 at KPDES outfall 020 leaving the C-746-U solid waste landfill in surface water. This contamination was determined to be sourced from recently

removed paneling from the C-340 demolition, that had high levels of surface contamination by a mobile uranium compound (likely uranyl fluoride (UO_2F_2)). In response, RHB began monitoring points along the discharge path from C-746-U, beginning in August 2013. Monitoring was conducted to ensure that effluent release limits were not being exceeded. These levels have decreased since the elevated levels were discovered and have been well below the effluent release limits during 2015. During the 4th quarter 2015, DOE implemented treatment on C-746-U discharges, significantly lowering the levels of contamination. Future results are expected to be comparable to background at current landfill inventory, but monitoring will continue.

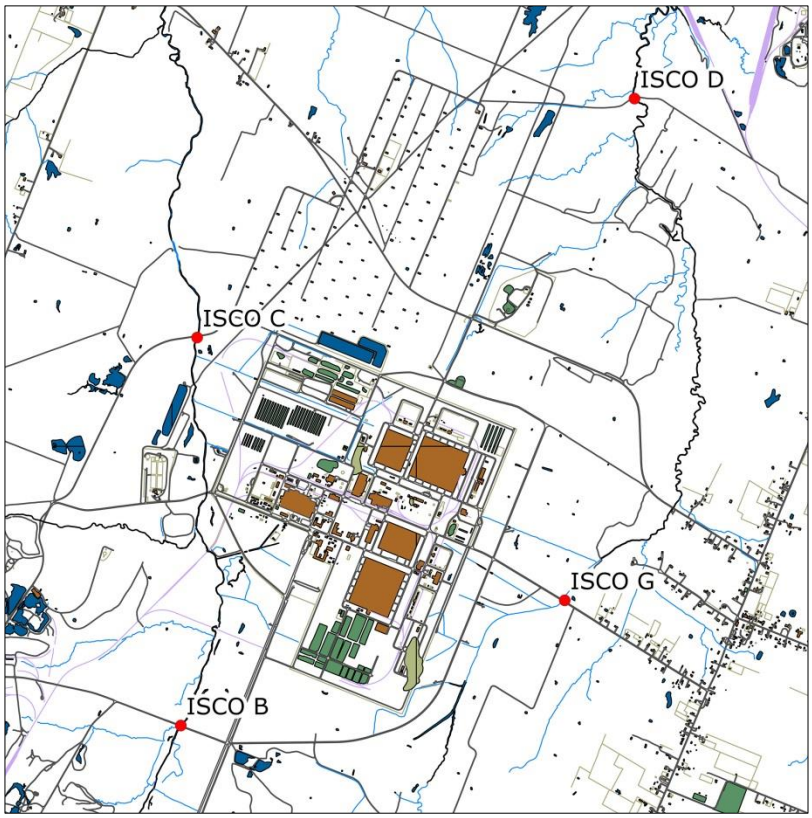


Figure 9. RHB ISCO Sampling Locations

In 2015, there were no abnormal 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 10) collected throughout the year at 21-day intervals. A gross alpha/beta analysis is performed on each filter, and the filters are composited quarterly for isotope specific analyses.

The locations for air monitoring were selected based on prevailing wind direction and expected release points/types from the plant. The background air monitor is 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 routinely evaluates the results from this activity, along with results from other activities at the site, to determine the need for additional monitoring locations or if any changes in current locations need to occur.

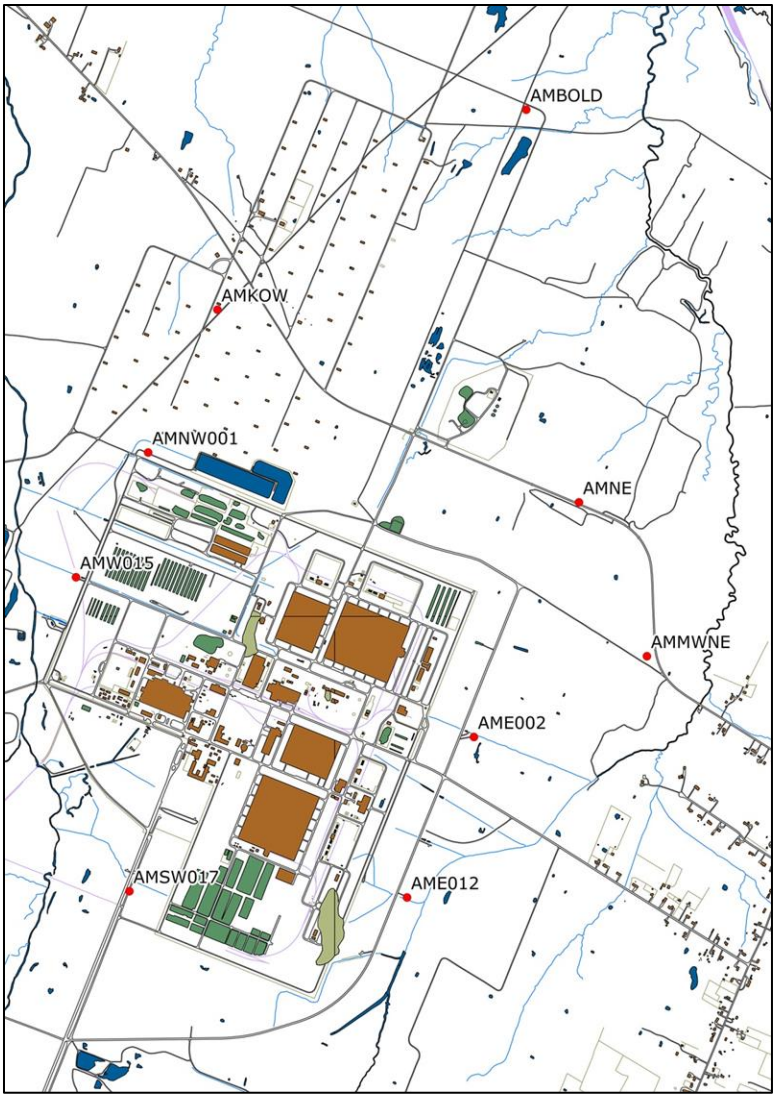


Figure 10. RHB Air Monitoring Locations

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

In 2015, there were no observed abnormal measurements from RHB air monitoring efforts.

Kentucky FFA Program Elements for 2015

Surface Water Operable Unit

The Operation and Maintenance Plan for the Surface Water Operable Unit dealing with signage around contaminated portions of the creeks was received on July 7. Kentucky provided a single comment on October 2, 2015. A D1/R2 version of the document was approved on Oct. 13, 2015.

Surface Water OU Documents reviewed in 2015:

Operation and Maintenance Plan for the Surface Water Operable Unit, *DOE/OR/07-1904&D1/R1*, comment submitted Oct. 2, 2015.

Operation and Maintenance Plan for the Surface Water Operable Unit, *DOE/OR/07-1904&D1/R2*, (replacement pages) approved Oct. 13, 2015.

Groundwater Operable Unit

Northeast Plume Containment System (Pump-and-Treat)

The Northeast plume containment system is operated to contain the higher concentration portions of the Northeast Plume. Two groundwater extraction wells, pumping at a combined average rate of 170 gpm, send water to an air stripper, which treats the water to less than the MCL of 5 ppb trichloroethene. Once it is treated, the water is discharged to a CERCLA outfall that flows to Little Bayou Creek. The extraction wells are located approximately 3000 feet northeast of the PGDP facility, near the crossing of Little Bayou Creek and Ogden Landing Road.

In 2015 the Northeast Plume system pumped 63,277,091 gallons of water from the two extraction wells which resulted in the removal of 111.1 pounds of TCE. Since Northeast Plume pumping operations began on Feb. 28, 1997, more than 3654.7 pounds of TCE have been removed from 1,534,091,477 gallons of extracted groundwater. An operational chart of the

Northeast Plume breaks down the operational efficiency and gallons of water treated during each month in 2015 (Table 2).

In 2013 the FFA parties began a project to optimize the Northeast plume containment system. A Remedial Action Work Plan, an Operation and Maintenance Plan and an Explanation of Significant Difference (to the 1995 Record of Decision) were submitted and commented on. An effluent treatment standard (goal) for Tc-99 became a point of contention and DOE invoked informal dispute in November 2013. Separate disputes on the RAWP and the ESD were combined into one and the issue (Tc-99 treatment standard) was elevated to formal dispute on Feb. 25, 2014. The dispute was eventually resolved July 30, 2015. To satisfy the terms of the dispute resolution, DOE will install a line of seven sentinel wells approximately 400 feet east of C-400 to be routinely monitored for TCE and Tc-99. These wells will provide an early warning in the event that Tc-99 is pulled east (away) from the C-400 area. An early warning system will allow the FFA parties time to develop a solution to that problem before the Tc-99 would make it to the new withdrawal wells.

Month	% Operational	Gallons	Month	% Operational	Gallons
January	90.3	1,004,550	July	100	9,247,700
February	96.4	8,523,200	August	93.5	10,722,900
March	90.3	8,552,650	September	100	9,320,900
April	100	9,864,900	October	100	9,696,333
May	100	10,310,340	November	100	9,205,567
June	100	10,124,160	December	100	9,534,300

Table 2. Northeast Plume Containment System Data

Northeast Plume Optimization Documents Reviewed In 2015:

D2/R1 Record of Decision for Interim Remedial Action at the Northeast Plume – Explanation of Significant Differences *DOE/LX/07*-1291&D2/R1 (Kentucky Conditional Concurrence on 09-30-15)

D2/R2 Record of Decision for Interim Remedial Action at the Northeast Plume – Explanation of Significant Differences *DOE/LX/07*-1291&D2/R2 (Kentucky Approval on 11-17-15)

D2/R1 Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action *DOE/LX/07-1280&D2/R1* (Kentucky Conditional Concurrence on 10-30-15)

Figure 11. Northeast Plume Groundwater Treatment Trailer

Northwest Plume Groundwater System

The northwest plume groundwater system consists of two extraction wells and the C-612 water treatment facility, which are both located at the plant's northwest corner. The pump-and-treat system was optimized in 2010. The optimized system is performing as designed. In 2015 the northwest plume system pumped 113,114,257 gallons of water from the two extraction wells which resulted in the removal of 1505.2 pounds of TCE. Since northwest plume pumping operations began on Aug. 28, 1995, more than 39,840.3 pounds of TCE has been removed from 2,007,339,997 gallons of extracted groundwater. An operational chart of the northwest plume breaks down the operational efficiency and gallons of water treated during each month in 2015 (Table 3).

In May and June and again in November and December, the twenty-year-old C-612 northwest plume treatment system was temporarily shut down for refurbishment. In the spring the computer operating system was replaced and new carbon beds were installed. Obsolete equipment was also removed. In the winter all of the PVC piping was replaced and the Tc-99 treatment system was changed to an exterior skid-mounted system, housed in a trailer outside of the building, to make changing out the beds easier. Upgrades to the NW Plume treatment system were conducted under the O&M Plan.

Month	% Operational	Gallons	Month	% Operational	Gallons
January	90.3	8,078,975	July	100	8,320,790
February	92.8	7,543,035	August	100	8,875,740
March	93.5	7,627,290	September	100	8,091,670
April	83.3	6,427,330	October	100	8,734,820
May	38.7	3,284,780	November	56.6	4,786,580
June	6.6	402,700	December	0	0

Table 3. Northwest Plume Groundwater System Data

Northwest Plume Groundwater System Documents Reviewed In 2015:

No documents were submitted for review in 2015.

Southwest Plume Sources

SWMU 1 C-747-C Oil Landfarm

Deep soil mixing using a large (8-ft) diameter auger, followed by steam and zero-valent iron injection commenced on April 10 at the SWMU 1 oil landfarm. The purpose of the project was to remove organic solvents (primarily TCE) from soil to a depth of approximately 60 feet bgs. A large crawler crane and drilling platform turned eight feet diameter augers to a depth of 60 feet while injecting steam and hot air. Off-gas from the mixing project was captured and a vacuum was achieved on the soil column beneath a 12-ft diameter containment shroud. Off-gas was treated with activated carbon to remove volatile organic compounds prior to discharge into the atmosphere. After steam injection, a zero-valent iron slurry was injected into the ground as the augers were being withdrawn, to treat any residual volatile organic solvents. The last of 258 large diameter borings was completed on October 8, 2015. Following treatment, the near-surface soils were mixed with quick lime, which acted as a stabilizing amendment. Heavy equipment was used to regrade the treatment area and replace the approximately four feet of soil, which was set aside prior to mixing. Post treatment sampling to verify the VOC concentrations remaining in the soil is scheduled for spring 2016 to allow the subsurface soil to cool.

Figure 12. Deep Soil Mixing at SWMU 1

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

In Feb. 2015, DOE submitted a remedial design work plan addendum for additional characterization of water samples taken at five foot intervals through the RGA at six locations, five in SWMU 211-A and one in 211-B. The addendum also included the decision rules for use to evaluate the data. Kentucky approved the addendum on Mar.4. Field work was conducted in June. The addendum to the final characterization report was submitted by DOE on Dec. 11. The

revised letter notifying EPA and Kentucky of DOE's preferred alternatives for SWMU 211A and B was submitted on Dec.17. The investigation concluded that for SWMU 211-A the conceptual site model (CSM) is valid. DOE recommended implementing bioremediation and long term monitoring at 211-A. For 211-B the CSM was found to be invalid because of the potential for DNAPL in the upper RGA. The Southwest Plumes Sources ROD only addresses VOCs in UCRS soils and shallow groundwater. The TCE concentrations found at 211-A, in the upper RGA, indicates an upgradient UCRS source that originates under the C-720 building or the upgradient source could be from 211-B. The active remediation (enhanced bioremediation) proposed in the current ROD, would not be effective against DNAPL in the RGA. The FFA parties plan to hold discussions on the path forward for 211-A and B in 2016.

Southwest Plume Sources Documents Reviewed in 2015:

D2/R2/A1 Addendum to the Remedial Design Work Plan for SWMUs 1, 211A and 211B Volatile Organic Compound Sources for the Southwest Groundwater Plume Sampling and Analysis Plan *DOE/LX/07-1268&D2/R2/A1* (Kentucky Approved on 03-04-15)

Groundwater Remedial Action – C-400 Building

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

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 remove volatile contaminants such as TCE from the subsurface. ERH was first demonstrated at PGDP during a treatability study in 2003 where approximately 1,900 gal of TCE was removed in the vicinity of a historic pipeline leak associated with C-400. During Phase I of the C-400 remediation project, ERH proved to be well suited to remediating contaminated soils near the surface; however, the technology was found to be less effective within the deeper portions (60 to 100 ft. bgs) of the contaminated Regional

Gravel Aquifer (RGA). When it became clear that another approach was needed to address TCE present in the deeper portions of the RGA a decision was made to divide Phase II of the C-400 remedial action into two parts. In 2014 ERH operations conducted during Phase IIa effectively treated near-surface contaminated soils by removing over 1,100 gal of TCE.

DOE chose to undertake a treatability study of steam enhanced extraction (SEE) in a small uncontaminated area located adjacent to the C-400 Phase IIB treatment area. The treatability study was developed during a collaborative approach in order to determine if steam will advance through the RGA enough to effectively and economically remove TCE within the lower RGA.

Phase IIb

The D2 Treatability Study Work Plan for Steam Injection (Phase IIb) includes the installation and operation of one steam injection well along with multiple temperature sensors spatially located around the injection well. The treatability study was designed "to observe the movement and distribution of steam using varying injection depths, rates, and pressures and provide data to refine the estimates of permeability, anisotropy/heterogeneity, and local extraction (well spacing, locations, steam injection rates, and timing) to assess the technical implementability and cost-effectiveness of steam injection." Data collected during the Phase IIb treatability study will be inserted into multiple 2-D and 3-D computer models to evaluate variations in SEE design components necessary to optimize and predict full-scale SEE implementation, if warranted. The Phase IIb treatability study began April 9 and was completed on June 30. The D1 Treatability Study Report was submitted Dec.21.

C-400 IRA Documents Reviewed In 2015:

D1 Treatability Study Report for the C-400 Interim Remedial Action Phase IIB Steam Injection Treatability Study *DOE/LX/07-2202&D1* (Dated 12-21-15)

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: SWMU 2, the C-749 Uranium Burial Ground; SWMU 3, the C-404 Low-Level Radioactive Waste Burial Grounds; SWMU 4, the C-747 Contaminated Burial Yard and C-748-B Burial Area; SWMU 5, the C-746-F Burial Yard; SWMU 6, the C747-B Burial Grounds; SWMU 7, the C-747-A Burial Grounds and Burn Area; SWMU 9, the C-746-S Landfill; SWMU 10, the C-746-T Landfill; SWMU 30, the C-747-A Burial Grounds and Burn Area and SWMU 145, the 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

On January 26, 2015 Kentucky conditionally concurred with the *Proposed Plan for SWMUs 5 and 6*. The single condition required that land use controls include an environmental covenant, meeting the requirements of Kentucky Uniform Environmental Covenant laws, be filed at the time of property transfer. DOE elevated the dispute to an informal level on March 27, 2015. Because it was a legal issue that could not be resolved informally, the dispute was elevated to formal status on May 1, 2015. It remained in formal dispute through the end of the year.

SWMUs 2, 3, 7 and 30

On Feb. 2, 2015, Kentucky issued additional conditions on the *D2 Feasibility Study for SWMUs 2, 3, 7 and 30 of the Burial Grounds OU*. These conditions required that land use controls include an environmental covenant, meeting the requirements of the Kentucky Uniform Environmental Covenant laws, be filed at the time of property transfer. On March 27, 2015, DOE invoked informal dispute on several of Kentucky's and EPA's conditions. These included the timing of the installation of the riprap intruder barrier on SWMUs 2 and 3, RCRA Subpart F

groundwater monitoring requirements ARARs, Corrective Action Management Unit ARARs, inclusion of alternatives that do not treat principle threat waste, waste description and discharge of wastewater and effluent limits for radionuclides, SWMU 3 releases and Alternative 3, and containment, surface controls, LUCs and monitoring for SWMU 2. The Feasibility Study remained in informal dispute until December 22, when DOE elevated the following conditions to formal dispute: environmental covenant under Kentucky UECA and land use controls, discharge of wastewater and radionuclide effluent limits and RCRA Subpart F groundwater monitoring requirements ARARs.

SWMU 4

SWMU 4 is being investigated using a phased approach to sample collection, with each subsequent phase being informed by the preceding one. April 14, 2015 was the Phase 4 field start for ten deep soil borings to the base of the Regional Gravel Aquifer. The first seven borings were installed and sampled with a quick turnaround time for sample results. This data helped to inform the placement of the last 3 borings. EPA and Kentucky gave permission to use direct push technology to do the deep soil borings; however, this did not prove to be successful because of the makeup of the RGA (problems with flowing sands).

Meetings were held in September and October to review the new Phase 4 data and plan the locations for the Phase 5 monitoring wells and test pits. Field work on the four Phase 5 monitoring wells began on November 3 and continued until mid-December. Excavating test pits in the burial pits is scheduled to begin in January 2016.

BGOU Documents Reviewed in 2015:

No BGOU documents were reviewed in 2015.

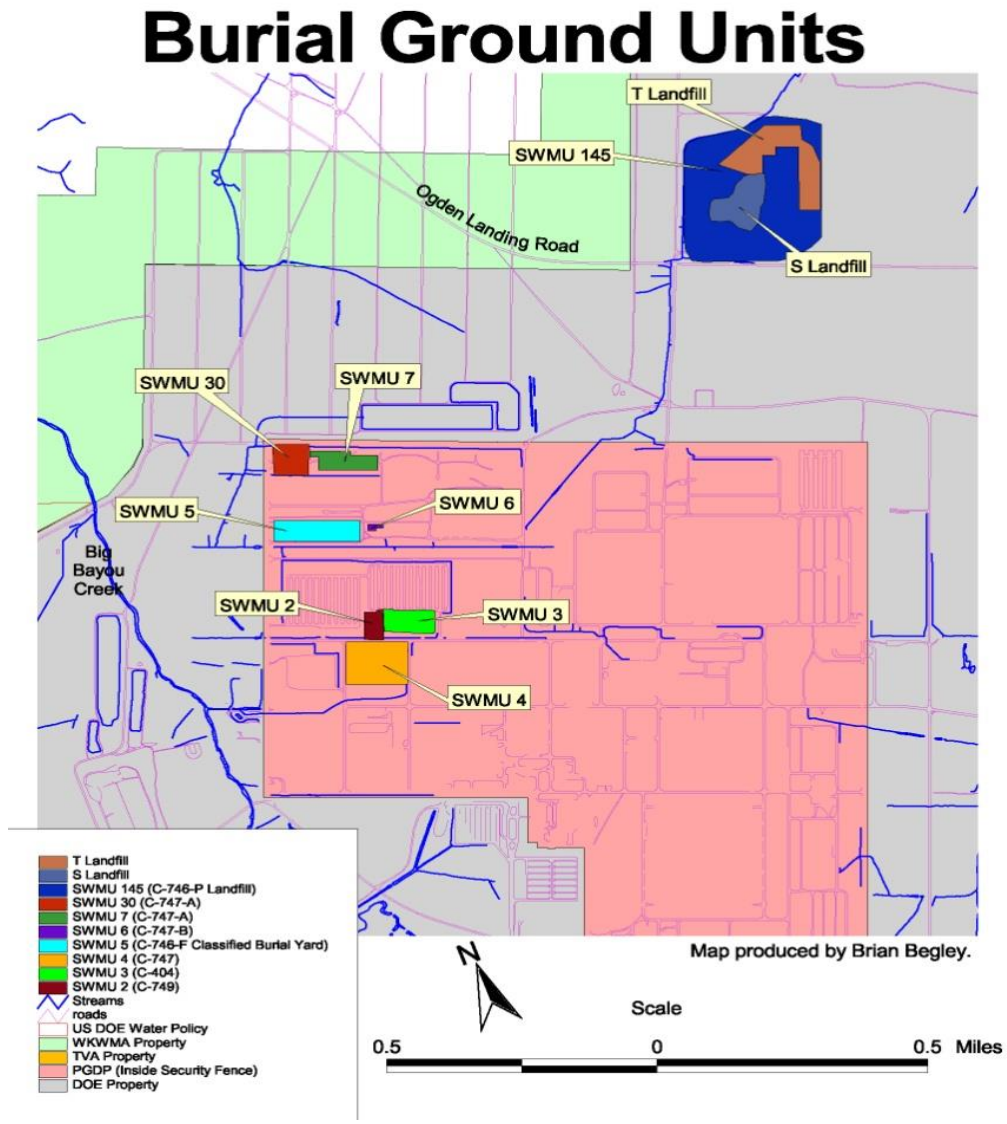


Figure 13. Burial Ground SWMUs

Soils Operable Unit

When the Soils OU RI1 was approved and shelved in 2013, it was planned that the 16 Soils SWMUs that required additional characterization would be the subject of a second RI. This project and the Sitewide Investigation were recognized as projects that could be expedited if additional funds became available. In 2014 additional funding became available, so scoping and field work was completed on these projects.

The *Soils Operable Unit Remedial Investigation 2 Report* D1 was issued on July 6. Kentucky provided comments on Sept. 30. Comment resolution meetings were held on Dec. 17 and 18.

Field work under the *Sitewide Evaluation Work Plan for Anomalies Located Outside the Limited Area* wrapped up in January 2015. The *Sitewide Evaluation Report for the Soils Operable Unit* D1 was issued on May 12, 2015. Kentucky provided comments on June 9, 2015. A D2 version of the report was issued on June 23. Kentucky conditionally concurred with the D2 report on July 17. A D2/R1 report was issued on July 23. Kentucky concurred with the document on July 24.

SWMU 27, an underground storage tank beside the C-720 building was opened and sampled according to the *Addendum to the Work Plan for the Soils OU RI/FS Remedial Investigation 2 Sampling and Analysis Plan.* The tank was sampled Feb.5. An *Addendum to the Soils OU Remedial Investigation Report for SWMU 27* was issued Sept. 17. Kentucky provided comments on Dec. 10.

Soils Operable Unit Documents Reviewed in 2015:

Sitewide Evaluation Work Plan for Anomalies Located Outside the Limited Area, *(DOE/LX/07-1256&D1)* Kentucky provided comments June 9.

Sitewide Evaluation Work Plan for Anomalies Located Outside the Limited Area, *(DOE/LX/07-1256&D2)* Kentucky conditionally concurred July 17.

Sitewide Evaluation Work Plan for Anomalies Located Outside the Limited Area, *(DOE/LX/07-1256&D2/R1)* Kentucky concurred July 24.

Soils Operable Unit Remedial Investigation 2 Report, *(DOE/LX/07-2306&D1)* Kentucky provided comments on Sept.30.

Addendum to the Soils OU Remedial Investigation Report for SWMU 27, *(DOE/LX/07-0358&D2/R1/A1)* Kentucky provided comments on Dec. 10.

Decontamination and Decommissioning Operable Unit

The Pre-GDP Decontamination and Decommissioning (D&D) Operable Unit has addressed 32 inactive facilities at the Paducah site, some of which have been out of service for decades. The C-410/420 Complex is the last of the inactive facilities to be addressed under this Operable Unit.

C-410/420 Complex Infrastructure D&D

The C-410/420 complex was brought down to slab in 2015. When contaminated storm water collected in subgrade (basement) areas some work was delayed until the FFA parties could agree on appropriate treatment standards for this storm water. The Removal Action Work Plan had neither anticipated nor provided for this event. The FFA parties agreed upon a treatment method and determined appropriate standards for discharge of the treated storm water. The FFA parties continue to work toward agreement for treatment levels for radionuclide contaminated wastewater and storm water for future CERCLA response actions at the site.

Figure 14. C-410/420 slab after demolition

The vast majority of the demolition debris generated during this project was characterized as low-level radioactive waste; and was shipped off-site. According to the approved Removal Action Work Plan the C-410/420 complex foundation and slab will be addressed under a future CERCLA response (Soils and Slabs Operable Unit). Flowable fill was utilized to bring subsurface features such as basements and sumps to grade. A sealant/fixative was applied to the slab and filled areas.

Finalization of all completion documentation for the C-410/420 complex and the D&D Operable Unit is scheduled for CY 2016.

Waste Management

Waste Disposition Alternatives (WDA) Project

During the next several decades large quantities of waste will be generated at the Paducah site. 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 Paducah site during the remaining 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 WDA 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.

In May of 2014, DOE initiated an informal dispute in response to certain conditions imposed by Kentucky and EPA that would need to be met prior to approval of the feasibility study. The FFA parties then spent the remainder of the year working collaboratively in an attempt to resolve the disputed conditions. The FFA parties successfully resolved three of Kentucky's conditions during CY 2014. KY/EPA conditions on RCRA groundwater monitoring citations and an EPA position on Corrective Action Management Unit (CAMU) specifics were not resolved in 2014.

Informal dispute resolution efforts in CY 2015 did not yield a resolution, and the dispute has been elevated to formal status, where resolution efforts continue into CY 2016. In the summer of 2015 an effort was undertaken on Sites 5A and 11 to determine if a TSCA variance would be needed. Piezometers were installed at both locations and depth to shallow groundwater was measured.

Following 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. If the preferred alternative is on-site disposition of PGDP CERCLA waste, then DOE will also propose a single location for construction of an on-site waste repository

Waste Disposition Alternatives Documents Reviewed in 2015:

No WDA documents were reviewed in 2015.

Solid Waste Management Units (SWMUs)

During the reporting period from Jan.1 to Dec. 31, 2015, Kentucky received eleven revised SARs (SWMU Assessment Report). Kentucky granted No Further Action (NFA) status for two SWMUs during 2015. Five SARs remain under review. 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. A summary of SWMU activity performed during 2015 is presented below.

REVISED AND NEWLY-DISCOVERED SWMU ASSESSMENT REPORTS SUBMITTED TO KENTUCKY BETWEEN JANUARY 1 AND DECEMBER 31, 2015

SWMU No.	Description	OU Location	Sub-project	Status	SAR Report Date	Date(s) SAR Amended	Date of NFA or RFI
3	C-404 Low Level Radioactive Waste Burial Ground	BGOU & TSD	Remedial & Permitted	Requires RFI	8/24/87	3/31/03 11/7/14	Under Review
32	C-728 Clean Waste Oil Tanks	Soils & Slabs OU	N/A	Requires RFI	8/24/87	6/2/15	Under Review
33	C-728 Motor Cleaning Facility	Remaining D&D & Soils & Slabs OU	N/A	Requires RFI	8/24/87	6/2/15	Under Review
90	C-720 Petroleum Naphtha Pipe	N/A	N/A	NFA	12/1/14	N/A	1/14/15
102A	Plant Storm Sewer - between the south side of the C-400 Building and Outfall 008	N/A	N/A	NFA	11/20/91 (Original SAR for 102)	11/14/14 (SAR Creation)	1/14/15
102B	Plant Storm Sewer associated with C-333-A, C-337-A, C-340, C-535 and C-537	SWOU	Removal Action	Requires RFI	11/20/91 (Original SAR for 102)	11/14/14 (SAR Creation)	1/14/15
194	McGraw Construction Facilities (Southside)	Soils OU & D&D OU	Remedial & DUF_6	Requires RFI	7/6/93	8/28/03 12/1/14	1/14/15
211A	C-720 TCE Spill Site Northeast	GWOU & Soils OU	SW Plume Sources & Remedial	Requires RFI	6/8/99 (Original SAR for 211)	11/14/14 (SAR Creation)	1/14/15
211B	C-720 TCE Spill Site Southeast	GWOU & Soils & Slabs OU	SW Plume Sources & N/A	Requires RFI	6/8/99 (Original SAR for 211)	11/14/14 (SAR Creation)	1/14/15
477	C-340 Metals Plant	Remaining Soils & Slabs OU	N/A	Requires RFI	7/18/01	9/14/01 11/14/01 7/23/15	Under Review
526	Internal Plant Drainage Ditches (Includes KPDES 016)	SWOU	Removal Action	Requires RFI	2/18/02	7/23/15	Under Review

SOLID WASTE MANAGEMENT UNITS THAT KENTUCKY GRANTED NO FURTHER ACTION STATUS BETWEEN JANUARY 1 AND DECEMBER 31, 2015

SWMU Number	Description	OU Location	Sub-project	Status	SAR Report Date	Date(s) SAR Amended	Date of NFA
90	C-720 Petroleum Naphtha Pipe	N/A	N/A	NFA	12/1/14	N/A	1/14/15
102A	Plant Storm Sewer - between the south side of the C-400 Building and Outfall 008	N/A	N/A	NFA	11/20/91	11/14/15	1/14/15

SWMU DOCUMENTS REVIEWED IN 2015

Revised SAR for SWMUs 32 and 33 received July 2.

Revised SARs for SWMUs 477 and 526 received July 23.

The SAR for SWMU 90 should have been submitted with the original August 24, 1987 SARs 1 to 96 submittal. After extensive efforts by both the DOE and Kentucky, no SAR for SWMU 90 was found. The DOE submitted a "newly-discovered" SAR for SWMU 90 on December 1, 2014, which was granted No Further Action on January 14, 2015.

SWMU 102 was split into SWMUs 102A and 102B in a submittal dated November 14, 2014 based on additional data and information gained during site investigations. SWMU 102A was granted NFA and SWMU 102B was assigned to the Surface Water Operable Unit – Remedial Action subsection in a letter dated January 14, 2015.

As of the end of the reporting period, five Revised SARs are under review, and a decision concerning their status is expected in January of 2016.