Commonwealth of Kentucky

Environmental Oversight Report 2019
Paducah Gaseous Diffusion Plant

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This 2019 Environmental Oversight Report, finalized in June 2020, 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, 2019, to Dec. 31, 2019. 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, 300 Sower Blvd., Frankfort, Kentucky 40601, phone 50-782-6317.

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Introduction

In July 2013, the Paducah Gaseous Diffusion Plant (PGDP) ended over 60 years of continuous uranium enrichment 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, deactivation, decontamination, and decommissioning. The PGDP is located on a 3,556-acre federal reservation in northwestern McCracken County, Kentucky. Most of the historical and ongoing operations at the PGDP occur within a footprint the size of approximately 750 acres. This area is surrounded and bounded by the West Kentucky Wildlife Management Area (WKWMA) to the north, east and west. Since construction, the PGDP has been owned by the DOE or its predecessor U.S. government agencies. The United States Enrichment Corporation (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 with the implementation of various activities at the site. Four Rivers Nuclear Partnership was the deactivation and environmental remediation contractor during calendar year (CY) 2019.

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 analyses have detected concentrations of primarily trichloroethene (TCE) and Technetium-99 (Tc-99), a radioactive by-product of historic PGDP process operations. Soil and sediment sampling analyses have detected the presence of polychlorinated biphenyls (PCBs) and uranium. In addition, historic surface water studies have documented polychlorinated biphenyl (PCB) concentrations in fish collected from both, Bayou Creek to the west of the site, and Little Bayou Creek to the east of the site.

Site cleanup activities are prioritized and sequenced in the fiscal year (FY) 2018/2019 Site Management Plan (SMP). Activities will focus on additional environmental investigations to determine if any impacts to the environment have occurred in areas within the 750 acres that have yet to be investigated or were previously inaccessible. C-400 Complex Operable Unit (OU) scoping activities, pertaining to the development of the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (WP), was the primary environmental focus during 2019.

At the PGDP, media-specific operable units (OU) were established by developing a site conceptual risk model for each solid waste management unit (SWMU) and Area of Concern. This process included a qualitative evaluation of contaminant types and concentrations, release mechanisms, likely exposure pathways, estimated points of exposure, and potential receptors. Potential receptors included current and reasonably foreseeable future land-use assumptions in the evaluation.

The OUs (based on the 2018-2019 SMP) identified for the PGDP are:

- C-400 Complex OU
- Groundwater OU
- Surface Water OU
- Soils OU
- Soils and Slabs OU (note: contains 17 Geographical Areas (GA))
- Burial Grounds OU
- Decontamination and Decommissioning (D&D) OU (Pre-GDP Shutdown)
- Decontamination and Decommissioning OU (Remaining Balance of Facilities)
- Lagoons OU
- Depleted Uranium Hexafluoride (DUF_6) Footprint Underlying Soils OU (DUFUS)
- CERCLA Waste Disposal Alternatives Operable Unit
- Comprehensive Site Operable Unit (CSOU)

A new addition to the Soils and Slabs OU is the “GA Concept” which is comprised of 17 areas to plan and group the actions that will address the remaining balance of plant soils and slabs. A final Comprehensive Site OU evaluation will occur at PGDP following completion of the remaining OUs.

Public Engagement

Citizens Advisory Board

The Paducah Citizens Advisory Board (CAB) is a stakeholders' board that provides advice and recommendations to DOE regarding environmental management programs at the PGDP. It is their responsibility to represent and communicate the views of their community as well as keep

the public informed on key issues, upcoming decisions and board recommendations. Kentucky's Division of Waste Management (DWM) and Cabinet for Health and Family Services (CHFS) are non-voting (ex-officio) members that serve as advisors and inform the CAB on their respective agencies' policies and views. The CAB is a local board organized under the umbrella charter of the Office of Environmental Management Site-Specific Advisory Board, whose activities are governed by the Federal Advisory Committee Act (FACA). The website for the Paducah CAB can be found at: https://www.energy.gov/pppo/pgdp-cab/paducah-citizens-advisory-board.

Full board CAB meetings and CAB educational meetings are held on alternating months the third Thursday of every month. Multiple representatives from Kentucky (AIP and FFA) were present at every meeting in 2019. The full board and educational meetings allow for meaningful interaction between the CAB board members and any members of the general public that attend. Kentucky's FFA Manager is an ex-officio member of the CAB.

Oversight Newsletter

The Kentucky Department for Environmental Protection (KDEP) Paducah Site Section releases periodic newsletters titled *Oversight News*. The newsletters are an effort to better inform the public and stakeholders about available resources and significant updates at the Paducah Site. Major features in the newsletters cover topics such as communication efforts by DOE and Kentucky's Energy and Environment Cabinet (EEC), Radiation Health Branch (RHB) monitoring, updates on the northwest and northeast plumes, historical actions and future planning for the C-400 Complex, and activities held at the WKWMA surrounding the PGDP. The newsletter also features Paducah Site Section staff changes whenever applicable.

Kentucky's Oversight Program

The Commonwealth of Kentucky is responsible for overseeing the environmental cleanup of the PGDP. The 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 the Commonwealth of Kentucky. The CHFS RHB has radiation authority for the Commonwealth of Kentucky, and also serves a critical role in implementing these two oversight programs.

State agencies and other organizations assisting the HWB and RHB with various types of activities and 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)
- Division of Environmental Program Support Lab
- Radiation Health Branch Radiation/Environmental Monitoring Section
- Program Planning and Administration Branch

For the purposes of this report, all references to activities conducted by the Paducah Gaseous Diffusion Plant Section of the DWM will be referred to as Kentucky. References to activities by other state government agencies that are not part of the EEC (and in some cases, not part of DWM) will be specified as appropriate.

Coordination with Kentucky state government agencies, federal agencies and citizen's groups is another important function of the Paducah Site Section. Kentucky regularly cooperates and interacts with the DOE, the U.S. Environmental Protection Agency (EPA), and the Paducah CAB. Kentucky is an active participant in federal facility DOE inter-governmental groups associated with the National Governor's Association Federal Facilities Task Force, the National Conference of State Legislatures' State and Tribal Government Working Group, the Environmental Council of the States, and the EPA's Federal Facilities Forum.

Federal Facility Agreement (FFA) / Site Management Plan (SMP)

The FFA is a three-party agreement between DOE Portsmouth/Paducah Project Office (PPPO), EPA Region 4, and the KDEP. 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 investigation and remediation. The FFA also provides a framework for project management, investigation, dispute resolution, and remediation.

The SMP establishes the clean-up priorities and enforceable milestones for the current FY and the next two FYs. The SMP is scoped annually and becomes part of the FFA as an appendix. If the three parties to the FFA cannot agree on the current year's SMP, then the last approvable SMP remains in effect. The SMP also documents the three-party prioritization strategy for the complete remediation of the PGDP in a life-cycle baseline and life-cycle plan. The FFA parties meet to scope revisions for the document in the months leading up to DOE's annual transmittal deadline on Nov. 15.

In early August 2017, the senior managers of DOE PPPO, EPA Region 4, and KDEP signed a Memorandum of Agreement (MOA) to reconfigure the sequence of all of the environmental remediation work at the Paducah site. DOE identified and initiated resequencing efforts in April/May 2016. While several factors influenced DOE's conclusion, the main factor was that DOE regained control of the Gaseous Diffusion Plant facilities in 2014, making the C-400 building accessible to investigate and clean-up.

The C-400 building has long been understood as the main source of the two ~four-mile long TCE groundwater (dissolved phase) contamination plumes, commonly identified as the Northeast and Northwest Plumes. The groundwater plumes are the largest known sources of contamination leaving the site and are therefore the main risk to human health and the environment. In 1989 DOE established an administrative boundary called the Water Policy Box. Within this area, DOE provided some free hookups to the municipal water supply. In order to clean up contamination associated with the C-400 Complex, a comprehensive investigation of the area beneath and around the C-400 building must be performed. This investigation will define all sources of contamination and how each contaminant is distributed vertically and laterally beneath the C-400 Complex.

In order to accomplish a comprehensive investigation of the C-400 Complex, the senior managers of the FFA agreed that the C-400 building would be demolished to slab by the first quarter of 2019. The plan being that once the building was down, then the area would be more accessible to heavy drilling equipment. Multiple documents for demolishing the C-400 building were submitted by DOE, which were not approved by the EPA. Multiple meetings occurred regarding the characterization of existing contamination within the multiple basement areas that exist in the C-400 building.

The C-400 MOA was not signed until August 2017 and at that time the senior managers agreed not to finalize a 2017 SMP, but instead to concentrate efforts toward a 2018 SMP. The draft 2018 SMP was scoped over several meetings with an independent technical facilitator to capture and guide discussions. The draft 2018 SMP was rewritten to incorporate the pre-GDP OUs with the post-GDP OUs. One of the new OUs was the C-400 Complex. The draft 2018 SMP was scoped by all three parties without the benefit of a DOE-Headquarters approved Life Cycle Baseline (LCB). This resulted in an initial draft 2018 SMP that consisted of >90% of all out-year planning dates labelled as TBD (To Be Determined). Once DOE received permission from their own headquarters to reveal dates in their LCB, the PGDP project completion date slid from 2032 to >2065. All remaining environmental projects, except the C-400 Complex OU and the area directly north of the C-720 “Machine Shop” Building, referred to as SWMU 211-A, will be moved decades into the future.

The D1 SMP resubmittal was transmitted on Jan. 16, 2018 after EPA and Kentucky determined the November 2017 SMP to be incomplete. Furthermore, DOE transmitted errata pages on Jan. 23, 2018. On Feb. 22, 2018 Kentucky issued comments and on April 16 DOE transmitted a D2 2018 SMP. The D2 version of the document did not contain any out-year enforceable milestones from the following OUs: groundwater, soil, burial grounds, and surface water. Kentucky invoked informal dispute with DOE on May 16, 2018 and DOE invoked informal dispute with EPA on June 15, 2018. Kentucky invoked formal dispute on July 30, 2018 and DOE invoked formal dispute with EPA on August 10, 2018. DOE requested that Kentucky issue a letter to align the formal dispute deadlines which occurred on August 27, 2018. Kentucky elevated the dispute it invoked to the Senior Executive Committee (SEC) level on Sept. 20, 2018 and DOE followed suit by invoking their dispute with the EPA on Sept. 24, 2018. There was no regulatory approval of a 2018 SMP; however, DOE requested that the next version of the Site Management Plan be titled with the years 2018-2019.

Site Management Plan Documents Reviewed In 2018 and 2019

FY 2018 Annual Revision to Site Management Plan Resubmittal (2418&D1/R1). Kentucky and EPA provided comments on Feb. 22 and March 2, 2018, respectively.

FY 2018 Annual Revision to Site Management Plan (2418&D2). Kentucky invoked informal dispute with DOE on May 16, 2018, formal dispute on August 27, 2018 and the dispute was elevated to the SEC on Sept. 20, 2018.

FY 2018 and 2019 Site Management Plan Memorandum of Agreement (MOA), dated April 4, 2019. Resolved the August 27, 2018 formal dispute (combined the 2018 and 2019 SMPs into a D2/R1 version).

FY 2018 and 2019 Site Management Plan (2418&D2/R1), dated April 26, 2019. EPA and Kentucky provided comments on May 9 and May 10, 2019, respectively.

FY 2018 and 2019 Site Management Plan (2418&D2/R2), dated August 20, 2019. Kentucky and EPA approved on August 29 and August 30, 2019, respectively.

FY 2020 Site Management Plan (2444&D1), dated November 15, 2019.

Agreement in Principle (AIP)

Under the AIP program, Kentucky conducts independent environmental monitoring activities and oversees DOE monitoring activities and procedures. Additionally, the program serves to disseminate information relevant to ongoing site cleanup activities to concerned citizens and the public in general. During 2019, the AIP wrote and distributed its 2019 Annual Environmental Sampling Plan and the 2018 Environmental Oversight Annual Report, which can be found electronically at https://eec.ky.gov/Environmental-Protection/Waste/hazardous-waste/Pages/paducah-gaseous-diffusion-plant.aspx.

A 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.

Kentucky AIP Program Sampling for 2019

One of the primary goals of the AIP is to monitor and evaluate current site activities through sampling and observation, in order to identify possible threats to human health and the environment. The secondary goal is to independently verify data collected by DOE contractors to insure data quality. To achieve these goals, AIP staff routinely observe DOE facilities and operations to identify environmental issues or concerns. Any resulting significant conditions or practices are brought to DOE's attention for review.

AIP staff collect independent environmental samples (soil, surface water, air, and groundwater) and also split samples with DOE contractors. Over the years AIP staff has also worked with

organizations such as the University of Kentucky in conducting scientific research apart from DOE cleanup and monitoring efforts. Some of the research involved collecting environmental samples. Samples collected by AIP, and by independent researchers working with AIP, are routinely sent to laboratories under contract to the AIP program (all laboratories are independent of US DOE) or, in the case of independent researchers, selected by the researcher. 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 media samples (primarily groundwater) to independently validate DOE's sampling results. Historically AIP has split tissue samples collected from animals living near the PGDP to monitor any potential impact to the biota.

For 2019, the primary AIP independent contract laboratories were TestAmerica Laboratories located in Earth City, Missouri, and two separate State Laboratories -the Kentucky Department for Environmental Protection Laboratory and the Cabinet for Health and Family Services' Radiation Health Branch Laboratory, both of Frankfort, Kentucky. All three are accredited, independent (of DOE) laboratories that meet or exceed the requirements set forth by governing EPA standards. The CHFS RHB analyzes groundwater samples as well as airborne and surface water samples collected using continuous monitoring equipment for gross alpha and gross beta concentrations, and gamma spectroscopy. If trigger levels for gross alpha and/or gross beta are exceeded, then CHFS will analyze the sample for isotopic radionuclides. AIP staff directly receives all analytical data from TestAmerica Laboratories, the Kentucky Department for Environmental Protection Laboratory, and CHFS. The results are verified and shared formally by Kentucky AIP staff electronically in the formats specified by the DOE and their contractors. DOE has developed a public website to share environmental data collected by their contractors, as well as Kentucky AIP, with the general public. Analytical results collected by Kentucky AIP and DOE contractors can be searched, viewed spatially, and downloaded on the PPPO Environmental Geographic Analytical Spatial Information System, referred to as PEGASIS.

AIP Groundwater Investigations

Groundwater Sampling

During 2019, AIP staff collected 78 samples from 57 different monitoring wells and 14 samples from 12 different residential wells. The 2019 AIP monitoring wells and seep sampling locations map (Figure 1) shows all wells sampled during the 2019 reporting period. The vast majority of the wells sampled were less than two miles from PGDP groundwater plumes and/or less than

two miles from the PGDP property boundary. This is a line of evidence to support the validation of DOE data collection procedures and confirms that DOE analytical laboratory results are accurate, reproducible and verifiable. AIP independent oversight of DOE's groundwater sampling program also helps to ensure that analytical results used to construct contaminant plume maps are verifiable.

AIP staff split 12 monitoring and 5 residential well water samples, plus an additional 3 field replicates, with DOE in 2019. In most cases, AIP staff arranged to split groundwater samples with DOE during their scheduled sampling activities. These sampling events were conducted to evaluate and substantiate that DOE Contractors are following their sampling procedures and to verify the quality and accuracy of their laboratory analyses. AIP also reviews DOE Contractor procedures to insure they are scientifically sound and in compliance with EPA guidance. The Kentucky AIP samples were shipped to independent analytical laboratories (not affiliated with DOE) and split sampling results demonstrated a general similarity between those samples collected and analyzed by independent laboratories and those collected and analyzed by DOE Contractors (Table 1). Of the 12 monitoring well samples split between AIP and DOE in 2019, most had similar TCE and Tc-99 concentrations (Table 1).

Seeps Sampled by Kentucky AIP

Six unique 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 observable (upwelling) in a channelized portion of LBC. The locations of the seeps can move by several feet over time and even disappear. The base flow in LBC is comprised primarily of discharges from plant outfalls. These seeps are located downstream of the Paducah Site, two miles from the plant and two miles from the confluence of LBC and the Ohio River. AIP staff check the LBC seep area monthly for any migrating or new seeps.

In 2019, AIP sampled LBC Seep #5 on August 14 and Nov. 6. The location of this seep can be seen on the 2019 AIP monitoring wells and seep sampling locations map in Figure 1. TCE concentrations here were 1.12 μg/L and 1.22 μg/L, respectively. In other months in 2019, seeps could not be identified because the water level was elevated and the seeps were submerged or not flowing. It should be noted that the Ohio River elevation directly impacts the water level of LBC in the vicinity of the seeps.

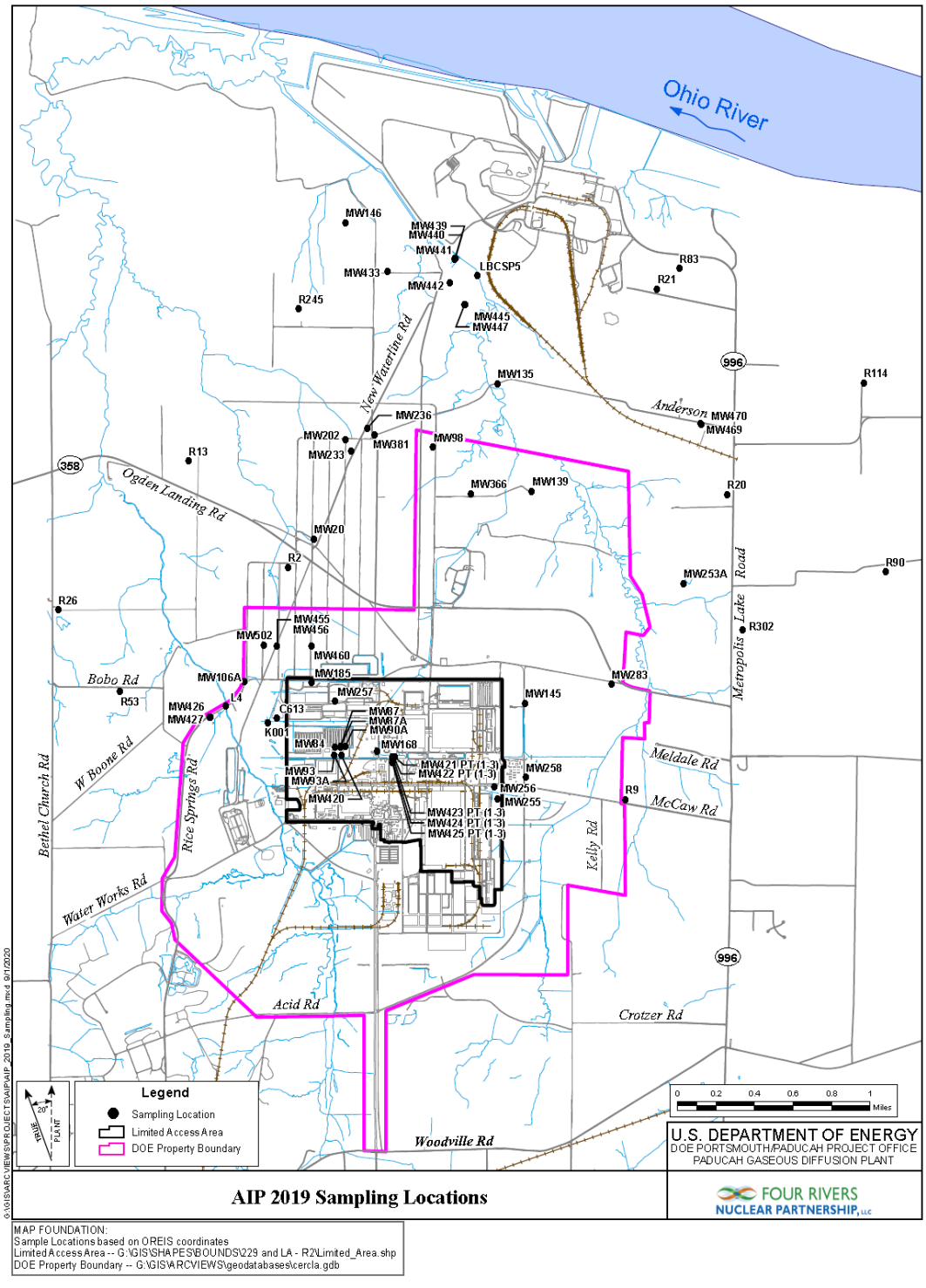

Figure 1. AIP 2019 MWs and Seep Sampling Locations

		AIP TCE µg/L		DOE TCE µg/L		AIP Tc-99 pCi/L		DOE Tc-99 pCi/L	
Well #	Sample Date	Value and/or Qualifier	DL	Value and/or Qualifier	DL	Value and/or Qualifier	MDA	Value and/or Qualifier	MDA
MW84	1/16/2019	3,900	200	5,580[1]	100	19.5 +/-1.23	3.62	28.8 +/-9.41	14.8
MW87	1/15/2019	1,900	50	2,380	50	9.51 +/-1.62	3.62	1.88 +/-11.1	19
MW90A	1/16/2019	57	2	69.9	1	10.2 +/-1.17	3.62	11.9 +/-9.49	15.8
MW93	1/16/2019	920	20	1,000	20	NA	NA	8.75 +/-13.1	22.1
MW145	7/9/2019	50.2	2.5	48.7	1	36.1 +/-1.37	3.94	20.8 +/-8.79	14.1
MW255	7/9/2019	202	2.5	173	4	2.76 +/-1.15	3.75	-6.71U +/-8.35	14.7
MW258	7/9/2019	313	2.5	302	4	NA	NA	-2.76 U +/-7.97	13.9
MW283	7/9/2019	77.5	0.5	78.4	1	NA	NA	3.22 U +/-6.55	11.1
MW420	1/15/2019	510	20	601	10	NA	NA	1.09 U +/-11	19
MW455	3/14/2019	35	1	36.9	1	13.1 +/-1.23	3.77	11.9 U +/-8.56	14,1
MW456	3/14/2019	7.5	1	8.12	1	NA	NA	4.82 +/-6.31	10.7
MW460	3/14/2019	530	20	636	25	171 +/-1.98	3.77	151 +/-11.6	12,2
R2	11/6/2019	4.5[1]	0.5	5.05	1	NA	NA	NS	NS
R13	11/6/2019	U	0.5	U	1	NA	NA	NS	NS
R26	11/6/2019	U	0.5	U	1	NA	NA	NS	NS
R53	11/6/2019	0.619 J	0.5	0.66	1	NA	NA	NS	NS
R245	11/6/2019	U	0.5	U	1	NA	NA	NS	NS

In Tc-99 samples, +/- represents the uncertainty in the measurement.
Kentucky samples were analyzed by TestAmerica of St. Louis and the Kentucky Radiation Health Branch.

[1]A field replicate was also analyzed. The higher of the two results is shown.
DL – Detection Limit
J – Estimated Quantitation
MDA – Minimum Detectable Activity
NA – Not applicable. Technetium-99 was not analyzed because the following criteria were not met:
Gross Alpha ≥ 5 pCi/L and Gross Beta ≥ 9 pCi/L
NS – Not sampled
U – TCE: Not detected; Tc-99: Value reported is <MDA and/or TPU.

Table 1. Split Sampling Results between EEC AIP & DOE

MW66 Water Elevation and TCE Concentration

During 2019, AIP staff continued to collect water elevations at MW66 to study seasonal variations in the groundwater table. A 2012 DOE sponsored document (*Technical Evaluation of Temporal Groundwater Monitoring Variability in MW66 and Nearby Wells, Paducah Gaseous Diffusion Plant*) concluded that the spikes in TCE concentration at MW66 were likely due to variations in regional and local groundwater flow conditions. The conclusions of the 2012 DOE study recommended continued sampling of MW66.

As shown in Figure 2, water levels at MW66 rose several feet during the winter and spring months, generally February through June, with the highest elevation of 331.01 ft. above mean sea level (AMSL) recorded in May 2019. Water levels dropped throughout the summer and autumn months declining to the lowest elevation of 323.67 ft. AMSL in December 2019. TCE results obtained by DOE during 2019 were 358 µg/L and 432 µg/L.

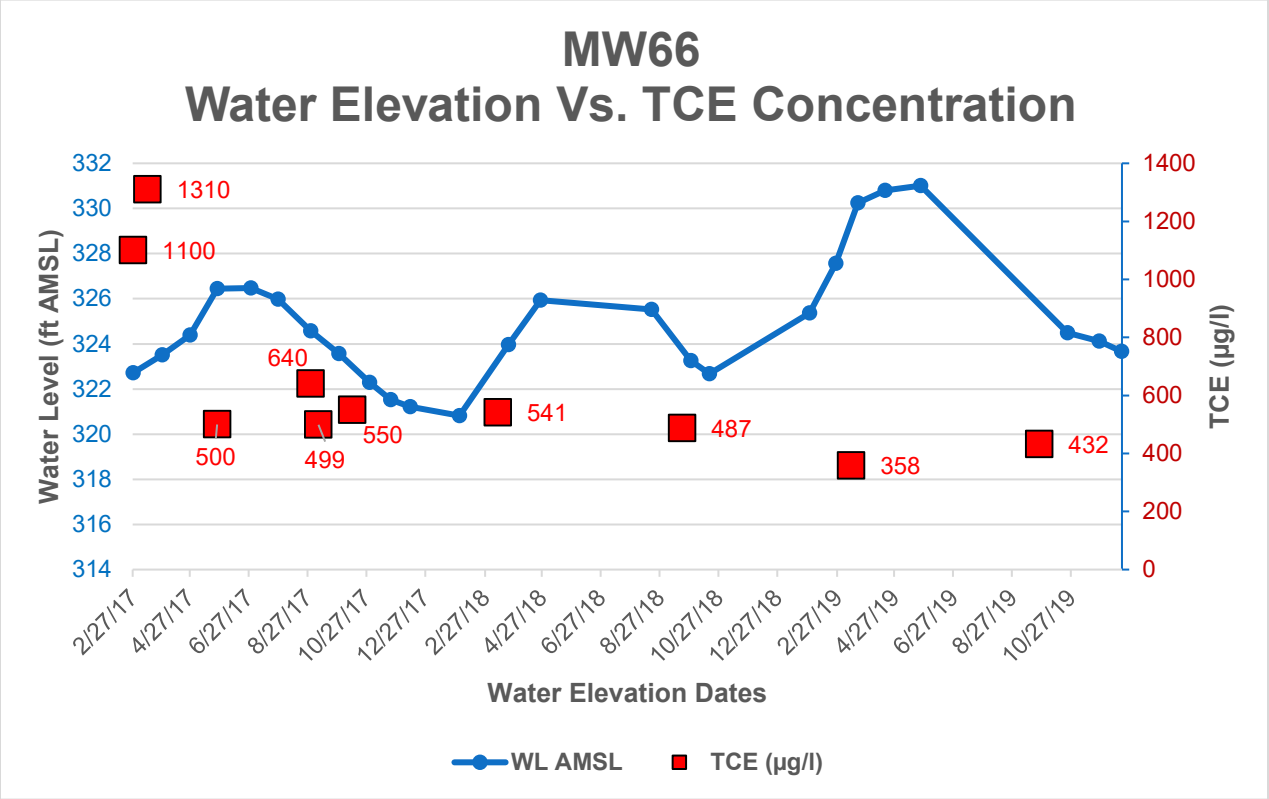

Figure 2. MW66 Water Elevation vs. TCE Concentration

An insufficient amount of TCE data was collected to make a determination concerning the correlation between the water levels and TCE concentrations within MW66.

Now that the trend for groundwater elevations has been identified, the information can be used to pinpoint which months additional TCE sampling will be added to the 2020 AIP Sampling Plan in order to continue investigating a potential correlation.

NW and NE Plume Extraction Well Area of Influence/Cone of Depression Assessments

Northwest Plume Extraction Wells

Water levels in 25 monitoring wells located in the northwest portion of the plant were measured in August 2018 by AIP staff. Water level measurements indicate that the high concentration portion of the plume is captured laterally within the cone of depression of EW232 and EW233 (see Figure 3). In relation to the two NW plume extraction wells, observed upgradient TCE concentrations appear to also be captured vertically by the two extraction wells.

EW232 and EW233 went online in August 2010, after being relocated further east from their dormant predecessors EW230 and EW231. The optimized EW232 and EW233 were moved to account for an observed eastward shift of the high concentration portion of the NW plume. The optimized extraction wells are screened in the upper and middle portions of the RGA. Kentucky AIP have been monitoring the potential for bypass underneath the extraction wells for several years. TCE concentrations in the Regional Groundwater Aquifer (RGA), surrounding the extraction wells were evaluated. Four of these monitoring wells are compared in Figure 4. These four monitoring wells illustrate that overall concentrations are decreasing over the time period 2009-2019.

Generally, TCE concentrations in the Northwest Plume monitoring wells near the extraction wells have stabilized in the last two to four years. In 2018 and 2019, the extraction wells pumped 102,160,438 gallons of water and 104,107,950 gallons of water, respectively. On the west side of the Northwest plume, MW248, MW250, and MW456 have shown decreasing TCE concentrations. Over the same time period, TCE concentrations in proximal deep downgradient wells also appear to be trending down. Kentucky AIP plans on continuing efforts to evaluate the monitoring wells surrounding the extraction wells to look for any indication that higher concentrations of TCE (dissolved phase) may be by-passing the Extraction Wells.

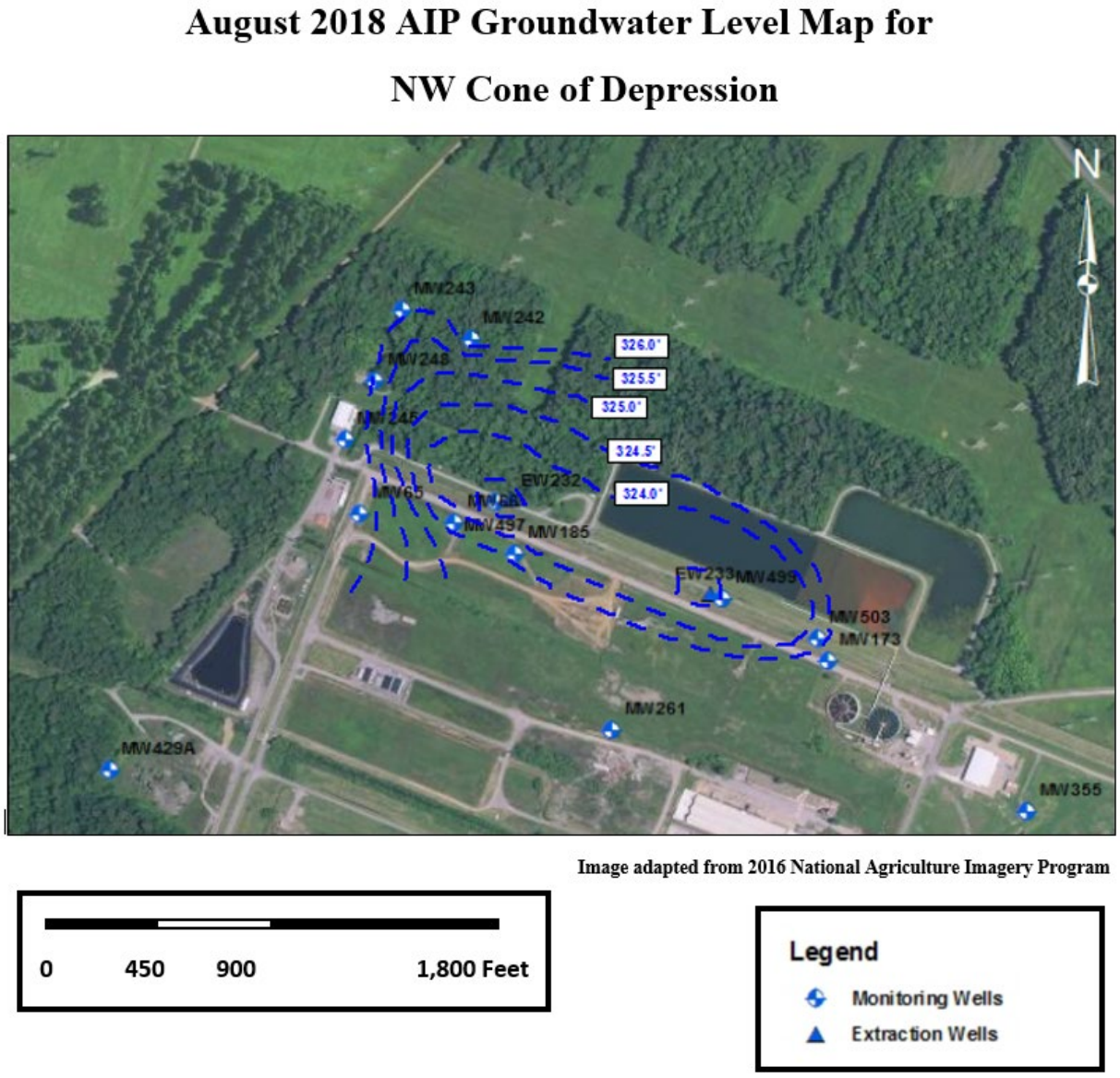

Figure 3. NW Groundwater Cone of Depression

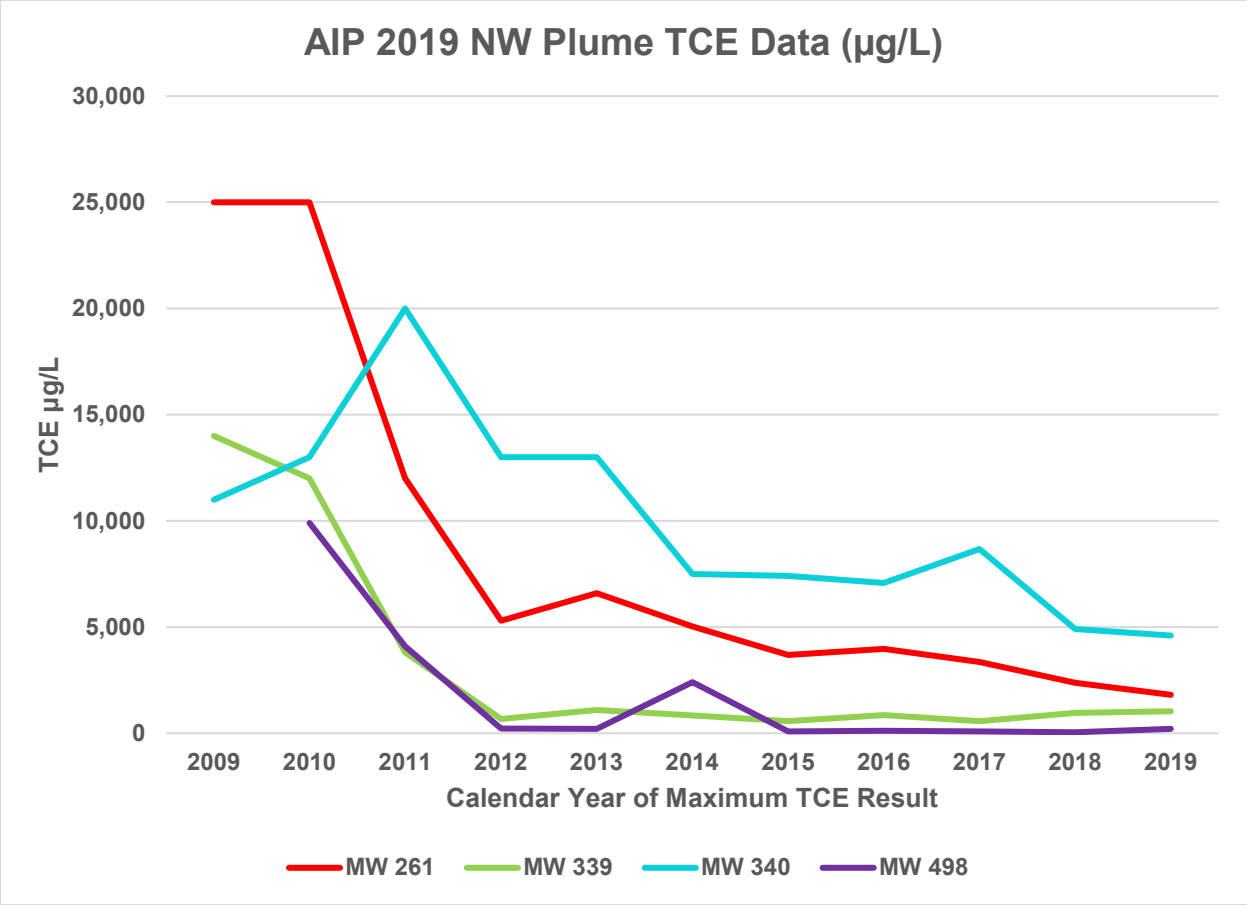

Figure 4. NW Plume TCE Data

Northeast Plume Extraction Wells

During the 2018 and 2019 reporting periods, the Northeast extraction wells (EW234 and EW235) removed 101,347,005 gallons of water and 80,064,755 gallons of water, respectively. Water levels in 32 monitoring wells, located in the northeast portion of the plant were measured in August 2018, as part of AIP's NE Plume Extraction Wells water level measurement program. Water elevation measurements were plotted to visualize the cone of depression present around EW234 and EW235 extraction wells (see Figure 5).

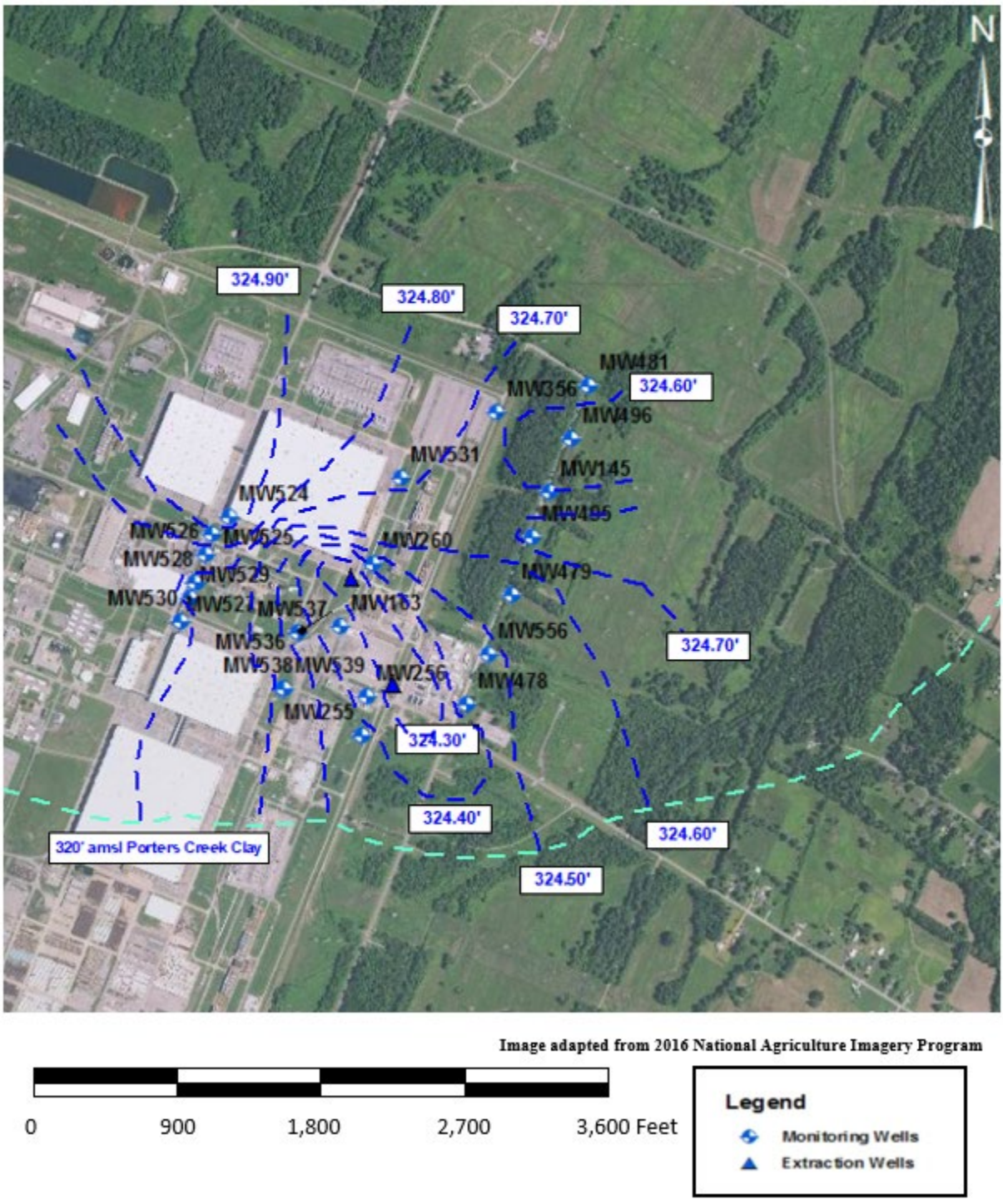

Figure 5. NE Groundwater Cone of Depression

EW234 and EW235 were installed as an optimization effort to the northeast system and officially started pumping October 10, 2017. The original wells EW331 and EW332 were placed in stand-by mode. The new extraction wells were installed to increase TCE mass removal, enhance control of the northeast plume migration at the eastern edge of the facility, and reduce further offsite migration.

Sampling results for several of the northeast plume transect monitoring wells, located ~800 ft. east of the C-400 Building, and revealed increasing TCE concentration trends in 2018 and 2019. Once increasing trends were observed, DOE reduced the flow rates on June 14, 2018. TCE increased in MW526 from the established baseline concentration of 267 μg/L to 2,790 μg/L in 2018, then drastically decreased in 2019 where it fluctuated between 1,250 and 1,460 μg/L. Similarly, TCE levels in MW529 (baseline concentration of 130 μg/L) increased to 3,070 μg/L in 2018 and continued to increase to 6,380 and then peaked at 8,320 July 2019. On the last quarterly sampling event in 2019, MW529 experienced a 50% reduction in TCE concentrations with a result of 4,150 μg/L.

The reduced extraction system pumping rates in mid-2018 appeared to be effective in halting TCE migration associated with the eastern side of the C-400 building from migrating eastward. Based on the final quarterly sampling event of 2019, the data suggests that TCE concentrations in MW526 and MW529 were decreasing from earlier highs. A similar pattern emerged at MW530 where TCE concentrations averaged ~800 μg/L in 2018 steadily decreased throughout 2019. This suggests that the reductions in the extraction well pumping rate is having a desired impact. Quarterly sampling of the transect wells by DOE field contractors will continue to be monitored and pumping rates in one or both EWs can be further modified based on concentration trends observed in the future.

Generally, TCE concentrations in the monitoring wells downgradient of EW234 and EW235 (MW145, MW478, MW479, MW495, and MW556) have changed little since the extraction wells were turned on. Monitoring of downgradient wells will continue to be performed by DOE field contractors on a routine basis. KY AIP staff will continue to observe, split, and independently sample MWs associated with the northeast plume monitoring well network.

C-400 Monitoring Wells Sampled by Kentucky AIP

Since July 2009, the AIP has monitored the effectiveness of various groundwater actions taken at C-400 by sampling all functional depths of the following downgradient multi-port monitoring wells: MW421, MW422, MW423, MW424 and MW425. These monitoring wells are located in the vicinity of the northwest corner of the C-400 building and are used to compare TCE concentrations over time. Each of the monitoring wells contain three screened intervals corresponding to the upper (shallow), middle, and lower (deep) RGA zones. The AIP has collected samples from these downgradient wells since 2009 and tracked the associated chemical data in order to chart downgradient impact of the remediation efforts (Figure 6).

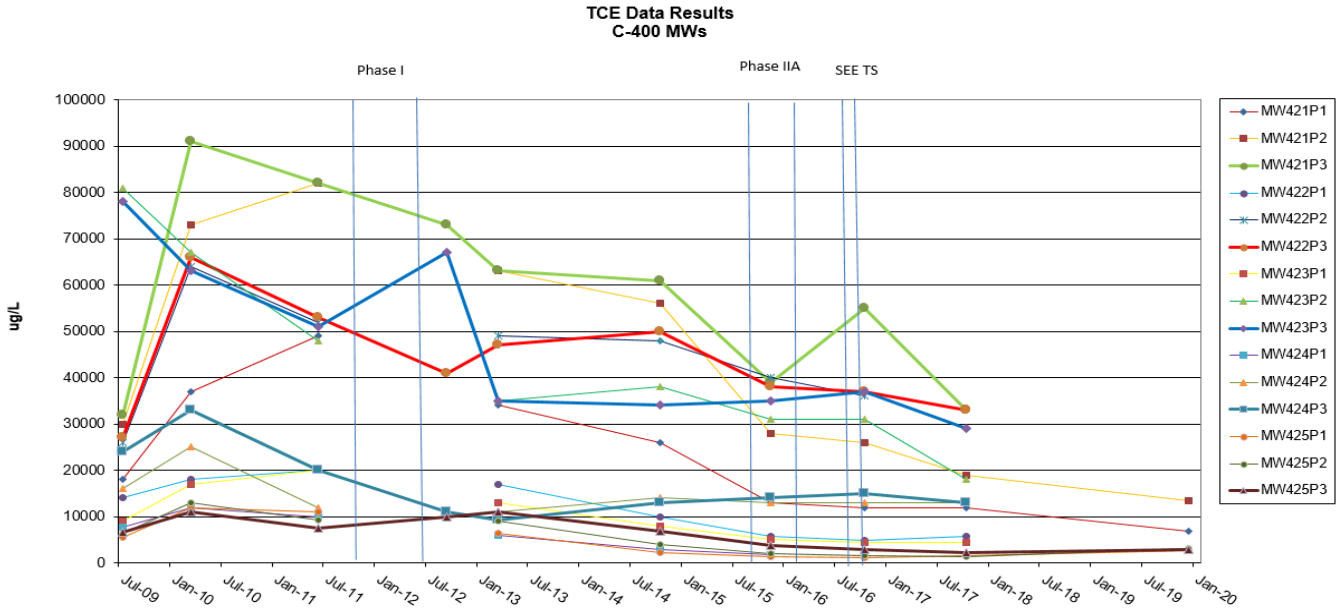

Figure 6. C-400 Monitoring Well TCE Data

AIP last collected split samples with DOE contractors from monitoring well clusters MW505, MW506, and MW507 in 2018. This well cluster is located hydraulically upgradient (south) of the C-400 remedial groundwater actions, (discussed in more detail below), taken to date. Each of the three monitoring wells has a unique screened interval corresponding to the shallow, middle, and deep RGA zones. This monitoring well cluster provides a comparison to several downgradient multi-port monitoring wells.

Sampling efforts of both up- and down-gradient monitoring well clusters will continue in AIP's 2020 sampling schedule in order to monitor contaminant mobilization that will occur during implementation of C-400 Complex OU RI field activities. The RI field activities will install ~112 soil borings of multiple depths, ~18 monitoring wells, and ~50 contingency borings will either be designated by consensus as a Membrane Interface Probe (MIP) and Dye-enhanced laser induced fluorescence system (DyeLIF) boring.

Several remedial actions have historically occurred around the C-400 Building to extract TCE from the subsurface. In 2003 a treatability study was conducted utilizing six-phase heating, a form of electrical resistance heating (ERH) which removed ~1,900 gallons (22,000 lbs.) of TCE. Phase I ERH became operational on March 29, 2010 and ran for seven months, removing ~535 gallons (6,525 lbs.) of TCE along the southern portions of the C-400 building. TCE levels in all downgradient wells showed a decline after the Phase I operational period. During Phase IIa, TCE totaling ~1,137 gallons (13,871 lbs.) was removed during ERH operation (Jan. 1 through Oct. 9, 2014). TCE levels also generally declined downgradient during the months and years following Phase IIa. In 2016 a treatability study utilizing steam enhanced extraction was conducted upgradient from the Phase IIb area and no extraction component was utilized. Increasing concentrations of TCE were observed in upgradient monitoring well cluster MW506 and MW507. The increase in TCE concentrations in the middle and lower RGA wells is suspected to be inadvertent mobilization, from southern portions of the Phase IIb area, during the Steam Enhanced Extraction Treatability Study in 2016. Concentrations leveled off in 2017 and continued to trend downward through 2019.

Concentrations in the majority of downgradient C-400 monitoring wells continue to decline over time or remain relatively constant. An increase in concentration was noted at MW421 P3 in 2016, but levels decreased in 2017. MW421 P3 is screened at a depth of 83 to 85 feet below ground surface (bgs). DOE data from 2011, 2012 and 2013 was used to supplement AIP data in this analysis. Only the deep wells, designated by P3, were sampled in 2012.

PGDP Sitewide Groundwater Flow Model

Groundwater models are used to help evaluate hydrogeologic systems in an effort to simulate and predict aquifer conditions and travel times. A groundwater model is a simplified mathematical representation of the subsurface hydrogeologic flow conditions at a site. The Paducah Gaseous Diffusion Plant (PGDP) Sitewide Groundwater Flow Model was created to develop a tool that can

assist in evaluating potential remedies. The Groundwater Model Working Group is comprised of technical experts that work collaboratively to develop, discuss, evaluate, refine, modify, and make recommendations in support of potential groundwater related projects.

In a series of meetings, DOE, EPA, Kentucky, and their associated contractors work together to revise the PGDP groundwater model in an effort to determine if additional data needs are necessary to support the evaluation of potential groundwater remedies. The first groundwater flow model at the PGDP was designed in 1990 and revised several times through 1997. A transport model was developed in 1997 and 1998. The next major revision to the model did not occur until 2008. That revision was developed to assist in determining additional data needs, evaluating potential remedies, calculating cleanup criteria, and developing inputs to design selected remedies. The model was further refined in 2012 to evaluate how potential variability in anthropogenic recharge rates (e.g., leaking water from plant utility lines) can influence groundwater flow and extraction well capture zone performance. Revisions to the 2016 model included revisions to the southern model boundary, refinement of anthropogenic recharge rates within the industrial area, upgradient Terrace Gravel recharge refinement, optimization of calibration periods by utilizing more complete synoptic water level datasets, refinement of lithologic/stratigraphic/hydrostratigraphic thickness intervals, and changing drain cells to river boundary cells in the lower reaches of Bayou and Little Bayou Creeks.

The PGDP groundwater model simulates flow within the Regional Gravel Aquifer (RGA) and essentially ignores flow in both the Upper Continental Recharge System (UCRS) and the McNairy Formations - which are the units above and below the RGA, respectively. The UCRS conveys natural and anthropogenic recharge vertically to the RGA and an evaluation was conducted to identify UCRS lithologic areas with less than 2-ft of clay above the RGA, which also was near suspected areas of elevated anthropogenic recharge. The underlying McNairy Formation is represented in the model as a no-flow boundary. The model includes an upgradient zone which accounts for recharge (upgradient input) to the model along Terrace Gravel deposits.

Prior to 2010 water elevations collected at PGDP were collected during sampling events which typically occurred over several months. Water level elevations fluctuated over time which introduced uncertainty into all water level potentiometric surface interpretations/maps prior to 2010. In August 2010 DOE initiated synoptic water level events on an annual basis. A synoptic water level event occurs over a relatively short time period (one-three days) when atmospheric conditions are expected to remain consistent. Subsequent revisions to the groundwater model

includes multiple sets of synoptic water level elevation events as a way to test model predictions against actual recorded conditions.

DOE submitted the 2016 update of the Paducah Gaseous Diffusion Plant Sitewide Groundwater Flow Model document to the regulators in April 2017, even though it is not subject to regulatory review and approval under the Federal Facilities Agreement (FFA). The 2016 update was the result of a collaborative approach and process undertaken by all three parties to the FFA, with an objective to represent and reflect groundwater flow conditions of the past, present, and future. The intent of the model update is to provide FFA decision makers with a tool that can predict how contamination will migrate in the RGA over time. Both Kentucky and EPA reviewed and provided comments and recommendations to be considered in the next groundwater model revision effort. The model will continue to be evaluated and updated periodically, as warranted. The Groundwater Modeling Group met on a quarterly basis during 2019.

Efforts to collect additional water level data (based on recommendations) to refine the groundwater model proceeded in 2018. For the first time, fifteen monitoring wells belonging to and located on Tennessee Valley Authority (TVA) property were collected by Kentucky AIP field staff as part of the sitewide synoptic water elevation monitoring event. The water level elevations (Table 2) were collected in 2018 by Kentucky AIP to enhance the DOE synoptic water level event that occurred during the same week. In 2019 Kentucky AIP discovered two more TVA wells, bringing the total of TVA wells to seventeen. Synoptic water level events occurred in August and December of 2019. The data collected during the 2018 and 2019 events was officially transmitted to DOE where it will be combined with the Paducah Site wells. The water level data will likely be used to refine future iterations of the groundwater model.

Well	OREIS Name	Measuring Point	Measured GW Elevation	Water Level	Date	Barometric Pressure (inHg)
TVAGW-6D	TVAGW-6D	368.8	322.75	46.05	8/15/2019	29.6
			320.31	48.49	12/19/2019	30.06
TVAGW-5D	TVAGW-5D	368.5	322.25	46.25	8/15/2019	29.6
			319.86	48.64	12/19/2019	30.06
TVAGW-4D	TVAGW-4D	365.8	322.19	43.61	8/15/2019	29.6
			319.88	45.92	12/19/2019	30.06
TVAGW-3D	TVAGW-3D	363.8	322.22	41.58	8/15/2019	29.6
			319.82	43.98	12/19/2019	30.06

Well	OREIS Name	Measuring Point	Measured GW Elevation	Water Level	Date	Barometric Pressure (inHg)
TVAGW-2D	TVAGW-2D	370	328.54	41.46	8/15/2019	29.6
			323.93	46.07	12/19/2019	30.06
TVAGW-1D	TVAGW-1D	370.1	322.69	47.41	8/15/2019	29.6
			319.8	50.3	12/19/2019	30.06
SHF-D8A	TVA-D8A	331.82	317.67	14.15	8/15/2019	29.6
			317.42	14.4	12/19/2019	30.07
SHF-D75B	TVA-D75B	353.08	311.88	41.2	8/15/2019	29.6
			314.3	38.78	12/19/2019	30.07
SHF-D74B	TVA-D74B	331.99	309.73	22.26	8/15/2019	29.6
			315.08	16.91	12/19/2019	30.07
SHF-D30B	TVA-D30B	324.61	303.62	20.99	8/15/2019	29.6
			313.73	10.88	12/19/2019	30.09
SHF-D17	TVA-D17	365.43	319.06	46.37	8/15/2019	29.6
			317.66	47.77	12/19/2019	30.03
SHF-D11B	TVA-D11B	321.79	307.63	14.16	8/15/2019	29.6
			313.85	7.94	12/19/2019	30.1
SHF-D10	TVA-D10	351.74	308.51	43.23	8/15/2019	29.6
			308.51	43.23	12/19/2019	30.07
SHF-201C	SHF-201C	323.75	309.02	14.73	8/15/2019	29.6
			308.3	15.45	12/19/2019	30.11
SHF-201B	SHF-201B	323.75	309.14	14.61	8/15/2019	29.6
			308.45	15.3	12/19/2019	30.11
SHF201A	SHF201A	323.75	309.18	14.57	8/15/2019	29.6
			308.4	15.35	12/19/2019	30.11
SHF-102G	SHF-102G	362.85	323.24	39.61	8/15/2019	29.6
			320.7	42.15	12/19/2019	30.07
Ohio River Elevation			300.69		8/15/2019	29.6
			312		12/19/2019	30.06

Table 2. 2019 AIP Synoptic Water Level Event

The Groundwater Modeling Working Group discussed methods for measuring surface water elevations in Metropolis Lake in 2018 and 2019. KY AIP staff assisted DOE and Contractors on

reconnaissance efforts along Metropolis Lake to search for suitable locations for placement of a measuring stick. KY AIP also worked with the Kentucky Nature Preserves Permitting Program Department to understand their expectations and concerns, which were passed along to DOE and their contractor. KY AIP also learned that TVA maintains and monitors an Ohio River gauging station which is included in table 2 and that information was shared with DOE and the groundwater modeling group project team.

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 specifically designed to collect surface water runoff from the facilities' 61-acre northwest watershed, which includes the 27-acre former scrap yard area. The sediment basin collects storm water runoff and allows suspended sediments 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.

The AIP C-613 Sediment Basin sampling regimen began in October of 2002. The C-613 Sediment Basin 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 trends to be determined. After sufficient information was collected, sampling was reduced to a quarterly sampling regimen that was established during the first quarter of 2008. This quarterly regimen was performed from 2008 to 2011. Due to budgetary constraints and the fact that analyte concentrations had stabilized, the sampling regimen was again modified in the first half of 2012, when the frequency of sample collection was again reduced from quarterly to semi-annually. The semi-annual sampling regimen, continued through 2019, includes one non-discharge sampling event per year to continue assessment of changes in contaminant concentrations that sediment basin releases may have on West Kentucky Wildlife Management Area (WKWMA) receptors.

The semi-annual sampling regimen for 2019 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.

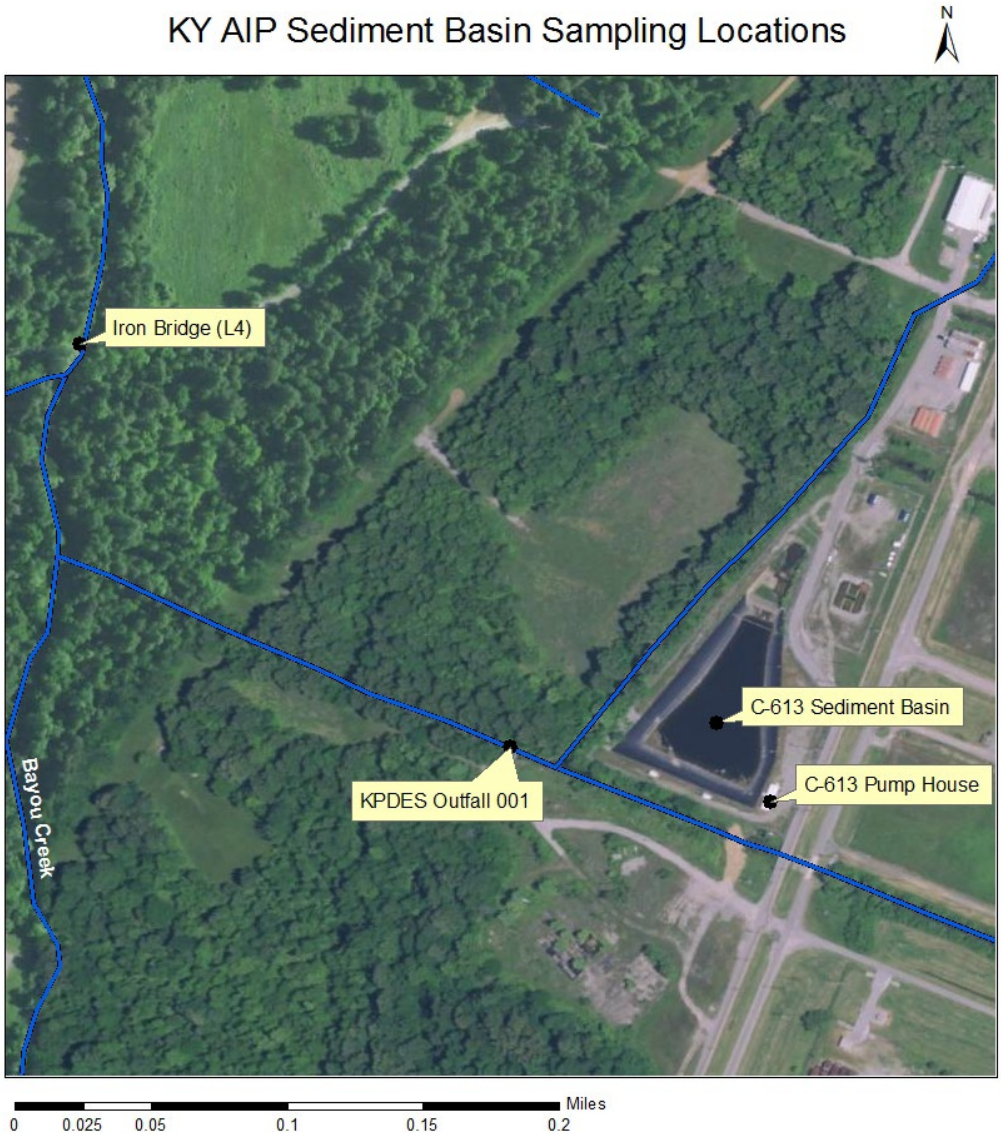

Figure 7. AIP Surface Water Sampling Locations

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 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. 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)
- -- Gross Alpha and Beta activity
- -- Metals, including Uranium and Mercury
- -- Isotopic Uranium (U-234, U-235 and U-238)

Results: TSS and pH

During the 2019 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 2019; the last flocculent treatment was in December of 2007. After the Scrap Metal Removal project was completed in March of 2007, DOE's service contractor planted and continues to maintain a well-developed grass cover over the (former) Scrap Yards area. Observations indicate the vegetative cover stabilizes the soil, reduces sediment flow into the basin and allows for greater absorption of rainfall. This results in low sediment basin turbidity measurements and low TSS sample results. Based on a comparison of these sample results and the Outfall 001 discharge requirements, AIP 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

The following is a presentation of the 2019 analytical results for the C-613 Sediment Basin:

2019 First Semi-Annual Sampling Event:

Results from the Discharge Event Samples Collected on May 22, 2019:

Analyte	Basin Inlet	MDL / MDC	Total Uncertainty (2σ +/-)	Basin Outlet (Outfall 001)	MDL / MDC	Total Uncertainty (2σ +/-)	Iron Bridge	MDL / MDC	Total Uncertainty (2σ +/-)
Uranium Metal (µg/L)	**110.0**	0.90	N/A	**13.0**	0.40	N/A	**1.9**	N/A	0.40
Gross Alpha (pCi/L)	**33.6**	0.81	1.98	**3.0**	0.81	0.65	**1.1**	0.81	0.49
Gross Beta (pCi/L)	**84.8**	2.79	2.52	**10.0**	2.79	1.19	**12.8**	2.79	1.26
U-234 (pCi/L)	**17.9**	0.14	2.06	**Not Analyzed**	--	--	**Not Analyzed**	--	--
U-235 (pCi/L)	**0.9**	0.17	0.34	**Not Analyzed**	--	Several --	**Not Analyzed**	--	--
U-238 (pCi/L)	**31.5**	0.14	3.30	**Not Analyzed**	--	--	**Not Analyzed**	--	--

Table 3. 2019 First Semi-Annual Sampling Event

2019 Second Semi-Annual Sampling Event:

Part 1: Results from the Non-Discharge Event Samples Collected on September 17, 2019:

The non-discharge sample was collected at a time 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 potential contaminant exposure to an average recreator, as this sample point borders the WKWMA. Several of the Basin Outlet and Iron Bridge radionuclide results indicate they were not analyzed. This actually means they were not analyzed for the analyte specified in the row. All samples are analyzed for gross alpha/gross beta utilizing gas flow proportional counters and for gamma emitting isotopes utilizing gamma

spectrometry. Uranium and plutonium isotopes are not specifically analyzed for unless the gross alpha results from the screening are greater than or equal to 5pCi/L. Technetium-99 is not analyzed for unless the gross beta results are greater than or equal to 9 pCi/L.

Part 1: Results from the Non-Discharge Event Samples Collected on September 17, 2019:

Analyte	Basin Outlet (Outfall 001)	MDL / MDC	Total Uncertainty (2σ +/-)	Iron Bridge	MDL / MDC	Total Uncertainty (2σ +/-)
Uranium Metal (µg/L)	**1.1**	0.40	N/A	**0.56**	0.40	N/A
Gross Alpha (pCi/L)	**0.05**	1.35	0.72	**0.05**	1.35	0.68
Gross Beta (pCi/L)	**4.45**	3.29	1.17	**2.96**	3.28	1.13
U-234 (pCi/L)	**Not Analyzed**	---	---	**Not Analyzed**	---	---
U-235 (pCi/L)	**50.3**	---	38.4	**4.80**	---	22.0
U-238 (pCi/L)	**Not Analyzed**	---	---	**Not Analyzed**	---	---

Part 2: Results from the Discharge Event Samples Collected on December 18, 2019:

Analyte	Basin Inlet	MDL / MDC	Total Uncertainty (2σ +/-)	Basin Outlet (Outfall 001)	MDL / MDC	Total Uncertainty (2σ +/-)	Iron Bridge	MDL / MDC	Total Uncertainty (2σ +/-)
Uranium Metal (µg/L)	**350.0**	0.40	---	**11.0**	0.40	---	**3.5**	0.40	---
Gross Alpha (pCi/L)	**88.13**	0.90	3.27	**4.11**	0.90	0.84	**0.43**	0.90	0.48
Gross Beta (pCi/L)	**214.82**	4.36	4.04	**4.43**	4.36	1.50	**0.98**	4.36	1.41
U-234 (pCi/L)	**16.2**	0.20	2.28	**Not Analyzed**	0.24	0.80	**Not Analyzed**	---	---
U-235 (pCi/L)	**0.9**	0.30	0.42	**Not Analyzed**	0.25	0.25	**Not Analyzed**	---	---
U-238 (pCi/L)	**28.4**	0.36	3.63	**Not Analyzed**	0.36	1.60	**Not Analyzed**	---	---

Table 4. 2019 Second Semi-Annual Non-Discharge Sampling Event

Sediment Basin sampling has been performed regularly since the Sediment Basin became operational in March of 2003. Discharge times, volumes and water quality parameters have been collected and compiled since November of 2004. The following data was compiled from 2003 to 2019 concerning average uranium concentrations (averaged from all results available for a given year) and the annual discharge through the Sediment Basin (in gallons). According to the National Oceanic and Atmospheric Administration (NOAA), the average yearly rainfall in the Paducah, Kentucky area is 49.1 inches. Average inlet and outlet Uranium metal (total) concentrations, Sediment Basin discharge volume, annual rainfall and percentage of annual rainfall for each year from 2003 through 2019 are as follows:

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

2004: Inlet: 371.0 µg/L Outlet: 206.0 µg/L
Annual Discharge: Nov & Dec 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)

2016: Inlet: 218.0 µg/L Outlet: 111.0 µg/L
Annual Discharge: 37,760,800 gallons Rainfall: 49.24 inches (100% of Average)

2017: Inlet: 165.0 µg/L Outlet: 114.0 µg/L
Annual Discharge: 31,345,800 gallons Rainfall: 46.33 inches (94% of Average)

2018: Inlet: 155.0 µg/L Outlet: 50.5 µg/L
Annual Discharge: 45,670,800 gallons Rainfall: 59.46 inches (121% of Average)

2019: Inlet: 230.0 µg/L Outlet: 12.0 µg/L
Annual Discharge: 63,012,000 gallons Rainfall: 49.08 inches (100% of Average)

Observations:

The data reports that the concentration of uranium metal has historically decreased by roughly one-half to three-fourths between the C-613 Sediment Basin inlet and Outfall 001 discharge point. The average reduction in uranium concentrations and radionuclide readings for 2019 was over 90%. This is the greatest percentage reduction since the Basin became operational. From 2003 to 2008, when active scrap metal removal was being performed, the average inlet concentration

was 374.0 µg/L. From 2009 to 2019, after the scrap metal had been removed, concentrations of uranium metal at Outfall 001 has varied from a low of 12.0 µg/L (2019) to a high of 114.0 µg/L (2017).

C-613 Sediment Basin Inlet:

The average inlet concentration in 2019 for uranium was 230.0 µg/L, which is the highest average since 2009. The eleven-year average inlet concentration from 2009 to 2019 was 191.4 µg/L. 2005 had the highest historically reported average inlet concentration of 458.0 µg/L and the lowest to date, in 2013, was 78.5 µg/L.

C-613 Sediment Basin Outlet (KPDES Outfall 001):

The average outlet concentration in 2019 was 12.0 µg/L, which was the lowest recorded to date. The highest reported average outlet concentration was 244.0 µg/L (2006), which was at the end of the scrap metal removal project and before the growth of a vegetative cover. The lowest concentration, 12.0 µg/L, occurred in 2019.

Iron Bridge

The average concentration of uranium metal at the Iron Bridge sampling point in 2019 during discharge sampling events was 2.7 µg/L. The concentration of uranium reported at the Iron Bridge non-discharge sampling event performed on September 17, 2019 was 0.56 µg/L. The Iron Bridge sampling point was first integrated into the sample regimen in 2007, and the average concentration of uranium metal in non-discharge events from 2007 to 2019 is 2.9 µg/L.

Conclusions:

The average 2019 discharge event inlet measurement for alpha particles in water was 60.8 pCi/L and the average outlet measurement was 3.5 pCi/L. The average 2019 inlet measurement for beta particle in water was 149.8 pCi/L and the outlet measurement was 7.2 pCi/L. Alpha and beta activity measurements showed an approximate 95% decrease between the C-613 Sediment Basin inlet and the Outfall 001 KPDES discharge point. The concentration of uranium metal also decreased from an inlet average of 230.0 µg/L to an outlet average of 12.0 µg/L, an approximate 95% reduction. Analytical results from the Iron Bridge sampling point reported nearly five times as much uranium metal during discharge events (2.7 µg/L) as opposed to the non-discharge event (0.56 µg/L).

Analysis of the data reports that uranium metal continues to be released during discharge events, which warrants continued oversight and management of on-site storm water. Based on data

analysis and field observations, AIP concludes that former Scrap Yard storm water runoff, building demolition and remedial investigation activities contribute to the off-site migration of metals and radionuclides. Interpretation of this data has determined that the Sediment Basin continues to serve its function by reducing the off-site migration of concentrations of metals, suspended solids and radionuclides. The greatest percentage of uranium metal reduction (inlet versus outlet concentration) since the basin's installation was observed in 2019. Therefore, AIP believes that the C-613 Sediment Basin is performing as designed and should continue operation.

Radiation Health Branch AIP Sampling

The 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 2019, RHB collected 1,636 samples and performed 1,038 analyses on those samples, plus 319 analyses on additional 110 samples collected by EEC.

Groundwater

RHB monitors groundwater by routinely collecting quarterly samples at 10 residential wells surrounding the site (Figure 8). Each sample is analyzed for gross alpha/beta counting and gamma spectroscopy. If gross alpha equals or exceeds 5 pCi/L and/or gross beta equals or exceeds 9 pCi/L, then technetium-99 is also analyzed.

The majority of the locations are private drinking water wells that are potentially impacted by the TCE and Tc-99 plumes 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 activities at the site, to determine the need for additional monitoring locations or modification of current locations.

In 2019, there were no abnormal measurements from RHB groundwater monitoring efforts.

Surface Water

RHB AIP monitors surface water by taking quarterly samples at 28 locations surrounding the site (Figure 9) and through continuous sampling at an additional 4 locations (Figure 10). (The sampling locations are labeled "ISCO" due to the brand name of the samplers that are used.)

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.

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 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 5 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 determined to be sourced from recently removed C-340 paneling that had high levels of surface contamination by a mobile uranium compound (likely UO_2F_2, uranyl fluoride). In response, RHB AIP began monitoring points in the discharge path from C-746-U, beginning in August 2013, in order to ensure that effluent release limits were not exceeded. These levels have naturally decreased with time and have been well below the effluent release limits. During the fourth quarter of 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.

In 2019, there were no abnormal measurements from samples collected at RHB AIP surface water monitoring locations.

Air

RHB AIP monitors air by taking continuous samples at 10 locations surrounding the site (Figure 11), collected at 21-day periods. 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 winds at the plant and expected release points/types from the plant. The background location 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 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 2019, there were no observed abnormal measurements from RHB AIP air monitoring efforts.

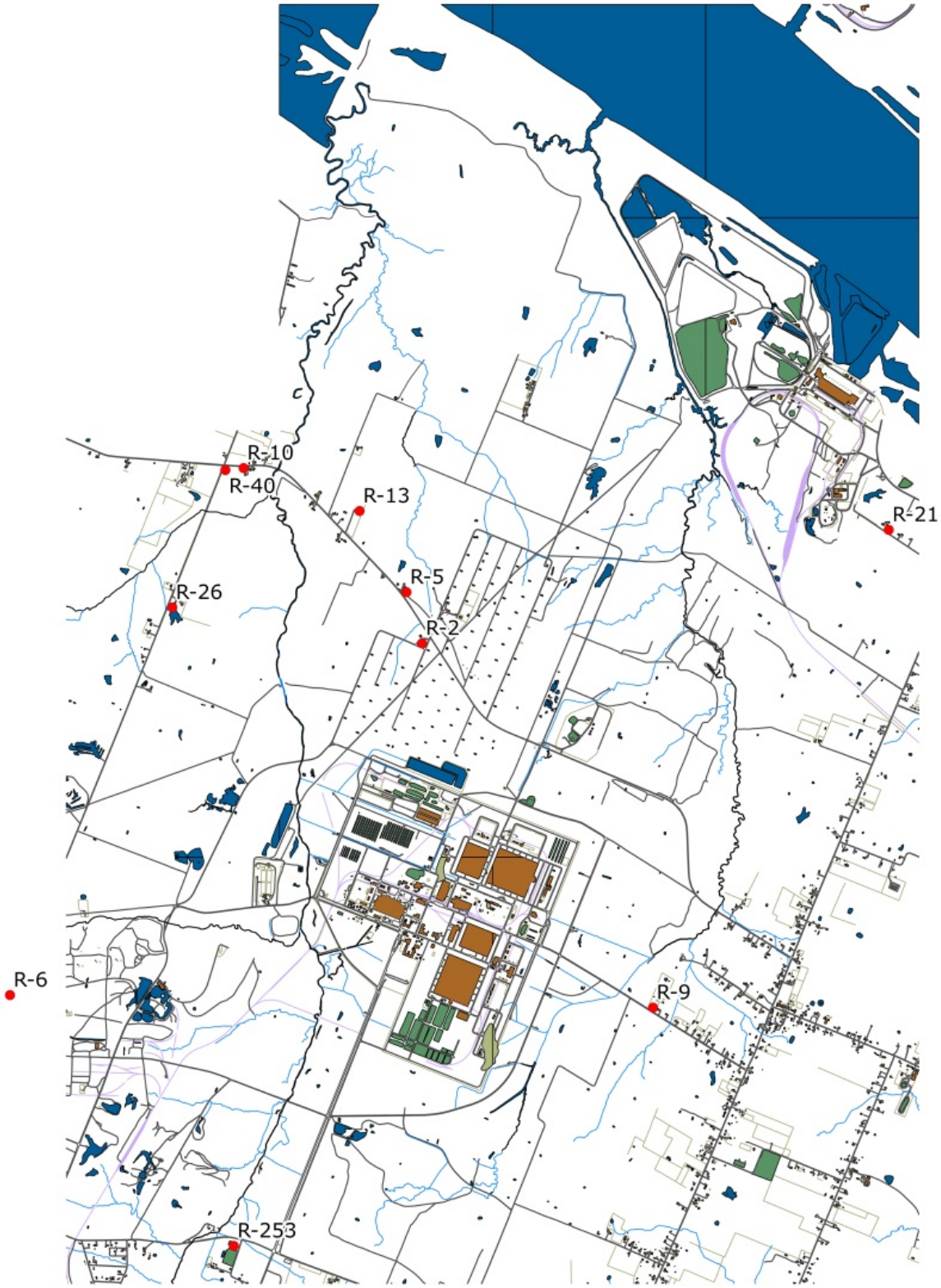

Figure 8. RHB AIP Groundwater Monitoring Locations

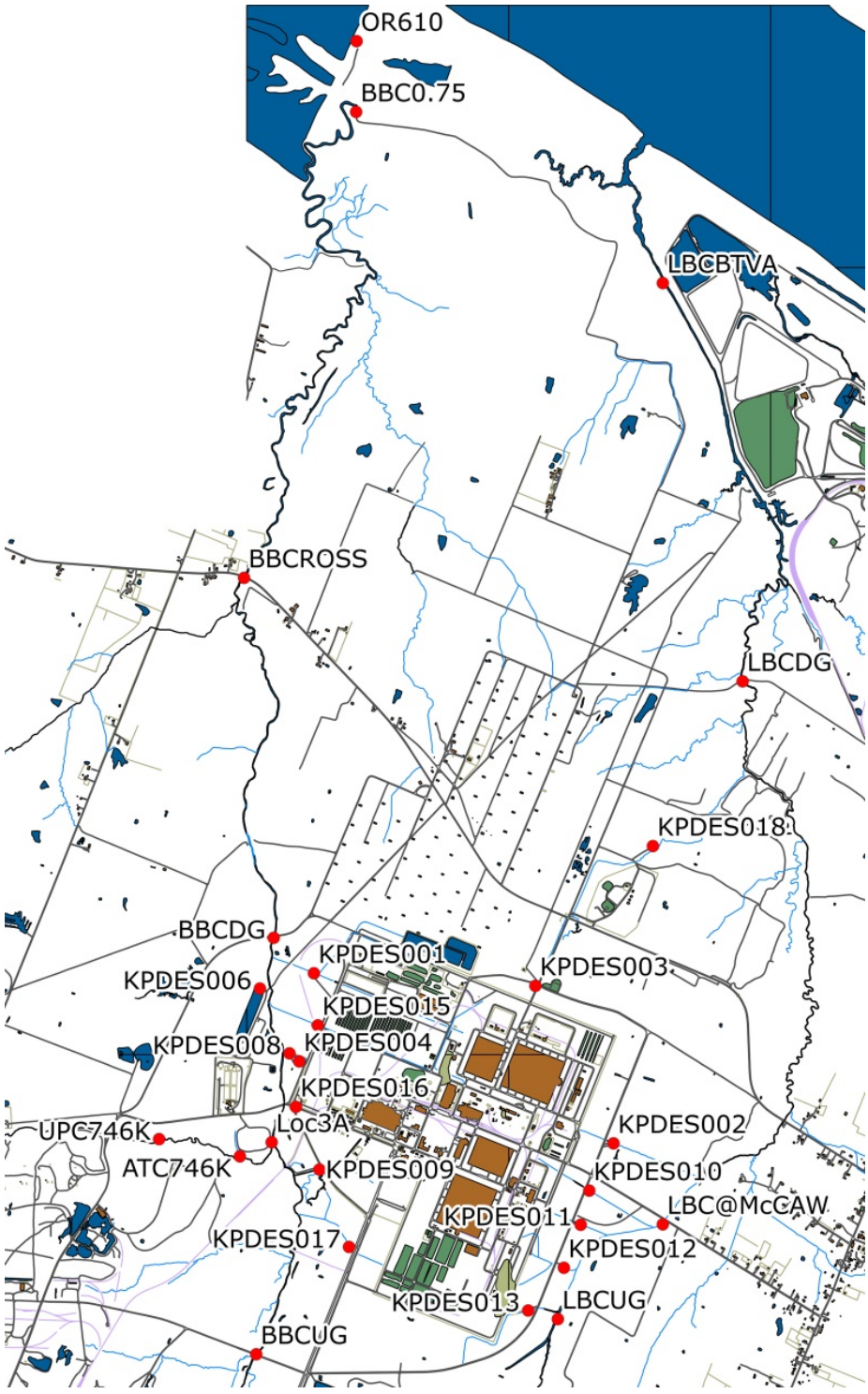

Figure 9. RHB AIP Quarterly Surface Water Sampling Locations

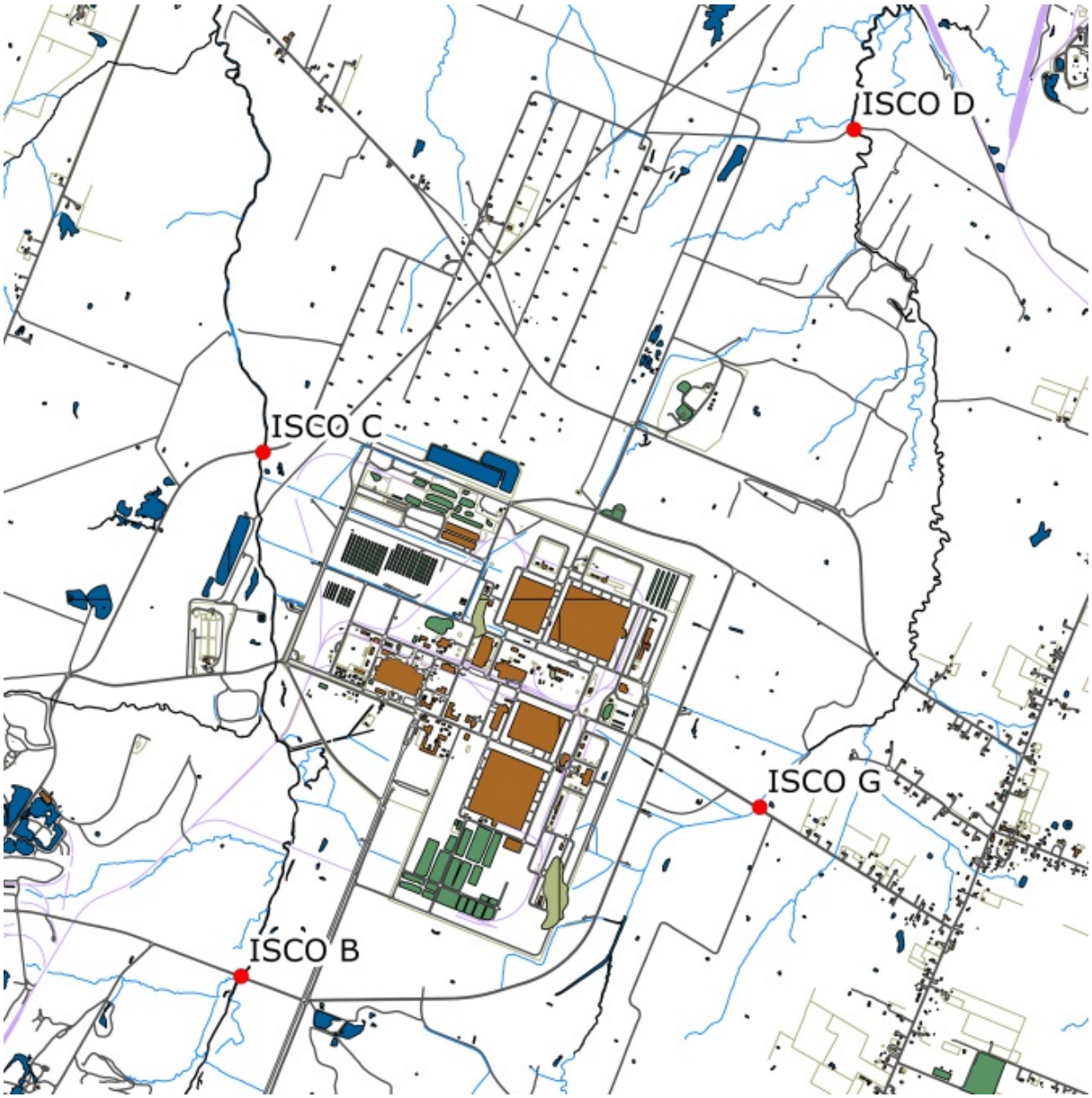

Figure 10. RHB AIP ISCO Sampling Locations

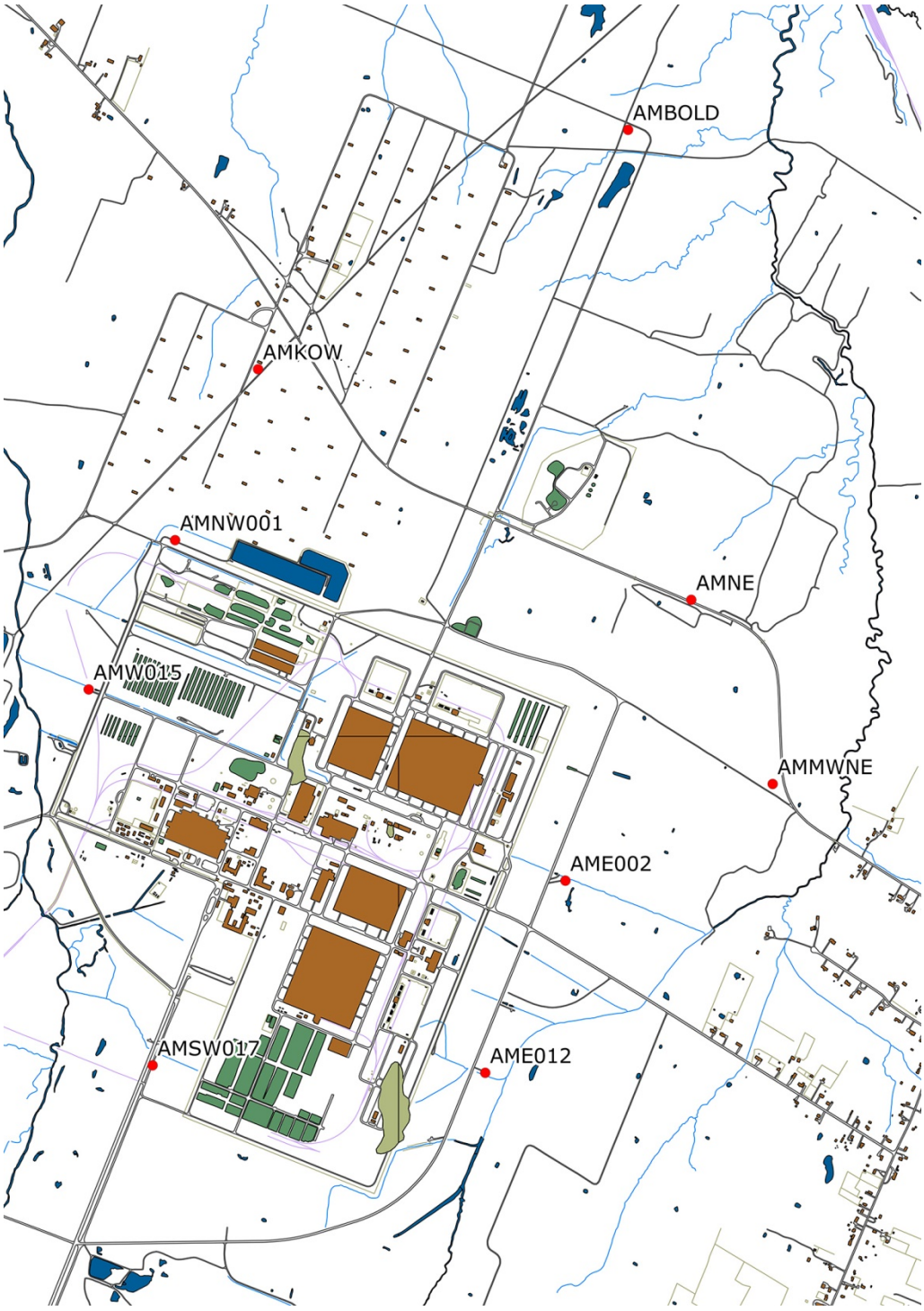

Figure 11. RHB AIP Air Monitoring Locations

Additional Oversight Activities

During 2019 DWM AIP staff routinely observed portions of the PGDP reservation on a weekly basis. Locations within the Limited Area 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 groundwater treatment unit, 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 burial grounds. Areas outside of the Limited Area observed weekly included wastewater lagoons, the Northeast and Northwest Plume Pump-and-Treat Units, the C-613 Sedimentation Basin, the K-Landfill, the water treatment plant and sedimentation ponds, and plant outfalls (001, 002, 006, 008, 009, 010, 011, 012, 013, 015, 016, 017). No significant issues requiring DOE's attention were noted during any oversight activity in 2017. The following is an abbreviated list of oversight activities that were completed in 2019:

- 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 2019 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.

- Concerns about an ongoing sanitary water leak from C-725 discharging across a paved area and into a storm drain were raised with DOE. The leak was then repaired within 30 days by the prime contractor after presenting the issue to DOE.

- A total of 6,678 monitoring well evaluations were completed. The components assessed during an evaluation include the well padlock, outer casing condition, protective bollards, the concrete pad and overall accessibility.

- Surveillances of SWMU activities were routinely conducted for proper management of SWMU material and spoils. These SWMUs were described in 16 Regulatory Notifications approved by the KDWM during 2019.

- Construction activities of a new TVA switchyard at C-755-N and associated transmission lines into the limited area were observed to ensure proper storm water runoff controls were installed and maintained throughout the project to minimize offsite mobilization of sediments.

- Monitoring of equipment removal from C-331, C-333, C-335, and C-337 associated with the deactivation of the process buildings was conducted as part of the weekly observation activities.

Kentucky FFA Program Elements for 2019

Surface Water Operable Unit

DOE reprioritized the Surface Water Operable Unit to an out-year activity after DOE's near term priority became the C-400 Complex OU. The SWOU is comprised of thirty (30) Solid Waste Management Units (SWMUs) which have likely contributed significant contamination to the creeks and outfalls that receive surface water runoff from the PGDP. This potential to affect off-site waterways is one of the main reasons for the prioritization of investigative and removal actions.

During uranium enrichment operations, the Paducah Site used in excess of 20 million gallons of water daily which was pumped from the Ohio River. After active enrichment operations ceased on July 25, 2013, the PGDP began using significantly less water. After use, water is discharged via unlined ditches through outfalls and into Little Bayou and Bayou Creeks. These two creeks converge and ultimately discharge back into the Ohio River. The Kentucky Division of Water regulates these outfall discharges under one Kentucky Pollutant Discharge Elimination System (KPDES) permit. Waters discharged through these Outfalls include storm water runoff, treated groundwater from pump-n-treat systems, process wastewater, cooling wastewater, sediment basin discharge water and sanitary wastewater.

Surface Water OU Documents reviewed in 2019

No Surface Water OU documents were received or reviewed in 2019.

C-400 Complex Operable Unit

C-400 Complex (C-400 OU) is a new OU, established in a Memorandum of Agreement on the C-400 Complex under the Federal Facility Agreement for the PGDP, which was signed on August 8, 2017. This agreement was incorporated into the 2018/2019 Site Management Plan (SMP). The C-400 OU is comprised of seven SWMUs, of which more may be added if new SWMUs are discovered during investigation, deactivation or demolition activities.

The Removal Notification for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/07-2420&D1) was received on January 10, 2018. The KDWM concurred with the D1 Removal Notification and the EPA submitted comments on February 9, 2018. The Removal Notification for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/07-2420&D2) was submitted on March 8, 2018. The KDWM provided (second) concurrence to the Removal Notification on April 16, 2018 and the EPA provided conditional concurrence on May 7, 2018. The DOE initiated Informal Dispute to EPA's conditional concurrence on June 4, 2018 and elevated to Formal Dispute on July 6, 2018.

The Action Memorandum for the C-400 Cleaning Building Non-Time Critical Removal Action was received on June 21, 2018, which the KDWM and EPA submitted comments on August 20, 2018. Based on the DOE's June 4, 2018 invocation of Informal Dispute, this document track was terminated in a letter dated September 19, 2018.

The Engineering Evaluation / Cost Analysis for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/-07-2435&D1) was received on May 2, 2018. The KDWM submitted comments on May 29, 2018 and the EPA submitted partial comments on June 1, 2018 and finalized their comments on June 26, 2018. The Engineering Evaluation / Cost Analysis for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/07-2435&D2) was submitted on August 22, 2018. On, August 22, 2018, the KDWM concurred with the D2 EE/CA and the EPA provided conditional concurrence. The DOE initiated Informal Dispute to EPA's conditional concurrence on September 21, 2018 and elevated to Formal Dispute on November 20, 2018.

Formal Dispute culminated in a signed Memorandum of Agreement for Resolution for the Removal Notification and the EE/CA which was submitted on August 12, 2019. This effectively terminated both document tracks. A draft Memorandum regarding the suspension of the CERCLA

documents (Removal Notification and EE/CA) was submitted on August 28, 2019. The EPA provided comments to the draft Memorandum on September 11, 2019 and the KDWM on September 16, 2019. The DOE then submitted a Final Memorandum on October 2, 2019, which the EPA approved on October 2, 2019 and the KDWM on October 7, 2019.

The Paducah Gaseous Diffusion Plant C-400 Cleaning Building Basement Slab and Subsurface Structures Sampling and Analysis Plan (2430&D1) was received on July 26, 2018. The EPA submitted comments on November 15, 2018 and the KDWM on November 21, 2018. In accordance with the terms and Condition #6 of the Final Memorandum dated October 2, 2019, the document will be incorporated into Chapter 9 of the Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit.

All three parties to the Federal Facilities Agreement met and collaborated throughout 2018 and 2019 to scope portions of the combined Remedial Investigation / Feasibility Study Workplan. The

Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit (DOE/LX/07-2433&D1), was received on November 19, 2018. The KDWM submitted comments on May 10 and the EPA on May 22, 2019. The Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit (DOE/LX/07-2433&D2) was submitted on September 18, 2019, and was approved by both the EPA and KDWM on October 1, 2019. A Notification of Field Start for the Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit was submitted on November 25, 2019. The Notification stated that field activities, such as gamma walkover surveys and maintenance/redevelopment of existing monitoring wells, were initiated on November 11, 2019.

C-400 COMPLEX OPERABLE UNIT DOCUMENTS REVIEWED IN 2019

Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex Operable Unit (DOE/LX/07-2433&D1), dated November 27, 2019. KDWM submitted comments on May 10, 2019 and EPA on May 22, 2019.

Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit (DOE/LX/07-2433&D2), dated September 18, 2019. KDWM and EPA approved the document on October 1, 2019.

(Draft) Memorandum of Agreement for Resolution of Formal Disputes on EPA Conditional Concurrence on the Removal Notification for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/07-2420&D2) and the *Engineering Evaluation / Cost Analysis for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit*

(DOE/LX/-07-2435&D2), dated August 28, 2019. EPA submitted comments to the (draft) MOA on September 11, 2019 and the KDWM on September 16, 2019.

(Final) Memorandum of Agreement for Resolution of Formal Disputes on EPA Conditional Concurrence on the Removal Notification for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/07-2420&D2) and the Engineering Evaluation / Cost Analysis for Demolition of the C-400 Cleaning Building in the C-400 Complex Operable Unit (DOE/LX/-07-2435&D2), dated October 2, 2019. EPA approved the (final) MOA on October 2, 2019 and the KDWM on October 7, 2019.

Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit - Notification of Field Start (DOE/LX/07-2433&D2), dated November 25, 2019.

Groundwater Operable Unit

Northeast Plume Containment System (Pump-and-Treat)

The Northeast Plume Containment System was installed to remove and treat groundwater from the higher concentration portions of the Northeast Plume. The system consists of extraction wells EW234 and EW235 and their respective water treatment units C-765 and C-765A. The treatment units each contain an air stripper, which treats the water to less than the effluent concentration goal of 30 ppb TCE. Once treated, the water from each unit is piped to a reservoir and discharged to CERCLA Outfall 001 (C001), which flows to Little Bayou Creek.

In 2019, the Northeast Plume extraction wells EW234 and EW235 pumped 80,064,755 gallons of water, which resulted in the removal of ~7.4 gallons of TCE. Since Northeast Plume pumping operations began on Feb. 28, 1997, approximately 336.7 gallons of TCE have been removed from 1,924,478,652 gallons of extracted groundwater. An operational chart (Table 6) of the Northeast Plume Containment System reports both the operational efficiency and gallons of water treated during each month in 2019.

Month	% Operational		Gallons	Month	% Operational		Gallons
	C765	C765A			C765	C765A	
January	99.9	49.3	6,019,995	July	67.2	91.1	6,041,050
February	68.8	99.9	5,866,315	August	99.8	35.5	5,560,593
March	74.7	100.0	6,613,082	September	99.9	99.9	7,529,809
April	99.9	100.0	7,531,682	October	94.9	93.4	7,332,012
May	99.7	98.0	7,733,406	November	99.0	99.7	7,522,596
June	29.4	97.3	4,517,697	December	99.9	100.0	7,808,518

Table 6. 2019 Northeast Plume Containment System Operation Data

During 2019, the Northeast Plume Interim Remedial Action Optimization Project continued with adjusting extraction well pumping rates and quarterly monitoring of seven (C-400) transect wells. Each transect well is spaced ~200 feet apart and located approximately 800 feet east of the C-400 building. Transect wells are monitored quarterly for volatile organic compounds (VOC) and Tc-99. These results are compared to background (pre-pumping) concentrations in order to provide an early warning in the event that TCE or Tc-99 is inadvertently pulled east (away) from the C-400 area by either of the two optimized extraction wells. If concentration trends significantly increase over time, the FFA parties will convene to develop a solution before TCE or Tc-99 can spread by migrating eastward from the C-400 building toward the two new extraction wells.

The quarterly 2019 sampling results for TCE concentrations continued to increase in some transect wells. Quarterly sampling of the transect wells will continue to monitor if optimization efforts are mobilizing contaminants away from the C-400 area

Northeast Plume Optimization Documents Reviewed In 2019:

No Northeast Plume groundwater system documents were received or reviewed in 2019.

Northwest Plume Containment System (Pump-N-Treat)

The Northwest Plume Containment System was installed to remove and treat groundwater from higher-concentration portions of the Northwest Plume. The system is located at the plant's northwest corner and consists of two extraction wells and the C-612 water treatment facility. The Northwest pump-and-treat system was optimized in 2010 and a major refurbishment and upgrade of the C-612 water treatment system was completed in early 2016. In 2019, the Northwest Plume System pumped 104,107,950 gallons of water from extraction wells EW232 and EW233, which resulted in the removal of 94.2 gallons of TCE. Since Northwest Plume pumping operations began on August 28, 1995, approximately 3,778.1 gallons of TCE have been removed from 2,429,302,511 gallons of extracted groundwater. An operational chart (Table 7) of the Northwest Plume Containment System reports both the operational efficiency and gallons of water treated during each month in 2019.

Month	% Operational	Gallons	Month	% Operational	Gallons
January	99.9	8,843,330	July	99.5	9,045,435
February	99.7	8,044,070	August	98.0	8,851,008
March	99.0	8,946,018	September	99.7	8,648,462
April	95.8	8,513,022	October	98.3	8,738,330
May	98.7	8,899,903	November	100.0	8,569,390
June	99.7	8,187,932	December	99.5	8,821,050

Table 7. 2019 Northwest Plume Groundwater System Operation Data

Northwest Plume Groundwater System Documents Reviewed In 2019:

No Northwest Plume groundwater system documents were received or reviewed in 2019.

Southwest Plume Sources

SWMU 1 C-747-C Oil Landfarm

A deep soil mixing remedial action using a large (8-ft) diameter auger, followed by steam with vapor extraction/treatment and zero-valent iron injection was completed in 2015 at the SWMU 1 Oil Landfarm. The purpose of the project was to remove organic solvents (primarily TCE) from 258 soil columns to a depth of approximately 60 feet bgs. The remedial action recovered 24 +/- 12 gallons of VOCs during operation. Passive treatment using zero-valent iron (ZVI) is on-going. Semi-annual sampling of SWMU 1 monitoring wells was performed to monitor the continuing effects of the ZVI. Monitoring wells MW543 and MW544 are located upgradient of the mixing area and have a downward trend in TCE concentrations for the 2018 and 2019 monitoring period. MW545 and MW547 are located downgradient of the mixing area and both had ever so slightly increasing concentrations of TCE in 2019. The remaining wells (MW161, MW542, MW543, MW544, MW546) saw an overall decrease in TCE concentrations in 2019 (Table 8).

Well #	Sample Date	AIP TCE µg/L	Gradient	Sample Date	DOE TCE µg/L	DOE DL	Conc. Trend ↑↓
MW161	No 2019 Data	No 2019 Data	Down	5/29/2019	568.0	10.0	↓
				6/5/2019	629.0	10.0	
				12/4/2019	435.0	10.0	
MW542	No 2019 Data	No 2019 Data	Down	6/5/2019	5.04	1.0	↓
				12/4/2019	1.89	1.0	
				12/4/2019	1.96	1.0	
MW543	No 2019 Data	No 2019 Data	Up	6/5/2019	10.10	2.0	↓
				12/4/2019	6.29	1.0	
MW544	No 2019 Data	No 2019 Data	Up	6/12/2018	239.0	5.0	↓
				12/17/18	104.0	2.0	
MW545	No 2019 Data	No 2019 Data	Down	6/5/2019	1.0	1.0	↑
				12/4/2019	1.04	1.0	
MW546	No 2019 Data	No 2019 Data	Down	6/5/2019	148.0	5.0	↓
				12/4/2019	76.30	1.0	
MW547	No 2019 Data	No 2019 Data	Down	6/5/2019	731.0	10.0	↑
				12/4/2019	763.0	20.0	

Table 8. SWMU 1 C-747-C Oil Landfarm TCE Concentrations

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

An investigation of RGA groundwater conducted in 2015 found TCE concentrations at SWMU 211-A in the upper RGA, indicating an upgradient UCRS source that possibly originating under the C-720 building or from SWMU 211-B. The investigation concluded that the conceptual site model (CSM) for SWMU 211-A is valid, and DOE recommended implementing bioremediation and long-term monitoring. The CSM for SWMU 211-B was found to be invalid because of analytical results indicating that DNAPL is likely nearby. The Southwest Plumes Sources ROD only addresses VOCs in UCRS soils and corresponding shallow groundwater. The three parties agreed that enhanced bioremediation could be effective even against higher VOC concentrations associated with DNAPL-like concentrations known to exist in the upper RGA.

Southwest Plume Sources Documents Reviewed in 2019:

30% Remedial Design Report for SWMU 211-A for VOC Sources to the Southwest Groundwater Plume (DOE/LX/07-2435&D1), dated January 30, 2019. KDWM and EPA submitted comments on April 30, 2019.

60% Remedial Design Report for SWMU 211-A for VOC Sources to the Southwest Groundwater Plume (DOE/LX/07-2435&D1), dated June 28, 2019. KDWM and EPA submitted comments on August 16, 2019.

90% Remedial Design Report for SWMU 211-A for VOC Sources to the Southwest Groundwater Plume (DOE/LX/07-2435&D1), dated December 20, 2019. EPA submitted comments on December 16, 2019, and KDWM approved the document on December 6, 2019.

The 100% Certified for Construction Remedial Design Report for SWMU 211-A for VOC Sources to the Southwest Groundwater Plume (DOE/LX/07-2435&D2), dated December 19, 2019. KDWM approved the document on December 20, 2019 and EPA on December 23, 2019.

Remedial Action Work Plan for SWMU 211-A Enhanced In Situ Bioremediation for Volatile Organic Compound Sources to the Southwest Groundwater Plume (DOE/LX/07-2443&D2), dated December 5, 2019.

Burial Grounds Operable Unit

The historic generation of various types of waste materials at the PGDP led to on-site multiple subsurface disposal areas referred to as burial grounds (Figure 12). The Burial Grounds OU is comprised of 12 such areas that are designated by their respective SWMU numbers: the C-749 Uranium Burial Ground (SWMU 2); the C-404 Low-Level Radioactive Waste Burial Grounds (SWMU 3); the C-747 Contaminated Burial Yard and C-748-B Burial Area (SWMU 4); the C-746-F Burial Yard (SWMU 5); the C-747-B Burial Grounds (SWMU 6); the C-747-A Burial Grounds and Burn Area (SWMU 7); the C-746-S Landfill (SWMU 9); the C-746-T Landfill (SWMU 10); the C-747-A Burial Grounds and Burn Area (SWMU 30); the Residential/Inert Landfill Borrow Area (P-Landfill) (SWMU 145); the C-746-B Pad (SWMU 472) and the Scrap Material West of C-746-A (SWMU 520).

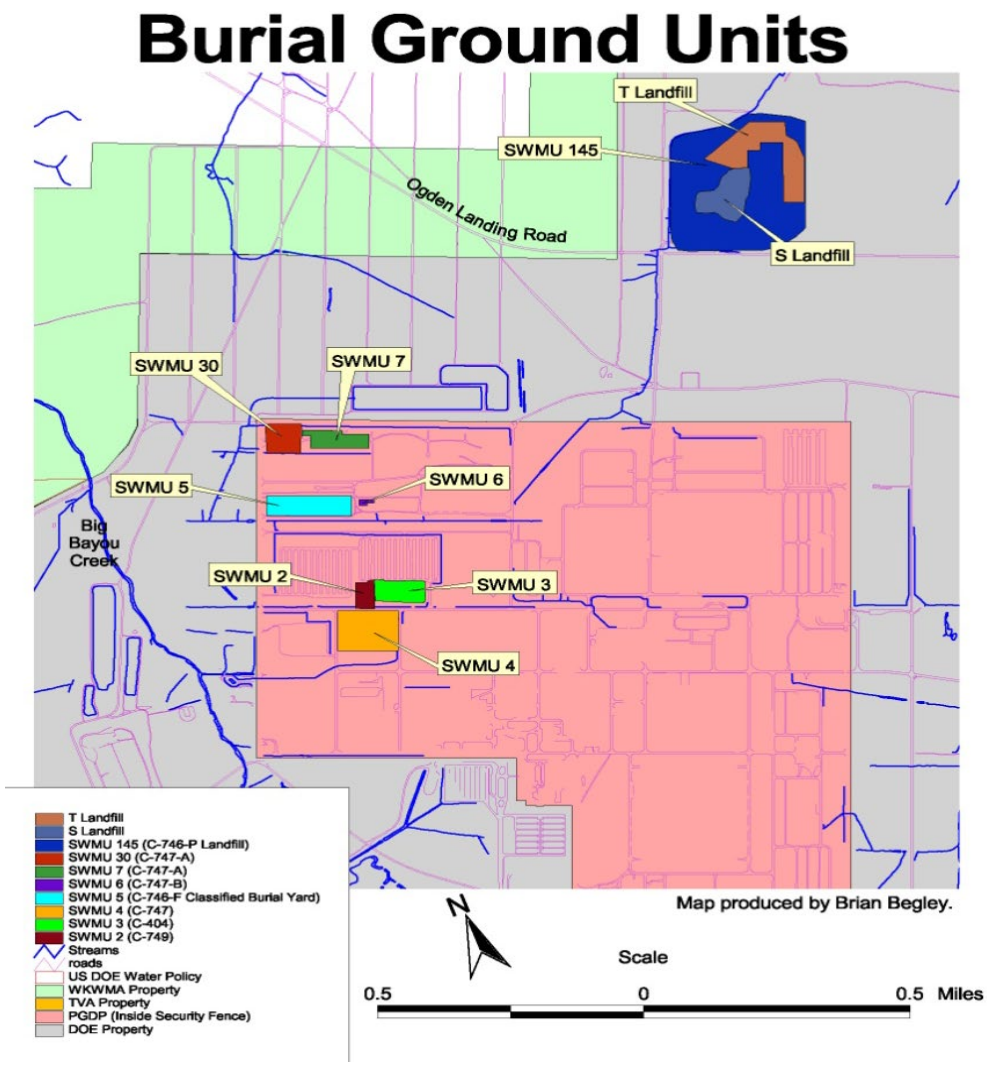

Figure 12. Burial Ground SWMUs

Burial Grounds Operable Unit Documents Reviewed in 2019:

No Burial Grounds Operable Unit documents were received or reviewed in 2019.

Soils Operable Unit

There are currently 63 SWMUs in the Soils Operable Unit. A major objective of the Soils OU investigations is to determine the nature and extent of contamination in the soils to a depth of 10 feet below grade surface (bgs) and 16 feet bgs near utility corridors.

Soils Operable Unit Documents Reviewed in 2018:

No Soils OU documents were received or reviewed in 2018.

Decontamination and Decommissioning Operable Unit

The pre-GDP D&D OU has addressed 17 inactive facilities at the Paducah site, some of which have been out of service for decades. The C-410/420 Complex was the last of the inactive facilities to be addressed under this OU. The scope of the pre-GDP shutdown D&D OU has been completed.

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 excavated. As much as 4.6 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 CERCLA waste disposal alternatives feasibility study.

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 the existing on-site C-746U 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 disposition in an off-site landfill. An on-site repository would allow for engineered disposal of non-hazardous, hazardous, Toxic Substances Control Act (TSCA), low-level radioactive and low-level radioactive mixed wastes on-site, thereby avoiding potentially more costly off-site disposal options. However, the option to ship all or a portion of the waste off-site to a DOE owned or commercial waste facility still exists.

Waste Disposition Alternatives Documents Reviewed in 2019:

No CERCLA Waste Disposal Alternatives documents were reviewed in 2019.

Solid Waste Management Units (SWMUs)

During the reporting period from Jan. 1 to Dec. 31, 2019, Kentucky received one revised Solid Waste Management Unit Assessment Report (SAR). No SWMUs were granted No Further Action (NFA) or assigned Requires Further Investigation (RFI).

REVISED AND NEWLY-DISCOVERED SWMU ASSESSMENT REPORTS SUBMITTED TO KENTUCKY BETWEEN JANUARY 1 AND DECEMBER 31, 2019

SWMU Number	Description	OU Location	Sub-project	Status	SAR Report Date	Date(s) SAR Amended	Date of RFI
513	C-411 Cell Maintenance Room Sump	Soils & Slabs OU	N/A	Requires RFI	8/29/2002	1/30/2019	8/29/2002

SOLID WASTE MANAGEMENT UNITS THAT KENTUCKY GRANTED NO FURTHER ACTION STATUS BETWEEN JANUARY 1 AND DECEMBER 31, 2019

SWMU Number	Description	(Former) OU Location	(Former) Sub-project	Status	SAR Report Date	Date(s) SAR Amended	Date of NFA
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

SWMU DOCUMENTS REVIEWED IN 2019

In 2019, one SAR Revision was submitted and no newly-discovered SWMUs were reported. At the end of the reporting period, no SARs were under review.