Commonwealth of Kentucky

Environmental Oversight Report 2020
Paducah Gaseous Diffusion Plant

Kentucky Division of Waste Management
300 Sower Boulevard
Frankfort, Kentucky 40601
502-782-6317

This 2020 Environmental Oversight Report, finalized in October 2022, 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. 16, 2020, to Dec. 31, 2020. 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 502-782-6317.

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Table of Contents

TABLES

FIGURES

ACRONYMS

Above Mean Sea Level	AMSL
Agreement in Principle	AIP
Below Ground Surface	bgs
Cabinet for Health and Family Services	CHFS
Calendar Year	CY
Citizens Advisory Board	CAB
Comprehensive Environmental Response, Compensation, and Liability Act	CERCLA
Comprehensive Site Operable Unit	CSOU
Decontamination and Decommissioning	D&D
Dense Non-Aqueous Phase Liquid	DNAPL
Department of Energy (US)	DOE
Depleted Uranium Hexafluoride	DUF_6
Depleted Uranium Hexafluoride (DUF_6) Footprint Underlying Soils	DUFUS
Division for Air Quality	DAQ
Division of Water	DOW
Dye-Enhanced Laser Induced Fluorescence	DyeLIF
Electrical Resistance Heating	ERH
Energy and Environment Cabinet	EEC
Environmental Protection Agency (US)	EPA
Extraction Well	EW
Federal Advisory Committee Act	FACA
Federal Facilities Agreement	FFA
Fiscal Year	FY
Gallons Per Minute	gpm
Geographical Area	GA
Kentucky Department for Environmental Protection	KDEP
Kentucky Pollutant Discharge Elimination System	KPDES
Little Bayou Creek	LBC
Membrane Interface Probe	MIP
Memorandum of Agreement	MOA
Minimum Detectable Activity	MDA
Monitoring Well	MW
Not Applicable	NA
Operable Unit	OU
Paducah Gaseous Diffusion Plant	PGDP

Parts Per Billion	ppb
Portsmouth/Paducah Project Office	PPPO
PPPO Environmental Geographic Analytical Spatial Information System	PEGASIS
Polychlorinated Biphenyl	PCB
Radiation Health Branch	RHB
Requires Further Investigation	RFI
Record of Decision	ROD
Regional Groundwater Aquifer	RGA
Remedial Investigation/Feasibility Study	RI/FS
Resource Conservation and Recovery Act	RCRA
Site Management Plan	SMP
Solid Waste Management Unit	SWMU
Solid Waste Management Unit Assessment Report	SAR
Technetium-99	Tc-99
Tennessee Valley Authority	TVA
Total Suspended Solids	TSS
Trichloroethene	TCE
Upper Continental Recharge System	UCRS
United States Enrichment Corporation	USEC
University of Kentucky Research Consortium for Energy and the Environment	KRCEE
Volatile Organic Compound	VOC
West Kentucky Wildlife Management Area	WKWMA
Work Plan	WP

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) 2020.

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) 2020/2021 Site Management Plan (SMP). Activities focus on environmental investigations to determine if any impacts or releases have occurred to the environment within the 750-acre Paducah Site that have yet to be investigated or were previously inaccessible. Field

activities associated with the C-400 Complex Operable Unit (OU) pertaining to the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (WP), was the primary environmental focus during 2020.

At the Paducah Site, 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 (AOC). 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 2020/2021 SMP) identified for the Paducah Site 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 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 final CSOU 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 Paducah Site. 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) routinely attend these meetings. The full board and educational meetings allow for meaningful interaction between the CAB board members and any members of the general public that choose to attend. In 2020, two CAB meetings were held. On January 16, 2020, a full board meeting was held. The most noteworthy part of this meeting was a DOE presentation featuring an update on C-400 Complex OU field work, the construction of a TVA Substation and progress on the deactivation of the C-531 Switchyard. In February 2020, a CAB educational meeting was held and a presentation on the proposed Enhanced In-Situ Bioremediation Remedial Action at SWMU 211-A was given. In addition, progress on the Environmental Baseline Survey Report for Parcel 1-A was presented. This turned out to be the last CAB meeting of the year as the coronavirus-19 pandemic prevented in-person meetings for the remainder of 2020. No in-person or virtual meetings would occur the rest of 2020.

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.

During 2020, two editions of Oversight News were issued. The Spring 2020 edition highlighted C-400 Remedial Investigation efforts that were underway, and another article summarized the plans for Enhanced In-Situ Bioremediation at SWMU 211-A. The Summer 2020 edition featured articles about the decommissioning and dismantling of former switchyards and monies earned by PACRO from the sale of recycled oils and metals. There was also an article memorializing the Record of Decision pertaining to the disposition (where it can be taken if declared a waste) of uranium oxide derived from the conversion of depleted uranium hexafluoride at the site. Due to the pandemic and a slowdown of work at the site, only two reports were generated during 2020.

Kentucky's Oversight Program

The Commonwealth of Kentucky (Kentucky) is responsible for overseeing the environmental cleanup of the PGDP and protecting human health and the environment. 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) federal grant programs for Kentucky. The CHFS RHB has radiation authority for Kentucky and 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)
- Office of Legal Services (OLS)
- 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 (Paducah Site) Section, within 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's government agencies, federal agencies and citizen's groups is another important function of the Paducah Site Section. Kentucky regularly cooperates and interacts with the U.S. 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. The FFA 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, planning dates, and enforceable milestones for the current fiscal year (FY) and the next two FYs. The SMP is evaluated and scoped annually. Once approved it 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 November 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 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. These groundwater plumes are the longest known contamination plumes leaving any DOE property within the United States and therefore constitute the main risk to human health and the environment associated with the Paducah Site. In 1989 DOE established an administrative geographical boundary called the Water Policy Box. Within this geographic area, DOE offered free hookups to the municipal water supply. In order to clean up contamination associated with the C-400 Complex Operable Unit (OU), a comprehensive investigation of the area beneath and around the C-400 building must be performed. This investigation set out in 2020 to define all sources of contamination and how each contaminant is distributed spatially (vertically and laterally) beneath the C-400 Complex OU.

In order to accomplish a comprehensive investigation of the C-400 Complex OU, 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, were moved out decades into the future.

The C-400 building is the main source of the two four-mile long TCE groundwater contamination plumes, commonly identified as the Northeast and Northwest Plumes. In order to clean up contamination at the C-400 complex, an exhaustive investigation of the nature and extent of contamination was needed to set the parameters for, and delineate the cleanup project area, beneath and surrounding the C-400 building. Scoping meetings for the investigation work plan, to be completed in a Remedial Investigation / Feasibility Study (RI/FS) Work Plan, began in 2018 and concluded in 2019. During the scoping process, sample locations were identified; concepts and data needs were determined; technical exchanges of investigation methods were discussed; and concerns relating to RI/FS Work Plan development were resolved.

Through meetings, discussions, and correspondence during the scoping process the DOE, EPA, and KDEP were able to mutually agree to the scope of the RI/FS Work Plan which received final approval from EPA and KDEP on October 7, 2019. The DOE announced implementation of the RI/FS Work Plan fieldwork on November 7, 2019. Initial field activities in the C-400 Complex OU included gamma walkover surveys, maintenance/redevelopment of existing monitoring wells, obstacle/infrastructure removal at designated sampling locations, and ground marking of drill locations and underground utilities. Installation of new monitoring wells began on March 3, 2020, and borings for soil samples commenced on March 10, 2020. Four monitoring wells had been installed and soil samples collected at three locations prior to the suspension of C-400 RI field activities

on March 24, 2020, due to the coronavirus-19 pandemic. Field activities resumed on July 28, 2020, with an additional 64 soil samples collected, 23 groundwater samples collected, and 7 monitoring wells installed by the end of 2020.

On December 5, 2019, DOE issued for review and comment the Remedial Action Work Plan for the SWMU 211-A Enhanced In-Situ Bioremediation for Volatile Organic Compounds. Following a review and resolution of comments on this document, KDEP issued concurrence for the RAWP on May 27, 2020. DOE entered informal dispute resolution due to conditions of approval from EPA on the RAWP about the area of contamination, on-site disposal, and radiological effluent limits. Negotiations to resolve the informal dispute continued through the remainder of 2020.

Site Management Plan Documents Reviewed In 2020

FY 2020 Site Management Plan (2444&D1), dated November 15, 2019. Kentucky submitted comments to the D1 on February 5, 2020 and the EPA on February 6, 2020, respectively.

FY 2020 Site Management Plan (2444&D2), dated April 21, 2020. Kentucky and EPA submitted (emailed) comments to the D2 on May 11, 2020.

FY 2020 Site Management Plan (2444&D2/R1), dated May 14, 2020. Kentucky approved the D2/R1 on May 15 and the EPA on May 21, 2020, respectively.

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 2020, the AIP wrote and distributed its 2020 Annual Strategic Environmental Sampling Plan, Oversight Newsletters, and drafted portions of the 2020 Environmental Oversight Annual Report. Electronic copies of all documents listed above can be found at https://eec.ky.gov/Environmental-Protection/Waste/hazardous-waste/Pages/paducah-gaseous-diffusion-plant.aspx. A fundamental task of the AIP program allows 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 2020

One of the primary goals of the AIP is to monitor and evaluate current site activities through sampling and observation, as well as to identify possible threats to human health and the environment. The secondary goal is to independently verify data collected by DOE contractors to ensure 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 to inform the public of current groundwater conditions. 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 2020, AIP independently contracted with TestAmerica Laboratories located in Earth City, Missouri, and used two 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 laboratories are independent (of DOE) laboratories. The CHFS RHB laboratory analyzes groundwater samples, as well as air and surface water samples 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, the KDEP 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 developed a public website to share environmental data 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 2020, AIP staff collected 78 samples from 57 different monitoring wells and 14 samples from 12 different residential wells. The 2020 AIP monitoring wells and seep sampling locations map (Figure 1) and residential well sampling map (Figure 2) shows all groundwater related locations sampled during the 2020 reporting period. Most of the wells sampled were located within two miles from PGDP groundwater plumes and/or less than two miles from the PGDP property boundary. Kentucky AIP environmental sampling results provide a line of evidence that supports validation of DOE data collection procedures and confirms that DOE analytical laboratory results are accurate, reproducible and independently verifiable. AIP independent oversight of DOE's groundwater sampling

program also helps to ensure that analytical results used to construct contaminant plume maps are accurate.

In 2020, AIP staff split water samples with DOE Contractors from 12 monitoring wells, 5 residential wells. Also, an additional 3 field replicates were split with DOE Contractors. 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 own 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. 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 Contractors in 2020, most had similar trichloroethene (TCE) and Technetium 99 (Tc-99) concentrations (Table 1).

Seeps Sampled by Kentucky AIP

At the beginning of 2020, 7 seeps in Little Bayou Creek were a part of Kentucky's sampling program. 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 have been known to even disappear for long periods of time. The base flow in LBC is comprised primarily of discharges from plant outfalls. These seeps are located downstream of the Paducah Site, approximately two miles south from the plant and approximately two miles from northeast of the confluence of LBC and the Ohio River. AIP staff check the LBC seep area monthly for any migrating and/or new seeps.

During an AIP walk down of LBC in June 2020, a new seep (#8) was discovered approximately a half-mile upstream of the area containing the other 7 seeps. The location of this seep in relation to the other 7 seeps is presented in Figure 3. The coordinates of the new seep were recorded and added to the AIP sampling program. Seep 8 was

sampled for TCE three times in 2020 by AIP personnel. TCE concentrations in the three samples were 0.985 ug/L, <0.5 ug/L, and 1.07 ug/L. For comparison, TCE concentrations in the other downgradient seeps sampled simultaneously ranged from undetected (<0.5 ug/l) to 1.63 ug/L. (Tc-99) concentrations from three Seep 8 samples collected during the year were 244 pCi/L (+/- 3.47), 35 pCi/L (+/- 1.37) and 22.7 pCi/L (+/- 1.24) Tc-99 concentrations from the other six seeps sampled simultaneously ranged from < 1.79 pCi/L to 28.5 pCi/L.

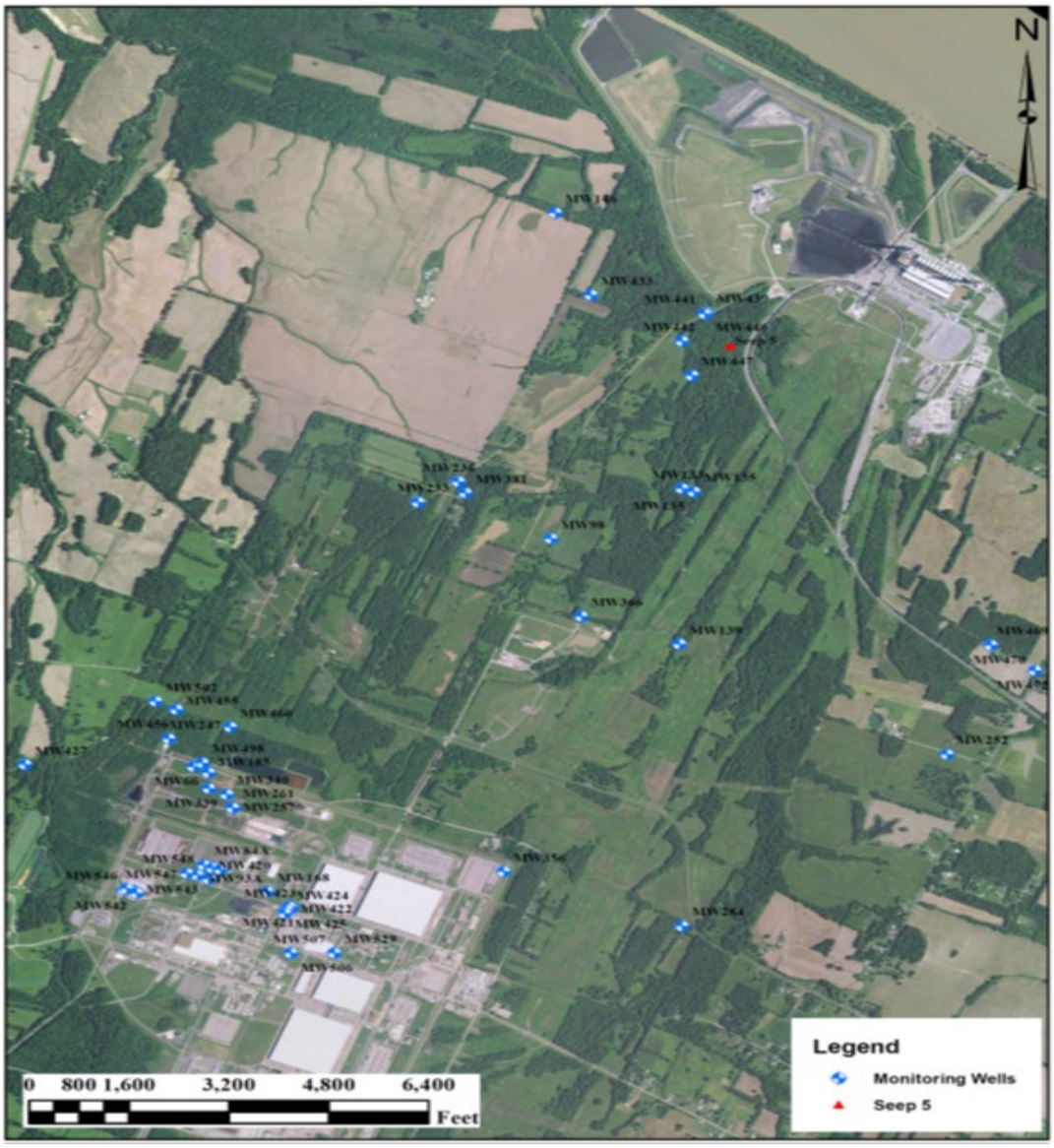

Figure 1. AIP 2020 MWs and Seep Sampling Locations

Figure 2. AIP 2020 Residential Well Sampling Locations

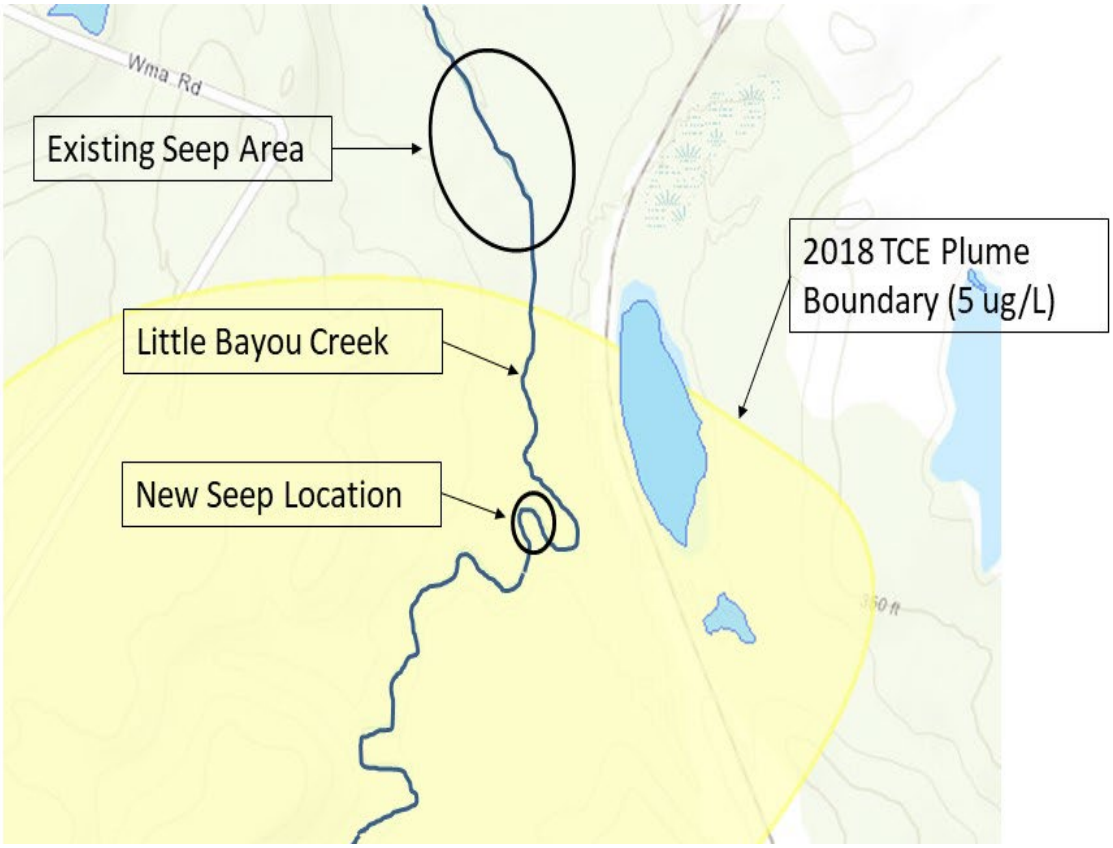

Figure 3: Location of Newly Discovered Seep #8

		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 Uncertainty	MDA	Value and Uncertainty	MDA
MW528	1/8/2020	126	0.5	130	2	55.3 +/- 1.46	3.75	63.1 +/- 10.3	12
MW84A	1/14/2020	1,780	50	2,910	50	236 +/- 2.21	3.75	297 +/- 18.8	22
MW87A	1/14/2020	2,320	50	2,580	50	NA	NA	1.16 +/- 12.2	21
MW90A	1/14/2020	116	0.5	92.9	1	11.4 +/- 1.21	3.75	7.15 +/- 13.8	23.4
MW420	1/14/2020	1,240	50	1,090	20	NA	NA	-3.61 +/- 12.3	21.2
MW93A	1/14/2020	1210	50	1,360	25	NA	NA	-1.5 +/- 11.9	20.5
MW455	3/4/2020	33.8	0.5	30.1	1	9.83 +/- 1.22	3.81	8.31 +/- 15.1	13.5
MW456	3/4/2020	5.82	0.5	5.34	1	NA	NA	7.83 +/- 3.37	13.4
MW506	6/8/2020	9,060	500	10,100	200	33.5 +/- 2.68	8.19	13.7 +/- 52.3	21.3
MW507	6/8/2020	4,380	500	4,370	50	34.8 +/- 2.69	8.19	13.8 +/- 54.5	21.4
MW543	6/16/2020	3.8	0.5	3.69	1	NA	NA	NA	NA
MW542	6/16/2020	1.65	0.5	1.54	1	NA	NA	NA	NA
MW547	6/16/2020	1,020	12.5	955	20	NA	NA	NA	NA
MW339	9/14/2020	1,090	0.5	933	20	96.0 +/- 1.67	3.85	116 +/- 12.3	14.8
R245	8/18/2020	U	0.5	U	1	2.24 +/- 1.11	3.61	NA	NA
R2	8/18/2020	5.16	0.5	4.29	1	1.35 +/- 1.10	3.61	NA	NA
R53	8/18/2020	U	0.5	U	1	-0.449 +/- 1.09	3.61	NA	NA
R26	8/18/2020	U	0.5	U	1	NA	NA	NA	NA
R40	8/18/2020	U	0.5	U	1	NA	NA	NA	NA
R13	8/18/2020	U	0.5	U	1	NA	NA	NA	NA

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

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

Northwest Plume Extraction Wells

AIP personnel did not collect independent water levels surrounding the Northwest Plume Extraction Wells during 2020. The most recent AIP cone of depression interpretation, based off AIP groundwater levels surrounding the Northwest Plume, is presented as Figure 4. 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 each have 20ft screens with the intake pumps located roughly 8 feet below the top of each well screen. The depth below ground surface for the pump intake at EW232 is 74.5ft and for EW233 it is 81.5ft. The lowest portion of the Regional Groundwater Aquifer (RGA) at EW232 is 88.8ft and at EW233 it is 95.7ft. AIP has conducted the water level monitoring for the last several years in order to evaluate the potential for high concentration TCE bypass under and around EW232 and/or EW233. TCE concentrations in the RGA (upper, middle, lower), surrounding the extraction wells were also evaluated. Four of these monitoring wells are compared in Figure 4. These four monitoring wells illustrate that overall concentrations are decreasing over the period from 2009 - 2020.

Generally, TCE concentrations in the NW Plume monitoring wells near the extraction wells have stabilized in the last two to four years. In 2020, the NW plume extraction wells pumped 102,160,438 gallons of water and 104,107,950 gallons of water, respectively. On the west side of the NW plume, MW248, MW250, and MW456 have shown decreasing TCE concentrations. Over the same period, TCE concentrations in proximal deep downgradient wells also appear to be trending down. AIP has speculated that the higher concentrations of TCE (dissolved phase) are by-passing the extraction wells. DOE conducted their own evaluation of the two NW Plume extraction wells in a white paper entitled *Evaluation of TCE Trends in MW460* where they independently concluded “that the likely condition is that the Northwest Plume is bypassing the EW232/EW233 well field within the lower RGA.” The same white paper provided an alternative explanation for

elevated TCE concentrations in MW460 as being residual downgradient TCE concentrations being pulled upgradient. The white paper also noted that higher concentrations (centroid) of TCE have shifted towards the east since 2010.

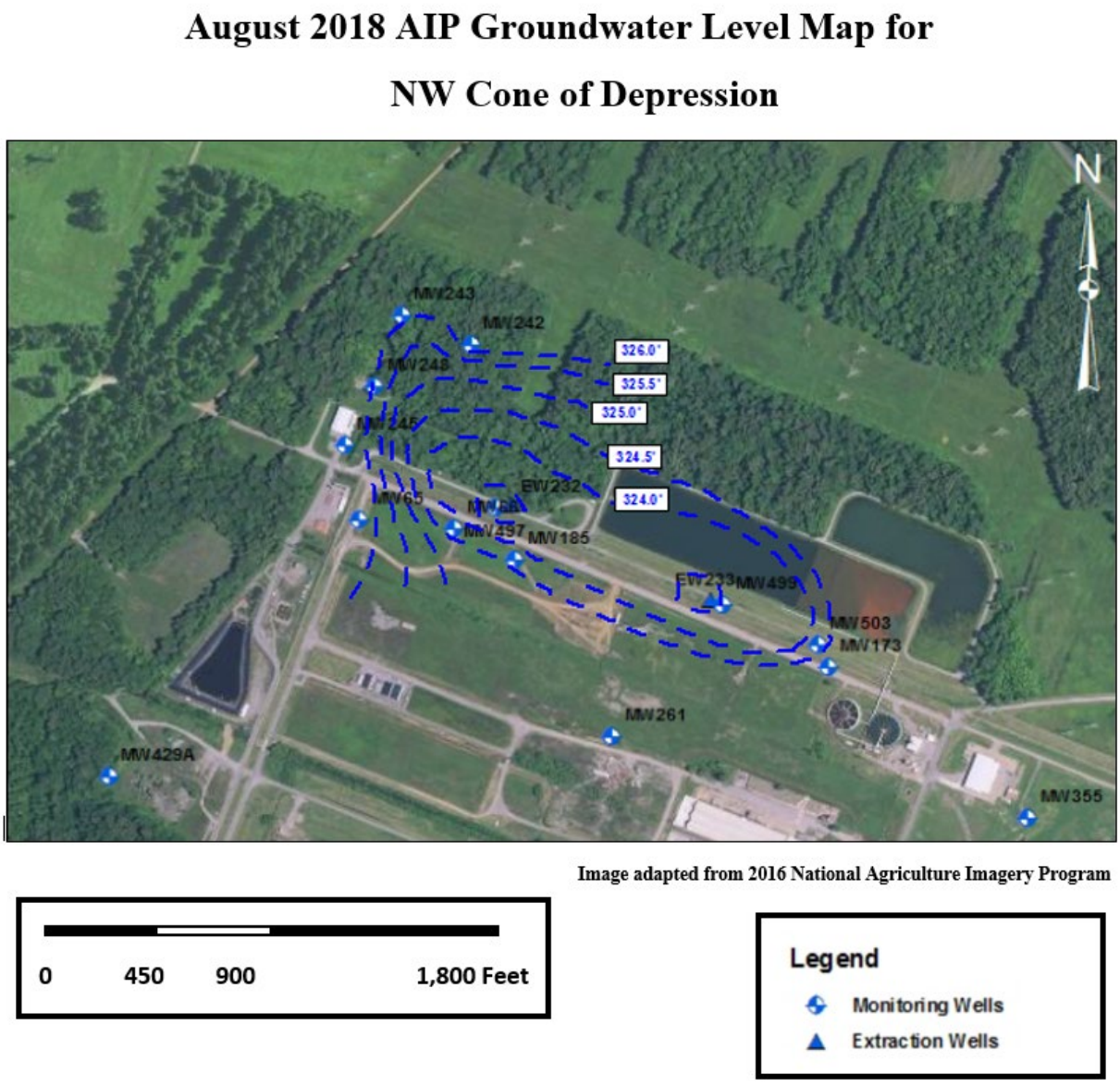

Figure 4. Northwest Groundwater Cone of Depression

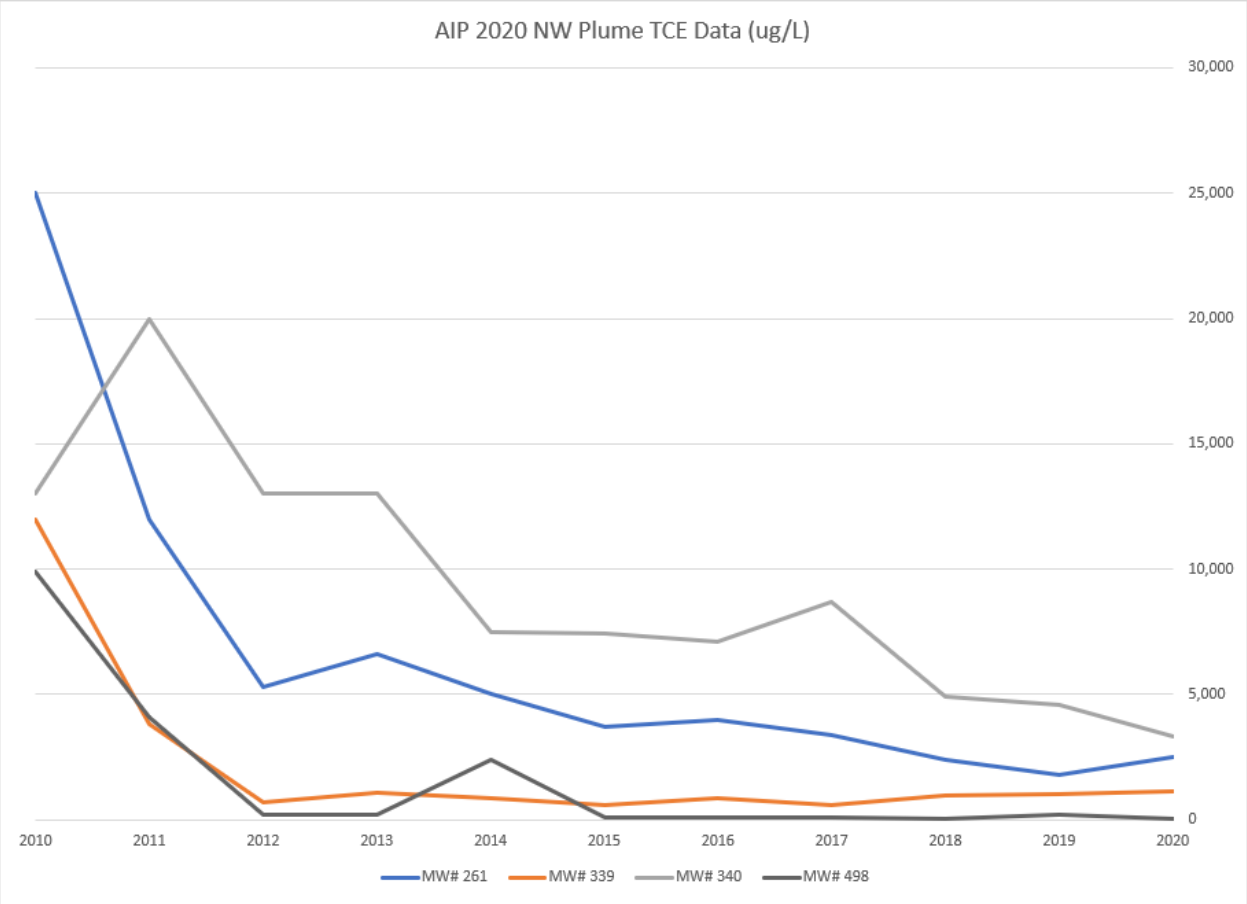

Figure 5. Northwest Plume TCE Data

Northeast Plume Extraction Wells

During the 2020 reporting period, the Northeast extraction wells (EW234 and EW235) removed 101,347,005 gallons of water and 80,064,755 gallons of water, respectively. AIP personnel did not collect water levels during 2020, but the most recent AIP (August 2018) for the Northeast Plume is presented as Figure 6. Water elevation measurements were plotted to visualize the cone of depression present around EW234 and EW235 extraction wells (see Figure 6).

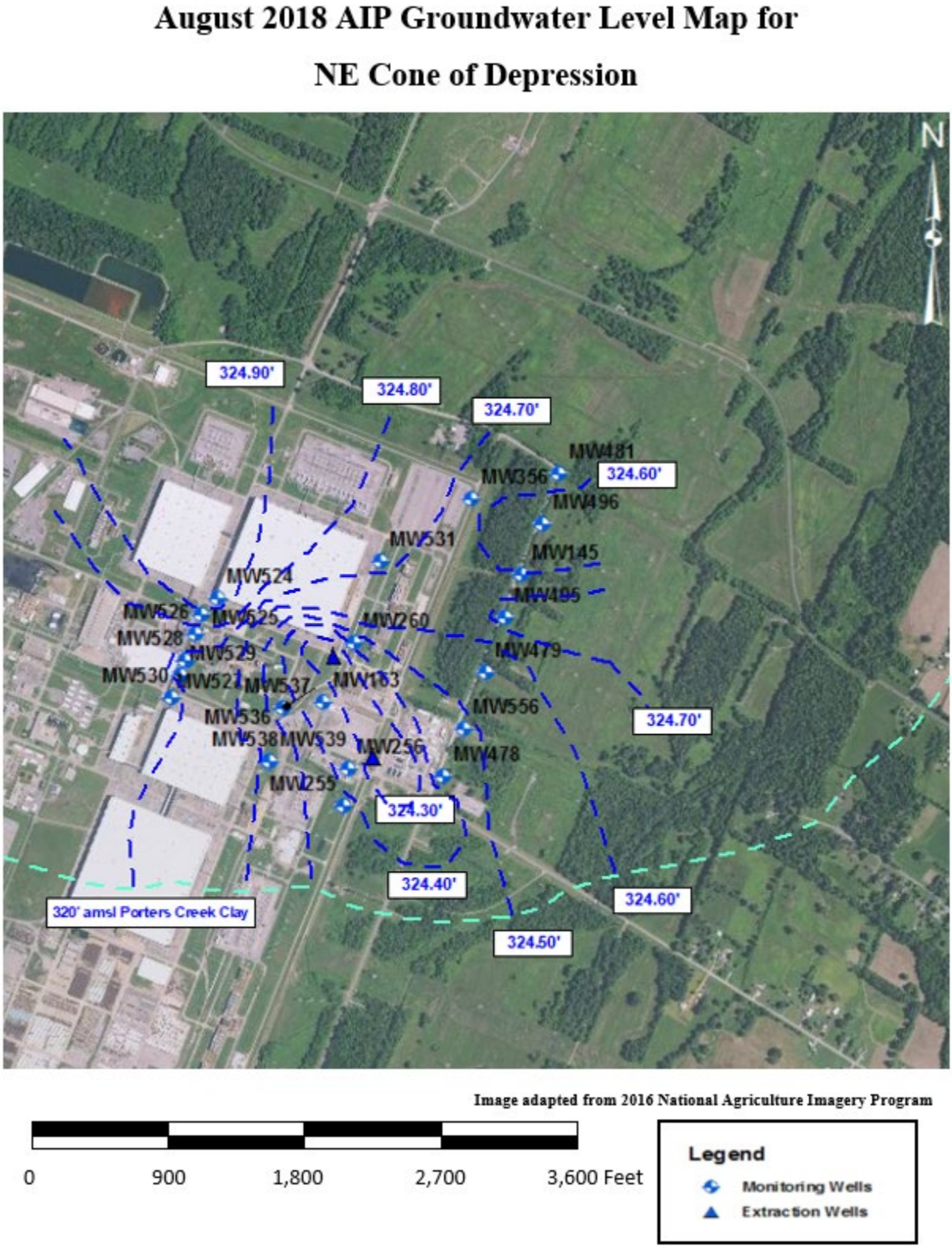

Figure 6. Northeast Groundwater Cone of Depression

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 revealed increasing TCE concentration trends in 2018. Once increasing TCE trends were observed, DOE consulted with KDEP and EPA which resulted in a reduction to pumping 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 µg/L and 1,460 µg/L. Results from four sampling events from MW526 during 2020 yielded results of 3,180 µg/L, 2,520 µg/L, 2,800 µg/L and 2,680 ug/L, in chronological order. This represents a significant rise in concentrations from 2019. Similarly, TCE levels in MW529 (baseline concentration of 130 µg/L) increased to 3,070 µg/L in 2018, continued to increase to 6,380 µg/L, and then peaked at 8,320 µg/L in 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 four samples collected in 2020, chronologically, yielded results of 4,020 µg/L, 5,880 µg/L, 3,240 µg/L and 3,180 ug/L, an overall trend of reduction from 2019 results. MW530 concentrations rose from 88.5 µg/L in early 2018 to 808 µg/L in June, 2018. Results steadily dropped during the remainder of 2018 and throughout 2019 to a low of 269 µg/L. Results continued to steadily decline during each sampling event in 2020, with an early year concentration of 171 µg/L and a last sampling event yielding a result of 80.1 µg/L.

The reduced extraction system pumping rates initiated in mid-2018 appear to be mostly favorable in reducing the eastern migration of TCE from the C-400 Building Complex. Concentrations of TCE in MW526 were higher during all sampling events in 2020 than they were in 2019, and concentrations were higher in three of the events in 2020 than they were during the peak in 2018. Concentrations of TCE in MW529 peaked in July 2019 and exhibited a declining trend in concentrations that continued through 2020.

Concentrations of TCE in MW530 showed a steady decline from June 2018 through 2020. Sampling results from MW529 and MW530 support the effectiveness of the lowered pumping rates in inhibiting mobilization of TCE from the C-400 Building Complex area. While concentrations in MW529 did peak in July 2019, this could be explained by a lag period where TCE had already mobilized eastward from the C-400 area prior to the reduction in pumping. Quarterly sampling of the transect wells by DOE contractors will continue to be monitored and pumping rates in one or both EWs can be further modified should future trends indicate continued mobilization.

TCE concentrations in the monitoring wells downgradient of EW234 and EW235 (MW145, MW478, MW479, MW495, and MW556) have varied. TCE concentrations in MW145 have fluctuated but remained within a range of 30 µg/L during the 2018-2020 period. MW479 has also fluctuated but the first and last samples collected during the three-year period were within 1 µg/L of each other. Similarly, concentrations of TCE in MW495 have ranged between 250 µg/L and 417 µg/L during the three-year period, but the first and last event results were only separated by 18 µg/L. Concentrations of TCE in MW478 have exhibited an overall increasing trend, while TCE detected in MW556 has steadily declined from early 2018 to the end of 2020. 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 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 to chart downgradient impact of the remediation efforts.

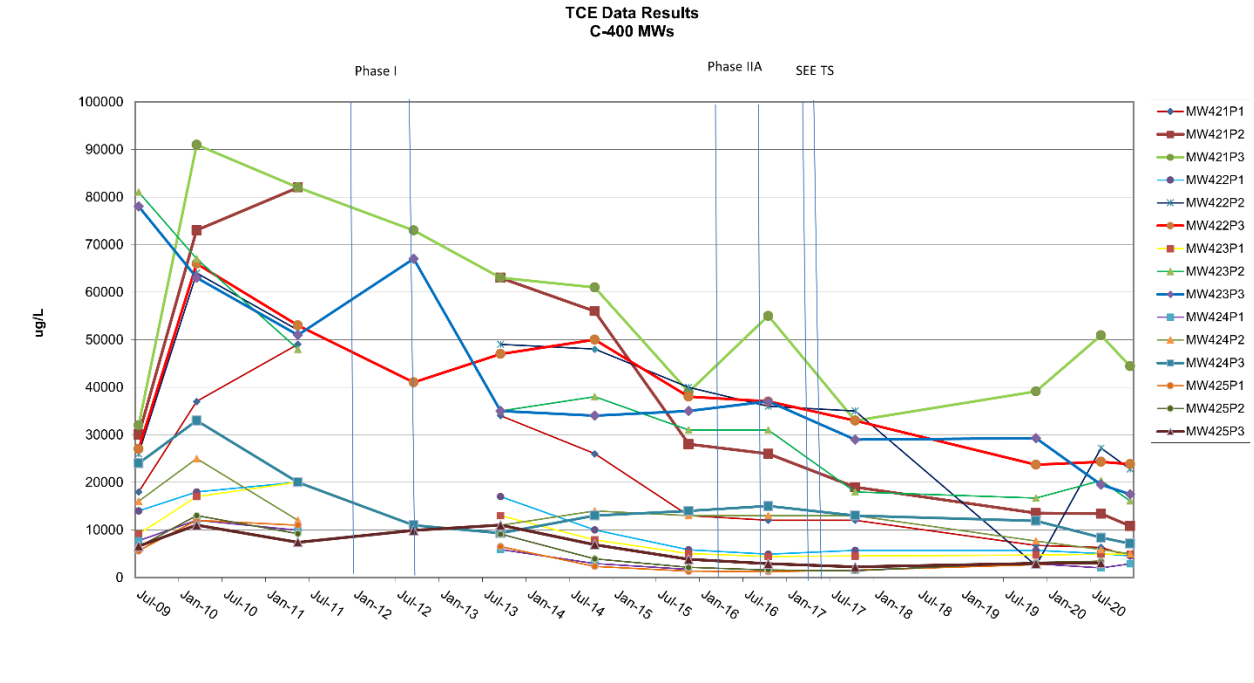

Figure 7. C-400 Monitoring Well TCE Data

AIP collected split-samples with DOE contractors from monitoring well clusters MW506 and MW507 in 2020. 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 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 2021 sampling schedule to monitor contaminant mobilization that will likely occur during implementation of C-400 Complex OU RI field activities. The C-400 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) or 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 trended downward through 2019. Sample results for MW506 and MW507 in 2020 maintained similar concentration levels since 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 in MW421 P3 in 2016, then decreased in 2017, and steadily increased throughout 2020. 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 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 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 routine 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 include multiple sets of synoptic water level elevation events 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 2020.

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 2020 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 March, and August of 2020. The 2020 synoptic water level events were interrupted by the global Covid-19 Pandemic.

The data collected during the 2020 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	328.24	40.56	3/23/2020	29.98
			320.5	48.3	8/27/2020	29.56
TVAGW-5D	TVAGW-5D	368.5	327.86	40.64	3/23/2020	30.00
			320.05	48.45	8/27/2020	29.56
TVAGW-4D	TVAGW-4D	365.8	328.71	37.09	3/23/2020	30.00
			320.15	45.65	8/27/2020	29.56
TVAGW-3D	TVAGW-3D	363.8	327.85	35.95	3/23/2020	30.00
			320.07	43.73	8/27/2020	29.56
TVAGW-2D	TVAGW-2D	370	331	39	3/23/2020	30.00
			325.6	44.4	8/27/2020	29.56
TVAGW-1D	TVAGW-1D	370.1	327.87	42.23	3/23/2020	30.00
			320.47	49.63	8/27/2020	29.56

SHF-D8A	TVA-D8A	331.82	326.61	5.21	3/23/2020	30.00
			317.15	14.67	8/27/2020	29.56
SHF-D75B	TVA-D75B	353.08	325.89	27.19	3/23/2020	29.93
			310.86	42.22	8/27/2020	29.56
SHF-D74B	TVA-D74B	331.99	326.66	5.33	3/23/2020	29.93
			309.79	22.2	8/27/2020	29.56
SHF-D30B	TVA-D30B	324.61	302.8	21.81	8/27/2020	29.56
SHF-D17	TVA-D17	365.43	326.03	39.4	3/23/2020	29.93
			317.33	48.1	8/27/2020	29.56
SHF-D11B	TVA-D11B	321.79	305.1	16.69	8/27/2020	29.56
SHF-D10	TVA-D10	351.74	324.32	27.42	3/23/2020	29.93
			308.04	43.7	8/27/2020	29.56
SHF-201C	SHF-201C	323.75	306.97	16.78	8/27/2020	29.52
SHF-201B	SHF-201B	323.75	306.81	16.94	8/27/2020	29.52
SHF201A	SHF201A	323.75	306.65	17.1	8/27/2020	29.52
SHF-102G	SHF-102G	362.85	321.25	41.6	8/27/2020	29.52
Ohio River Elevation (TVA)				325.76	3/23/2020	29.93
				300.9	8/27/2020	29.56

Table 2. 2020 AIP Synoptic Water Level Events

AIP staff assisted DOE and Contractors on reconnaissance efforts along Metropolis Lake to search for suitable locations for placement of a semi-permanent measuring stick to more precisely gauge fluctuations in lake levels. AIP personnel 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. AIP personnel also learned that TVA maintains and monitors an Ohio River gauging station (Table 2), which 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 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 exhibit a pH outside the 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 2020, 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 2020 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 8. AIP Surface Water 2020 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)

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 2020 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 2020; 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 2020 analytical results for the C-613 Sediment Basin results from the Discharge Event Samples Collected on April 23, 2020:

Table 3. 2020 First Semi-Annual Discharge Sampling Event:

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)	**280.0**	0.40	N/A	**150.0**	0.40	N/A	**51.0**	N/A	0.40
Gross Alpha (pCi/L)	**83.36**	0.61	3.03	**57.01**	0.61	2.34	**9.87**	0.61	0.95
Gross Beta (pCi/L)	**125.50**	1.61	2.22	**74.71**	1.61	1.73	**15.75**	1.61	0.91
U-234 (pCi/L)	**82.41**	0.26	7.69	**51.8**	0.44	5.80	**16.40**	0.24	1.90
U-235 (pCi/L)	**6.02**	0.19	0.96	**3.71**	0.26	0.83	**0.83**	0.20	0.32
U-238 (pCi/L)	**152.00**	0.26	13.80	**94.60**	0.21	10.10	**29.00**	0.29	3.04

2020 Second Semi-Annual Sampling Event:

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 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 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 5.0 pCi/L. Technetium-99 will be analyzed if the gross beta results are equal to or exceed 9.0 pCi/L.

Part 1: Results from the Non-Discharge Event Samples Collected on September 15, 2020:

Table 4. 2020 Second Semi-Annual Non-Discharge Sampling Event

Analyte	Basin Outlet (Outfall 001)	MDL / MDC	Total Uncertainty (2σ +/-)	Iron Bridge	MDL / MDC	Total Uncertainty (2σ +/-)
Uranium Metal (µg/L)	**1.7**	0.4	N/A	**1.3**	0.4	N/A
Gross Alpha (pCi/L)	**0.13**	2.394	1.644	**0.95**	2.394	1.774
Gross Beta (pCi/L)	**19.95**	5.486	2.362	**19.65**	5.486	2.360
U-234 (pCi/L)	N/A	N/A	N/A	N/A	N/A	N/A
U-235 (pCi/L)	N/A	N/A	N/A	N/A	N/A	N/A
U-238 (pCi/L)	N/A	N/A	N/A	N/A	N/A	N/A
Tc-99 (pCi/L)	**2.94**	3.85	1.18	**5.64**	3.85	1.13

Part 2: Results from the Discharge Event Samples Collected on October 20, 2020:

Table 5. 2020 Second Semi-Annual Discharge Sampling Event:

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)	**55.0**	0.4	N/A	**28.00**	0.4	N/A	**5.9**	0.4	N/A
Gross Alpha (pCi/L)	**17.31**	0.898	1.38	**7.68**	1.303	1.10	**1.63**	1.303	0.714
Gross Beta (pCi/L)	**72.25**	1.952	1.84	**36.49**	2.833	1.712	**20.41**	2.833	1.405
U-234 (pCi/L)	**11.40**	0.262	1.34	**5.55**	0.277	0.821	N/A	N/A	N/A
U-235 (pCi/L)	**0.81**	0.161	0.31	**0.57**	0.192	0.259	N/A	N/A	N/A
U-238 (pCi/L)	**20.60**	0.284	2.11	**10.20**	0.276	1.23	N/A	N/A	N/A
Tc-99	**51.70**	3.46	1.37	**18.30**	3.460	1.17	**1.13**	3.460	1.060

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 2020 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 2020 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)

2020: Inlet: 167.5 µg/L Outlet: 89.0 µg/L

Annual Discharge: 38,828,500 gallons Rainfall: 58.28 inches (109% 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 2020 was roughly 50%. From 2003 to 2008, when active scrap metal removal was being performed, the average inlet concentration was 374.0 µg/L. From 2009 to 2020, after the scrap metal had been removed, concentrations of uranium metal at Outfall 001 have 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 2020 for uranium was 167.5 µg/L, which is close to the average since 2009. The twelve-year average inlet concentration from 2009 to 2020 was 172.2 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 2020 was 89.0 µg/L, which was higher than the twelve-year average of 71.0 µg/L from 2009 to 2020. 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 2020 during discharge sampling events was 28.4 µg/L. The concentration of uranium reported at the Iron Bridge non-discharge sampling event performed on September 15, 2020, was 1.3 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 2020 is 3.2 µg/L.

Conclusions:

The average 2020 discharge event inlet measurement for alpha particles in water was 50.34 pCi/L and the average outlet measurement was 32.3 pCi/L. The average 2020 inlet measurement for beta particles in water was 99.0 pCi/L and the outlet measurement was 55.6 pCi/L. Alpha and beta activity measurements showed an approximate 45-50% 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 167.5 µg/L to an outlet average of 89.0 µg/L, an approximate 50% reduction. Analytical results from the Iron Bridge sampling point reported nearly twenty-two times as much uranium metal during discharge events (28.4 µg/L) as opposed to the non-discharge event (1.3 µg/L).

Analysis of the data reported 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. 2020 analytical data reported an approximately 50% reduction in the concentration of uranium metal and radionuclide readings, which is within historic norms. 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 2020, RHB collected 1,616 samples and performed 950 analyses on those samples, plus 420 analyses on an additional 157 samples collected by EEC.

Groundwater

RHB monitors groundwater by routinely collecting quarterly samples at 10 residential wells surrounding the site (Figure 9). 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 off 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 2020, 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 10) and through continuous sampling at an additional 4 locations (Figure 11). Note: 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 2020, 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 12), 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 2020, there were no observed abnormal measurements from RHB AIP air monitoring efforts.

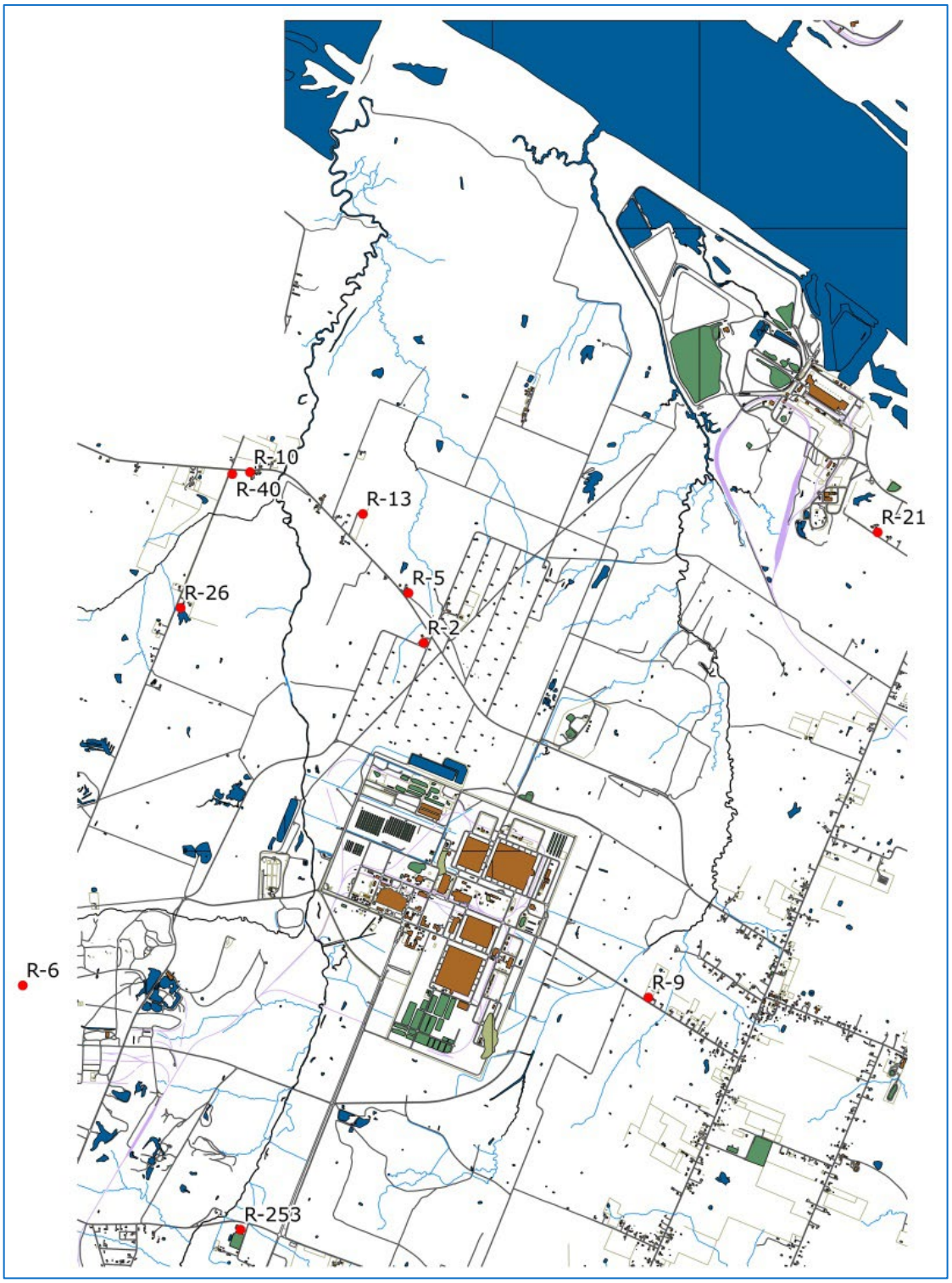

Figure 9. RHB AIP 2020 Groundwater Monitoring Locations

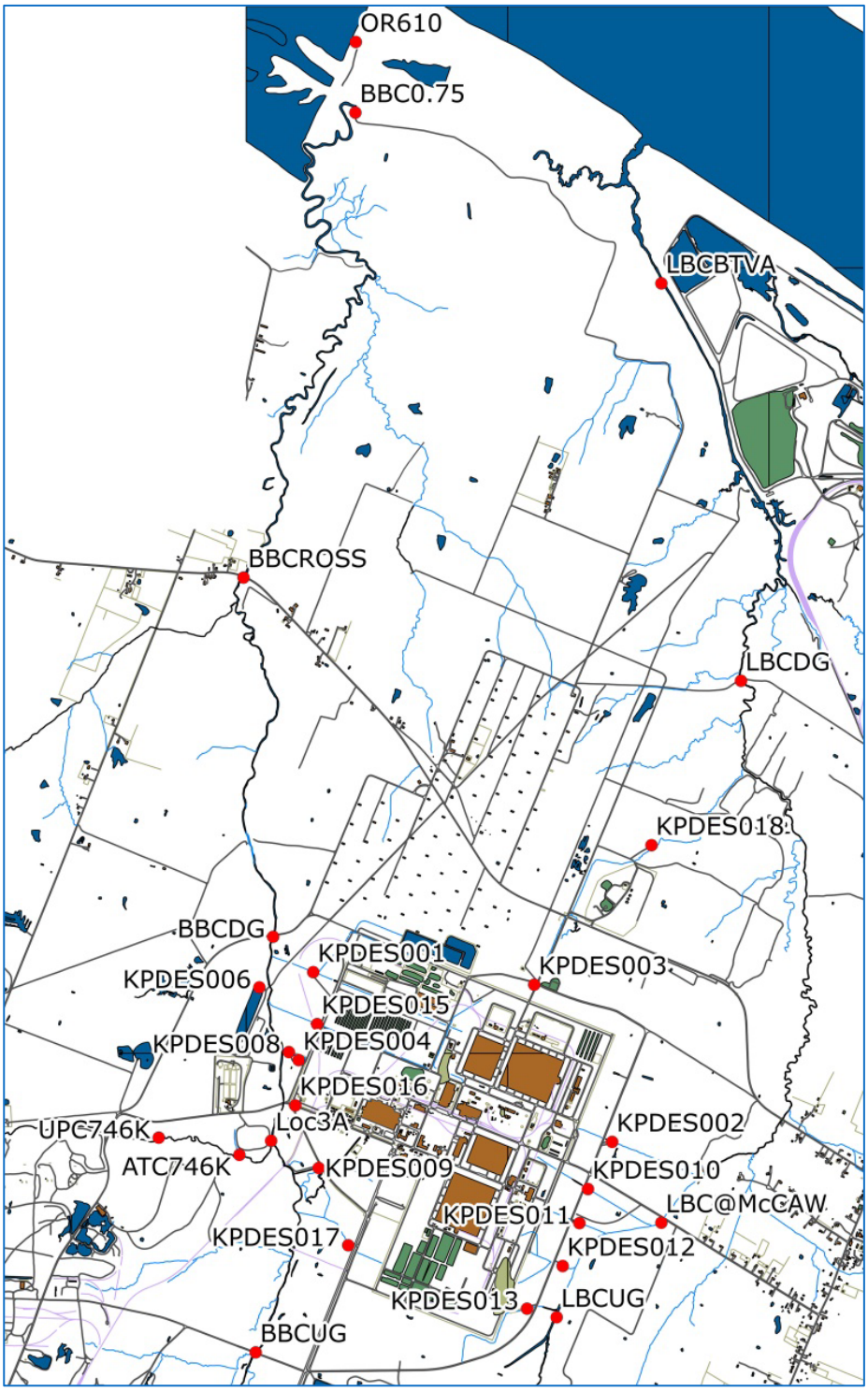

Figure 10. RHB AIP 2020 Quarterly Surface Water Sampling Locations

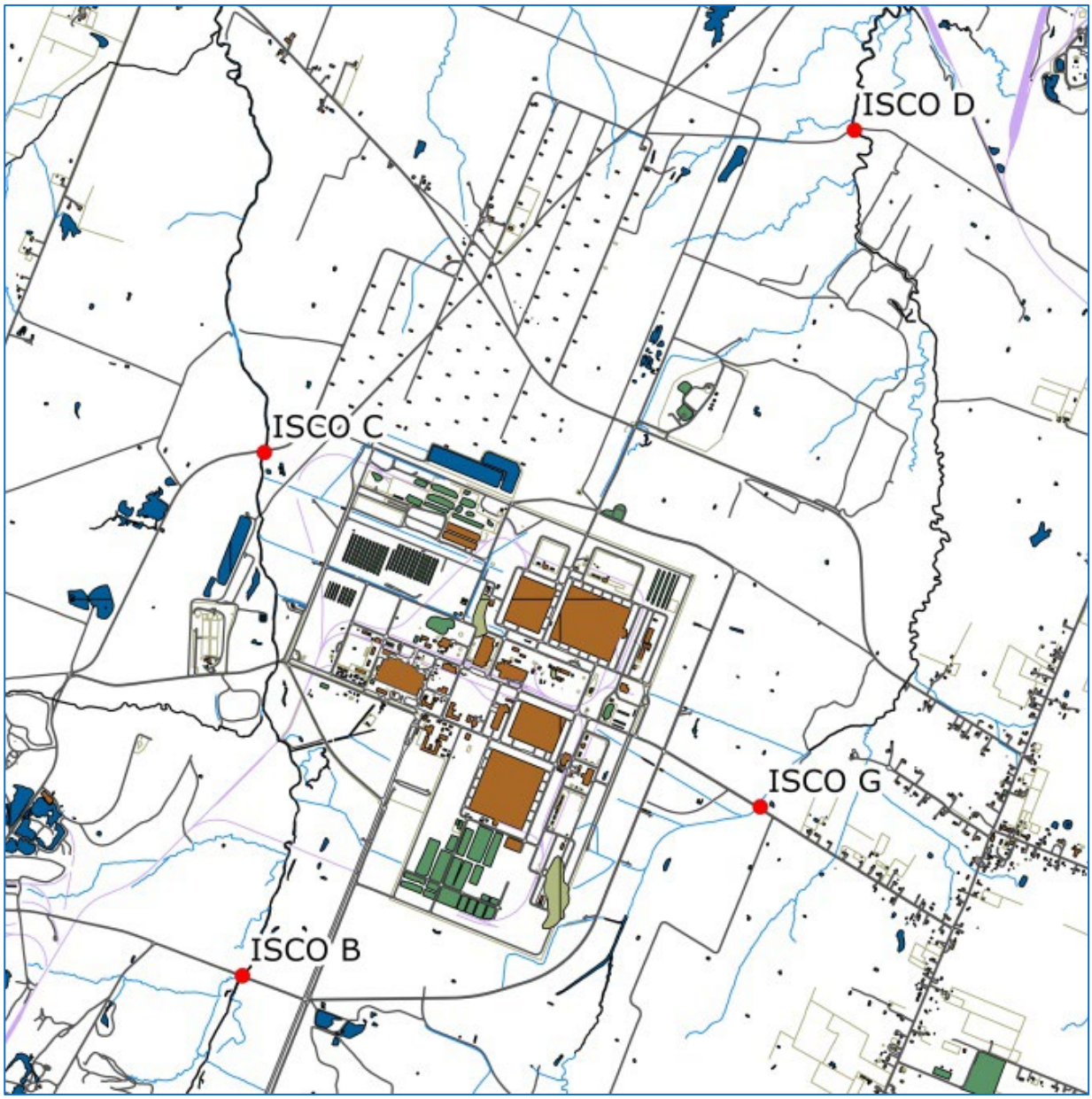

Figure 11. RHB AIP 2020 ISCO Sampling Locations

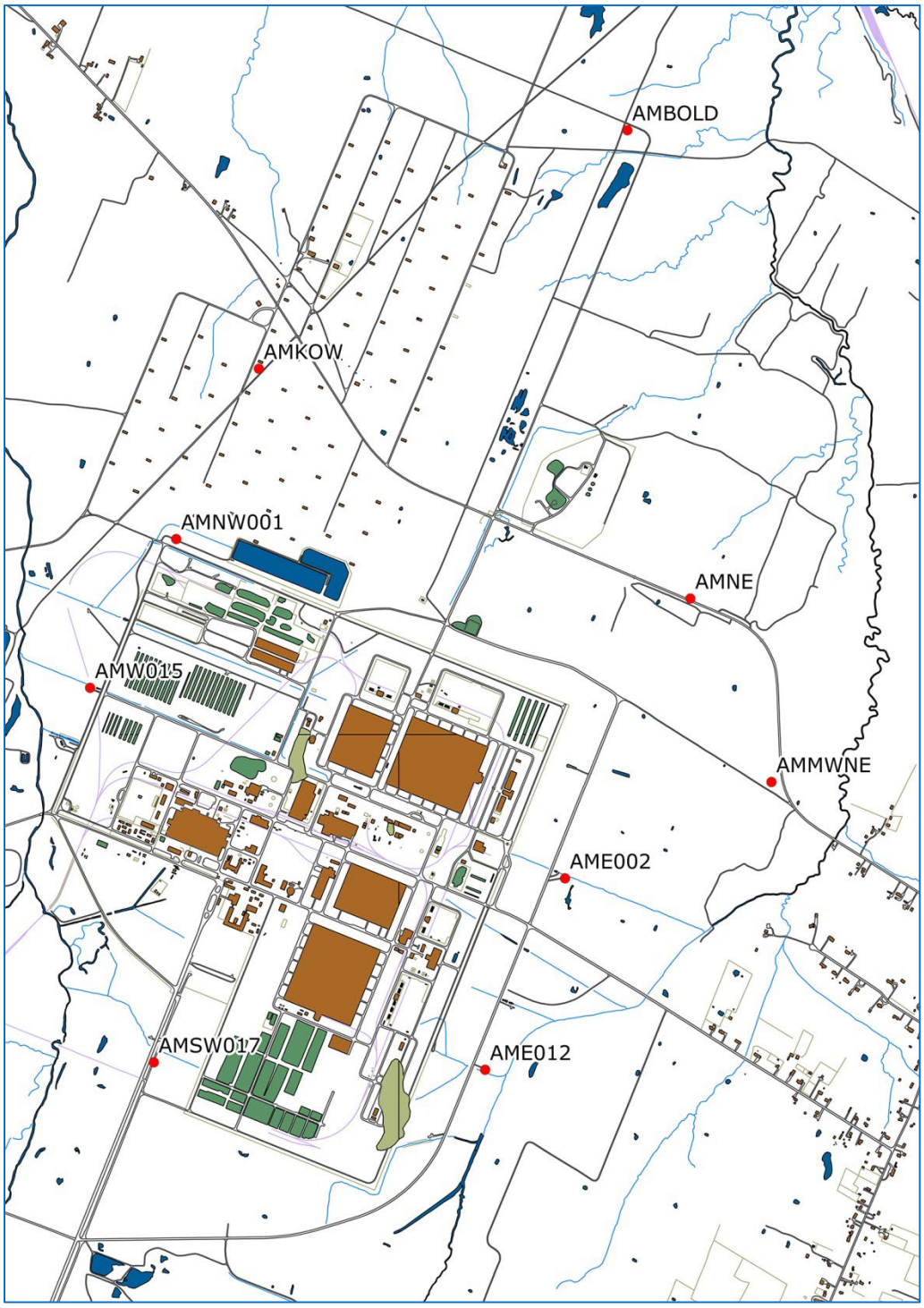

Figure 12. RHB AIP 2020 Air Monitoring Locations

Additional Oversight Activities

During 2020, 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 2020. The following is an abbreviated list of oversight activities completed in 2020:

- 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. The nickel ingots were observed twice in 2020 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.
- A total of 10,101 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 14 Regulatory Notifications approved by the KDWM during 2020.
- 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 2020

Surface Water Operable Unit

Surface Water Operable Unit (SWOU)

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) and Others (Outfalls 017, 018, 019/020 and 526). These SWMUs 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 approximately 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.

DOCUMENTS REVIEWED IN 2020

No Surface Water Operable Unit documents were received or reviewed in 2020.

C-400 Complex Operable Unit (C-400 OU)

The 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 is incorporated into the 2020/2021 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.

KDWM received and reviewed the *Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit* (DOE/LX/07-2433&D2/R1), dated March 5, 2020. The D2/R1 version only updated page changes and was subsequently approved by both the KDWM and EPA on March 6, 2020.

Field work commenced with drilling activities which began on March 2, 2020, but were ceased on March 25, 2020 due to the COVID-19 pandemic. Field work was resumed during the week of August 3, 2020 and continued throughout the calendar year.

DOCUMENTS REVIEWED IN 2020

Remedial Investigation / Feasibility Study Work Plan for the C-400 Complex Operable Unit (Page Changes) (DOE/LX/07-2433&D2/R1), dated March 5, 2020. Both the KDWM and the EPA approved the page changes on March 6, 2020.

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 KPDES Outfall 001, which flows to Little Bayou Creek.

In 2020, the Northeast Plume extraction wells EW234 and EW235 pumped 89,693,973 gallons of water, which resulted in the removal of 10.61 gallons of TCE. Northeast Plume pumping operations began on February 28, 1997. As of December 31, 2020, the system had extracted approximately 2,014,172,625 gallons of groundwater, and 347 gallons of TCE was removed. An operational chart of the Northeast Plume Containment System reports both the operational efficiency and gallons of water treated during each month in 2020 is presented below.

Table 6. 2020 Northeast Plume Containment System Operation Data

Month	Percent Operational		Gallons	Month	Percent Operational		Gallons
	C-765	C-765-A			C-765	C-765-A	
January	99.7	99.4	7,747,006	July	90.8	100.0	7,420,180
February	100.0	100.0	7,304,872	August	100.0	99.9	7,816,318
March	99.2	99.3	7,737,482	September	99.5	100.0	7,550,155
April	100.0	100.0	7,568,720	October	62.0	100.0	6,113,983
May	100.0	100.0	7,811,939	November	99.7	99.7	7,563,296
June	99.3	99.3	7,526,295	December	94.8	99.5	7,533,727

During 2020, 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 sentinel 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 and results are compared to background (pre-pumping) concentrations to provide an early warning if TCE or Tc-99 is pulled east (away) from the C-400 area by the two optimized extraction wells. If concentration trends significantly increase over time, the FFA parties will meet to develop a solution before TCE or Tc-99 can spread by migrating eastward toward the two new extraction wells.

The FFA senior parties signed an MOA in 2015 which outlined actions that would be taken to prevent the extraction wells from causing or contributing to the undesirable expansion of TCE and Tc-99 from C-400 within the NE Plume. The quarterly 2020 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 2020:

Operation and Maintenance Plan for the Northeast Plume Interim Remedial Action (DOE/LX/07-1535&D3/R7, dated August 19, 2020. The EPA approved the D4/R6 version on September 18, 2020, and the KDWM submitted comments on September 22, 2020.

Operation and Maintenance Plan for the Northeast Plume Interim Remedial Action (DOE/LX/07-1535&D3/R8, dated November 6, 2020. Both EPA and the KDWM approved the D3/R8 version on November 12, 2020.

Northwest Plume Containment System (Pump-and-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 2020, the Northwest Plume System pumped 104,574,926 gallons of water from extraction wells EW232 and EW233, which resulted in the removal of 83.08 gallons of TCE. Northwest Plume pumping operations began on August 28, 1995. During that time, the system extracted 2,551,701,340 gallons of groundwater, and approximately 3,861.2 gallons of TCE were removed. An operational chart of the Northwest Plume Containment System reports both the operational efficiency and gallons of water treated during each month in 2020 is presented below

Table 7: 2020 Northwest Plume Groundwater System Operation Data

Month	Percent Operational	Gallons	Month	Percent Operational	Gallons
January	98.9	8,784,605	July	99.7	8,966,873
February	99.5	8,336,337	August	99.5	8,894,497
March	98.7	8,874,798	September	99.9	8,591,040
April	100.0	8,822,250	October	100.0	8,846,490
May	99.0	8,825,735	November	97.8	8,524,340
June	98.9	8,643,115	December	98.0	8,464,846

Northwest Plume Groundwater System Documents Reviewed In 2020:

Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action (DOE/LX/07-1253&D4/R6), dated August 19, 2020. The EPA approved the D4/R6 version on September 18, 2020, and the KDWM submitted comments on October 8, 2020.

Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action (DOE/LX/07-1253&D4/R7), dated November 23, 2020. The EPA approved the D4/R7 version on November 23, 2020, and the KDWM November 24, 2020.

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) may still be on-going. Semi-annual sampling of SWMU 1 monitoring wells was performed to monitor the continuing effects of the ZVI. Table 8 displays trend analysis of several VOCs. The trend determinations were made by reviewing data collected during 2019 (not listed in Table 8) and 2020. MW161 and MW542

are located downgradient of the mixing area and had decreasing trends of TCE in 2020, while VC concentrations were stable. Concentrations of TCE in upgradient well MW543 decreased, while VC concentrations fluctuated. Downgradient well MW545 contained stable concentrations of TCE while VC concentrations decreased. Upgradient well MW544 and side-gradient well MW546 contained fluctuating concentrations of TCE and VC. Reported concentrations of TCE in MW547 increased for the 2020 reporting year while VC concentrations were stable.

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

Well #	Sample Date	TCE µg/L	TCE[1] Conc. Trend	1,1-DCE µg/L	1,1-DCE[1] Conc. Trend	VC µg/L	VC[1] Conc. Trend
MW 161 (DG)	6/15/20	278	↓	3.7	↓	5 U	Stable
	12/2/20	315		2.35		5 U	
MW 542 (DG)	6/16/20	1.54	↓	1 U	Stable	1.33	Stable
	6/16/20	1.65 (KDEP)		ND (KDEP)		1.81 (KDEP)	
	12/2/20	.87		1 U		1 U	
MW 543 (UG)	6/16/20	3.69	↓	.51	↓	9.04	Fluctu-ating
	6/16/20	3.8 (KDEP)		.51 (KDEP)		12.2 (KDEP)	
	12/02/20	1.79		.4		7.42	
MW544 (UG)	6/15/20	105	Fluctu-ating	2.12	Stable	11.4	Fluctu-ating
	12/02/20	236		2.96		88.5	
MW545 (DG)	6/15/20	1.16	Stable	1 U	Stable	1.35	↓
	12/02/20	.73		1 U		1.7	
MW546 (SG)	3/30/20	100 (KDEP)	Fluctu-ating	2.6 J (KDEP)	Stable	240 (KDEP)	Fluctu-ating
	6/15/20	194		3.16 J		129	
	7/13/20	286 (KDEP)		3.6 (KDEP)		137 (KDEP)	
	12/02/20	61.5		1		3.32	
MW 547	6/16/20	955		11.4 J		20 U	

(DG)	6/16/20	**1,020** (KDEP)	↑	**12.6** (KDEP)	↑	**12.5 D,U** (KDEP)	Stable
	12/02/20	**1,190**		**15 J**		**20 U**	

[1]Trend determinations were made by evaluating all sampling data collected from January, 2020 through December, 2020.

Bold red numbers = result above MCL of 5 ppb for TCE, 7 ppb for 1,1-DCE and 2 ppb for VC

Bold blue numbers = laboratory detection limit above MCL

J = Estimated

U = Not detected above listed detection limit

D = Analyzed at higher dilution

DG = Downgradient

UG = Upgradient

SG = Sidegradient

SWMU 211-A and 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 the 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 would 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 2020:

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&D1), dated December 5, 2019. Both the KDWM and EPA submitted comments on January 31, 2020.

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 March 30, 2020. Conditional concurrence was granted by the EPA on May 26, 2020 and the KDWM on May 27, 2020.

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), DOE invocation of Informal Dispute, dated June 26, 2020. Informal Dispute negotiations continued into calendar year 2021.

Burial Grounds Operable Unit

The historic generation of various types of waste materials at the PGDP led to on-site subsurface disposal 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: 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) and the Residential/Inert Landfill Borrow Area (P-Landfill) (SWMU 145).

BGOU Documents Reviewed in 2020:

No Burial Ground Operable Unit documents were reviewed in 2020.

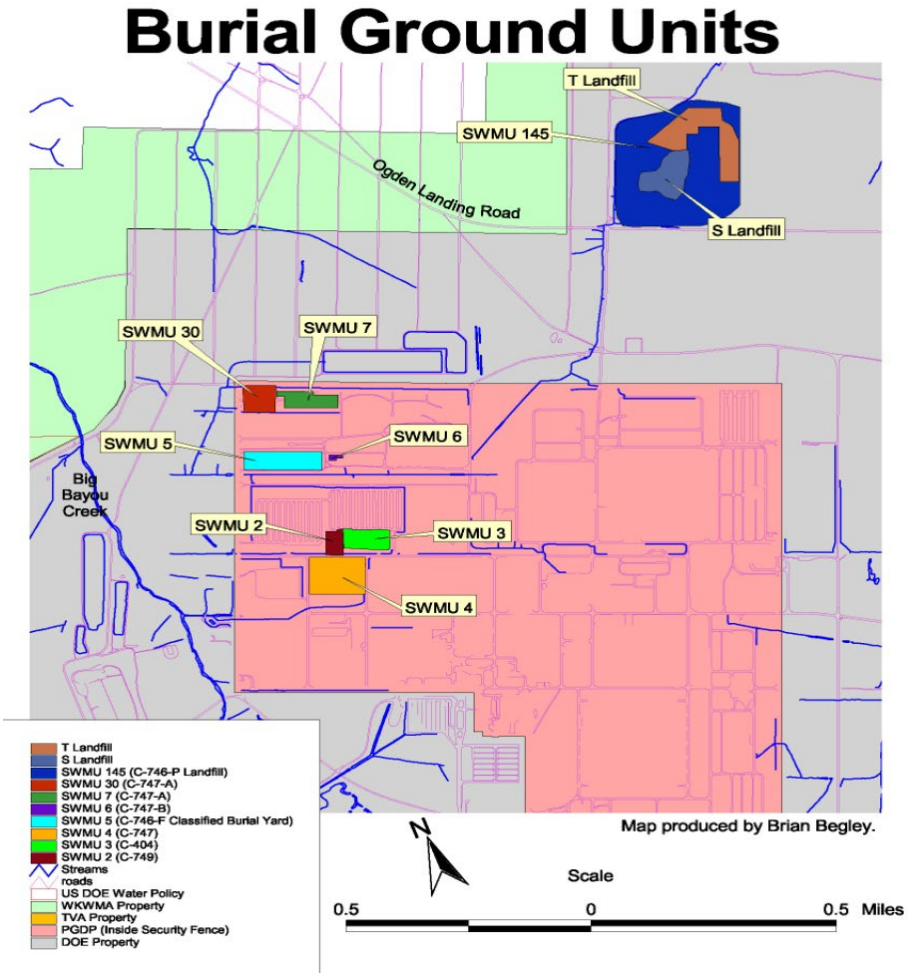

Figure 13. Burial Ground SWMUs

Soils Operable Unit

There are currently 72 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.

Soils Operable Unit Documents Reviewed in 2020:

No Soils Operable Unit documents were reviewed in 2020.

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

Over 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 4.6 million cubic yards of waste are projected to be generated at the Paducah site during the remaining course of site cleanup. Where this waste will eventually be disposed of is the subject of a CERCLA waste disposal alternatives feasibility study.

The WDA Feasibility Study evaluates two general disposal options, on-site 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 sub-category assumes that some of the waste generated will go to an existing on-site solid waste landfill. The high-volume sub-category 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 safe disposal of non-hazardous, hazardous, TSCA, low-level radioactive and low-level radioactive mixed wastes on-site, thereby avoiding more expensive off-site disposal options. However, the option to ship a portion or all the waste off-site to a DOE owned or commercial waste facility still exists.

Waste Disposition Alternatives Documents Reviewed in 2020:

No CERCLA Waste Disposal Alternatives Evaluation documents were reviewed in 2020.

Solid Waste Management Units (SWMUs)

During the reporting period from January 1 to December 31, 2020, Kentucky received no revised Solid Waste Management Unit Assessment Reports (SARs). Three SWMUs were granted No Further Action (NFA) and none were assigned Requires Further Investigation (RFI) status.

Table 9. Revised and Newly Discovered SWMU Assessment Reports Submitted to Kentucky Between January 1 and December 31, 2020

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

Table 10. Solid Waste Management Units that Kentucky Granted No Further Action Status Between January 1 and December 31, 2020

SWMU Number	Description	(Former) OU Location	(Former) Sub-project	Status	SAR Report Date	Date(s) SAR Amended	Date of NFA
94	KOW Trickling Filter and Leach Field	COE (No OU)	N/A	NFA	10/1/90	N/A	1/15/20*
157	KOW Toluene Spill Area	COE (No OU)	N/A	NFA	12/26/91	N/A	1/15/20*

182	Western Portion of Yellow Water Line	COE (No OU)	N/A	NFA	2/8/93	4/5/96	1/15/20*

COE: Corps of Engineers.

*: SWMUs 94, 157 and 182 were granted NFA by the Kentucky Superfund Branch

SWMU DOCUMENTS REVIEWED IN 2020

In 2020, no SARs Revisions or newly discovered SWMUs were submitted. Four SWMUs 94, 95, 157 and 182 were transferred to COE Responsibility (Not in an OU) via a COE letter dated March 13, 1996. These four SWMUs are referred to as “COE SWMUs” in the Site Management Plan in which the COE accepted responsibility for investigation and remediation became the responsibility of the COE. The Superfund Branch granted NFA to SWMUs 94, 157 and 182 in a letter dated January 15, 2020. Please note that SWMU 95 (KOW Burn Area) still needs RFI. At the end of the reporting period, no SARs were under review.