Department of Energy

Portsmouth/Paducah Project Office
1017 Majestic Drive, Suite 200
Lexington, Kentucky 40513
(859) 219-4000

October 6, 2025

Mr. David Ruckstuhl
Director of Contracts and Procurements
Four Rivers Nuclear Partnership, LLC
5511 Hobbs Road
Kevil, Kentucky 42053

PPPO-02-10034725-26

Dear Mr. Ruckstuhl:

DE-EM0004895: CONDITIONAL APPROVAL OF DELIVERABLE NO. 42, FINAL ENVIRONMENTAL MONITORING PLAN FISCAL YEAR 2026, CP2-ES-0006/FR12

Reference: Letter from M. Redfield to J. Stokes, "Four Rivers Nuclear Partnership, LLC—Deliverable No. 42—FINAL *Environmental Monitoring Plan Fiscal Year 2026 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR12," (FRNP-25-9678), dated September 25, 2025

The U.S. Department of Energy (DOE) conditionally approves the Four Rivers Nuclear Partnership, LLC Deliverable No. 42, final *Environmental Monitoring Plan Fiscal Year 2026, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR12. Please incorporate the comments (Enclosure 1) and send the final version to DOE by October 14, 2025.

Additionally, please consider the following comments (Enclosure 2) for Environmental Monitoring Plan Fiscal Year 2027.

If you have any questions or require additional information, please contact Angus MacKelvey at (270) 349-7526

Sincerely,

JENNIFER STOKES

Digitally signed by JENNIFER STOKES
Date: 2025.10.06 15:36:57 -04'00'

Jennifer A. Stokes
Contracting Officer
Portsmouth/Paducah Project Office

Enclosures:
1. Summary of Comments on *Environmental Monitoring Plan Fiscal Year 2026,* CP2-ES-0006/FR12
2. Summary of Comments on *Environmental Monitoring Plan Fiscal Year 2027*

cc w/enclosures:
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CP2-ES-0006/FR12

Environmental Monitoring Plan
Fiscal Year 2026
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

CLEARED FOR PUBLIC RELEASE

Environmental Monitoring Plan
Fiscal Year 2026
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

Date Issued—October 2025

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC,
managing the
Deactivation and Remediation Project at the
Paducah Gaseous Diffusion Plant
under Contract DE-EM0004895

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APPROVALS

Environmental Monitoring Plan
Fiscal Year 2026
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

CP2-ES-0006/FR12

October 2025

Approved by:

BRETT SMOTHERS (Affiliate) Digitally signed by BRETT SMOTHERS (Affiliate)
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Brett Smothers/Date
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Bruce Ford/Date
Environmental Services Director

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Katrina Hall/Date
Environmental Stewardship Manager

DOE Approval Letter: PPPO-02-10034725-26 Date: 10/06/2025

Effective Date: October 27, 2025

Required Review Date: October 06, 2026

Nuclear Safety Documentation: N/A per CP3-NS-2001, Step 6.1.1.C

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REVISION/CHANGE LOG				
Revision/ Change Letter	**Description of Changes**	**Pages Affected**	**Date of Revision/Change**	**Approved By (signature on file)**
FR0*	Initial release.	All	January 2016	Signature on file
FR1	Annual revision of document as required by U.S. Department of Energy Order 436.1, *Departmental Sustainability*. See executive summary (ES-1, ES-2) for description of changes made to fiscal year 2018 environmental monitoring plan.	All	December 20, 2017	Signature on file
FR2	Annual revision of document as required by DOE O 436.1. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2019 EMP.	All	November 13, 2018	Signature on file
FR3	Additional revisions to document. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2019 EMP.	All	March 18, 2019	Signature on file
FR4	Additional revisions to document. The planned colloidal borescope and pressure transducer deployment in support of the groundwater strategy project.	All	September 4, 2019	Signature on file
FR5	Annual revision of document as required by DOE O 436.1 See Executive Summary (ES-1, ES-2) for description of changes made to FY 2020 EMP.	All	October 11, 2019	Signature on file
FR6	Annual revision of document as required by DOE O 436.1. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2021 EMP.	All	September 22, 2020	Signature on file
FR7	Annual revision of document as required by DOE O 436.1. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2022 EMP.	All	November 15, 2021	Signature on file
FR8	Annual revision of document as required by DOE O 436.1. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2023 EMP.	All	November 4, 2022	Signature on file

REVISION/CHANGE LOG				
Revision/ Change Letter	**Description of Changes**	**Pages Affected**	**Date of Revision/Change**	**Approved By (signature on file)**
FR9	Additional revisions to document. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2023 EMP.	All	July 12, 2023	Signature on file
FR10	Annual revision of document as required by DOE O 436.1. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2024 EMP.	All	November 20, 2023	Signature on file
FR11	Annual revision of document as required by DOE O 436.1A, Departmental Sustainability. See Executive Summary (ES-1, ES-2) for description of changes made to FY 2025 EMP.	All	September 25, 2024	Signature on file
FR12	Annual revision of document. See Executive Summary (ES-1, ES-2, ES-3) for description of changes made to FY 2026 EMP.	All	October 06, 2025	Signature on file

*This document was initially released in December 1998, titled, *Paducah Site Environmental Monitoring Plan*, BJC/PAD-37.

CONTENTS

TABLES

FIGURES

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ACRONYMS

AEC	Atomic Energy Commission
AIP	Agreement in Principle
ASD	alternate source demonstration
ASER	Annual Site Environmental Report
CAP-88	Clean Air Act Assessment Package-88
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CY	calendar year
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DQO	data quality objective
DUF_6	depleted uranium hexafluoride
E	effective dose
EDE	effective dose equivalent
EDL	environmental dosimeter location
EM	environmental monitoring
EMP	Environmental Monitoring Plan
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ERPP	Environmental Radiation Protection Program
FFA	Federal Facility Agreement
FRNP	Four Rivers Nuclear Partnership, LLC
FY	fiscal year
GSA	General Services Administration
ISMS	Integrated Safety Management System
KAR	*Kentucky Administrative Regulation*
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDOW	Kentucky Division of Water
KDWM	Kentucky Division of Waste Management
KPDES	Kentucky Pollutant Discharge Elimination System
LA	Limited Area
MCL	maximum contaminant level
MCSA	Mission Conversion Services Alliance, LLC
MDA	minimum detectable activity
MDL	method detection limit
MEI	maximally exposed individual
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
O	Order
O&M	operation and maintenance
OREIS	Oak Ridge Environmental Information System
OU	operable unit
PGDP	Paducah Gaseous Diffusion Plant
PPA	property protection area
PPPO	Portsmouth/Paducah Project Office
PQL	practical quantification limit
QA	quality assurance

QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
ROD	Record of Decision
SARA	Superfund Amendments Reauthorization Act
SPCC	spill prevention control and countermeasure
SWMU	solid waste management unit
TED	total effective dose
VOC	volatile organic compound
WKWMA	West Kentucky Wildlife Management Area
WMP	Watershed Monitoring Plan

EXECUTIVE SUMMARY

This Paducah Site Environmental Monitoring Plan (EMP) for fiscal year (FY) 2026 is intended to document the rationale, sampling frequency, parameters, and analytical methods for environmental monitoring (EM) activities at the Paducah Site and provide information on site characteristics, environmental pathways, dose assessment methodologies, and quality assurance management.

EM at the Paducah Site consists of effluent monitoring and environmental surveillance activities and supports the evaluation and assessment of unplanned releases. Monitoring is conducted for a variety of media including air, surface water, groundwater, and sediment.

This EMP is comprised of the main text that details rationale and objectives, as well as four appendices. Appendix A is a summary of the Paducah Site permits and agreements; Appendix B is a well inventory; Appendix C lists all individual sampling programs, along with their sampling frequencies, methods, action limits, and parameter lists; and Appendix D contains the quality assurance project plan for executing the work described in this EMP.

Sampling frequencies and sampling parameters that were modified for a sampling program that was permit-driven or collected as a result of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or a Resource Conservation and Recovery Act (RCRA) decision document were changed only if the permit allowed the change. Data collected under existing permits and under CERCLA or RCRA decision documents will continue to be evaluated in FY 2026. If changes are deemed appropriate based on trending analyses, they will be proposed via a permit modification or decision document change (as applicable) and implemented immediately after approval by the regulatory agencies. These changes will be incorporated in the FY 2027 EMP. If sampling is modified due to a change in a sampling approach or by physical limitations, such as a dry well, then those conditions will be documented in the data assessment package for that given project.

The Energy Policy Act of 1992 provided for lease of the enrichment facilities to a commercial entity that operated the enrichment facilities from 1998 to 2013. In 2014, the leased facilities were returned to the U.S. Department of Energy (DOE) control, and a DOE contractor began management of the facilities for DOE. These returned facilities are undergoing deactivation in preparation for decommissioning. DOE also is responsible for environmental remediation of the site. DOE is conducting environmental remediation activities under CERCLA. DOE also has oversight of the Depleted Uranium Hexafluoride (DUF_6) Conversion Facility, which converts cylinders of DUF_6 to a more stable form for reuse and/or disposal. Changes to the sampling programs reflected in the FY 2026 EMP include, but are not limited to, the following actions, which are described later in more detail:

C-404 Low-Level Radioactive Waste Burial Ground (RCRA Detection Status Monitoring)

Laboratory analysis of trichloroethene (TCE) will be added to the required analytical parameters for monitoring wells MW414, MW416, MW549, MW550, and MW551. As a result of a statistical exceedance for technetium-99 (Tc-99) in MW84A, one year of quarterly monitoring for radionuclides will be conducted for C-404 compliance monitoring wells.

Northeast Plume Operation and Maintenance Program

As part of the Northeast Plume operation and maintenance (O&M) program optimization, routine sampling conducted at monitoring wells MW255 and MW256 will be transitioned from a quarterly to a semiannual frequency schedule. The Northeast Plume O&M plan requires semiannual sampling of MW255 and

MW256; however, these wells were sampled more frequently (quarterly), beginning in FY 2011, to provide timely assessment of Northeast Plume optimized extraction well operations (DOE 2021a).

C-400 Monitoring Wells Program

As part of the C-400 monitoring well program optimization, routine sampling conducted at monitoring wells MW505, MW506, MW507, MW557, MW558, MW559, MW560, MW561, MW562, MW564, MW565, MW566, MW567, MW568, MW569, MW572, MW573, and MW574 will be transitioned from a quarterly to an annual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring wells MW505, MW506, MW507, and MW560. Routine sampling conducted at monitoring wells MW178, MW405, MW406, MW407, MW408, MW563, MW570, and MW571 will be transitioned from a quarterly to a semiannual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring wells MW406, MW407, and MW408. Routine sampling conducted at monitoring wells MW175 and MW342 will be transitioned from a semiannual to an annual frequency schedule. Routine sampling conducted at monitoring wells MW155, MW156, and MW341 will be discontinued and removed from the C-400 monitoring wells program. Data collected under the Northeast Plume O&M program is adequate for future monitoring of these wells. All modifications made to the C-400 monitoring wells program are supported by consistent TCE and Tc-99 data trends, which reflect stable and/or declining contaminant levels and are consistent with DOE guidance for optimizing long-term monitoring strategies.

Environmental Surveillance Groundwater Monitoring Program

- **Groundwater Environmental Surveillance—Quarterly Wells**

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at monitoring well MW403 will be transitioned from a quarterly to an annual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring well MW403. Routine sampling conducted at monitoring wells MW132, MW354, and MW431 will be transitioned from a quarterly to a semiannual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring wells MW354 and MW431.

- **Groundwater Environmental Surveillance—Semiannual Wells**

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at monitoring wells MW197, MW326, MW327, and MW330 will be transitioned from a semiannual to an annual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring well MW326. Routine sampling conducted at monitoring wells MW98, MW102, MW133, MW135, and MW239 will be transitioned from a semiannual to a biennial frequency schedule. Routine sampling conducted at monitoring wells MW549, MW550, and MW551 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-404 Landfill monitoring program is adequate for future monitoring of the wells.

- **Groundwater Environmental Surveillance—Annual Wells**

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at monitoring wells MW71, MW99, MW139, MW150, MW191, MW203, MW253A, MW345, MW346, MW347, MW440, MW445, MW447, MW448, MW463, MW464, MW469, MW470, MW471, MW472, and MW477 will be transitioned from an annual to a biennial frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring wells MW71, MW191, MW440, MW445, MW447, and MW448. Analytical parameters for monitoring well MW203 will be reduced to

include Tc-99 analysis only. Laboratory analysis of Tc-99 will be discontinued for monitoring wells MW68, MW187, MW236, MW240, MW418, MW419, MW450, MW488, MW491, and MW492. Routine sampling conducted at monitoring well MW161 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the solid waste management unit (SWMU) 1 C-747-C Oil Land Farm monitoring wells program is adequate for future monitoring of the well.

- **Groundwater Environmental Surveillance—Biennial Wells**

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at monitoring wells MW404, MW481, and MW482 will be transitioned from a biennial to an annual frequency schedule. In addition, laboratory analysis of Tc-99 will be discontinued for monitoring wells MW404, MW481, and MW482. Laboratory analysis of Tc-99 will be discontinued for monitoring wells MW193, MW328, MW329, MW442, MW443, MW444, MW451, and MW489. Analytical parameters for monitoring well MW341 will be reduced to include uranium analysis only. Routine sampling conducted at monitoring wells MW343, MW405, MW406, MW407, and MW408 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-400 monitoring wells program is adequate for future monitoring of the wells. Routine sampling conducted at monitoring wells MW67, MW76, MW86, MW89, MW92, MW95A, MW226, MW227, MW414, and MW416 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-404 Landfill monitoring program is adequate for future monitoring of the wells. Routine sampling conducted at monitoring wells MW106A, MW146, MW201, MW202, MW432, MW435, and MW452 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the Water Policy Boundary Monitoring Program is adequate for future monitoring of these wells. Routine sampling conducted at monitoring wells MW163, MW260, MW479, MW480, MW495, and MW496 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the Northeast Plume O&M Program is adequate for future monitoring of these wells.

All modifications made to the Environmental Surveillance Groundwater Monitoring Program are supported by consistent TCE and Tc-99 data trends which reflect stable and/or declining contaminant levels and are consistent with optimizing long-term monitoring strategies for the Paducah Site.

Environmental Dosimeters

Three new environmental dosimeter locations (EDLs) (EDL-98, EDL-99, and EDL-100) have been added to the environmental dosimeter surveillance network outside the property protection area (PPA) and inside the DOE boundary on the east side of the Paducah Site. These locations are shown in Figure C.18.

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1. INTRODUCTION

1.1 PURPOSE

This Paducah Site Environmental Monitoring Plan (EMP) for fiscal year (FY) 2026 is intended to document the rationale, sampling frequency, parameters, and analytical methods for environmental monitoring (EM) activities at the Paducah Site and provide information on site characteristics, environmental pathways, dose assessment methodologies, and quality assurance (QA) management. Guidance for EM is included in U.S. Department of Energy (DOE) Order (O) DOE O 458.1, *Radiation Protection of the Public and the Environment*; DOE-HDBK-1216-2015 Change Notice 1, *Environmental Radiological Effluent Monitoring and Environmental Surveillance* (DOE 2015), hereinafter identified as the Radiological Guide; and Commonwealth of Kentucky and federal regulations that implement federal environmental laws. The purpose of the Radiological Guide is to identify procedures, systems, methods, instruments, and practices that may be used to plan and implement radiological effluent monitoring and environmental surveillance that meet the requirements in DOE O 458.1.

This FY 2026 EMP supports meeting requirements in DOE O 458.1 at the site. DOE O 458.1 establishes standards and requirements for DOE operations with respect to protection of the public and the environment against undue risk from radiation.

This EMP also supports permit requirements and supplements the ongoing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial investigations being conducted at the Paducah Site under the Federal Facility Agreement (FFA) for the Paducah Gaseous Diffusion Plant (PGDP) (EPA 1998). A new overall cleanup strategy for the site was discussed among the FFA parties in late FY 2023. The FY 2025 Site Management Plan establishes plans to integrate and accelerate Paducah Site cleanup decisions for environmental media, deactivation and decommissioning, and waste disposal alternatives (DOE 2024a). This EMP is integrated with operable unit (OU) investigations and/or remedial actions to help provide collection of optimal data sets.

1.2 SCOPE

EM at the Paducah Site consists of effluent monitoring and environmental surveillance activities and supports the evaluation and assessment of unplanned releases. Monitoring is conducted routinely for a variety of media including air, surface water, groundwater, and sediment. Effluent monitoring is the direct measurement or the collection and analysis of liquid discharges and gaseous emissions to the environment. Environmental surveillance is the direct measurement or the collection and analysis of ambient air, surface water, groundwater, sediment, and other media.

- In order for DOE and Four Rivers Nuclear Partnership, LLC, (FRNP) to comply with applicable environmental, public health, and resource protection requirements cost-effectively, the EMP is evaluated and modified, as appropriate. These modifications may include adjusting the number of monitoring wells that are sampled, changing sampling frequency of certain activities, or eliminating parameters to avoid duplication of data. As a contractor for DOE at the Paducah Site, FRNP evaluates optimization of sampling efforts in order to provide a comprehensive data set to the affected projects. Changes to the EMP, as a result of these evaluations, will be documented in the EMP rationale section and in each specific project section in Appendix C of the EMP. Changes that occur and are implemented during the FY will be documented in the following year's EMP. Optimization of permit-required sampling also is performed, but will be implemented only when approved by the regulatory agencies.

The Paducah Site EMP is evaluated and modified, as appropriate, using the data quality objective (DQO) methodology on an FY basis (i.e., October 1 through September 30) (EPA 2006). Measurement quality objectives are addressed in Appendix D, the "Environmental Monitoring Quality Assurance Project Plan" (QAPP), which is consistent with *Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan,* DOE/LX/07-2502&D1 (Programmatic QAPP) (DOE 2024b). Project data, following data verification, data assessment, and data validation, are placed into and reported from the Paducah Oak Ridge Environmental Information System (OREIS). Data loaded into Paducah OREIS then is available to public stakeholders via the PPPO Environmental Geographic Analytical Spatial Information System (a.k.a. PEGASIS). Results are published and made available to the public in the form of the Annual Site Environmental Report (ASER).

QA is assured through assessments and management reviews. At a minimum, a management review of a sampling activity mandated by a permit will be conducted on an annual basis.

Operational sampling included in the Title V air permit is considered outside the scope of the EMP. FRNP will implement the appropriate operational sampling. While this EMP addresses liquid effluent monitoring from the DUF_6 conversion facility, which is operated by Mission Conversion Services Alliance, LLC, (MCSA) this EMP does not address gaseous emissions monitoring that is conducted by MCSA in support of their air permit.

1.3 RATIONALE

The rationale for EM activities at the Paducah Site for FY 2026 is premised by the understanding that sampling frequency, sampling parameters, and analytical methods must be sufficient to meet regulatory and contractual requirements and support appropriate DOE orders and guidance cost-effectively.

Data collected under existing permits, National Emission Standards for Hazardous Air Pollutants (NESHAP) Management Plan (FRNP 2019), and under CERCLA or Resource Conservation and Recovery Act (RCRA) decision documents will continue to be evaluated in FY 2026. Sampling frequencies and sampling parameters that were modified for a sampling program that was permit-driven or collected as a result of a CERCLA or RCRA decision document were changed only if the permit or decision document allowed the change. If, during FY 2026, changes are deemed appropriate based on trending analyses, changes will be proposed via a permit modification or decision document change and implemented immediately after approval by the regulatory agencies. These changes will be incorporated in the FY 2027 Paducah Site EMP. If sampling is modified due to a change in a sampling approach or by physical limitations, such as a dry well, then those conditions will be documented in the data assessment package for that given project.

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Environmental Dosimeters

Three new environmental dosimeter locations (EDLs) (EDL-98, EDL-99, and EDL-100) have been added to the environmental dosimeter surveillance network outside the property protection area (PPA) and inside the DOE boundary on the east side of the Paducah Site. These locations are shown in Figure C.18.

1.4 GENERAL CONSIDERATIONS

1.4.1 Site Description

The Paducah Site is located in a generally rural area of McCracken County, Kentucky [population approximately 67,420 (DOC 2023)]. Uranium enrichment ceased in May 2013. The uranium enrichment process facility consisted of a diffusion cascade and extensive support facilities. The cascade, including product and tails withdrawal, is housed in six large process buildings. The plant is located on a reservation consisting of approximately 3,556 acres in western McCracken County, 10 miles west of Paducah, Kentucky, [population approximately 26,750 (DOC 2023)] and 3.5 miles south of the Ohio River. DOE property has a heavily developed industrial area, with nonindustrial lands around it. Approximately 1,427 acres of the nonindustrial land are licensed to the Commonwealth of Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA). The land licensed to the Commonwealth of Kentucky contains access roads and multiple rights-of-way for electrical transmission lines, but it is otherwise a mixture of woodlands and meadows.

The population within a 50-mile radius of the Paducah Site is about 504,000. Within a 10-mile radius of the Paducah Site, the population is approximately 94,180 (DOC 2023).

1.4.2 Site Background Information

Before World War II, the area now occupied by the Paducah Site was used for agricultural purposes. Numerous small farms produced various grain crops, provided pasture for livestock, and included large fruit orchards.

During World War II, a 16,126-acre tract was assembled for construction of Kentucky Ordnance Works, which subsequently was operated by the Atlas Powder Company until the end of the war. At that time, it was turned over to the Federal Farm Mortgage Corporation and then to the General Services Administration (GSA).

In 1950, the U.S. Department of Defense (DoD) and DOE's predecessor, the Atomic Energy Commission (AEC), began efforts to expand fissionable material production capacity. As part of this effort, the National Security Resources Board was instructed to designate power areas within a strategically safe area of the United States. Eight government-owned sites initially were selected as candidate areas. In October 1950, as a result of joint recommendations from DoD, U.S. Department of State, and AEC, President Harry S. Truman directed AEC to expand further production of atomic weapons. One of the principal facets of this expansion program was the provision for a new gaseous diffusion plant. On October 18, 1950, AEC approved the Paducah Site for uranium enrichment operations and formally requested the Department of the Army to transfer the site from GSA to AEC. Of the 7,566 acres acquired by the AEC, 1,361 acres subsequently were transferred to the Tennessee Valley Authority (Shawnee Fossil Plant Site), and approximately 2,700 acres were conveyed to the Commonwealth of Kentucky for wildlife conservation and for recreational purposes as the WKWMA.

Although construction of PGDP was not complete until 1954, production of enriched uranium began in 1952. Recycled uranium from nuclear reactors was introduced into the PGDP enrichment cascades in 1953 and continued through 1964. In 1964, cascade feed material was switched solely to virgin-mined uranium. Use of recycled uranium resumed in 1969 and continued through 1976. In 1976, the practice of recycling uranium feed material from nuclear reactors was halted and never resumed. During the recycling time periods, Paducah received approximately 100,000 metric tons of recycled uranium containing an estimated 328 grams of plutonium-239 (Pu-239), 18,400 grams of neptunium-237 (Np-237), and 661,000 grams of Tc-99. The majority of the Pu-239 and Np-237 was separated out during the initial chemical conversion to

uranium hexafluoride (UF_6). Concentrations of transuranics (e.g., Pu-239 and Np-237) and Tc-99 are believed to have been deposited on internal surfaces of process equipment and in waste products.

The Energy Policy Act of 1992 provided for lease of the enrichment facilities to a commercial entity that operated the enrichment facilities from 1998 to 2013. In 2014, the leased facilities were returned to DOE control, and a DOE contractor began management of the facilities for DOE.

PGDP was placed on the U.S. Environmental Protection Agency (EPA) National Priorities List on May 3, 1994, with an effective date of June 30, 1994. Environmental restoration is being addressed under an FFA with EPA and the Commonwealth of Kentucky (EPA 1998). The FFA became effective February 13, 1998.

1.5 PLAN OBJECTIVES

The following are the main objectives of this EMP.

- Ensure the early identification of potential adverse environmental impacts associated with DOE operations through effluent monitoring and environmental surveillance.
- Ensure that analytical work supporting EM is implemented using the following:
  - — A consistent system for collecting, assessing, and documenting environmental data of known and documented quality;
  - — A validated and consistent approach for sampling and analysis of samples to ensure laboratory data meet program-specific needs and requirements; and
  - — An integrated sampling approach to avoid duplicative data collection.
- Support the “fully implemented status” of the Paducah Site Environmental Management System (EMS).
- Support the implementation of the Paducah Site Integrated Safety Management System (ISMS).
- Ensure integration of EMS into the site’s ISMS.

Outputs from implementation of the EMP may be used to do the following:

- Provide data for use in the ASER, which informs the public about releases and potential impacts from DOE operations to human health and the environment;
- Identify DOE operations pollutant contributions;
- Provide ancillary data that may be required to assess the consequences of a spill or release;
- Identify significant changes in sample analytical results;
- Support or supplement data needs for CERCLA actions; and
- Provide a mechanism for long-term data collection needs under the FFA, when applicable.

1.6 PLAN OVERVIEW

Section 1 is used to describe the program's relevant historical and current information. Section 2 of this document describes effluent monitoring for liquid and airborne radiological constituents. Section 3 discusses meteorological monitoring, which is collected from the National Weather Service. Section 4 addresses, by media, environmental surveillance activities undertaken to monitor the radiological impacts of DOE operations. Section 5 describes the dose calculation methods used for the site. Section 6 provides various reporting requirements. Section 7 lists references utilized in the preparation of this plan.

The appendices provide detailed information regarding site permits, groundwater well information, sampling program details, QA, and data management.

1.7 MEASURING FACILITY IMPACT

The Radiological Guide requires comparisons of the measured concentrations against measured concentrations at "background" locations. For the purposes of this EMP, a "background" location also is called a reference location and is defined as an area unaffected by releases from the Paducah Site. The area could, however, be impacted by other anthropogenic sources, such as emissions from industrial and commercial facilities. When no standards or criteria exist for contaminants that may have an impact on human health or the environment, comparisons to concentrations at reference locations can be made to determine if concentrations are significantly higher near the Paducah Site boundary.

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2. EFFLUENT MONITORING

Effluent monitoring is the collection and analysis of samples or measurements of liquid and gaseous effluents for the purpose of characterizing and quantifying contaminants, assessing radiation exposures of members of the public, providing a means to control effluents at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements. It also helps evaluate the effectiveness of effluent treatment and control; helps identify potential environmental problems and evaluate the need for remedial actions or mitigation measures; supports permit revision and/or reissuance; and detects, characterizes, and helps to report unplanned releases. Effluent monitoring is initiated to demonstrate compliance with one or more federal or Commonwealth of Kentucky regulations, permit conditions, or environmental commitments made in environmental impact statements, environmental assessments, DOE Orders and guides, or other official documents. Table 1 lists the various routine effluent monitoring activities performed at the Paducah Site. This table includes monitoring of liquid effluents, but it does not include gaseous effluents by MCSA operations or FRNP. MCSA and FRNP conduct gaseous emissions monitoring on their systems, as described in Section 1 of this EMP. Ambient air monitoring, which is required by NESHAP, is included within this EMP. A summary of permits and compliance agreements is included in Appendix A.

Table 1. Routine Liquid Effluent Monitoring

Program	Number of Locations	Sampling Frequency
Surface Water		
C-746-S&T Landfills	3[a]	Quarterly
C-746-U Landfill	3[a]	Quarterly
Environmental Radiation Protection Program (ERPP) near Kentucky Pollutant Discharge Elimination System (KPDES) Outfalls	14	Monthly
KPDES[b]		
Outfall (K001)	1	Weekly
Outfall (K002, K004[c], K006, K008, K009, K010, K011, K012, K013, K015, K016, K017, K019[d], K020)	14	Monthly
Outfall Toxicity[e] (K001, K017)	2	Quarterly
CERCLA Outfall		
C001	1	Weekly and quarterly
Leachate		
C-746-S Landfill	1	As required and annually
C-746-U Landfill	1	As required and annually
C-404 Landfill	1	As required

[a] One location, L154, is cited in the Solid Waste Landfill Permit for both the C-746-S&T Landfills and for the C-746-U Landfill. L154 is included in the totals for both landfills. Total number of locations sampled equals five.

[b] Sampling frequency reflects most frequent analyses required by the permit and does not reflect field measurement analyses.

[c] K004 is sampled twice per month.

[d] K019 is sampled when the C-746-U Landfill sedimentation pond is discharged through the outfall.

[e] K001 is monitored for chronic toxicity. K017 is monitored for acute toxicity. Toxicity requirements for K010 and K011 were removed in October 2024.

NOTE: Sampling locations and frequencies are detailed in Appendix C.

The primary statute governing the monitoring of effluents to surface water is the Clean Water Act (with the exception of radionuclides), which requires the issuance of a National Pollutant Discharge Elimination

System (NPDES) permit.[1] EPA has delegated administration of the NPDES Program to the Kentucky Division of Water (KDOW) KPDES Program. The KPDES permit requires radiological monitoring at some of the permitted outfalls for reporting purposes only.

Sampling and analytical methods meet the requirements described in 40 *CFR* Part 136 or the KPDES permit. In addition, DOE O 458.1, *Radiation Protection of the Public and the Environment*, and the Radiological Guide provide general and detailed guidance regarding the establishment of effluent monitoring programs for radiological parameters.

Rationale and Design Objectives. To ensure the protection of public health and the environment, the technical/regulatory objectives identified as part of DQOs for the Effluent Monitoring Program include the following:

- Verifying compliance with applicable federal, Commonwealth of Kentucky, and local effluent regulations and DOE Orders;
- Determining compliance with commitments made in environmental impact statements, environmental assessments, or other official documents;
- Evaluating the effectiveness of treatment processes and pollution control;
- Identifying potential environmental problems and evaluating the need for remedial actions or mitigating measures;
- Supporting permit revision and/or reissuance;
- Detecting, characterizing, and reporting unplanned releases; and
- Measuring changes in monitored concentrations of constituents in effluent over time.

In addition, Section 2.0 of the Radiological Guide recommends that this plan document the following:

- Effluent monitoring (sampling or *in situ* measurement) extraction locations used for providing quantitative effluent release data for each outfall;
- Procedures and equipment used to perform the extraction and measurement;
- Frequency and analyses required for each extraction (continuous monitoring and/or sampling) location;
- Method detection limit (MDL)/minimum detectable activity (MDA) and accuracy by analyte;
- QA components; and
- Effluent outfall alarms (not required at the Paducah Site).

The preceding requirements are addressed as follows.

- Appendix C of this document lists all effluent monitoring locations, specifies sampling and field measurements, as well as analytical method information, and also lists the sampling frequency at each

[1] Radioactive materials that are regulated under the Atomic Energy Act of 1954 are excluded from the Clean Water Act.

location and the required analytical parameters and analytical methods. Additionally, Appendix C specifies the sampling driver for each sampling program (e.g., permit, CERCLA decision document). Generally, data collected as part of this document not only meets permit and CERCLA decision requirements, but it also provides data sets that may be used in future CERCLA decision documents.

- Appendix D of this document provides the QAPP. All QA components required to be followed are outlined within this plan. The QAPP identifies reporting limits [or practical quantification limits (PQLs)] and MDLs/MDAs. In cases where reporting limits (or PQLs) are specified under a given regulatory driver, those requirements are denoted as such within the QAPP.

- Each laboratory receives a statement of work for all sampling activities. The reporting limits (or PQLs) found in the QAPP are specified in the statement of work as a condition of work. If a laboratory cannot meet these limits, and if the limits are not a matter of regulatory compliance, the contractor project manager may approve the increased reporting limits (or PQLs) and/or MDLs/MDAs.

- Monitoring results from the KPDES outfalls are summarized in the discharge monitoring reports, which are submitted on a monthly basis to the KDOW as required by the KPDES permit. Notifications of exceedances to the permit are submitted per the specifications within the permit. Surface water monitoring results at the landfills are summarized in quarterly reports and submitted to the Kentucky Division of Waste Management (KDWM) on a quarterly basis.

Evaluation of Effluents. Effluents, regardless of whether they contain radiological contaminants from new or modified facilities, are to be evaluated against permit conditions (as applicable) by the Environmental Compliance support personnel. Additionally, data are reviewed by the ERPP organization for evaluation and trending purposes and to determine any required response.

Physical/Chemical/KPDES. KPDES is the regulatory program administered by KDOW for discharge of wastewaters to the waters of the Commonwealth of Kentucky. The DOE Paducah Site KPDES permit, KY0004049, establishes monitoring requirements for the discharge of effluent and surface water runoff.

The permit defines limits on the concentration and amounts of specific chemicals that can be discharged and on the physical impact of those discharges (e.g., temperature or biological harm) to surface waters.

Processes for DOE operations have been evaluated to determine the chemicals, radiological components, and physical parameters (e.g., temperature) likely to affect the KPDES-permitted effluents. Effluents from permitted landfills are evaluated during the reporting and permit renewal processes.

Radiological. Based on the evaluation of emissions and the results of radiological monitoring from historical data sets, neither continuous monitoring nor continuous sampling with frequent analyses is required by DOE O 458.1. The KPDES permit requires radiological analyses at some of the outfall locations (Figure C.13).

Effluent sampling is required by the ERPP. Radiological data sets of effluent water near the KPDES outfalls (Figure C.14), along with surveillance data of surface water and sediments slightly downstream (Figures C.16 and C.17), are evaluated as part of the ERPP.

Program Implementation Procedures. The FRNP EM Manager (or designee) is responsible for implementing all relevant aspects of the EMP. In that role, the FRNP EM Manager reports through a line organization to the Environmental Services Director and provides centralized coordination responsibilities.

2.1 LIQUID

2.1.1 Surface Water

Surface water leaving KPDES outfalls/the CERCLA outfall includes rainfall runoff from cylinder yards and landfills and effluent from site processes. The intent of monitoring is to assess compliance with Commonwealth of Kentucky and federal regulations, permits, and DOE Orders and to assess the impact of DOE operations on the local environment.

C-746-S&T and C-746-U Landfills Surface Water. Rainfall runoff from three locations at C-746-U Landfill and three locations at C-746-S&T Landfills (Figure C.12) are sampled quarterly for parameters listed in Appendix C. Although three locations are cited for each, there are only five unique locations.

KPDES Monitoring. Fifteen effluent sampling points covered by the KPDES permit are illustrated in Appendix C (Figure C.13).

2.1.2 Leachate

C-746-S and C-746-U Landfills Leachate. Untreated leachate from the solid waste landfills is sampled annually and is analyzed for the parameters listed in Appendix C in accordance with permit requirements.

C-404 Landfill Leachate. Leachate samples are collected from the C-404 Landfill Leachate Collection System and analyzed for the parameters listed in Appendix C in accordance with permit requirements.

2.2 AIRBORNE

Airborne emissions are regulated by the Kentucky Division for Air Quality. For emissions that may be harmful to the public or the environment, permits are required from the Division for Air Quality. Operations at the Paducah Site require air permits. Ambient air monitoring, which monitors fugitive emissions from all Paducah Site operations, is conducted by nine continuous air monitors, as described in the approved Paducah Site NESHAP Management Plan, CP2-EC-0002/FR2 (FRNP 2019). This includes one background location.

Operational sampling included in the Title V air permit (V-21-011) is considered outside the scope of the EMP. FRNP will implement the appropriate operational sampling included in the Title V air permit (V-21-011). This data will be available in the event it is needed to evaluate site conditions; however, this sampling is considered outside the scope of the EMP. Additionally, the DUF_6 facility maintains a Conditional Major, Operating permit (F-21-018), which also is considered outside the scope of the EMP.

3. METEOROLOGICAL MONITORING

DOE operations may have airborne radionuclide and chemical emissions from various sources, such as CERCLA remedial actions, as well as fugitive emissions and stack emissions from deactivation of the gaseous diffusion buildings. The Paducah Site requires meteorological monitoring data to support both chemical and radiological evaluations. The Radiological Guide recommends that a meteorological monitoring program appropriate to site activities be established. The Paducah Site no longer operates the on-site meteorological tower to collect meteorological data. Meteorological data sets purchased from other sources and historical data collected at the site may be used to model the radiological and chemical emissions. Purchased meteorological data is procured from accredited meteorological measuring stations that are in close proximity to the site.

3.1 CHEMICAL EMISSIONS

DOE operations may have airborne chemical emissions from various sources, such as CERCLA remedial actions, as well as fugitive emissions.

3.2 RADIOLOGICAL EMISSIONS

Operations at the Paducah Site may have airborne radiological emissions from various sources, such as CERCLA remedial actions, deactivation activities, DUF_6 conversion activities, as well as fugitive emissions. Modeling to demonstrate compliance with NESHAP regulations is conducted using the Clean Air Act Assessment Package-88 (CAP-88). In accordance with the NESHAP Management Plan (FRNP 2019), meteorological data utilized for CAP-88 are compiled from the National Weather Service at Paducah and the National Climatic Data Center's "Climate at a Glance" database. Other dose modeling software such as RESRAD-OFFSITE or RESRAD-BIOTA may be used with appropriate meteorological data sets.

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4. ENVIRONMENTAL SURVEILLANCE

Environmental surveillance is the collection and analysis of samples or direct measurements of air, water, sediment, and other media from DOE sites and their environs for the purpose of determining compliance with applicable standards and permit requirements, assessing radiation exposures of members of the public, and assessing the effects, if any, on the local environment; therefore, the environmental surveillance program is a comprehensive environmental program addressing radiological and nonradiological parameters.

In support of DOE O 458.1, *Radiation Protection of the Public and the Environment*, the Paducah Site performs monitoring of remedial actions and activities to monitor that members of the public are not exposed to ionizing radiation at a total effective dose (TED) exceeding 100 mrem (1 mSv) in a year from all site-related sources of ionizing radiation and exposure pathways. Air emissions are covered under 40 *CFR* Part 61, NESHAP. Under 40 *CFR* § 61.92, emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent (EDE) of 10 mrem per year.

DOE activities must be conducted to ensure that radionuclides contained in liquid effluents do not cause private or community drinking water systems to exceed an annual dose of 4 mrem per year for radionuclides emitting beta particle and photon radioactivity per 40 *CFR* § 141.66 (d)(1), which is more limiting than DOE O 458.1 limit of 10 mrem per year. For monitoring of community drinking water systems, 40 *CFR* Part 141 allows for environmental surveillance data to be used in the vicinity of nuclear facilities. Plant environmental surveillance sampling locations are within the Bayou Creek and Little Bayou Creek systems prior to confluence with the Ohio River. The sample results from these locations are evaluated against the radionuclide maximum contaminant levels (MCLs) of 40 *CFR* § 141.66. If needed for comparison purposes, a background sample of the Ohio River water is collected upstream of the site. The plant effluent sampling results can be evaluated against the background location sampling results.

DOE O 458.1 defines “public dose” as the dose received by member(s) of the public from exposure to radiation and to radioactive material released by a DOE radiological activity whether the exposure is within a DOE site boundary or off-site. It does not include doses received from radon and its decay products in air (regulated separately under DOE O 458.1), occupational exposures, doses received from naturally occurring “reference” radiation, or doses received by a patient from medical procedures. The determination of the public dose, as established by EPA regulation 40 *CFR* Part 61, differs in that the 10 mrem EDE per year limit applies to dose received where the members of the public reside.

The Radiological Guide recommends that DOE facilities perform routine surveillance if an annual dose of site origin at the site boundary exceeds either 5 mrem per year effective dose (E) to an individual or 100 person-rem collective E within a radius of 80 km (about 50 miles) of a central point on the site. Historically, as reported in previous ASERs, the annual dose due to DOE operations at the Paducah Site boundary has been less than 5 mrem per year E (individual) or 100 person-rem collective E.

An overview of routine environmental surveillance is provided in Table 2, which lists for each program the number of sampling locations, sampling frequency, sample type, and parameters for the analysis performed.

Table 2. Routine Environmental Surveillance

Program	Number of Locations	Sampling Frequency	Sample Type	Parameters
Groundwater				
Surveillance	29	Annually	Grab	See Appendix C
Surveillance	64	Biennially (Sampled FY 2025—will be sampled in FY 2027)	Grab	See Appendix C
Surveillance	12	Semiannually	Grab	See Appendix C
Surveillance Geochemical	37	Triennially (Sampled FY 2025—will be sampled in FY 2028)	Grab	See Appendix C
C-746-S&T Landfills	25[a]	Quarterly	Grab	See Appendix C
C-746-U Landfill	21[a]	Quarterly	Grab	See Appendix C
C-404 Landfill	9	Semiannually/Quarterly Radionuclides	Grab	See Appendix C
C-746-K Landfill	3	Semiannually	Grab	See Appendix C
Northeast Plume	34	Quarterly	Grab	See Appendix C
Northeast Plume	2	Semiannually	Grab	See Appendix C
Northwest Plume	28	Semiannually	Grab	See Appendix C
Northwest Plume	5	Quarterly	Grab	See Appendix C
C-400	20	Annually	Grab	See Appendix C
C-400	14	Semiannually	Grab	See Appendix C
SWMU 1	7	Semiannually	Grab	See Appendix C
SWMU 211-A	28	Semiannually	Grab	See Appendix C
Water Policy Boundary—NW	23	Quarterly	Grab	See Appendix C
Water Policy Boundary—NE	7	Annually	Grab	See Appendix C
Residential Carbon Filter System	1	Semiannually	Grab	See Appendix C
Surface Water and Seeps				
Surface Water and Seeps	3	Quarterly	Grab	See Appendix C
Surface Water—ERPP	6/2	Quarterly/Annually	Grab	See Appendix C
C-613 Sediment Basin	1	Quarterly	Grab	See Appendix C
C001 (Northeast Plume)	1/1	Weekly/Quarterly	Grab	See Appendix C
KPDES[b]				
Outfall (K001)	1	Weekly	Grab	See Appendix C
Outfall (K002, K004[c], K006, K008, K009, K010, K011, K012, K013, K015, K016, K017, K019, K020)	14	Monthly	Grab	See Appendix C
Outfall Toxicity[d] (K001 and K017)	2	Quarterly	Composite and Grab[d]	See Appendix C
Sediment				
Sediment	14	Semiannually	Grab	See Appendix C
Sediment—ERPP	6	Annually	Grab	See Appendix C
Ambient Air	9/9	Weekly/Quarterly	N/A	See Appendix C
Meteorologic[e]	N/A	N/A	N/A	N/A
Environmental Dosimeters	67/7	Quarterly	Continuous	External Gamma/Neutron

[a] Four of the same wells are cited in the Solid Waste Landfill Permit for C-746-S&T and C-746-U Landfills. For these totals, the wells are counted for both programs. Also, for the C-746-S&T Landfills locations, the count of 25 wells includes two wells that are measured only for water level. Twenty-three locations are sampled for analytical laboratory parameters.

[b] Sampling frequency reflects most frequent analyses required by the permit and does not reflect field measurement analyses.

[c] K004 is sampled twice per month.

[d] K001 is monitored for chronic toxicity. K017 is monitored for acute toxicity. Toxicity requirements for K010 and K011 were removed in October 2024.

[e] Information is taken from the National Weather Service and historic data sets.

4.1 GROUNDWATER

4.1.1 Introduction

The Paducah Site, located in the Jackson Purchase region of western Kentucky, lies within the northern tip of the Mississippi Embayment portion of the Gulf Coastal Plain Province. The stratigraphic sequence in the region consists of Cretaceous, Tertiary, and Quaternary sediment unconformably overlying Paleozoic bedrock. The *Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III* (Clausen et al. 1992) discusses geology and hydrogeology of the Paducah Site in detail. Additional information regarding the geology and hydrogeology at the Paducah Site is covered in the *2023 Update of the Paducah Gaseous Diffusion Plant Sitewide Groundwater Flow Model* (DOE 2024c) for the Paducah Site. The most recent groundwater contaminant plume maps were developed in 2023 and are contained in *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2024 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (FRNP 2025).

Manual water level measurements and pressure transducer measurements are being collected to measure seasonal changes in the potentiometric surface at representative sites across the Regional Gravel Aquifer (RGA) groundwater basin. Monitoring wells to be evaluated under this project are indicated in Table B.4 of Appendix B.

The synoptic water level events will continue to be performed semiannually to support ongoing groundwater evaluations, including groundwater modeling. Also, in support of groundwater evaluations and groundwater modeling, during the semiannual synoptic water level events, water level elevation at Metropolis Lake will be measured. A survey control point has been established near the lake.

4.1.2 Rationale and Design Criteria

The groundwater monitoring program consists of routine compliance monitoring designed to ensure the protection of public health and the environment. The technical criteria identified as part of DQOs for the groundwater monitoring program include the following:

- Obtain data to determine baseline conditions of groundwater quality and quantity;
- Demonstrate compliance with and implementation of all applicable regulations and DOE Orders;
- Provide data to allow early detection of groundwater pollution or contamination;
- Identify existing and potential groundwater contamination sources and maintain surveillance of these sources; and
- Provide data for making decisions about waste disposal on land-based units and the management and protection of groundwater resources.

The following addresses specific laws, regulations, and orders.

DOE Orders. Neither DOE Orders nor the Radiological Guide requires specific groundwater sampling frequencies or parameters. Instead, DOE Orders require that sample collection programs reflect specific facility needs. Type and frequency of sampling shall be adequate to characterize effluent streams and to identify existing and potential groundwater contamination sources. Monitoring verifies that releases are stable or diminishing without causing environmental harm. This EMP was written to include effluent monitoring and environmental surveillance at the Paducah Site. In order to provide a data set that is assessed

for potential environmental impacts, a comparison data set from samples collected from areas that are not impacted by site operations also is required. Such sample locations are called “background” locations.

Commonwealth of Kentucky Regulation. Preparation of a Groundwater Protection Plan that addresses requirements to ensure protection for all current and future uses of groundwater and to prevent groundwater pollution is required by 401 *KAR* 5:037. This requirement was addressed by DOE, by writing and implementing the Groundwater Protection Plan, according to 401 *KAR* 5:037, prior to the deadline of August 24, 1995. The current Groundwater Protection Plan is *Groundwater Protection Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-1000 (FRNP 2024a). This document is reviewed and revised, as needed, to reflect current site operations.

Agreement in Principle Sampling. The Agreement in Principle (AIP) provides sampling and inspection of the differing monitoring programs. The oversight includes inspections (including monitoring well inspections and surface water area inspections), sample analysis, and data quality. KDWM AIP personnel conduct independent groundwater and surface water sampling and obtain DOE sample splits.

AIP personnel also respond to questions and concerns from the public, including sampling of residential wells. The AIP personnel participate in public meetings to provide an independent view of the effect of the Paducah Site on the local environment and health of the public.

CERCLA Actions. A requirement of the FFA is to determine the nature and extent of off-site contamination (attributed to historical releases from Paducah facilities). This requirement is addressed through the remedial investigation process and ongoing remedial actions for OUs at the Paducah Site, as well as for the sampling under this EMP. Ongoing remedial actions at the Paducah Site include the following.

The *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant* (Water Policy) (DOE 1994) stipulated the need to ensure that residential landowners whose well water was contaminated by PGDP sources were provided with water. The Water Policy was established in accordance with the Administrative Consent Order, following an Engineering Evaluation/Cost Analysis, and was written to document the preferred alternative addressing the need for protection of human health due to the presence of groundwater contamination originating from the Paducah Site. As soon as possible after contamination was found in local residential water supply wells, the affected households were supplied with bottled water. Construction of water mains allowed access to water lines for homes in the affected area. This was accomplished as a non-time-critical removal action under CERCLA. The Action Memorandum provided the sampling strategy only at the time the document was prepared and referred future sampling to the Sampling and Analysis Plan Addendum, which was superseded by the EMP. Currently, 27 wells are sampled in support of the action (Figures C.9 and C.10). DOE also is sampling two additional residential wells and MW20 near Ogden Landing Road northwest of the Paducah Site in support of further assessment of the west side of the Northwest Plume and Water Policy Boundary evaluation (Figure C.9).

Record of Decision for Interim Remedial Action for the Groundwater Operable Unit for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE 2005) requires monitoring well sampling. This sampling provides a meaningful tool for evaluating the downgradient dissolved-phase contamination in the Northwest Plume and the efficacy of the C-400 Interim Remedial Action (Figure C.6).

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-2426&D2* (DOE 2020), the Operation and

Maintenance Plans for the Northeast and Northwest Plumes were revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP.

Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky[2] requires well sampling in order to monitor the nature and extent of groundwater contamination and to evaluate any cyclic trends in water quality that may affect contaminant migration (DOE 2021b). There are 28 wells to be sampled semiannually for the Northwest Plume (Figure C.5). In addition, five wells will be sampled quarterly in order to evaluate trends in TCE and Tc-99 concentrations along the Northwest Plume.

Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky[2] (DOE 2021a), and the *Remedial Action Work Plan for the Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (DOE 2018) require quarterly sampling of 34 wells and semiannual sampling of two wells for the Northeast Plume (Figure C.4). The Northeast Plume O&M plan requires sampling of a CERCLA outfall in order to monitor effluent from the Northeast Plume Containment System. The sampling requirements for the CERCLA outfall are included in this EMP.

The field activities associated with the source remedial actions for the Southwest Plume at SWMU 1, C-747–C Oil Land Farm, and SWMU 211-A, C-720 TCE Spill Site Northeast, were completed in 2016 and 2022, respectively. Both remedial actions incorporated *in situ* source treatment with an initial fieldwork phase followed by long-term maintenance and monitoring during which passive treatment of volatile organic contaminants continues. The long-term monitoring requirements for SWMU 1 and SWMU 211-A are contained in the following project documents:

- SWMU 1—*Addendum to the Remedial Action Work Plan for In Situ Source Treatment by Deep Soil Mixing of the Southwest Groundwater Plume Volatile Organic Source at the C-747-C Oil Landfarm (Solid Waste Management Unit 1) at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-1287&D2/A1/R1 (DOE 2014),

- SWMU 211-A—*Remedial Action Work Plan for SWMU 211-A Enhanced In Situ Bioremediation for Volatile Organic Compound Sources to the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-2443&D2/R2 (DOE 2021c); and the *Certified for Construction Remedial Design Report for SWMU 211-A for Volatile Organic Compound Sources to the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-2435&D2 (DOE 2019).

In 2024, the continued monitoring requirements for each SWMU were incorporated into the *Operation and Maintenance and Environmental Monitoring Plan for Solid Waste Management Units 1 and 211-A Remedial Actions for Volatile Organic Compound Sources to the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2501&D2 (DOE 2024d). For SWMU 1, the document requires sampling of monitoring wells in order to monitor the progress of contaminant reduction in the RGA groundwater following soil mixing. Seven wells will be sampled semiannually in FY 2026 (Figure C.7). For SWMU 211-A, it requires semiannual sampling (FY 2024—FY 2028) of 18 performance monitoring wells and 10 long-term monitoring wells (Figure C.8). Sampling at SWMU 211-A will be conducted to assess ongoing bioremediation in the subsurface, assess zero-valent iron for continued volatile organic compound (VOC) reduction, and assess continued reduction of TCE and degradation products such that VOC migration from contaminated subsurface soils in the treatment areas

[2] O&M plans also specify production sampling. Sampling and monitoring of treatment systems are not captured within this EMP.

of SWMU 211-A do not result in the exceedance of MCLs in the RGA over time as enhanced *in situ* bioremediation degrades TCE in the Upper Continental Recharge System .

4.1.2.1 Landfill groundwater monitoring program

C-746-S and C-746-T Landfills. C-746-S and C-746-T Solid Waste Landfills are closed landfills owned by DOE. These landfills currently are in postclosure status under the landfill permit. The groundwater is monitored utilizing a total of 25 monitoring wells near the two landfills (Figure C.1). Of these 25, 23 are used for collection of samples to analyze organic, inorganic, and radiological parameters. The remaining two are used for water level measurements. Additional analytical information is found in Appendix C.

C-746-U Landfill. The C-746-U Solid Waste Landfill is an operating landfill owned and managed by DOE. This landfill currently is being operated as a contained landfill under the landfill permit; 21 monitoring wells (Figure C.1) are monitored quarterly for organic, inorganic, and radiological parameters. Additional analytical information is found in Appendix C. Sampling and monitoring of the treatment system is not captured within this document because it is part of the daily operations of the landfill.

C-404 Landfill. The C-404 Hazardous Waste Landfill is currently subject to post-closure monitoring under the Hazardous Waste Management Facility Permit KY8-890-008-982. The C-404 Hazardous Waste Landfill currently is being monitored under detection monitoring (semiannual sampling) and compliance monitoring (quarterly) for radionuclides according to permit requirements, including Attachment E of the permit, "Groundwater Monitoring." The groundwater is monitored utilizing nine monitoring wells (Figure C.2). There are six downgradient and three upgradient compliance point wells. Per the permit, sample aliquots shall be withdrawn in the following order: volatiles, total metals, and radionuclides. Remaining permit requirements may follow the radionuclide sample collection. Samples are to be collected twice a year: January through March as one sampling event and July through September as the second event. Results from the January through March event are reported to KDWM by May 30 and results from the July through September event are reported to KDWM by November 30. On May 28, 2025, KDWM was notified of a confirmed statistical exceedance for Tc-99 in MW84A as part of the C-404 semiannual reporting. This exceedance was evaluated and determined to not conform to the 2007 alternate source demonstration (ASD); therefore, beginning with the calendar quarter following the month for which the statistical exceedance was reported for a radionuclide, quarterly compliance monitoring is required for radionuclides only, per Permit Part E, Section 7.1. At the end of one year of quarterly monitoring, a report will be submitted to KDWM that identifies the fate and transport of the radionuclides. Wells to be sampled are listed in Table C.4 and radionuclides to be sampled are listed in Table C.5. The first quarterly sample was collected in July 2025. Quarterly sampling will continue until approval is received from KDWM to return to semiannual sampling. Results of this compliance monitoring are reported semiannually.

An ASD was conducted in 2021 in response to a statistical exceedance for Tc-99 in MW84A. This ASD has determined that the Tc-99 contamination is indicative of dissolved contamination in the RGA and is not derived from contamination associated with construction of RGA well MW84A (FRNP 2021). In accordance with the permit, compliance monitoring for radiological constituents was conducted quarterly at the C-404 Landfill during FY 2022 and the first quarter of FY 2023. Compliance monitoring for radiological constituents was completed in FY 2023 and was discontinued during FY 2024. The latest period of quarterly compliance monitoring was initiated in July 2025 because of another statistical exceedance for Tc-99 in MW84A as discussed above.

In support of a potential future ASD at the C-404 Landfill, upper RGA monitoring wells at the landfill and upgradient areas are being sampled and analyzed for metals and sulfate. The additional metals and sulfate analysis includes middle RGA monitoring wells MW337 and MW338. Sulfate analyses are extended to upgradient monitoring wells MW227, MW333, MW414, MW416, MW549, MW550, and MW551.

Prior to sample collection, KDWM shall be notified one week in advance. Notification may be made in writing or electronic format. Electronic mail shall be submitted to pertinent KDWM field personnel.

All groundwater wells (monitoring wells, piezometers, etc.) will be inspected annually during the third quarter of the calendar year (CY). The wells will be inspected for the condition of the Kentucky Groundwater Data Repository identification, the outer casing, the concrete pad, the bumper posts, painting, the well cap, the lettering and numbers, lock and hasp, well access, vegetation control, and well fittings and tubing. Items will be repaired, as necessary. The wells will be inspected annually for excessive sedimentation by performing a depth sounding at each MW. If a well is found that no longer meets the requirements of 40 *CFR* Part 264 Subpart F, the well will be abandoned in accordance with 401 *KAR* 6:350 and the Hazardous Waste Management Facility Permit. If a replacement well is needed, it will be installed in accordance with 401 *KAR* 6:350 and the requirements of the Hazardous Waste Management Facility Permit.

C-746-K Landfill. Sampling of three monitoring wells (Figure C.3) is conducted to evaluate the potential impact of historical waste disposal activities at the C-746-K Landfill on the groundwater quality parameters, which are analyzed semiannually, as identified in Appendix C. The Record of Decision (ROD) for Waste Area Groups 1 and 7 (DOE 1998) discussed sampling that was being conducted at the time of the ROD development; however, the ROD allowed for modifications to the sampling strategy with documentation of the strategy in a Sampling and Analysis Plan addendum, which was replaced by the EMP. Sampling of these wells is not required by a permit, but is conducted in support of the FFA CERCLA investigation and RCRA facility investigations according to the FFA. Additional analytical information is found in Appendix C.

4.1.2.2 Surveillance monitoring program

Environmental Surveillance Program. In order to monitor the nature and extent of groundwater contamination and to monitor groundwater quality, 64 nonbackground monitoring wells and one background well are sampled biennially, 29 nonbackground monitoring wells and one background well are monitored annually, and 12 monitoring wells are sampled semiannually, as shown in Figure C.11.[3] Sampling of these monitoring wells is not driven by a permitted process, but is conducted in support of the FFA CERCLA investigations. The inclusion of these monitoring wells in this program does not exclude them from other sampling programs. For ease of review, Appendix B of this document contains a well inventory list, which acts as a crosswalk for each monitoring well and sampling program.

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-2426&D2*, (DOE 2020) the *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant*, *Paducah, Kentucky*, (DOE 2021a) was revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP. MW100, MW150, MW409, MW410, MW411, MW473, MW474, MW475, and MW476 are sampled in support of the Environmental Surveillance program, and these wells also are sampled in support of Water Policy boundary monitoring.

The sampling frequency for this program was modified in the FY 2011 EMP from a quarter/semiannual basis to an annual/biennial basis and further modified for FY 2026. These modifications were justified by an evaluation of the data collected over 10 years, which showed that there had not been significant changes

[3] Based on an assessment of available data to monitor contaminant trends, environmental surveillance monitoring is being reduced to 29 locations for annual sampling, 12 locations for semiannual sampling, and 64 locations for biennial sampling.

that merited the need for sampling as frequently. The monitoring wells that were selected to be monitored annually were selected based on their location within the plumes. Sixty-eight biennial monitoring wells were sampled in FY 2025; therefore, the biennial monitoring wells will not be sampled in FY 2026. Both background wells were sampled in FY 2025; therefore, the two background wells will not be sampled in FY 2026.

Two background wells will be sampled biennially to monitor the background water chemistry of wells located upgradient of the plant to compare with monitoring wells potentially impacted from plant activities.

Environmental Surveillance (Geochemical Monitoring) Program. In order to monitor the effects of natural attenuation of groundwater contamination and to monitor groundwater quality, 37 monitoring wells are to be sampled every three years (Table C.29). Sampling of these wells is not driven by a permitted process, but is conducted in support of the FFA CERCLA investigations. The sampling frequency for this program was modified in the FY 2011 EMP. The sampling frequency was modified from an annual basis to a triennial basis. These monitoring wells were sampled in FY 2025 as part of the triennial basis sampling strategy; therefore, these wells will not be sampled in FY 2026.

4.1.3 Extent and Frequency of Monitoring

Appendix B provides information for all wells used at the Paducah Site, as well as residential wells located off-site. The groundwater sampling frequency and parameters, which are identified in Appendix C, are reviewed annually. The information detailed in Appendix C is the planning document for all monitoring and lists sites to be monitored, the governing program(s), monitoring wells, parameters, analytical methods, and the sampling frequency.

4.1.4 Program Implementation Procedures

Organization. The FRNP EM Manager (or designee) is responsible for implementing all relevant aspects of the EMP.

Plans. The *Groundwater Protection Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-1000 (FRNP 2024a), addresses the following specific requirements listed in Section 3(3) of 401 *KAR* 5:037:

(a) General information regarding the facility and its operation;

(b) Identification of activities associated with the facility, as identified in Section 2 of the regulation;

(c) Identification of all practices chosen for the plan to protect groundwater from pollution;

(d) Implementation schedules for the protection practices;

(e) Description of and implementation schedule for employee training necessary to ensure implementation of the plan;

(f) A schedule of required inspections, as applicable; and

(g) Certification of the plan by the appropriate Paducah Site representative.

These plans and the EMP provide the framework of the Groundwater Monitoring Program.

4.2 SURFACE WATER/SEDIMENT ENVIRONMENT

Surface Water. Measurement of water quality parameters in surface water samples provides a general guide to the environmental health of the system. Certain contaminants (e.g., VOCs) that are not particularly concentrated in other media are more efficiently analyzed in water samples.

Sediment. A single sediment sample can represent information that would require a large number of water samples, spaced over a period of time, to reconstruct. Sediment acts to collect, concentrate, and store specific kinds of contaminants at specific locations. Concentrations of contaminants in sediments represent integrated measures of aqueous contaminant concentrations over some preceding period of time.

The Environmental Surveillance Program at the Paducah Site for surface water and sediment evolved over a number of years in response to regulatory and community concerns. Initially, the prudent action was to sample surface water at the permitted outfalls and upstream and downstream within the receiving streams to assess potential impacts. Since that time, DOE has conducted remediation/removal efforts at the site, which has decreased the potential for surface water and sediment contamination. Additionally, the effluent and surface water runoff from outfalls leaving the plant site is monitored to confirm no current impacts from ongoing operations. Monitoring at the outfalls is permitted by KDOW through the KPDES permit and radiological parameters are monitored under DOE O 458.1 requirements. Limited radiological samples for surface water and sediment are collected in the environment to verify the effectiveness of the outfall sampling and to evaluate the accumulation of radionuclides in the environment.

4.2.1 Rationale and Design Criteria

The surface water and sediment sampling sites included in this EMP are located on selected receiving streams downstream from primary contaminant sources and reference streams. The reference streams are located either off-site or on-site, but upstream of contaminant sources. Sample sites were selected to prioritize areas where the public had access and to capture any and all emissions from the plant site. Contaminant sources include both point sources (e.g., effluent outfalls) and nonpoint sources, such as waste disposal areas or burial grounds.

4.2.2 Extent and Frequency of Monitoring

4.2.2.1 Surface water program

Previously, the KPDES permit required sampling for polychlorinated biphenyls (PCBs) and TCE at 19 locations upstream and downstream from Paducah Site operations. The current KPDES permit does not require this sampling; therefore, these locations were removed from this program in FY 2018, with the exception of the C-746-K Landfill locations. The C-746-K Landfill locations will be sampled per the ROD for Waste Area Groups 1 and 7 (DOE 1998).

For radiological parameters, surface water is sampled quarterly at six locations and annually at two locations (Figure C.16). Two locations, L1 (background) and L30 (a location just downstream of the Paducah Site), are sampled annually. L29A (background) is sampled quarterly. This sampling is performed to evaluate all potential radiological effluents leaving the site and to evaluate the effectiveness of the outfall sampling program. This supports the implementation of DOE O 458.1 through the ERPP (FRNP 2024b). Additional analytical information is found in Appendix C.

4.2.2.2 Sediment program

Sediment samples are collected semiannually from 14 locations, one of which is considered a background location (Figure C.17). Five locations and one background location are sampled for radiological parameters to evaluate the effectiveness of the plant effluent monitoring and to monitor the accumulation of contaminants in the environment. Sediment is sampled near the surface water and biological stations at locations downstream from plant operations and in background (reference) streams. Station locations coincide with those for surface water in Bayou Creek and Little Bayou Creek. Of note: Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise. Additional analytical information is found in Appendix C. An assessment code of "DRY" has been added in OREIS with the description of "Result reported on a dry weight basis," for data generated starting in FY 2014, as applicable.

4.2.3 Program Implementation Procedures

The FRNP EM Manager (or designee) is responsible for implementing all relevant aspects of the EMP. In that role, the FRNP EM Manager reports through a line organization to the Environmental Services Director and provides centralized coordination responsibilities.

4.3 TERRESTRIAL ENVIRONMENT

Woodlands, meadows, and cultivated fields dominate the rural landscape around the DOE Reservation. Immediately adjacent to the DOE Reservation is WKWMA, which is used by a considerable number of hunters, trappers, and anglers each year. Hunting and trapping activities may include such wildlife as rabbit, deer, quail, raccoon, squirrel, dove, turkey, waterfowl, and beaver. Additionally, the Kentucky Department of Fish and Wildlife Resources (KDFWR) sponsors field hunting trials for dogs within the WKWMA.

This section discusses the terrestrial environment near the Paducah Site that could become radiologically contaminated as a result of releases of materials from current or past DOE operations. Farm-raised animal products, as well as local wildlife in the area, may be contaminated through water releases. Wildlife and animal products, including meat, eggs, and milk, may become contaminated through animal ingestion of contaminated water, sediment, other animals, or through direct contact with contaminated areas. The subsequent ingestion of these products can lead to a dose to man and is discussed in subsequent sections. Concentrations of both radionuclide and chemical contaminants are evaluated in the terrestrial environment. The Radiological Guide suggests that if wild game, such as deer or game birds, is available locally, these species should be considered for radiological sampling purposes. Due to downward trends and continued lack of detectable results, this sampling is not performed. Additional details of these evaluations are discussed below.

4.3.1 Rationale and Design Criteria

AIRDOS-EPA computer code contained in the latest version of the CAP-88, which implements a steady-state, Gaussian plume, atmospheric dispersion model, is used to calculate environmental concentrations of the estimated released airborne radionuclides and then uses U.S. Nuclear Regulatory Commission (NRC) Regulatory Guide 1.109 food chain models[4] to calculate human exposures, both internal and external, to receptors. The human exposure values then are used by EPA's version of the DARTAB computer code to calculate radiation doses to the public from radionuclides released during the year.

[4] Additional information regarding modeling is provided in the annual NESHAP report.

4.3.1.1 Soils

Very low amounts of airborne radionuclides are emitted at the Paducah Site. A portion of the airborne radionuclides is estimated to be deposited in soil. Irrigation and deposition through waterborne radionuclides is an incomplete pathway because municipal water is used at nearby residences for household purposes (including activities such as watering plants and lawns). See Section 4.3.1 for air modeling information.

4.3.1.2 Animal products

Very low amounts of airborne radionuclides are emitted at the Paducah Site. A portion of the airborne radionuclides is estimated to be deposited in soil and on food crops where they may be absorbed into plants and then may be ingested by animals. Animal products then may be ingested by the public. Irrigation and deposition through waterborne radionuclides is an incomplete pathway because municipal water is used at nearby residences for household purposes (including activities such as watering plants and lawns). The Paducah Site estimates doses from animal products to the receptors based on these estimated airborne emissions. See Section 4.3.1 for air modeling information.

4.3.1.3 Food crops and vegetation

Very low amounts of airborne radionuclides are emitted at the Paducah Site. A portion of the airborne radionuclides is estimated to be deposited in soil and on food crops and vegetation where they may be absorbed into food crops and vegetation. These food crops then may be ingested by the public. Irrigation and deposition through waterborne radionuclides is an incomplete pathway because municipal water is used at nearby residences for household purposes (including activities such as watering plants and lawns). The Paducah Site estimates doses from food crops to the receptors based on these estimated airborne emissions. See Section 4.3.1 for air modeling information. The air modeling uses default values, which may not be reflective of the Paducah Site.

4.3.1.4 Wildlife

Wildlife monitoring (e.g., deer) historically was conducted near the Paducah Site. In 2011, an extensive review was conducted of data sets from 20 years of deer harvesting events. As a result of this review, the deer monitoring was eliminated because of a downward trend and a continued lack of detection in the results, as well as an overall downward trend in the concentration of contaminants found at the Paducah Site due to remediation efforts.

4.4 EXTERNAL RADIATION

The Paducah Site conducts routine surveillance of external gamma and neutron radiation exposure to monitor any effects due to past releases of radionuclides and current operations involving radioactive sources (e.g., depleted uranium hexafluoride cylinder management). Historical monitoring has shown that the background-corrected external gamma and neutron radiation dose from routine DOE operations at the Paducah Site boundary to the maximally exposed individual (MEI) member of the public is under 5 mrem per year E (individual) and 1 person-rem per year collective dose for the exposed population. Routine surveillance of external gamma radiation with environmental dosimeters is conducted to provide data to model direct external radiation from sources located on-site consistent with DOE O 458.1. Neutron dosimetry monitoring near cylinder yards has been in place in previous years and is not used to determine public exposure but is used for information purposes only.

4.4.1 Objectives

The goal for external radiation monitoring is to calculate the E of the MEI member of the public using DOE-approved dose conversion factors, realistically expected parameters from the Risk Methods Document (DOE 2024e), and background corrected values, as applied to all objectives.

The objectives for external exposure monitoring are the following.

- Establish the radiation dose potentially received by a member of the public from direct exposure to DOE operations.
- Calculate the E to a member of the public in areas freely accessible to members of the public.
- Calculate the E to a member of the public at the DOE boundary.
- Calculate the E to the MEI member of the public.

4.4.2 Rationale and Design Criteria

The external radiation monitoring program is designed to provide exposure data on direct radiation from DOE operations to members of the public. The Deactivation and Remediation Contractor uses a surveillance network of environmental dosimeters to monitor this direct radiation. The surveillance network is divided into five groups, which are used to monitor: Group 1, background locations; Group 2, locations inside the Limited Area (LA); Group 3, locations outside the LA and inside the PPA; Group 4, locations outside the PPA and inside the DOE boundary and Group 5 locations outside the DOE boundary. The dosimeter locations are also placed in areas that, historically, received the highest radiation exposure. The EDLs are identified in Appendix C, Figure C.18.

4.4.3 Extent and Frequency of Monitoring

The extent and frequency of monitoring for external gamma radiation are determined based on the principle that the exposure levels decrease with distance from the sources and that the levels are relatively constant over time.

Public access assumptions are that (1) the PPA fence for the secured area provides a physical boundary beyond which the public has no access; (2) the locations of residences and communities outside the reservation are known; and (3) individual exposure scenarios may vary.

Environmental gamma dosimeters are located at 67 locations and neutron dosimeters are located at seven of these monitoring locations. The monitoring locations are divided into five groups. Group 1 locations are used for background analysis. Group 2 locations are located inside or on the perimeter of the LA. Group 3 locations are located outside the LA and inside the PPA. Group 4 locations are located outside the PPA and inside the DOE boundary. Group 5 locations are located outside the DOE boundary.

The environmental dosimeters are collected and analyzed quarterly. When the dosimeters are collected, the following quarter's dosimeters are placed at the same locations when possible. Appendix C, Table C.51, lists the EDLs and Figure C.18 shows the EDLs.

Additional information on the external radiation monitoring program, which includes how to perform data analysis of the environmental data results, is found in the current revision of CP5-ES-0103, *Reference Guide for Environmental Radiation Protection*.

4.5 AMBIENT AIR

DOE complies with 40 *CFR* Part 61, Subpart H, to control airborne emissions of radionuclides. This compliance includes evaluation of activities that have potential radionuclide emissions. The EDE from point sources is calculated based on monitoring information for each source.[5]

In addition to point sources, DOE has identified potential fugitive and diffuse sources of radionuclides. In accordance with the Paducah Site NESHAP Management Plan, CP2-EC-0002/FR2, ambient air is monitored to measure concentrations of radionuclides from all sources, including fugitive and diffuse (FRNP 2019). The ambient air monitoring network is comprised of nine air monitoring stations surrounding the site, including one background station (Figure C.19). Additional analytical information is found in Appendix C.

Because the public dose has been below 10 mrem per year consistently, additional sampling beyond the ambient air monitoring is not warranted for the FY 2026 EMP.

4.6 VEGETATION/SOIL

Very low amounts of airborne radionuclides are emitted at the Paducah Site from DOE sources. A portion of the airborne radionuclides is estimated to be deposited in soil and on vegetation. The Paducah Site estimates doses through the food chain to the receptors based on these estimated airborne emissions. See Section 4.3.1 for air modeling information.

4.7 ANIMAL PRODUCTS

Very low amounts of airborne radionuclides are emitted at the Paducah Site from DOE sources. A portion of the airborne radionuclides are estimated to be deposited in soil and on food crops where they may be absorbed into plants and then may be ingested by animals. Animal products then may be ingested by the public. Irrigation and deposition through waterborne radionuclides is an incomplete pathway because municipal water is used at nearby residences for household purposes (including activities such as watering plants and lawns). The Paducah Site estimates doses from animal products to the receptors based on these estimated airborne emissions. See Section 4.3.1 for air modeling information.

4.8 WATERSHED BIOLOGICAL MONITORING

Historically, a Watershed Monitoring Plan (WMP) was required to meet KPDES permit requirements. The WMP detailed the Paducah Site's biological monitoring program.

In 2011, the WMP was modified to eliminate the requirement for biological monitoring in the creeks surrounding the site. The justification for elimination of biological monitoring in creeks was that, over the years, the watersheds had been sampled extensively to the point that further collection of aquatic organisms could result in a deleterious effect on the aquatic community; therefore, biological sampling no longer was required. Elimination of the program also was supported by the fact that measured concentrations associated with radionuclides of concern at the Paducah Site in fish were low and there was an overall downward trend in the concentration of contaminants due to remediation efforts.

[5] For Paducah Site radionuclides of concern, E is equivalent to EDE.

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5. DOSE CALCULATIONS

Effluent releases due to operations at the Paducah Site from DOE sources may contain radionuclides. After release, these substances disperse through the environment by transport mechanisms by which they eventually may reach and affect humans. This section describes the methodologies used to model the dispersion of radionuclides and to estimate human exposure resulting from the intake of the dispersed radionuclides. Human exposures to radionuclides are characterized in terms of TED to the public MEI and to the entire population residing within 50 miles of the site. Site-specific pathways may be used that have current or potential future pathways that are not listed in the Risk Methods Document (DOE 2024e). The Risk Methods Document states that during the DQO process for a specific project, risk analyses will be used to identify qualitatively the preliminary chemicals of potential concern, receptors that may be exposed to contaminants, locations at which exposure may occur, and pathways by which contaminants may reach these locations. This information will be used to develop the conceptual site model against which the new data collected can be compared. Exposure factors will be based on information contained in the Risk Methods Document or in consultation with project teams for site-specific parameters. In addition to the dose assessments in support of the ASER, individual projects also may perform dose assessments to establish bounding scenarios to ensure that any future public radiological exposures are maintained within the limits established in DOE Orders. The assumptions and parameters used in these project-specific assessments are found within the individual project technical derivations.

5.1 CONFORMANCE WITH STANDARDS FOR PUBLIC DOSE CALCULATIONS

Models selected to assess environmental transport of and human exposures to substances released from DOE operations are codified or approved for use by DOE. The models are appropriate for the physical and environmental situation encountered and for the data available to characterize the situation. Input data, including default values, are documented and evaluated for applicability to the situation being modeled.

A complete set of potential human exposure pathways is considered in the assessments of radiological exposures. Those pathways that represent the potential exposures to the most exposed individual and to the entire population residing within 50 miles of the site are evaluated as appropriate. The pathways that are evaluated are discussed in Sections 5.3 and 5.4.

Descriptions of the models and computer codes may consist of references to published descriptions or of actual mathematical formulations developed for special calculations. Surface water and groundwater modeling are conducted, as necessary, to conform to applicable requirements of the Commonwealth of Kentucky and of the regional EPA office.

5.2 MAJOR CONSIDERATIONS

Members of the public may receive radiation doses from the Paducah Site from DOE sources from materials released to the air and waters. In addition, some members of the public may receive low level radiation doses through direct external irradiation by radiation emanating from the cylinder yards located within the secured area of the plant. Doses are estimated for all potentially important exposure pathways relevant to the above exposure media. Table 3 lists environmental release and transport mechanisms that apply to emissions from DOE operations. Estimation of the consequences of radionuclide or chemical releases from DOE operations must consider all potential pathways by which these materials may reach the surrounding population. To aid in selecting potentially important pathways, a land use survey was performed. This survey recorded and mapped the locations of all residences, farms for animal products, and vegetable

gardens within a 3-mile radius of the site. All identified locations were plotted on a map divided into 16 equal sectors corresponding to the 16 cardinal compass points. This land use survey and other potential pathways are summarized in the Risk Methods Document (DOE 2024e).

Table 3. Environmental Transport Mechanisms Applicable to Releases from DOE Operations

Releases to water	Remain dissolved or suspended in water Deposit on ground via irrigation* Deposit on vegetation via irrigation* Deposit in sediment Uptake to biota
Releases to air	Remain suspended in air Deposit on ground Deposit on vegetation Uptake to biota

*The protective measures taken in support of the Water Policy preclude the use of potentially contaminated water for irrigation. The inclusion of irrigation as a potentially completed exposure pathway is for informational purposes only, and the doses are not modeled.

This information was compared to modeling results to identify the MEI. Demographic data from 2020 were obtained from the Bureau of the Census to document characteristics of the people who live near the site. As part of the management of the Water Policy, property surrounding the Paducah Site is evaluated annually to ensure that there have been no changes to property ownership.

As part of a CERCLA site investigation (CH2M HILL 1991), a survey was taken of users of surface and groundwater in the vicinity of the Paducah Site to determine the number of residents using water wells within a 4-mile radius and to determine the number of surface water intakes on the Ohio River up to 15 miles downstream from the Paducah Site.

No resident or business responding to the survey reported using a private intake on the Ohio River or on Bayou Creek or Little Bayou Creek for any part of their water supply.

Figures 1 and 2 list potential environmental pathways to humans and associated media for the transport mechanisms given in Table 3. Sections 5.3, 5.4, and 5.5 discuss the environmental transport, food chain, and dosimetric models used to evaluate human exposures due to current or past DOE operations. Input data to the models are evaluated using site-specific (collected under the EM and surveillance activities described earlier in this plan), historical data, and generic (default) values.

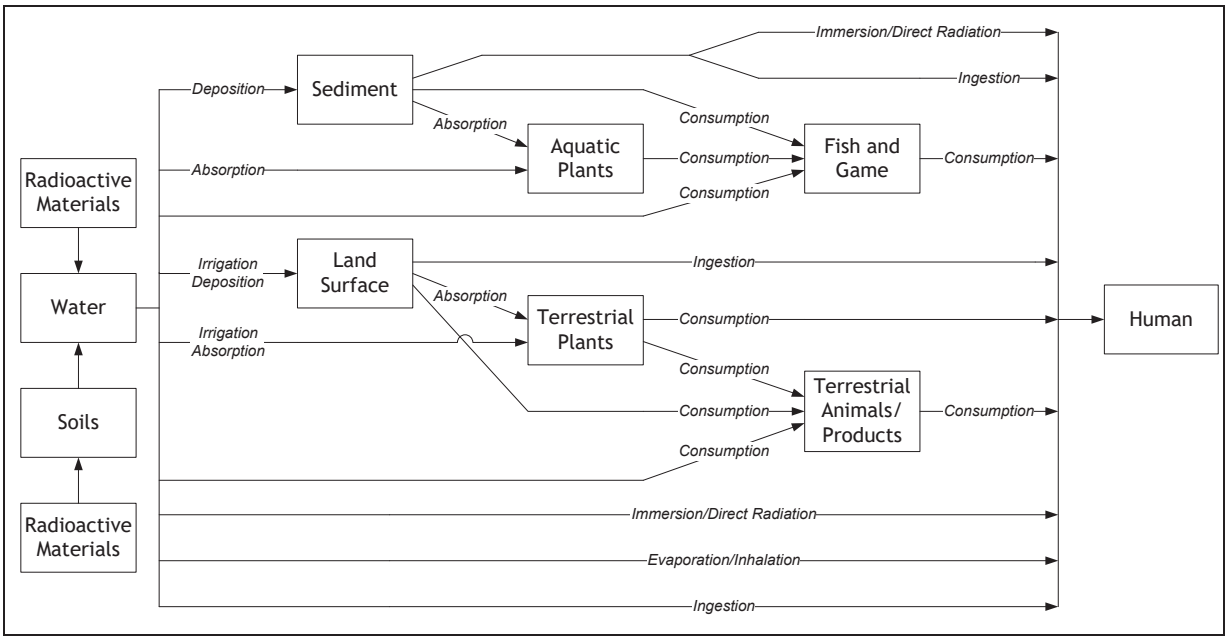

Figure 1. Possible Pathways between Radioactive Materials Released to the Water and Humans

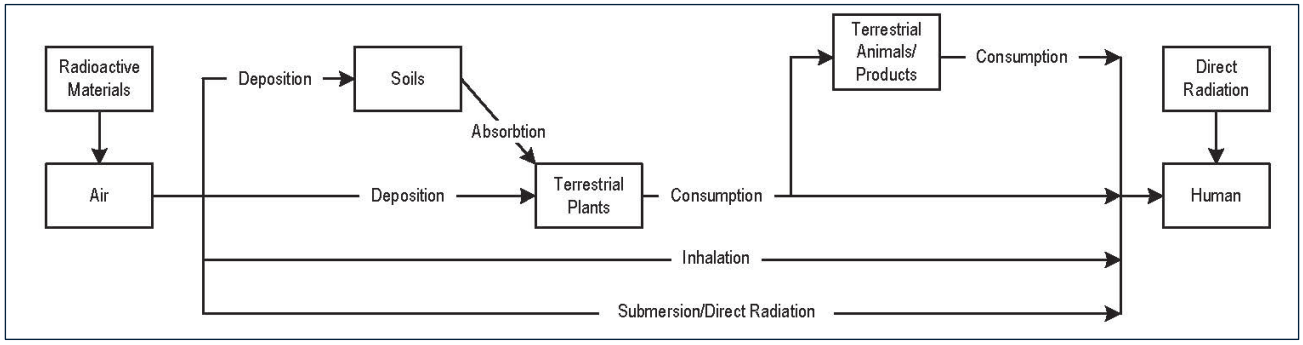

Figure 2. Possible Pathways between Radioactive Materials Released to the Air and Humans

5.3 TRANSPORT MODELS

This section describes the methodologies used to characterize environmental concentrations of radiological materials released from current or past DOE operations. In some cases, transport models are used to predict concentrations; in other cases, measured concentrations are available. When both predicted and measured concentrations are available, the measured concentrations are used to verify modeling predictions.

5.3.1 Atmospheric Transport

Contaminants released to air may be inhaled by individuals, cause direct radiation by submersion, or deposit on vegetation that may be consumed by farm animals or humans.

Dose calculations on atmospheric releases are described in Section 5.4.1.

5.3.2 Water Transport

Contaminants released to water may remain dissolved or suspended in water (groundwater or surface water), deposited in sediment, deposited on ground or vegetation by irrigation, absorbed into plants and animals, or may infiltrate to the groundwater.[6] Quantities of radionuclides released to surface waters are determined by sampling permitted outfalls in each of the local receiving streams. Contamination of private wells with both Tc-99 and TCE due to releases from historical DOE operations led to a response action in 1988. DOE supplied potable water to affected residents and installed an interim water supply for each resident whose water had TCE above the laboratory reporting limit of 1 ppb. For a long-term water supply, a community water line was extended to the residents with contaminated wells. Irrigation of gardens and watering of livestock using contaminated well water has ceased. Presently, groundwater transport is not regularly modeled for public dose calculations; however, site-specific CERCLA projects develop information to support transport modeling, as necessary. This information is used to support risk management decisions made for CERCLA projects.

5.3.3 Soil Transport

Contaminants deposited in soils and sediments may be absorbed into plants and vegetation that are consumed by farm animals or humans. Additional routes of exposure from soils and sediment are direct irradiation, indirect pathways, and incidental ingestion. Dose calculations on soil releases are discussed in Sections 5.4.3 through 5.4.5.

5.4 ENVIRONMENTAL PATHWAY MODELS

This section describes the methodologies that are used to characterize mechanisms for human uptake and exposure to the radiological contaminant concentrations described in Section 5.3. As in Section 5.3, both modeling and sampling are used to obtain contaminant concentrations in media and foods to which humans may be exposed. In addition, environmental gamma radiation exposure is measured through a dosimetry program.

5.4.1 Contaminants in Air

The ambient air surrounding the Paducah Site is monitored to evaluate public exposure to airborne radionuclides. The results of this ambient air monitoring are used by DOE to demonstrate compliance with Commonwealth of Kentucky and federal regulations as well as with DOE Orders. The DOE contribution to airborne radioactivity from DOE operations at the Paducah Site normally is too low to be detected in the presence of natural background radiation in the environment; therefore, as required under 40 *CFR* Part 61, Subpart H, potential doses to the public from point sources also are calculated with a dispersion model. This model calculates how measured quantities of released radionuclides mix with the atmosphere, where they travel, and where they could deposit. Once the dispersion is calculated, population data and concentration/dose conversion factors are used to calculate individual and population doses. These doses include exposure from all the pathways represented in Figure 2, although the primary route of exposure is inhalation. The ambient air monitoring data collected from the ambient air monitoring network are used to assess the impact of emissions of all point and fugitive sources.

The radiation dose calculations are performed using the latest version of CAP-88 computer codes. This package contains EPA's most recent version of the AIRDOS-EPA computer code. The code uses a steady-

[6] The protective measures taken in support of the Water Policy preclude the use of potentially contaminated water for irrigation. The inclusion of irrigation as a potentially completed exposure pathway is for informational purposes only, and the doses are not modeled.

state, Gaussian plume, atmospheric dispersion model to calculate environmental concentrations of released radionuclides.[7] The code also uses NRC Regulatory Guide 1.109 for food chain models to calculate human exposures, both internal and external, to radionuclides deposited in the environment. DOE uses EPA's latest version of the DARTAB computer code that uses the human exposure values to calculate radiation doses to the public from radionuclides released during the year. The dose calculations use dose conversion factors from the latest version of the RADRISK data file, which EPA provides with CAP-88.

5.4.2 Contaminants in Water

Potential direct routes of human exposure to contaminants in waters include ingestion (incidental ingestion while swimming), immersion (swimming, wading, showering), direct irradiation (boating, skiing, shoreline use), and inhalation (e.g., release of contaminants during household use of water). Indirect pathways involve deposition in sediment (Section 5.4.3), contaminants in soil (Section 5.4.4), contaminants in or on food crops (Section 5.4.5), and contaminants in terrestrial animals and fish (Section 5.4.6).

DOE O 458.1 requires conducting radiological activities to ensure that radionuclides from DOE activities contained in liquid effluents do not cause private or public drinking water systems to exceed the drinking water MCL in 40 *CFR* Part 141. Per 40 *CFR* Part 141, environmental surveillance data may be used in the vicinity of a nuclear facility to verify compliance with 40 *CFR* Part 141 radiological limits for drinking water. Surveillance data from Bayou and Little Bayou Creeks also may be used to verify compliance with 40 *CFR* Part 141 prior to their entrance into the Ohio River.

If the surveillance data from Bayou and Little Bayou Creeks exceed the limits for drinking water, samples are compared to the Ohio River background upstream of the Paducah Site to demonstrate DOE compliance.

Surface water is not used for drinking or irrigation near the plant. In 1990, a survey of surface water and groundwater users in the vicinity of the Paducah Site was conducted to determine the number of residents using water wells within a 4-mile radius and to determine the number of surface water intakes on the Ohio River within 15 miles downstream of the plant (CH2M HILL 1991). No residents or businesses that responded to the survey questionnaire reported using a private surface water intake on the Ohio River, Bayou Creek, or Little Bayou Creek for any part of their water supply. Private groundwater wells were the major water supply for residents surrounding the Paducah Site. Most residents reported using water from their residential wells for drinking, irrigation, and domestic uses. As part of the management of the Water Policy (DOE 1994), property surrounding the Paducah Site is evaluated annually to ensure there have been no changes to property ownership. Dose to the hypothetical MEI is calculated based on incidental ingestion of surface water due to swimming in Bayou and Little Bayou Creeks (outfall locations are not included because water within these locations is not indicative of a body of water that a person could enter). The assumptions based on the Risk Methods Document are that a hypothetical recreator may swim 45 days a year, for 2.6 hours a day, with an incidental ingestion of 0.092 liters per hour, and be in different locations throughout the wildlife management area (DOE 2024e). The annual average of the surface water results from the various sampling locations are utilized to calculate a dose for each sample location and the sample location with the maximum estimated dose is assigned to the MEI. Collective dose is not calculated for the incidental ingestion of surface water pathway because it is unlikely that a population of individuals would swim repeatedly in either Bayou or Little Bayou Creeks. This pathway is more likely to involve individuals; therefore, it is more suited for MEI dose calculation.

[7] Additional information regarding modeling is provided in the annual NESHAP report.

In September 1988, following the discovery of contamination in residential drinking water wells, water was supplied to all residents whose wells contained detectable levels of TCE and gross beta. In 1992, a Water Policy was developed, which specified that residents in the Water Policy box were to receive supplied water either through bottled water or municipal water. That effort was completed May 31, 1994.

The dose to a resident from drinking water ingestion is not a realistic exposure pathway.

Measured concentrations are compared with federal and Commonwealth of Kentucky standards and with historical concentrations for each contaminant found.

5.4.3 Contaminants in Sediment

Discharges from DOE operations to surface waters may result in accumulations in sediment of radionuclides. Potential routes of human exposure from sediment are direct irradiation, indirect pathways, and incidental ingestion. An example of an indirect pathway is a fish ingesting contaminated sediment and subsequent human ingestion of the fish.

External irradiation from contaminated sediment in Little Bayou Creek is a pathway of potential importance. Radionuclides deposited on the shores of rivers or creeks may accumulate over a period of time, leading to external irradiation of persons standing on contaminated surfaces. The amount of the nuclides built up on the shoreline depends on the concentration in the water, the depth of deposit, and the length of the period of buildup. The dose to persons depends on the time spent near the contaminants. This exposure time is expected to be minimal because warning signs are posted in this area that indicate the possible presence of contamination. An estimated collective dose for the incidental ingestion of sediment within plant creeks and ditches pathway has been calculated by multiplying the dose to the MEI from incidental ingestion of sediment by a total estimated number of visitors hiking within the wildlife management area annually (150 persons) (DOE 2024e). This pathway is more likely to involve individuals; therefore, it is more suited for MEI dose calculation.

Incidental ingestion of contaminated sediment may result from exposure during fishing, hunting, or other recreational activities.

5.4.4 Contaminants in Soil

A portion of the airborne radionuclides is estimated to be deposited in soil and on food crops where they may be absorbed into plants and then may be ingested by animals. Animal products then may be ingested by the public. The Paducah Site estimates doses from animal products to the receptors based on these estimated airborne emissions. AIRDOS-EPA computer code contained in the latest version of CAP-88, which implements a steady-state, Gaussian plume, atmospheric dispersion model, is used to calculate environmental concentrations of the estimated released airborne radionuclides and then uses NRC Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to receptors. The human exposure values then are used by the EPA's version of the DARTAB computer code contained in the latest version of CAP-88 to calculate radiation doses to the public from radionuclides released during the year.

Contaminants also may be deposited in soil due to irrigation of crops from groundwater and/or surface water. As part of a CERCLA site investigation, a survey was taken of users of surface and groundwater in the vicinity of the Paducah Site to determine the number of residents using water wells within a 4-mile radius, as specified in the 1990 land use survey, and to determine the number of surface water intakes on the Ohio River up to 15 miles downstream from the site (CH2M HILL 1991).

No resident or business responding to the survey reported using a private intake on the Ohio River, Bayou Creek, or Little Bayou Creek for any part of their water supply. Because irrigation of gardens and watering of livestock using contaminated well water has ceased, this form of exposure is not modeled.

5.4.5 Contaminants in or on Food Crops

A portion of the airborne radionuclides is estimated to be deposited in soil and on food crops where they may be absorbed into food crops. These food crops then may be ingested by the public. The Paducah Site estimates doses from food crops to the receptors based on these estimated airborne emissions. AIRDOS-EPA computer code contained in the latest version of CAP-88, which implements a steady-state, Gaussian plume, atmospheric dispersion model, is used to calculate environmental concentrations of the estimated released airborne radionuclides and then uses NRC Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to receptors. The human exposure values then are used by the EPA's version of the DARTAB computer code contained in the latest version of CAP-88 to calculate radiation doses to the public from radionuclides released during the year.

Contaminants also may be deposited on vegetation due to irrigation of crops from groundwater and/or surface water. As part of a CERCLA site investigation, a survey was taken of users of surface and groundwater in the vicinity of the Paducah Site to determine the number of residents using water wells within a 4-mile radius and to determine the number of surface water intakes on the Ohio River up to 15 miles downstream from the site (CH2M HILL 1991).

No resident or business responding to the survey reported using a private intake on the Ohio River, Bayou Creek, or Little Bayou Creek for any part of their water supply. As part of the management of the Water Policy, property surrounding the Paducah Site is evaluated annually to ensure that there have been no changes to property ownership. Because irrigation of gardens and watering of livestock using contaminated well water has ceased this form of exposure is not modeled.

5.4.6 Contaminants in Terrestrial Animals and Fish

Contaminants may accumulate in animals from eating contaminated feed, drinking contaminated water, and breathing contaminated air. Contaminants may accumulate in fish when they eat contaminated foods and equilibrate with surrounding waters. Indirect pathways for human exposure to contaminants in animals and fish are eating meat and fish. Because both measured concentrations and bioconcentration factors associated with radionuclides of concern at the Paducah Site in animals and fish are low, assessments of these pathways are not performed for the EMP; however, radionuclide impact to animals and fish is evaluated per project based on the expected concentration of radionuclides discharged.

Biota in the aquatic community are not sampled. Biota in the watersheds were sampled previously to the extent that further collection of aquatic organisms would have had deleterious effects on the aquatic community (PRS 2006).

A portion of the airborne radionuclides are estimated to be deposited in soil and on food crops where they may be absorbed into plants and then may be ingested by domestic animals. Domestic animal products then may be ingested by the public. The Paducah Site estimates doses from animal products to the receptors based on these estimated airborne emissions. AIRDOS-EPA computer code contained in the latest version of CAP-88, which implements a steady-state, Gaussian plume, atmospheric dispersion model, is used to calculate environmental concentrations of the estimated released airborne radionuclides and then uses NRC Regulatory Guide 1.109 food chain models to calculate human exposures, both internal and external, to

receptors.[8] The human exposure values then are used by the EPA's version of the DARTAB computer code contained in the latest version of CAP-88 to calculate radiation doses to the public from radionuclides released during the year.

During the 20-year period of deer harvesting at the site, dose assessments from the ingestion of deer meat were performed using measured concentrations of contaminants. In 2011, an evaluation was conducted of the data sets from the years of deer harvesting events (LATA Kentucky 2011). As a result of this review, the deer harvest was eliminated because of a downward trend and a continued lack of detection in the results, as well as an overall downward trend in the concentration of contaminants found at the Paducah Site due to remediation efforts. The elimination of the deer harvest program was documented in the FY 2012 EMP.

5.4.7 Direct Radiation

The only identified source of potential exposure to the public from radiation emanating from radionuclides contained in structures and other objects is gamma radiation from the uranium cylinder storage yards. It is very improbable that members of the public would be exposed to gamma radiation from these uranium cylinders found in the storage yards due to limited exposure time, distance from the access points of the public to the cylinder yards and shielding. Collective doses for direct radiation are calculated, based on the total estimated number of visitors hiking within WKWMA annually.

5.5 INTERNAL DOSIMETRY MODELS

The results of all dose calculations are reported in terms of TED, the sum of E received during the year from external exposures, plus the 50-year committed equivalent dose from intake of radionuclides during the year.[9] Appropriate dose conversion factors based on site-specific factors and uses that are used in the calculations are obtained from DOE O 458.1 reference documents such as these: International Commission on Radiological Protection Publication 60 and 40 *CFR* Part 141, *National Primary Drinking Water Regulations.* Although not used in specific dose calculations, the derived concentration standard values given in DOE-STD-1196-2022 may be used in assessing the magnitude of dose to the public associated with measured concentrations of radionuclides in liquid effluents and can be used for evaluation of when to apply best available technology.

5.6 RADIATION DOSE TO AQUATIC AND TERRESTRIAL BIOTA

Compliance with DOE-STD-1153-2019, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, regarding the absorbed dose rate limit to native organisms (e.g., invertebrates, fish, raccoons, and muskrats) is demonstrated using a graded approach to show compliance with DOE dose limits using RESRAD-BIOTA software. Current practice estimates absorbed doses by multiplying measured radionuclide concentrations in surface waters by internationally recognized, organism-specific dose rate factors for external and internal exposures and summing the external and internal contributions.

5.7 REPORTS AND RECORDS

Doses to the maximally exposed member of the public and to the population are published in the ASER. In addition, if a radiological release that exceeds any limit contained in paragraphs 2.f.(2), 2.f.(5), 2.g.(4),

[8] Additional information regarding modeling is provided in the annual NESHAP report.
[9] For Paducah Site radionuclides of concern, EDE is equivalent to E.

2.g.(5)(a), 2.g.(7), 2.g.(8)(a)4 or 2.i.(1) of DOE O 458.1 Chg 5 (AdminChg), *Radiation Protection of the Public and the Environment*, dated January 30, 2025, or exceeds the 40 *CFR* § 61.92 requirements, then the Paducah Site notifies DOE Headquarters.

All input data used in dose calculations are considered as records requiring "permanent retention."

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6. REPORTS

6.1 INTRODUCTION

This section provides an overview of the reporting requirements that are followed by DOE utilizing data generated under the EMP. These requirements have been established in regulations, statutes, and orders issued by regulatory agencies and by DOE and are addressed specifically in the individual sections of this plan. In addition to the reporting requirements listed, data generated under the EMP also is used in preparing regulatory documents completed under the FFA, as appropriate. Revisions to the groundwater conceptual model use data generated under this EMP.

It is the policy of DOE to comply with all applicable environmental requirements, and those listed here are subject to supersession and/or amendment as well as being variable in applicability to individual DOE facilities.

6.2 REPORTING REQUIREMENTS

The preparation and disposition of reports relevant to EM are shown in Table 4, Applicable Reporting Requirements. The ASER contains a summary for the effluent monitoring and environmental surveillance data for each CY. The ASER includes a summary of sampling results collected throughout the year as part of programmatic, environmental sampling activities and regulatory permit requirements. All permit activities, such as mitigation action plans, new requirements, or emission sources are described.

The ASER also includes the information from the Superfund Amendments Reauthorization Act (SARA) 6.3 Title III, Section 313, *Toxic Chemical Release Inventory Report*, on quantities of nonradiological chemical emissions to the environment from unplanned releases. The ASER also includes the chemicals reported in the Emergency Planning and Right-to-Know Act, Section 312, Hazardous Chemical Inventory.

Table 4. Applicable Reporting Requirements

Reporting	Due Date	Source of Requirement	Requirement
ASER	October 1	DOE O 231.1B and DOE O 458.1 (and ERPP)	All DOE facilities that conduct significant environmental protection programs shall prepare an ASER for DOE. The report must provide a comprehensive review of the environmental surveillance programs, status of environmental compliance, and effluent data for nonradioactive pollutants.
Annual NESHAP Compliance Report	June 30	NESHAP 40 *CFR* Part 61 Subpart H	Reporting shall include results from monitoring of radionuclide emissions to the ambient air, as well as, required dose calculations. Ambient air monitoring data are included in the NESHAP reports for assessment of fugitive and diffuse emission sources.
Discharge Monitoring Report	The 28th of each month	Clean Water Act	Discharge Monitoring Reports are required for compliance with KPDES permit KY0004049.

Table 4. Applicable Reporting Requirements (Continued)

Reporting	Due Date	Source of Requirement	Requirement
Annual PCB Document	July 1	40 *CFR* § 761.180	The Annual PCB Document is required for PCBs in use and PCB wastes.
SARA Section 313	July 1	SARA Title III	Covered facilities shall report to EPA and the Commonwealth of Kentucky, all environmental releases of specified toxic chemicals that are manufactured, processed, or otherwise used in excess of specified thresholds.
SARA Section 312	March 1	SARA Title III	Annual Hazardous Chemical Inventory Report.
C-746-U Landfill Compliance Monitoring Report	Quarterly	401 *KAR* 47:130	This report is required in accordance with the Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045.
Landfill Quarterly Operating Report	Quarterly	401 *KAR* 47:130	This report is required in accordance with the Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045.
C-746-S&T Landfills Compliance Monitoring Report	Quarterly	401 *KAR* 47:130	This report is required in accordance with the Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045.
C-404 Landfill Groundwater Monitoring Report	May, November	40 *CFR* Part 264 Subpart F	This report is required in accordance with Paducah Hazardous Waste Management Facility Permit KY8-890-008-982.
Environmental Monitoring Plan	October 1 Annually	DOE O 458.1 (and ERPP)	Requires a plan to characterize the exposures and doses to individuals and to the population; and evaluate the potential impacts to the biota in the vicinity of DOE activity.
Groundwater Protection Plan	Three Years; Last Updated August 2021	401 *KAR* 5:037	Requires a plan to ensure protection for all current and future uses of groundwater and to prevent groundwater pollution.
Best Management Practices Plan	Five Years; Last Updated September 2024	KPDES permit (KPDES permit is required by the Clean Water Act)	This plan is required by KPDES permit KY0004049.
Spill Prevention Control and Countermeasure (SPCC) Plan	Reviewed Every Three Years or within 6 months of significant changes (additions and subtractions); Last Updated November 2024	40 *CFR* Part 112	Requires regulated facilities to prepare and implement a SPCC. The purpose of a SPCC Plan is to form a comprehensive spill prevention program that minimizes the potential for discharges.
Annual External Radiation Monitoring Report	March 1	DOE O 458.1 (and ERPP)	This report estimates the external radiation dose on an annual basis; summary info also is included in the ASER.
FFA Semiannual Report	April 30 October 30	FFA	This report is required by the FFA. Data generated in many of the sampling programs referenced in Appendix C are reported in this report.

7. REFERENCES

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APPENDIX A

PADUCAH PERMIT SUMMARY

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U.S. DEPARTMENT OF ENERGY PERMIT SUMMARY FOR THE PADUCAH GASEOUS DIFFUSION PLANT

Permit Type	Issuer	Expiration Date	Permit Number	Permittee
AIR				
Title V Air Permit*	Kentucky Division for Air Quality (KDAQ)	9/12/2026	V-21-011	Four Rivers Nuclear Partnership, LLC (FRNP)
Conditional Major Operating Air Permit	KDAQ	7/27/2026	F-21-018	Mission Conversion Services Alliance, LLC (MCSA)
WATER				
Kentucky Pollutant Discharge Elimination System (KPDES)	Kentucky Division of Water (KDOW)	1/31/2028	KY0004049	U.S. Department of Energy (DOE), FRNP, and MCSA
Permit to Withdraw Public Water	KDOW	N/A	0900	MCSA
Water Treatment Registration (Public Water System)	KDOW	N/A	PWS No. 0732457	MCSA
SOLID WASTE				
Solid Waste Landfill Permit [C-746-S Residential Landfill (Closed), C-746-T Inert Landfill (Closed), C-746-U Contained Landfill]	Kentucky Division of Waste Management (KDWM)	11/04/2026	SW07300014 SW07300015 SW07300045	DOE/FRNP
RCRA				
Hazardous Waste Management Facility Permit	KDWM	8/07/2035	KY8-890-008-982	DOE/FRNP

*Operational sampling included in the Title V air permit is considered outside the scope of the Environmental Monitoring Plan. FRNP will implement the appropriate operational sampling to meet the requirements of the Title V air permit.

U.S. DEPARTMENT OF ENERGY COMPLIANCE AGREEMENTS SUMMARY FOR THE PADUCAH GASEOUS DIFFUSION PLANT

Agreement	Effective Date	Expiration Date	Entities
TSCA CA (Toxic Substances Control Act Compliance Agreement)	05/2017 (Modification)	N/A	U.S. Environmental Protection Agency (EPA) and DOE
Federal Facility Compliance Agreement Agreed Order/Site Treatment Plan	09/1997	N/A	KDWM and DOE
Federal Facility Agreement	02/1998	Ongoing	Commonwealth of Kentucky, EPA, and DOE
Agreed Order for Waste, Air, and Water Violations	10/2003	Ongoing	Commonwealth of Kentucky and DOE
Agreed Order for DUF_6 Management	10/2003	Ongoing	KDWM and DOE

APPENDIX B

WELL PROGRAM INVENTORY

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ACRONYMS

211SA	SWMU 211-A groundwater well semiannual sampling
400GA	C-400 groundwater well annual sampling
400GSA	C-400 groundwater well semiannual sampling
404G	C-404 Landfill groundwater well sampling
A	annually
AB	abandoned
AB-IP	abandoned in place
CARB	Carbon Filter Treatment System residential well sampling
CM	construction monitoring well
DOE	U.S. Department of Energy
EW	extraction well
FY	fiscal year
FYR	inspection coordinated with the submittal of the Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Review
GC	geochemical surveillance triennial sampling
GWESA	groundwater environmental surveillance annual sampling
GWESBA	groundwater environmental surveillance biennial sampling
GWESSA	groundwater environmental surveillance semiannual sampling
GWNEQ	groundwater Northeast Plume quarterly sampling
GWNESA	groundwater Northeast Plume semiannual sampling
GWNWQ	groundwater Northwest Plume operation and maintenance quarterly sampling
GWNWSA	groundwater Northwest Plume operation and maintenance semiannual sampling
GWSWMU1	groundwater Solid Waste Management Unit 1
KDFWR	Kentucky Department of Fish and Wildlife Resources
KG	C-746-K Landfill groundwater well sampling
LRGA	Lower Regional Gravel Aquifer
M	In the Water Level column, “M” indicates water levels are collected monthly
MRGA	Middle Regional Gravel Aquifer
MW	monitoring well
NA	not applicable
NS	not sampled
PT	pressure transducer
PZ	piezometer
Q	In the Water Level column, “Q” indicates water levels are collected quarterly
R	residential
RGA	Regional Gravel Aquifer
SA	In the Water Level column, “SA” indicates water levels are collected semiannually
SG	C-746-S&T Landfills groundwater well
SWMU	solid waste management unit
TVA	Tennessee Valley Authority
UCRS	Upper Continental Recharge System
UG	C-746-U Landfill groundwater well
Unknown	information is unknown, cannot be confirmed, or is unavailable
URGA	Upper Regional Gravel Aquifer
WPB-NE	Water Policy Boundary Monitoring Program—Northeast annual sampling
WPB-NW	Water Policy Boundary Monitoring Program—Northwest quarterly sampling

Table B.1 includes 434 current monitoring wells (MWs) and piezometers (PZs) and a listing of the sampled residential wells.

Table B.1. Well Program Inventory

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW1	RGA	AB 1994	NA	NA	NA	NA
MW2	Unknown	AB 1988	NA	NA	NA	NA
MW3	Unknown	AB 1988	NA	NA	NA	NA
MW4	Unknown	AB 1988	NA	NA	NA	NA
MW5	Unknown	AB 1988	NA	NA	NA	NA
PZ5G	Unknown	Current	DOE	NS	SA	A
PZ5S	Unknown	Current	DOE	NS	SA	A
MW6	Unknown	AB 1988	NA	NA	NA	NA
MW7	UCRS	AB 1994	NA	NA	NA	NA
MW8	RGA	AB 1994	NA	NA	NA	NA
MW9	RGA	AB 1994	NA	NA	NA	NA
MW10	RGA	AB	NA	NA	NA	NA
MW11	UCRS	AB 1994	NA	NA	NA	NA
MW12	RGA	AB 1994	NA	NA	NA	NA
MW13	UCRS	AB 1994	NA	NA	NA	NA
MW14	UCRS	AB 1994	NA	NA	NA	NA
MW15	RGA	AB 1994	NA	NA	NA	NA
MW16	UCRS	AB 1994	NA	NA	NA	NA
MW17	RGA	AB 1994	NA	NA	NA	NA
MW18	UCRS	AB 1994	NA	NA	NA	NA
MW19	RGA	AB 1994	NA	NA	NA	NA
MW20 (also R4)	URGA	Current	KDFWR	WPB-NW	SA	A
MW21	RGA	AB 1994	NA	NA	NA	NA
MW22	RGA	AB 1994	NA	NA	NA	NA
MW23	Porters Creek Clay Well	AB 1994	NA	NA	NA	NA
MW24	Porters Creek Clay Well	AB 1994	NA	NA	NA	NA
MW25	Porters Creek Clay Well	AB 1994	NA	NA	NA	NA
MW26	Porters Creek Clay Well	AB 1994	NA	NA	NA	NA
MW27	Porters Creek Clay Well	AB 1994	NA	NA	NA	NA
MW28	UCRS	AB 1994	NA	NA	NA	NA
MW29	UCRS	AB 1994	NA	NA	NA	NA
MW30	UCRS	AB 1994	NA	NA	NA	NA
MW31	UCRS	AB 1994	NA	NA	NA	NA
MW32	UCRS	AB 1994	NA	NA	NA	NA

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW33	UCRS	AB	NA	NA	NA	NA
MW34	UCRS	AB 1994	NA	NA	NA	NA
MW35	UCRS	AB 1994	NA	NA	NA	NA
MW36	UCRS	AB 1994	NA	NA	NA	NA
MW37	UCRS	AB 1994	NA	NA	NA	NA
MW38	RGA	AB 1994	NA	NA	NA	NA
MW39	RGA	AB 1994	NA	NA	NA	NA
MW40	RGA	AB 1994	NA	NA	NA	NA
MW41	RGA	AB 1994	NA	NA	NA	NA
MW42	RGA	AB 1994	NA	NA	NA	NA
MW43	RGA	AB 1994	NA	NA	NA	NA
MW44	RGA	AB 1994	NA	NA	NA	NA
MW45	RGA	AB 1987	NA	NA	NA	NA
MW46	RGA	AB 1994	NA	NA	NA	NA
MW47	UCRS	AB 1994	NA	NA	NA	NA
MW48	RGA	AB 1994	NA	NA	NA	NA
MW49	UCRS	AB 1994	NA	NA	NA	NA
MW50	RGA	AB 1994	NA	NA	NA	NA
MW51	RGA	AB 1994	NA	NA	NA	NA
MW52	RGA	AB 1994	NA	NA	NA	NA
MW53	RGA	AB 1994	NA	NA	NA	NA
MW54	RGA	AB 1994	NA	NA	NA	NA
MW55	RGA	AB 1987	NA	NA	NA	NA
MW56	UCRS	AB 1987	NA	NA	NA	NA
MW57	UCRS	AB 1994	NA	NA	NA	NA
MW58	UCRS	AB 1990	NA	NA	NA	NA
MW59	RGA	AB	NA	NA	NA	NA
MW60	UCRS	AB	NA	NA	NA	NA
MW61	RGA	AB	NA	NA	NA	NA
MW62	RGA	AB	NA	NA	NA	NA
MW63	URGA	Current	DOE	GWNWSA	SA	A
MW64	UCRS	Current	DOE	NS	SA	A
MW65	LRGA	Current	DOE	GWNWSA	SA	A
MW66	URGA	Current	DOE	GWNWSA	SA	A
MW67	MRGA	Current	DOE	404G	Q, SA	A
MW68	LRGA	Current	DOE	GWESA	SA	A
MW69	UCRS	Current	DOE	NS	SA	A
MW70	RGA	AB 1994	NA	NA	NA	NA
MW71	URGA	Current	DOE	GWESBA	SA	A
MW72	MRGA	Current	DOE	NS	SA	A
MW73	MRGA	Current	DOE	NS	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
PZ74	UCRS	Current	DOE	NS	SA	A
MW75	UCRS	Current	DOE	NS	SA	A
MW76	MRGA	Current	DOE	404G	Q, SA	A
MW77 (PZ)	MRGA	Current	DOE	NS	SA	A
MW78	MRGA	Current	DOE	NS	SA	A
MW79	MRGA	Current	DOE	NS	SA	A
MW80	MRGA	Current	DOE	NS	SA	A
MW81	MRGA	Current	DOE	NS	SA	A
MW82	UCRS	Current	DOE	NS	SA	A
MW83	UCRS	Current	DOE	NS	SA	A
MW84	RGA	AB 2019	NA	NA	NA	NA
MW84A	MRGA	Current	DOE	404G	Q, SA	A
MW85	UCRS	Current	DOE	404G	Q, SA	A
MW86	LRGA	Current	DOE	404G	Q, SA	A
MW87	RGA	AB 2019	NA	NA	NA	NA
MW87A	MRGA	Current	DOE	404G	Q, SA	A
MW88	UCRS	Current	DOE	404G	Q, SA	A
MW89	LRGA	Current	DOE	404G	Q, SA	A
MW90	RGA	AB 2001	NA	NA	NA	NA
MW90A	URGA	Current	DOE	404G	Q, SA	A
MW91	UCRS	AB 2017	NA	NA	NA	NA
MW91A	UCRS	Current	DOE	404G	Q, SA	A
MW92	LRGA	Current	DOE	404G	Q, SA	A
MW93	RGA	AB 2019	NA	NA	NA	NA
MW93A	MRGA	Current	DOE	404G	Q, SA	A
MW94	UCRS	Current	DOE	404G	Q, SA	A
MW95	RGA	AB 2001	NA	NA	NA	NA
MW95A	LRGA	Current	DOE	404G	Q, SA	A
MW96	UCRS	Current	DOE	NS	SA	A
MW97	RGA	AB 1996	NA	NA	NA	NA
MW98	MRGA	Current	DOE	GWESBA	Q, SA	A
MW99	MRGA	Current	TVA	GWESBA, GC	SA	A
MW100	LRGA	Current	TVA	GWESA, GC	Q, SA	A
PZ101	Terrace Gravel	Current	DOE	NS	SA	A
MW102	McNairy	Current	DOE	GWESBA	SA	A
MW103	MRGA	Current	DOE	GWESBA	SA	A
MW104	UCRS	AB 1996	NA	NA	NA	NA
MW105	RGA	AB	NA	NA	NA	NA
MW106	RGA	AB 2014	NA	NA	NA	NA
MW106A	MRGA	Current	DOE	WPB-NW	SA	A
PZ107	URGA	Current	DOE	NS	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW108	MRGA	Current	DOE	NS	SA	A
PZ109	MRGA	Current	DOE	NS	SA	A
PZ110	MRGA	Current	DOE	NS	SA	A
PZ111	UCRS	Current	DOE	NS	SA	A
PZ112	UCRS	AB 2017	NA	NA	NA	NA
PZ113	RGA	AB 2017	NA	NA	NA	NA
PZ114	McNairy	Current	DOE	NS	SA	A
PZ115	McNairy	Current	DOE	NS	SA	A
PZ116	RGA	AB 2017	NA	NA	NA	NA
PZ117	MRGA	Current	DOE	NS	SA	A
PZ118	MRGA	Current	DOE	NS	SA	A
MW119	RGA	AB	NA	NA	NA	NA
MW120	McNairy	Current	DOE	GWESSA	SA	A
MW121	McNairy	Current	KDFWR	GWESSA	SA	A
MW122	McNairy	Current	DOE	GWESSA	SA	A
MW123	MRGA	Current	KDFWR	NS	SA	A
MW124	LRGA	Current	DOE	GWNEQ	SA	A
MW125	LRGA	Current	KDFWR	GWESA, GC	Q, SA	A
MW126	MRGA	Current	DOE	GWNEQ	SA	A
MW127	UCRS	AB-IP 1996	NA	NA	NA	NA
MW128	UCRS	AB-IP 1996	NA	NA	NA	NA
MW129	Terrace Gravels	AB-IP 1996	NA	NA	NA	NA
MW130	Terrace Gravels	AB-IP 1996	NA	NA	NA	NA
MW131	Terrace Gravels	AB-IP 1996	NA	NA	NA	NA
MW132	LRGA	Current	DOE	GWESSA	M, SA	A
MW133	McNairy	Current	TVA	GWESBA	SA	A
MW134	LRGA	Current	KDFWR	GC, WPB-NW	SA	A
MW135	LRGA	Current	TVA	GWESBA	SA	A
MW136	UCRS	AB	NA	NA	NA	NA
MW137	MRGA	Current	TVA	NS	SA	A
MW138	UCRS	Current	TVA	NS	SA	A
MW139	MRGA	Current	DOE	GWESBA	Q, SA	A
MW140	McNairy	AB 1999	NA	NA	NA	NA
MW141	RGA	AB 1998	NA	NA	NA	NA
MW142	RGA	AB 1998	NA	NA	NA	NA
MW143	UCRS	AB 1998	NA	NA	NA	NA
MW144	LRGA	Current	DOE	GWNEQ	SA	A
MW145	LRGA	Current	DOE	GWNEQ, GC	SA	A
MW146	LRGA	Current	TVA	WPB-NW	SA	A
MW147	MRGA	Current	TVA	NS	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW148	MRGA	Current	Private—Residential	GWESBA	SA	A
MW149	UCRS	Current	Private—Residential	GWESBA	SA	A
MW150	LRGA	Current	Private—Residential	GWESBA	SA	B
MW151	Terrace Gravels	Current	Private—Residential	NS	SA	A
MW152[f]	RGA	AB 2018	NA	NA	NA	NA
MW153[g]	UCRS	AB 2018	NA	NA	NA	NA
MW154	UCRS	Current	DOE	NS	SA	A
MW155	LRGA	Current	DOE	GWNEQ	SA	A
MW156	URGA	Current	DOE	GWNEQ	SA	A
MW157	UCRS	Current	DOE	NS	SA	A
MW158	RGA	AB 1999	NA	NA	NA	NA
MW159	RGA	AB 1999	NA	NA	NA	NA
MW160	UCRS	AB 1999	NA	NA	NA	NA
MW161	LRGA	Current	DOE	GWSWMU1, GC	SA	A
MW162	UCRS	Current	DOE	NS	SA	A
MW163	LRGA	Current	DOE	GWNEQ, GC	SA	A
MW164	UCRS	Current	DOE	NS	SA	A
MW165	RGA	AB 2014	NA	NA	NA	NA
MW165A	URGA	Current	DOE	GWNWSA	Q, SA	A
MW166	UCRS	Current	DOE	NS	SA	A
MW167	UCRS	Current	DOE	NS	SA	A
MW168	URGA	Current	DOE	GWESBA	SA	A
MW169	MRGA	Current	DOE	GWESA	SA	A
MW170	UCRS	Current	DOE	NS	SA	A
MW171	UCRS	Current	DOE	NS	SA	A
MW172	UCRS	Current	DOE	NS	SA	A
MW173	URGA	Current	DOE	GWNWSA	Q, SA	A
MW174	UCRS	Current	DOE	GWESBA	SA	A
MW175	MRGA	Current	DOE	400GA	SA	A
MW176	UCRS	Current	DOE	NS	SA	A
MW177	UCRS	Current	DOE	NS	SA	A
MW178	URGA	Current	DOE	400GSA	SA	A
MW179	RGA	AB 2003	NA	NA	NA	NA
MW180	UCRS	Current	DOE	NS	SA	A
MW181	RGA	AB 2000	NA	NA	NA	NA
MW182	UCRS	Current	DOE	GWESA	SA	A
183, Not Installed	NA	NA	NA	NA	NA	NA
MW184	UCRS	AB 1998	NA	NA	NA	NA

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW185	MRGA	Current	DOE	NS	SA	A
MW186	UCRS	Current	DOE	GWESA	SA	A
MW187	UCRS	Current	DOE	GWESA	SA	A
MW188	MRGA	Current	DOE	GC	SA	A
MW189	UCRS	Current	DOE	NS	SA	A
MW190	UCRS	Current	DOE	NS	SA	A
MW191	MRGA	Current	DOE	GWESBA	SA	A
MW192	UCRS	Current	DOE	NS	SA	A
MW193	URGA	Current	DOE	GWESBA, GC	M, Q, SA	A
MW194	MRGA	Current	KDFWR	WPB-NW	SA	A
MW195	UCRS	AB 1994	NA	NA	NA	NA
MW196	Terrace Gravels	Current	DOE	NS	SA	A
MW197	URGA	Current	DOE	GWESA	Q, SA	A
MW198	UCRS	Current	DOE	NS	SA	A
MW199	LRGA	Current	Private—Residential	WPB-NW	SA	A
MW200	MRGA	Current	KDFWR	GWESBA	Q, SA	A
MW201	MRGA	Current	KDFWR	GC, WPB-NW	SA	A
MW202	LRGA	Current	KDFWR	WPB-NW	SA	A
MW203	MRGA	Current	DOE	GWESBA, 211SA	SA	A
MW204	UCRS	Current	DOE	NS	SA	A
MW205	URGA	Current	DOE	GWESBA	SA	A
MW206	RGA	AB 2014	NA	NA	NA	NA
MW207	UCRS	Current	DOE	NS	SA	A
MW208	UCRS	AB 2012	NA	NA	NA	NA
MW209	UCRS	AB 2016	DOE	NA	NA	NA
MW210	UCRS	Current	DOE	NS	SA	A
MW211	UCRS	Current	DOE	NS	SA	A
MW212	UCRS	Current	DOE	NS	SA	A
MW213	UCRS	Current	DOE	NS	SA	A
MW214	UCRS	Current	DOE	NS	SA	A
MW215	UCRS	Current	DOE	NS	SA	A
MW216	UCRS	Current	DOE	NS	SA	A
MW217	UCRS	Current	DOE	NS	SA	A
MW218	UCRS	Current	DOE	NS	SA	A
MW219	UCRS	Current	DOE	NS	SA	A
MW220	URGA	Current	DOE	SG	Q, SA	A
MW221	URGA	Current	DOE	SG	Q, SA	A
MW222	URGA	Current	DOE	SG	Q, SA	A
MW223	URGA	Current	DOE	SG	Q, SA	A
MW224	URGA	Current	DOE	SG	Q, SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW225	URGA	Current	DOE	NS	Q, SA	A
MW226	LRGA	Current	DOE	404G	Q, SA	A
MW227	URGA	Current	DOE	404G	Q, SA	A
228, Not Installed	NA	NA	NA	NA	NA	NA
229, Not Installed	NA	NA	NA	NA	NA	NA
230, Not Installed	NA	NA	NA	NA	NA	NA
231, Not Installed	NA	NA	NA	NA	NA	NA
232, Not Installed	NA	NA	NA	NA	NA	NA
MW233	MRGA	Current	KDFWR	NS	SA	A
MW234	RGA	AB 2002	NA	NA	NA	NA
MW235	RGA	AB 2002	NA	NA	NA	NA
MW236	LRGA	Current	KDFWR	GWESA	SA	A
MW237	UCRS	Current	KDFWR	NS	SA	A
MW238	MRGA	Current	KDFWR	NS	SA	A
MW239	McNairy	Current	KDFWR	GWESBA	SA	A
MW240	MRGA	Current	KDFWR	GWESA	SA	A
MW241	RGA	AB 2003	NA	NA	NA	NA
MW241A	MRGA	Current	KDFWR	NS	SA	A
MW242	MRGA	Current	DOE	GWNWSA, GC	SA	A
MW243	MRGA	Current	DOE	GWNWSA	SA	A
MW244	MRGA	Current	DOE	GWNWSA	SA	A
MW245	MRGA	Current	DOE	GWNWSA	SA	A
MW246	UCRS	Current	DOE	NS	SA	A
MW247	McNairy	Current	DOE	GWESSA	SA	A
MW248	MRGA	Current	DOE	GWNWSA	SA	A
MW249	MRGA	Current	DOE	NS	SA	A
MW250	MRGA	Current	DOE	GWNWSA	SA	A
PZ251	UCRS	Current	DOE	NS	SA	A
MW252	LRGA	Current	Private—Residential	GWESA	SA	A
MW253	RGA	AB 2019	NA	NA	NA	NA
MW253A	LRGA	Current	Private—Residential	GWESBA	SA	A
254, Not Installed	NA	NA	NA	NA	NA	NA
MW255	LRGA	Current	DOE	GWNESA	SA	A
MW256	LRGA	Current	DOE	GWNESA, GC	SA	A
MW257	MRGA	Current	DOE	GC	SA	A
MW258	LRGA	Current	DOE	GWNEQ, GC	SA	A
259, Not Installed	NA	NA	NA	NA	NA	NA
MW260	LRGA	Current	DOE	GWNEQ, GC	SA	A
MW261	LRGA	Current	DOE	GWESA, GC	SA	A
MW262	LRGA	Current	DOE	GWESBA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW263	RGA	AB 2003	NA	NA	NA	NA
MW264	RGA	AB 2003	NA	NA	NA	NA
MW265	RGA	AB 2000	NA	NA	NA	NA
MW266	RGA	AB 2003	NA	NA	NA	NA
MW267	RGA	AB 2003	NA	NA	NA	NA
MW268	RGA	AB 2002	NA	NA	NA	NA
MW269	RGA	AB 2002	NA	NA	NA	NA
MW270	RGA	AB 2000	NA	NA	NA	NA
MW271	RGA	AB 2002	NA	NA	NA	NA
MW272	RGA	AB 2002	NA	NA	NA	NA
MW273	RGA	AB 2002	NA	NA	NA	NA
MW274	RGA	AB 2002	NA	NA	NA	NA
MW275	RGA	AB 2002	NA	NA	NA	NA
MW276	RGA	AB 2002	NA	NA	NA	NA
MW277	RGA	AB 2000	NA	NA	NA	NA
PZ278	UCRS	AB 1997	NA	NA	NA	NA
PZ279	UCRS	AB 1997	NA	NA	NA	NA
PZ280	UCRS	AB 1997	NA	NA	NA	NA
PZ281	UCRS	AB 1997	NA	NA	NA	NA
PZ282	UCRS	AB 1997	NA	NA	NA	NA
MW283	LRGA	Current	DOE	GWNEQ	SA	A
MW284	LRGA	Current	DOE	NS	SA	A
285, Not Installed	NA	NA	NA	NA	NA	NA
286, Not Installed	NA	NA	NA	NA	NA	NA
PZ287	LRGA	Current	DOE	NS	SA	A
MW288	LRGA	Current	DOE	GWNEQ, GC	SA	A
PZ289	LRGA	Current	DOE	NS	SA	A
PZ290	LRGA	Current	DOE	NS	SA	A
MW291	LRGA	Current	DOE	GWNEQ	SA	A
MW292	LRGA	Current	DOE	GWNEQ, GC	SA	A
MW293	RGA	AB 2003	NA	NA	NA	NA
MW293A	MRGA	Current	DOE	GWNEQ	SA	A
MW294	RGA	AB 2003	NA	NA	NA	NA
MW294A	LRGA	Current	DOE	NS	SA	A
295, Not Installed	NA	NA	NA	NA	NA	NA
296, Not Installed	NA	NA	NA	NA	NA	NA
297, Not Installed	NA	NA	NA	NA	NA	NA
298, Not Installed	NA	NA	NA	NA	NA	NA
299, Not Installed	NA	NA	NA	NA	NA	NA
MW300	Terrace Gravels	Current	DOE	KG	SA	A
MW301	Terrace Gravels	AB 2014	NA	NA	NA	NA

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW302	Terrace Gravels	Current	DOE	KG	SA	A
MW303	Terrace Gravels	AB 1994	NA	NA	NA	NA
MW304	Terrace Gravels	Current	DOE	NS	SA	A
MW305	Eocene	AB 2020	NA	NA	NA	NA
MW306	Eocene	AB 2020	NA	NA	NA	NA
MW307	Eocene	AB 2020	NA	NA	NA	NA
MW308	Eocene	AB 2020	NA	NA	NA	NA
MW309	Terrace Gravels	AB 2020	NA	NA	NA	NA
MW310	Terrace Gravels	AB 2020	NA	NA	NA	NA
MW311	Terrace Gravels	AB 2020	NA	NA	NA	NA
MW312	UCRS	AB 2016	DOE	NA	NA	NA
MW313	UCRS	Current	DOE	NS	SA	A
MW314	UCRS	AB 2016	DOE	NA	NA	NA
MW315	UCRS	Current	DOE	NS	SA	A
MW316	UCRS	Current	DOE	NS	SA	A
MW317	Terrace Gravels	Current	DOE	NS	SA	A
MW318	Terrace Gravels	AB 2016	DOE	NA	NA	NA
319, Not Installed	NA	NA	NA	NA	NA	NA
320, Not Installed	NA	NA	NA	NA	NA	NA
321, Not Installed	NA	NA	NA	NA	NA	NA
322, Not Installed	NA	NA	NA	NA	NA	NA
323, Not Installed	NA	NA	NA	NA	NA	NA
324, Not Installed	NA	NA	NA	NA	NA	NA
MW325	LRGA	Current	DOE	NS	SA	A
MW326	LRGA	Current	DOE	GWESA	SA	A
MW327	LRGA	Current	DOE	GWESA	SA	A
MW328	MRGA	Current	DOE	GWESBA, GC	SA	A
MW329	URGA	Current	DOE	GWESBA, GC	SA	A
MW330	MRGA	Current	DOE	GWESA	SA	A
331, Not Installed	NA	NA	NA	NA	NA	NA
332, Not Installed	NA	NA	NA	NA	NA	NA
MW333	MRGA	Current	DOE	GWESBA, 404G	Q, SA	A
PZ334	UCRS	Current	DOE	NS	SA	A
PZ335	UCRS	Current	DOE	NS	SA	A
PZ336	UCRS	Current	DOE	NS	SA	A
MW337	MRGA	Current	DOE	GWESBA, 404G	Q, SA	A
MW338	MRGA	Current	DOE	GWESBA, 404G	Q, SA	A
MW339	LRGA	Current	DOE	GWNWQ, GC	SA	A
MW340	LRGA	Current	DOE	GWNWQ	SA	A
MW341	MRGA	Current	DOE	GWNEQ, GWESBA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW342	MRGA	Current	DOE	400GA	SA	A
MW343	LRGA	Current	DOE	400GSA, GC	SA	A
MW344	URGA	Current	DOE	KG	SA	A
MW345	Rubble Zone	Current	DOE	GWESBA	SA	A
MW346	Rubble Zone	Current	DOE	GWESBA	SA	A
MW347	Rubble Zone	Current	DOE	GWESBA	SA	A
PZ348	UCRS	Current	DOE	NS	SA	A
PZ349	URGA	Current	DOE	NS	SA	A
PZ350	UCRS	Current	DOE	NS	SA	A
PZ351	URGA	Current	DOE	NS	SA	A
MW352	RGA	AB 2002	NA	NA	NA	NA
MW353	MRGA	Current	DOE	NS	Q, SA	A
MW354	MRGA	Current	DOE	GWESSA	SA	A
MW355	LRGA	Current	DOE	GWNWSA	SA	A
MW356[a]	McNairy	Current	DOE	GWESSA	SA	A
MW357	URGA	Current	DOE	UG	Q, SA	A
MW358	LRGA	Current	DOE	UG	Q, SA	A
MW359	UCRS	Current	DOE	UG	Q, SA	A
MW360	URGA	Current	DOE	UG	Q, SA	A
MW361	MRGA	Current	DOE	UG	Q, SA	A
MW362	UCRS	Current	DOE	UG	Q, SA	A
MW363	URGA	Current	DOE	UG	Q, SA	A
MW364	LRGA	Current	DOE	UG	Q, SA	A
MW365	UCRS	Current	DOE	UG	Q, SA	A
MW366	URGA	Current	DOE	UG	Q, SA	A
MW367	LRGA	Current	DOE	UG	Q, SA	A
MW368	UCRS	Current	DOE	UG	Q, SA	A
MW369	URGA	Current	DOE	UG/SG	Q, SA	A
MW370	MRGA	Current	DOE	UG/SG	Q, SA	A
MW371	UCRS	Current	DOE	UG	Q, SA	A
MW372	URGA	Current	DOE	UG/SG	Q, SA	A
MW373	LRGA	Current	DOE	UG/SG	Q, SA	A
MW374	UCRS	Current	DOE	UG	Q, SA	A
MW375	UCRS	Current	DOE	UG	Q, SA	A
MW376	UCRS	Current	DOE	UG	Q, SA	A
MW377	UCRS	Current	DOE	UG	Q, SA	A
378, Not Installed	NA	NA	NA	NA	NA	NA
379, Not Installed	NA	NA	NA	NA	NA	NA
MW380	LRGA	Current	KDFWR	NS	SA	A
MW381	MRGA	Current	KDFWR	GC	SA	A
382, Not Installed	NA	NA	NA	NA	NA	NA

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
383, Not Installed	NA	NA	NA	NA	NA	NA
MW384	URGA	Current	DOE	SG	Q, SA	A
MW385	LRGA	Current	DOE	SG	Q, SA	A
MW386	UCRS	Current	DOE	SG	Q, SA	A
MW387	URGA	Current	DOE	SG	Q, SA	A
MW388	MRGA	Current	DOE	SG	Q, SA	A
MW389	UCRS	Current	DOE	SG	Q, SA	A
MW390	UCRS	Current	DOE	SG	Q, SA	A
MW391	MRGA	Current	DOE	SG	Q, SA	A
MW392	LRGA	Current	DOE	SG	Q, SA	A
MW393	UCRS	Current	DOE	SG	Q, SA	A
MW394	URGA	Current	DOE	SG	Q, SA	A
MW395	MRGA	Current	DOE	SG	Q, SA	A
MW396	UCRS	Current	DOE	SG	Q, SA	A
MW397	LRGA	Current	DOE	SG	Q, SA	A
398, Not Installed	NA	NA	NA	NA	NA	NA
399, Not Installed	NA	NA	NA	NA	NA	NA
400, Not Installed	NA	NA	NA	NA	NA	NA
MW401	LRGA	Current	DOE	NS	SA	A
MW402	MRGA	Current	DOE	NS	SA	A
MW403	RGA (Multi-zone)	Current	DOE	GWESA, GC	SA	A
MW404	RGA (Multi-zone)	Current	DOE	GWESA, GC	SA	A
MW405	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW406	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW407	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW408	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW409	LRGA	Current	Private—Residential	GWESSA, GC	SA	A
MW410	LRGA	Current	Private—Residential	GWESSA	SA	A
MW411	MRGA	Current	Private—Residential	GWESSA	SA	A
412, Not Installed	NA	NA	NA	NA	NA	NA
413, Not Installed	NA	NA	NA	NA	NA	NA
MW414	MRGA	Current	DOE	404G, GC	Q, SA	A
MW415	LRGA	Current	DOE	GWESBA	Q, SA	A
MW416	MRGA	Current	DOE	404G	Q, SA	A
MW417	LRGA	Current	DOE	GWESBA	Q, SA	A
MW418	MRGA	Current	DOE	GWESA	Q, SA	A
MW419	LRGA	Current	DOE	GWESA	Q, SA	A
MW420	MRGA	Current	DOE	404G	Q, SA	A
MW421	RGA (Multi-zone)	Current	DOE	400GSA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW422	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW423	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW424	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW425	RGA (Multi-zone)	Current	DOE	400GSA	SA	A
MW426	URGA	Current	DOE	GC, WPB-NW	SA	A
MW427	LRGA	Current	DOE	GC, WPB-NW	SA	A
MW428	LRGA	Current	DOE	GWNWSA	SA	A
MW429	RGA	AB 2009	NA	NA	NA	NA
MW429A	URGA	Current	DOE	GWNWSA	SA	A
MW430	LRGA	Current	DOE	GWNWSA	SA	A
MW431	LRGA	Current	DOE	GWESSA	SA	A
MW432	MRGA	Current	DOE	WPB-NW	SA	A
MW433	MRGA	Current	TVA	WPB-NW	SA	A
434, Not Installed	NA	NA	NA	NA	NA	NA
MW435	LRGA	Current	TVA	WPB-NW	SA	A
436, Not Installed	NA	NA	NA	NA	NA	NA
437, Not Installed	NA	NA	NA	NA	NA	NA
438, Not Installed	NA	NA	NA	NA	NA	NA
MW439	MRGA	Current	TVA	GWESBA, GC	SA	A
MW440	LRGA	Current	TVA	GWESBA	SA	A
MW441	LRGA	Current	TVA	GC, WPB-NW	SA	A
MW442	LRGA	Current	KDFWR	GWESBA	SA	A
MW443	LRGA	Current	KDFWR	GWESBA	SA	A
MW444	LRGA	Current	KDFWR	GWESBA	SA	A
MW445	MRGA	Current	TVA	GWESBA	SA	A
446, Not Installed	NA	NA	NA	NA	NA	NA
MW447	LRGA	Current	TVA	GWESBA, GC	SA	A
MW448	MRGA	Current	KDFWR	GWESBA	M, SA	A
449, Not Installed	NA	NA	NA	NA	NA	NA
MW450	LRGA	Current	KDFWR	GWESA	SA	A
MW451	URGA	Current	KDFWR	GWESBA	SA	A
MW452	LRGA	Current	KDFWR	WPB-NW	SA	A
MW453	URGA	Current	KDFWR	GWESA	SA	A
MW454	LRGA	Current	KDFWR	GWESA	SA	A
MW455	MRGA	Current	DOE	GWNWQ	SA	A
MW456	LRGA	Current	DOE	GWNWQ	SA	A
MW457	URGA	Current	DOE	GWNWSA	SA	A
MW458	LRGA	Current	DOE	GWNWSA	M, SA	A
MW459	URGA	Current	DOE	GWNWSA	SA	A
MW460	LRGA	Current	DOE	GWNWQ	SA	A
MW461	URGA	Current	DOE	GWNWSA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW462	LRGA	Current	DOE	GWNWSA	SA	A
MW463	MRGA	Current	TVA	GWESBA	SA	A
MW464	LRGA	Current	TVA	GWESBA	SA	A
MW465	MRGA	Current	TVA	GWESBA	SA	A
MW466	MRGA	Current	TVA	GWESBA	SA	A
MW467	URGA	Current	TVA	GWESBA	SA	A
MW468	MRGA	Current	TVA	GWESBA, GC	SA	A
MW469	MRGA	Current	TVA	GWESBA	SA	A
MW470	LRGA	Current	TVA	GWESBA	SA	A
MW471	MRGA	Current	TVA	GWESBA	SA	A
MW472	LRGA	Current	TVA	GWESBA	SA	A
MW473	LRGA	Current	Private—Residential	GWESBA, GC	SA	A
MW474	LRGA	Current	Private—Residential	GWESBA, GC	SA	A
MW475	MRGA	Current	Private—Residential	GWESBA	M, SA	A
MW476	LRGA	Current	Private—Residential	GWESBA	SA	A
MW477	LRGA	Current	TVA	GWESBA	M, SA	A
MW478	MRGA	Current	DOE	GWESBA, GWNEQ	SA	A
MW479	URGA	Current	DOE	GWNEQ	SA	A
MW480	LRGA	Current	DOE	GWNEQ	SA	A
MW481	MRGA	Current	DOE	GWESA	SA	A
MW482	LRGA	Current	DOE	GWESA	SA	A
MW483	MRGA	Current	Private—Residential	GWESA	SA	A
MW484	LRGA	Current	Private—Residential	GWESA	SA	A
MW485	MRGA	Current	Private—Residential	GWESBA	SA	A
MW486	RGA	AB 2019	NA	NA	NA	NA
MW486A	LRGA	Current	Private—Residential	GWESSA	SA	A
MW487	LRGA	Current	Private—Residential	GWESBA	SA	A
MW488	MRGA	Current	Private—Residential	GWESA	SA	A
MW489	MRGA	Current	KDFWR	GWESBA	SA	A
MW490	LRGA	Current	KDFWR	GWESBA	SA	A
MW491	URGA	Current	DOE	GWESA	M, SA	A
MW492	LRGA	Current	DOE	GWESA	SA	A
MW493	URGA	Current	DOE	GWESBA	SA	A
MW494	MRGA	Current	DOE	GWESBA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW495	LRGA	Current	DOE	GWNEQ	SA	A
MW496	LRGA	Current	DOE	GWNEQ	SA	A
MW497	MRGA	Current	DOE	GWNWSA	SA	A
MW498	LRGA	Current	DOE	GWNWSA	SA	A
MW499	MRGA	Current	DOE	GWNWSA	SA	A
MW500	LRGA	Current	DOE	GWNWSA	SA	A
MW501	MRGA	Current	DOE	GWNWSA	SA	A
MW502	LRGA	Current	DOE	GWNWSA	SA	A
MW503	LRGA	Current	DOE	GWNWSA	SA	A
MW504	URGA	Current	DOE	GWNWSA	SA	A
MW505	URGA	Current	DOE	400GA	SA	A
MW506	MRGA	Current	DOE	400GA	SA	A
MW507	LRGA	Current	DOE	400GA	SA	A
MW508	UCRS	AB 2014	DOE	NA	NA	NA
MW509	UCRS	AB 2014	DOE	NA	NA	NA
MW510	UCRS	AB 2014	DOE	NA	NA	NA
MW511	UCRS	AB 2020	DOE	NA	NA	NA
MW512	UCRS	AB 2020	DOE	NA	NA	NA
MW513	UCRS	AB 2020	DOE	NA	NA	NA
MW514[b]	UCRS	Current	DOE	NS	SA	A
MW515[b]	UCRS	Current	DOE	NS	SA	A
MW516[b]	UCRS	Current	DOE	NS	SA	A
MW517 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW518 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW519 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW520 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW521 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW522 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW523 (PZ)[c]	UCRS	Current	DOE	NS	SA	A
MW524[d]	MRGA	Current	DOE	GWNEQ	SA	A
MW525[d]	MRGA	Current	DOE	GWNEQ	SA	A
MW526[d]	MRGA	Current	DOE	GWNEQ	SA	A
MW527[d]	MRGA	Current	DOE	GWNEQ	SA	A
MW528[d]	LRGA	Current	DOE	GWNEQ	SA	A
MW529[d]	LRGA	Current	DOE	GWNEQ	SA	A
MW530[d]	LRGA	Current	DOE	GWNEQ	SA	A
MW531	LRGA	Current	DOE	GWNEQ	SA	A
MW532 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW533	LRGA	Current	DOE	GWNEQ	SA	A
MW534 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW535 (PZ)[e]	LRGA	Current	DOE	NS	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW536	LRGA	Current	DOE	GWNEQ	SA	A
MW537	LRGA	Current	DOE	GWNEQ	SA	A
MW538	MRGA	Current	DOE	GWNEQ	SA	A
MW539	LRGA	Current	DOE	GWNEQ	SA	A
MW540 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW541 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW542	URGA	Current	DOE	GWSWMU1	SA	A
MW543	URGA	Current	DOE	GWSWMU1	SA	A
MW544	URGA	Current	DOE	GWSWMU1	SA	A
MW545	URGA	Current	DOE	GWSWMU1	SA	A
MW546	URGA	Current	DOE	GWSWMU1	SA	A
MW547	URGA	Current	DOE	GWSWMU1	SA	A
MW548	LRGA	Current	DOE	GWESBA, 404G	Q, SA	A
MW549	URGA	Current	DOE	404G	Q, SA	A
MW550	URGA	Current	DOE	404G	Q, SA	A
MW551	URGA	Current	DOE	404G	Q, SA	A
552, Not Installed	NA	NA	NA	NA	NA	NA
MW553 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW554 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW555 (PZ)[e]	LRGA	Current	DOE	NS	SA	A
MW556	LRGA	Current	DOE	GWNEQ	SA	A
MW557[h]	URGA	Current	DOE	400GA	SA	A
MW558[h]	MRGA	Current	DOE	400GA	SA	A
MW559[h]	LRGA	Current	DOE	400GA	SA	A
MW560[h]	URGA	Current	DOE	400GA	SA	A
MW561[h]	MRGA	Current	DOE	400GA	SA	A
MW562[h]	LRGA	Current	DOE	400GA	SA	A
MW563[h]	URGA	Current	DOE	400GSA	SA	A
MW564[h]	MRGA	Current	DOE	400GA	SA	A
MW565[h]	LRGA	Current	DOE	400GA	SA	A
MW566[h]	URGA	Current	DOE	400GA	SA	A
MW567[h]	MRGA	Current	DOE	400GA	SA	A
MW568[h]	LRGA	Current	DOE	400GA	SA	A
MW569[h]	URGA	Current	DOE	400GA	SA	A
MW570[h]	MRGA	Current	DOE	400GSA	SA	A
MW571[h]	LRGA	Current	DOE	400GSA	SA	A
MW572[h]	LRGA	Current	DOE	400GA	SA	A
MW573[h]	LRGA	Current	DOE	400GA	SA	A
MW574[h]	URGA	Current	DOE	400GA	SA	A
MW575	URGA	Current	DOE	211SA	SA	A
MW576	MRGA	Current	DOE	211SA	SA	A

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
MW577	URGA	Current	DOE	211SA	SA	A
MW578	MRGA	Current	DOE	211SA	SA	A
MW579	URGA	Current	DOE	211SA	SA	A
MW580	MRGA	Current	DOE	211SA	SA	A
MW581	URGA	Current	DOE	211SA	SA	A
MW582	URGA	Current	DOE	211SA	SA	A
MW583[f]	RGA	Planned	TVA	NA	NA	NA
MW584 (PZ)[j]	UCRS	Current	DOE	NS	NA	NA
MW585 (PZ)[j]	UCRS	Current	DOE	NS	NA	NA
MW586	MRGA	Current	DOE	211SA	SA	A
PW001	URGA	Current	DOE	211SA	NA	A
PW002	UCRS	Current	DOE	211SA	NA	A
PW003	UCRS	Current	DOE	211SA	NA	A
PW004	URGA	Current	DOE	211SA	NA	A
PW005	UCRS	Current	DOE	211SA	NA	A
PW006	UCRS	Current	DOE	211SA	NA	A
PW007	URGA	Current	DOE	211SA	NA	A
PW008	UCRS	Current	DOE	211SA	NA	A
PW009	UCRS	Current	DOE	211SA	NA	A
PW010	URGA	Current	DOE	211SA	NA	A
PW011	UCRS	Current	DOE	211SA	NA	A
PW012	UCRS	Current	DOE	211SA	NA	A
PW013	URGA	Current	DOE	211SA	NA	A
PW014	UCRS	Current	DOE	211SA	NA	A
PW015	UCRS	Current	DOE	211SA	NA	A
PW016	URGA	Current	DOE	211SA	NA	A
PW017	UCRS	Current	DOE	211SA	NA	A
PW018	UCRS	Current	DOE	211SA	NA	A
R2	Unknown	Current	Private—Residential	WPB-NW	SA	FYR
R9	Unknown	Current	Private—Residential	WPB-NE	NA	FYR
R10[i]	Unknown	Current	Private—Residential	WPB-NW	NA	NA
R13	Unknown	Current	Private—Residential	WPB-NW	SA	FYR
R14	Unknown	Current	Private—Residential	WPB-NW	SA	FYR
R20	RGA	Current	Private—Residential	WPB-NE	SA	FYR
R21	Unknown	Current	Private—Residential	WPB-NE	SA	FYR
R26	Unknown	Current	Private—Residential	WPB-NW	SA	FYR

Table B.1. Well Program Inventory (Continued)

Well Number	Screened Zone	Status	Property Where Located	Sampled (Analytical)	Water Level	Inspection
R40[i]	Unknown	Current	Private—Residential	WPB-NW	NA	NA
R53	Unknown	Current	Private—Residential	WPB-NW	SA	FYR
R83	Unknown	Current	Private—Residential	WPB-NE	SA	FYR
R90	Unknown	Current	Private—Residential	WPB-NE	NA	Outside Water Policy
R114	Unknown	Current	Private—Residential	WPB-NE	NA	Outside Water Policy
R245	Unknown	Current	Private—Residential	WPB-NW	SA	FYR
R302	RGA	Current	Private—Residential	WPB-NE	SA	FYR
R424	RGA	Current	Private—Residential	CARB	NA	Outside Water Policy

[a] MW initial lithologic log indicated well was completed in the RGA; however, the lithology has been reinterpreted to show a higher top of McNairy.

[b] MWs associated with Southwest Plume project. These MWs are not required to be sampled in fiscal year (FY) 2026.

[c] PZs associated with the Solid Waste Management Unit (SWMU) 4 project. These PZs will be evaluated for their acceptance into the environmental monitoring program. Abandonment will be determined after the completion of the evaluation.

[d] Transect monitoring wells associated with the Northeast Plume Optimization project.

[e] PZs associated with the Northeast Plume Optimization project.

[f] MW152 was abandoned in October 2018 in order for the Tennessee Valley Authority to construct a new process water basin. MW583 is reserved for a potential replacement for MW152.

[g] MW153 was abandoned in October 2018 in order for the Tennessee Valley Authority to construct a new process water basin.

[h] MWs installed as part of the C-400 Remedial Investigation/Feasibility Study.

[i] Residential wells along Ogden Landing Road are being sampled in support of the Water Policy.

[j] PZs are associated with the C-400 Remedial Investigation/Feasibility Study. Water level measurements are not collected from these PZs.

Note: Piezometers now will be given an MW designation and noted as (PZ) to be consistent with the remedial action work plans.

Note: Residential wells inside of the Water Policy Box will be inspected during a Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Review period to verify that the well is not functioning as a water source. There are residential wells that are not sampled and are not listed in this table but will be included in this inspection. Those residential wells outside of the Water Policy Box may be accessed by the landowner.

Table B.2 includes an inventory of nonconventional borings. Nonconventional borings are defined as those borings that were installed as part of a short-term project where the borings never were part of the Environmental Monitoring well inventory or the borings were not part of the well inventory in recent years.

Table B.2. Nonconventional Borings Inventory

Project Installed	ID	Status
6-Phase	(22) Vacuum Piezometers	Abandoned in 2010
C-400, Phase I	(10) Vacuum Piezometers	Abandoned
Cylinder Drop Test Site Investigation	PE01	Abandoned
	PE02	
	PN01	
	PN02	
	PS01	
	PS02	
	PW01	
	PW02	
	PZ01	
	PZ02	
	PZ03	
	PZ04	
	PZ05	
	PZ06	
	PZ07	
	PZ08	
	PZ09	
	PZ10	
	PZ11	
	PZ12	
Groundwater Phase III	SWMU2-10 (20')	Abandoned in 1994
	Z-1	
	Z-2	
	Z-3	
	Z-5	
	Z-6	
	Z-7	
	Z-9	
	Z-10	
	Z-II	
	Z-13	
	Z-14	
	Z-15	

Table B.2. Nonconventional Borings Inventory (Continued)

Project Installed	ID	Status
LASAGNA	2A-PZ01	Abandoned
NE Plume Aquifer Test	PZ1G	Abandoned in 1994
	PZ2G	
	PZ4G	
	PZ4S	
Outfalls 10, 11, & 12 Investigation	LB-04 PZ	Abandoned
	011-02PZ	
	012-04 PZ	
	204-02	
	204-07	
	204-08	
	204-09	
	204-10	
	204-11	
	204-12	
	204-14	
	204-15	
	204-26	
	204-27	
Seismic	Z-12	Present
	Z-16	
SI Phase II Aquifer Test	PZ3G	Abandoned in 2020
	PZ3S	
SW Plume Permeable Treatment Zone	CM01	Abandoned in 2020
	CM02	
	CM03	
	CM04	
	CM05	
	CM06	
	CM07	
	CM08	
	CM09	
	CM10	
	CM11	
	CM12	
SWMU 13 Investigation	1-013-001	Abandoned
	4-013-004	No Evidence of PZ Found
	7-013-009	Abandoned

Table B.2. Nonconventional Borings Inventory (Continued)

Project Installed	ID	Status
UK Creek Studies	BB1A	Abandoned
	BB1B	Abandoned
	BB1Y	Abandoned
	BB1Z	Abandoned
	BB2A	Abandoned
	BB2B	Abandoned
	BB3A	Abandoned
	BB3B	Abandoned
	BB3Y	Abandoned
	BB4A	Abandoned
	BB4B	Destroyed by flood
	BB5A	Destroyed by flood
	BB5B	Abandoned
	BB5C	Abandoned
	BB5Y	Abandoned
	BB5Z	Abandoned
	LB1A	Destroyed by flood
	LB1B	Destroyed by flood
	LB1C	Destroyed by flood
	LB1D	Abandoned
	LB1E	Abandoned
	LB1F	Abandoned
	LB1G	Abandoned
	LB1Y	Abandoned
	LB1Z	Abandoned
	LB2A	Destroyed by flood
	LB2B	Destroyed by flood
	LB2C	Destroyed by flood
	LB2D	Abandoned
	LB2E	Abandoned
	LB6A	Abandoned
	LB6B	Abandoned
	LB6Y	Abandoned
	LB6Z	Abandoned
	LB3A	Abandoned
	LB3B	Abandoned
	LB4A	Abandoned
	LB4B	Abandoned
	LB7Y	Abandoned

Table B.2. Nonconventional Borings Inventory (Continued)

Project Installed	ID	Status
WAG 3	004-009PZ	No Evidence of PZ Found
	004-033PZ	
	004-035PZ	
	004-036PZ	
	004-037PZ	
	004-045 PZ	
	005-016PZ	
	006-017PZ	
	006-018PZ	
	006-028PZ	
	006-029PZ	
WAG 6	011-008	Abandoned
	026-002	
	040-001	
	047-001	
	203-001	
	400-003	
	400-016	
	400-017	
	400-021	
	400-022	
	400-025	
	400-026	
	400-027	
	400-030	
	400-031	
	400-033	
	400-063	
	400-083	
WAG 22, SWMUs 2 & 3	SWMU 2-3 (20’)	No Evidence of PZ Found
	SWMU 2-5 (20’)	
	SWMU 2-8 (10’)	
	SWMU 2-10 (10’)	
	SWMU 2-16 (20’)	
	SWMU 2-17 (10’)	
	SWMU 2-17 (20’)	
WAG 22, SWMUs 7 & 30	GWS-1	No Evidence of PZ Found
	GWS-2	
	WLM-1	
	WLM-2	
	WLM-5	

Table B.2. Nonconventional Borings Inventory (Continued)

Project Installed	ID	Status
WAG 27	PZ1/720-012	Abandoned in 2020
	PZ-2/720-013	
	PZ-3/720-015	
	PZ-4/720-017	
	PZ-5/720-019	
WDA Temp PZs	5A-1	Abandoned in 2020
	5A-2	
	5A-3	
	5A-4	
	5A-5	
	5A-6	
	5A-7	
	5A-8	
	5A-9	
	5A-10	
	11-1 (T1-1)	Abandoned in 2020
	11-2 (T1-2)	Abandoned in 2020*
	11-3 (T1-3)	Abandoned in 2020
	11-4 (T2-1)	
	11-5 (T2-2)	
	11-6 (T2-3)	
	11-7 (T3-1)	
	11-8 (T3-2)	
	11-9 (T3-3)	

*During walkdowns performed in preparation of the fieldwork for the MW abandonment project, it was discovered that this PZ had not been abandoned previously. This PZ was abandoned during the MW abandonment project in 2020.

WATER LEVELS

Water level measurements are divided into two programs: (1) measurement of water levels at wells that support potentiometric surface map development in relation to the permitted landfills; and (2) synoptic measurements of water levels at all current wells that support potentiometric surface map development for the greater Paducah Site. Wells associated with the potentiometric surface maps at the permitted landfills, as indicated in Table B.3, are measured quarterly within as short a time period as possible, not to exceed a 24-hour period. (Note: Wells denoted as "commitment wells" are those wells formally agreed upon to be measured, but are not listed specifically in the permit. Wells denoted as "noncommitment wells" are measured as a best management practice.) The synoptic measurements, as indicated in Table B.1 (wells with a semiannual "Water Level" frequency), are completed within a single week. In support of actions and decisions for a forthcoming Comprehensive Site Operable Unit Record of Decision at the site, the synoptic water level events will be performed semiannually for FY 2026. Water level measurements will be collected from Metropolis Lake at the same time as the synoptic water level events.

Manual water level measurements and pressure transducer (PT) measurements are being collected to measure seasonal changes in the potentiometric surface at representative sites across the RGA groundwater basin. MWs to be evaluated under this project are indicated in Table B.4.

Table B.3. Water Levels in Support of Permitted Landfills

C-404 Landfill Wells Quarterly Water Levels (9)
MW84A
MW85
MW87A
MW88
MW90A
MW91A
MW93A
MW94
MW420
Commitment Wells (7) [a]
MW67
MW76
MW227
MW333
MW337
MW414
MW416
Noncommitment Wells (12)
MW86
MW89
MW92
MW95A
MW226
MW338
MW415
MW417
MW548
MW549
MW550
MW551

C-746-U Landfill Wells Quarterly Water Levels (21)	
MW357	MW368
MW358	MW369 [b]
MW359	MW370 [b]
MW360	MW371
MW361	MW372 [b]
MW362	MW373 [b]
MW363	MW374
MW364	MW375
MW365	MW376
MW366	MW377
MW367	
Noncommitment Wells (9)	
MW98	MW173
MW100	MW193
MW125	MW197
MW139	MW200
MW165A	

C-746-S&T Landfills Wells Quarterly Water Levels (25)
MW220
MW221
MW222
MW223
MW224
MW225 [c]
MW353 [c]
MW369 [b]
MW370 [b]
MW372 [b]
MW373 [b]
MW384
MW385
MW386
MW387
MW388
MW389
MW390
MW391
MW392
MW393
MW394
MW395
MW396
MW397
Noncommitment Wells (2)
MW418
MW419

[a] Per a DOE commitment, PPPO-02-640-08, (pertaining to C-404 Landfill permitting process) water level measurements will be taken for seven additional wells that were not cited within the permit within a 24-hour window of when water level measurements are collected on the C-404 wells cited in the permit. Although these wells are not identified in the permit, the obtained water level measurement data will be reported to Kentucky Division of Waste Management as part of the semiannual report.

[b] Wells are cited in the Solid Waste Landfill Permit for C-746-S&T and C-746-U Landfills.

[c] Based on the approved permit on for the C-746-S&T Landfills, these two wells are cited in the permit; however, the permit only requires water level measurements for these wells.

Table B.4. Monitoring Wells Planned For Pressure Transducer Deployment and Monthly Water Level Measurements

WELL NUMBER	MONTH 1	MONTH 2	MONTH 3	MONTH 4	MONTH 5	MONTH 6	MONTH 7	MONTH 8	MONTH 9	MONTH 10	MONTH 11	MONTH 12
MW132	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT
MW193	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1	M1
MW448	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT
MW458	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT
MW475	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT
MW477	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT
MW491	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT	M1+PT

M1: manual water level collected once per month

PT: pressure transducer

APPENDIX C

ENVIRONMENTAL SAMPLING FREQUENCY AND PARAMETERS

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CONTENTS

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TABLES

FIGURES

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ACRONYMS

ASD	alternate source demonstration
ASER	Annual Site Environmental Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CY	calendar year
DOE	U.S. Department of Energy
EDL	environmental dosimeter location
EM	environmental monitoring
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
ERPP	Environmental Radiation Protection Program
EW	extraction well
FFA	Federal Facility Agreement
FPDP	Fluor Federal Services, Inc., Paducah Deactivation Project
FRNP	Four Rivers Nuclear Partnership, LLC
FY	fiscal year
KAR	*Kentucky Administrative Regulations*
KDOW	Kentucky Division of Water
KDWM	Kentucky Division of Waste Management
KPDES	Kentucky Pollutant Discharge Elimination System
MCL	maximum contaminant level
MW	monitoring well
NESHAP	National Emission Standard for Hazardous Air Pollutants
PEGASIS	PPPO Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
RFI	Resource Conservation and Recovery Act Facility Investigation
RGA	Regional Gravel Aquifer
ROD	Record of Decision
SWMU	solid waste management unit
VOC	volatile organic compound

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C.1. INTRODUCTION

There are 434 active monitoring wells (MWs) and piezometers that are monitored as part of the Environmental Monitoring (EM) Program. Active wells either are in an analytical sampling program or may be evaluated only for water level measurements. This appendix shows a summary of each analytical sampling program. (Note: Wells denoted as "noncommitment wells" are measured as a best management practice, but are not listed in the permit.)

In addition to MW locations, the sampling programs within this appendix include sampling parameters for other locations covered in the EM Program (i.e., surface water and sediment programs).

Each summary includes the environmental sampling frequencies, parameters, analytical methods, the sampling drivers, rationale for conducting the sampling, which document(s) the sampling results are reported in, and a list of locations that are sampled.

An effort has been made to reduce the amount of sampling performed to support fiscal responsibility of the EM program at the site. The criteria used to determine less frequent sampling include the following:

- New understanding of contaminant migration pathways and contaminants present,
- Review of historical results and long-term trends,
- Analyses to determine if the MW meets the current and future objectives of the Groundwater Operable Unit, and
- Addition of new MWs that may eliminate the need for sampling older MWs.

A brief summary of changes that have been made from the fiscal year (FY) 2025 to the FY 2026 Environmental Monitoring Plan (EMP) is included in each sampling program section. The changes described in this appendix were made using the criteria listed above. Data collected under the sampling programs defined in this appendix will be evaluated in FY 2026. Based on trending results, if changes are deemed appropriate, they will be proposed via a permit modification or via modification of the appropriate driver and reflected in the FY 2027 EMP. In those cases where sampling cannot be performed due to an uncontrollable condition, such as blocked access to an MW due to flooding conditions, the sampling staff will denote the reason as to why the sample could not be collected.

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C.2. GROUNDWATER MONITORING

The Paducah Site samples MWs and residential wells on a routine basis. Additionally, MWs are monitored for water levels on a routine basis. The EM Manager is responsible for accepting any new MWs installed and assuring that the wells meet the following standards:

(1) Construction requirements, as outlined in either the statement of work, field sampling plan, or work plan for the project;

(2) Acceptance criteria for well development, as outlined in the U.S. Department of Energy's (DOE) Four Rivers Nuclear Partnership, LLC, (FRNP) procedures;

(3) Requirements for pump and packer placement; and

(4) The well is functioning properly and has no deficiencies.

MWs that do not meet these requirements will not be accepted by the EM Manager until all deficiencies have been corrected. More specific requirements to the acceptance of MWs are detailed in procedure CP4-ES-0069*, Monitoring Well and Associated Infrastructure Installation*. MWs are inspected, at a minimum, on an annual basis per the procedure CP4-ES-0074, *Monitoring Well Inspection and Maintenance*. Outlines for well rehabilitation methods are found in CP2-ES-0024, *Monitoring Well Maintenance Implementation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

Specified methods found in Appendix C are U.S. Environmental Protection Agency (EPA)-approved methods, as applicable. In some instances, such as with radionuclides, EPA-approved methods are unavailable. For this EMP, the currently used laboratory's analytical procedure is noted as the method of choice. If an analysis is conducted at another laboratory during FY 2026, an equivalent procedure will be used upon approval by the EM Manager.

C.2.1 GROUNDWATER MONITORING PROGRAM FOR LANDFILL OPERATIONS

C-746-S, C-746-T, and C-746-U Landfills (Solid Waste Landfill Monitoring)

Frequency: Quarterly

Driver: Sampling requirements are outlined in the Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045 issued by the Kentucky Division of Waste Management (KDWM) and *Groundwater Monitoring Plan for the Solid Waste Permitted Landfills (C-746-S Residential Landfill, C-746-T Inert Landfill, and C-746-U Contained Landfill) at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-PROJ-0139, June 2014.

Reported: Quarterly Compliance Monitoring Reports, as required by the permit, and the Annual Site Environmental Report (ASER)

Rationale: To evaluate the potential impact of historical waste disposal activities at the C-746-S&T Landfills, as well as historical and current waste disposal activities at the C-746-U Landfill on groundwater quality and to comply with compliance monitoring requirements, as set forth in the solid waste landfill permit.

Comments: For Solid Waste Landfill Permit, SW07300014, SW07300015, SW07300045, the reporting requirement for maximum contaminant level (MCL) is as follows: "If the analysis of groundwater sample results indicates contamination (i.e., a statistical or MCL exceedance) as specified in 401 *KAR* 48:300 Section 8(1), the owner or operator shall notify the Cabinet within 48 hours of receiving the results and shall arrange to split sample no later than ten (10) days from the receipt of the results. [401 *KAR* 48:300 Section 7]"

MW sampling is performed and reported collectively for the C-746-S and C-746-T Landfills. Sample collection order is as follows: volatiles (including total organic halides), total organic carbon, polychlorinated biphenyls (PCBs), metals and cyanide, water quality cations and anions, and radionuclides. If samples are being collected at a location where it is anticipated that sample volume is not adequate, then the order of collection will be volatiles followed by radionuclides.

Data collected under this program will be evaluated. Based on trending results, if changes are deemed appropriate, they will be proposed via a permit modification and reflected in the FY 2027 EMP.

Table C.1 lists MWs for the C-746-S and C-746-T landfills, Table C.2 lists MWs for the C-746-U Contained Landfill, and Table C.3 lists the quarterly analytical parameters for these landfills. Methods included in Table C.3 are equivalent methods to those listed in the current *Groundwater Monitoring Plan for the Solid Waste Permitted Landfills (C-746-S Residential Landfill, C-746-T Inert Landfill, And C-746-U Contained Landfill) at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-PROJ-0139. Locations are shown on Figure C.1.

Table C.1. C-746-S and C-746-T Landfills Wells (23[a])

MW220	MW370[b]	MW387	MW393
MW221	MW372[b]	MW388	MW394
MW222	MW373[b]	MW389	MW395
MW223	MW384	MW390	MW396
MW224	MW385	MW391	MW397
MW369[b]	MW386	MW392	
MW225[a]	MW353[a]		

[a] The total number of wells cited in the permit associated with the C-746-S&T Landfills is 25; however, two of these wells (MW225, MW353) only require water level measurement. The total number of analytically sampled wells is 23.

[b] Wells are sampled with the C-746-U Landfill sampling event; these four wells are not counted in the sampling event for the C-746-S&T Landfills, but are reported in the Compliance Monitoring Reports for both the C-746-U and C-746-S&T Landfills. These wells are upgradient wells for the C-746-U Landfill and are downgradient wells for the C-746-S&T Landfills.

Table C.2. C-746-U Landfill Wells (21)

MW357	MW363	MW368	MW373*
MW358	MW364	MW369*	MW374
MW359	MW365	MW370*	MW375
MW360	MW366	MW371	MW376
MW361	MW367	MW372*	MW377
MW362			

*These four wells are not counted in the totals for the C-746-S&T Landfills, but are reported in the Compliance Monitoring Reports for both the C-746-U and C-746-S&T Landfills. These wells are upgradient wells for the C-746-U Landfill and are downgradient wells for the C-746-S&T Landfills.

Table C.3. C-746-S, C-746-T, C-746-U Quarterly Analytical Parameters

Field Parameters				
	Conductivity	Dissolved Oxygen	pH	Turbidity
	Depth to Water	Eh[a] (approx)	Temperature	
Volatiles				
8260D	1,1,1,2-Tetrachloroethane	2-Butanone	Carbon Tetrachloride	Methylene Chloride
	1,1,1-Trichloroethane	2-Hexanone	Chlorobenzene	Styrene
	1,1,2,2-Tetrachloroethane	4-Methyl-2-pentanone	Chloroethane	Tetrachloroethene
	1,1,2-Trichloroethane	Acetone	Chloroform	Toluene
	1,1-Dichloroethane	Acrolein	Chloromethane	*trans*-1,2-Dichloroethene
	1,1-Dichloroethene	Acrylonitrile	*cis*-1,2-Dichloroethene	*trans*-1,3-Dichloropropene
	1,2,3-Trichloropropane	Benzene	*cis*-1,3-Dichloropropene	*trans*-1,4-Dichloro-2-Butene
	1,2-Dibromoethane	Bromochloromethane	Dibromochloromethane	Trichloroethene
	1,2-Dichlorobenzene	Bromodichloromethane	Dibromomethane	Trichlorofluoromethane
	1,2-Dichloroethane	Bromoform	Dimethylbenzene, Total[b]	Vinyl Acetate
	1,2-Dichloropropane	Bromomethane	Ethylbenzene	Vinyl Chloride
	1,4-Dichlorobenzene	Carbon Disulfide	Iodomethane	
8011	1,2-Dibromo-3-chloropropane			
Anions				
9056A	Bromide	Fluoride	Nitrate as Nitrogen	Sulfate
	Chloride			
300.0	Iodide			
Metals				
6020B	Aluminum	Chromium	Nickel	Uranium
	Antimony	Cobalt	Potassium	Vanadium
	Arsenic	Copper	Rhodium	Zinc
	Barium	Iron	Selenium	Barium, Dissolved[c]
	Beryllium	Lead	Silver	Chromium, Dissolved[c]
	Boron	Magnesium	Sodium	Uranium, Dissolved[c]
	Cadmium	Manganese	Tantalum	
	Calcium	Molybdenum	Thallium	
7470A	Mercury			
PCBs[d]				
8082A	PCB, Total	PCB-1232	PCB-1248	PCB-1260
	PCB-1016	PCB-1242	PCB-1254	PCB-1268
	PCB-1221			
Radionuclides				
9310	Alpha Activity	Beta Activity		
AN-1418	Radium-226			
904.0M	Radium-228[e]			
905.0M	Strontium-90			
Tc-02-RC M	Technetium-99			
Th-01-RC M	Thorium-230	Thorium-232[e]		
906.0M	Tritium			
Wet Chemistry				
410.4	Chemical Oxygen Demand			
9012B	Cyanide			
160.1	Total Dissolved Solids			
9060A	Total Organic Carbon			
9020B	Total Organic Halides			

[a] Oxidation-reduction potential calibrated as Eh.
[b] Xylenes
[c] Permit does not require analysis of dissolved metals. These parameters are analyzed in support of understanding the source of contaminants potentially observed in wells in comparison to total metals.
[d] PCBs are required under the solid waste permits to be monitored quarterly for the C-746-U Landfill and annually for the C-746-S&T Landfills.
[e] Permit does not require analysis of radium-228 and thorium-232. These parameters are analyzed in support of demonstrating compliance with DOE Order 458.1 for the C-746-U Landfill.

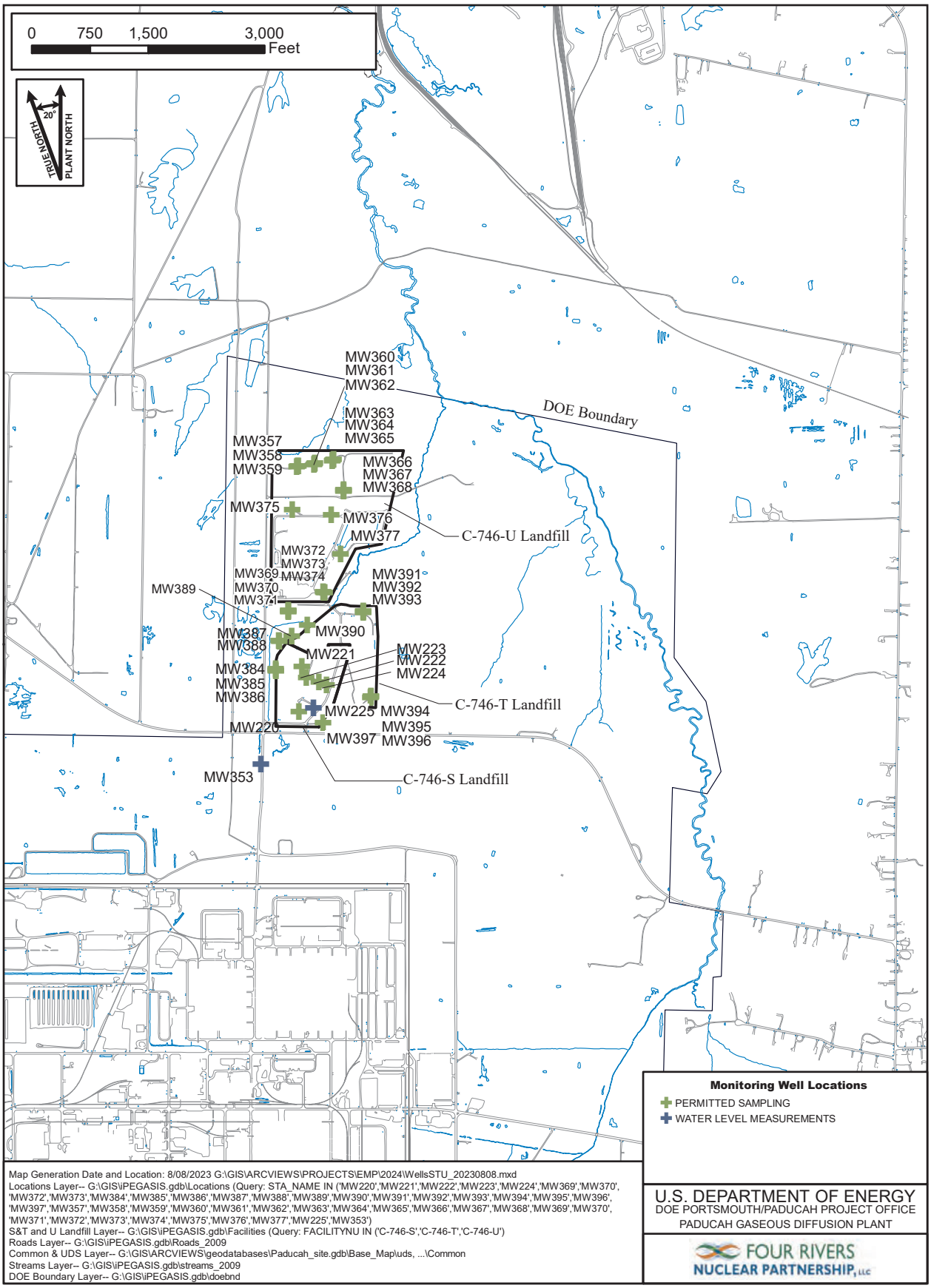

Figure C.1. Groundwater Monitoring Wells near the C-746-S, T, and U Landfills

C-404 Low-Level Radioactive Waste Burial Ground (Resource Conservation and Recovery Act Detection Status Monitoring)

Frequency: Semiannually/Quarterly (radionuclides only)

Driver: The semiannual parameters are required to be sampled per Hazardous Waste Management Facility Permit, KY8-890-008-982.

Reported: Semiannual C-404 Groundwater Monitoring Report required by the permit, and the ASER

Rationale: To monitor the C-404 Low-Level Radioactive Waste Burial Ground under detection monitoring program regulations.

Rule: Perform statistical evaluation for each constituent to determine if there is a statistically significant exceedance over background levels. If a statistically significant exceedance is indicated, notification to KDWM must be made within 7 days of confirmation of the exceedance. The statistical exceedance is evaluated with respect to the 2007 alternate source demonstration (ASD) to determine if the results are consistent with findings of the ASD. This evaluation will assess whether the contamination is from the C-404 Landfill or another source.

Comments: In the event that only a partial sample can be obtained, the following priority will be followed: field parameters, trichloroethene (TCE), metals, and radionuclides. The dissolved metal samples (arsenic, cadmium, chromium, lead, mercury, selenium, and uranium) are filtered at the off-site laboratory.

On May 28, 2025, KDWM was notified of a confirmed statistical exceedance for Tc-99 in MW84A as part of the C-404 semiannual reporting. This exceedance was evaluated and determined to not conform to the 2007 alternate source demonstration; therefore, beginning with the calendar quarter following the month for which the statistical exceedance was reported for a radionuclide, quarterly compliance monitoring is required for radionuclides only, per Permit Part E, Section 7.1. At the end of one year of quarterly monitoring, a report will be submitted to KDWM that identifies the fate and transport of the radionuclides. Wells to be sampled are listed in Table C.4 and radionuclides to be sampled are listed in Table C.5. The first quarterly sample was collected in July 2025. Quarterly sampling will continue until approval is received from KDWM to return to semiannual sampling.

In support of a potential future ASD at the C-404 Landfill, upper Regional Gravel Aquifer (RGA) MWs at the landfill and upgradient areas are being sampled and analyzed for metals and sulfate. The additional metals and sulfate analysis includes middle RGA wells MW337 and MW338. Metals and sulfate analyses are extended to upgradient wells MW227, MW333, MW414, MW416, MW549, MW550, and MW551. Beginning in FY 2026, analysis of TCE will be added to the required analytical parameters for MW414, MW416, MW549, MW550, and MW551.

Field parameters (pH, temperature, conductivity, dissolved oxygen, Eh,[1] and turbidity) are measured using a water quality meter. Other field parameters, such as depth to water and barometric pressure, are measured prior to sampling.

[1] Oxidation-reduction potential calibrated as Eh.

Prior to sample collection, KDWM shall be notified one week in advance. Notification may be made in writing or electronic format. Electronic mail shall be submitted to pertinent KDWM field personnel.

A listing of MWs for the C-404 Landfill is presented in Table C.4 and the analytical parameters are presented in Table C.5. Alternate SW-846 methods may be substituted with prior written approval from KDWM. A listing of MWs for the C-404 Landfill Noncommitment is present in Table C.6 and analytical parameters are presented in Table C.7. Locations are shown on Figure C.2.

Table C.4. C-404 Landfill Wells (9)

C-404 Landfill Wells (9)			
MW84A	MW88	MW91A	MW94
MW85	MW90A	MW93A	MW420
MW87A			

Table C.5. C-404 Landfill Semiannual Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Anions				
9056A	Sulfate[b]			
Volatiles				
8260D	Trichloroethene			
Metals				
6020B	Arsenic	Lead	Arsenic, Dissolved[b]	Selenium, Dissolved[b]
	Cadmium	Manganese[b]	Cadmium, Dissolved[b]	Uranium, Dissolved[b]
	Chromium	Selenium	Chromium, Dissolved[b]	
	Iron[b]	Uranium	Lead, Dissolved[b]	
7470A	Mercury	Mercury, Dissolved[b]		
Radionuclides[c]				
Tc-02-RC M	Technetium-99			
U-02-RC M	Uranium-234	Uranium-235	Uranium-238	
Wet Chemistry				
9060A	Total Organic Carbon[b]			

[a] Oxidation-reduction potential calibrated as Eh.
[b] Not required by the permit.
[c] Radionuclides will be sampled quarterly during FY 2026.

Table C.6. C-404 Landfill Noncommitment Wells[a] (17)

Noncommitment Wells (17)			
MW67[b]	MW95A[b]	MW337	MW548[b,d]
MW76[b]	MW226[b]	MW338	MW549[c]
MW86[b]	MW227	MW414[c]	MW550[c]
MW89[b]	MW333	MW416[c]	MW551[c]
MW92[b]			

[a] Routine sampling of these wells is not required by the permit.
[b] MWs will be analyzed for Field Parameters, Volatiles, and Radionuclides only in Table C.7.
[c] MWs will be analyzed for Field Parameters, Volatiles, Metals, and Anions only in Table C.7.
[d] MW548 was installed during Phase V of Solid Waste Management Unit (SWMU) 4 and is intended to serve as a complementary well to MW333 in order to detect trends for TCE in the RGA near the C-404 Landfill.

Table C.7. C-404 Landfill Noncommitment Semiannual Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Anions				
9056A	Sulfate			
Volatiles				
8260D	Trichloroethene			
Metals				
6020B	Arsenic	Lead	Arsenic, Dissolved	Selenium, Dissolved
	Cadmium	Manganese	Cadmium, Dissolved	Uranium, Dissolved
	Chromium	Selenium	Chromium, Dissolved	
	Iron	Uranium	Lead, Dissolved	
7470A	Mercury	Mercury, Dissolved		
Radionuclides				
Tc-02-RC M	Technetium-99			

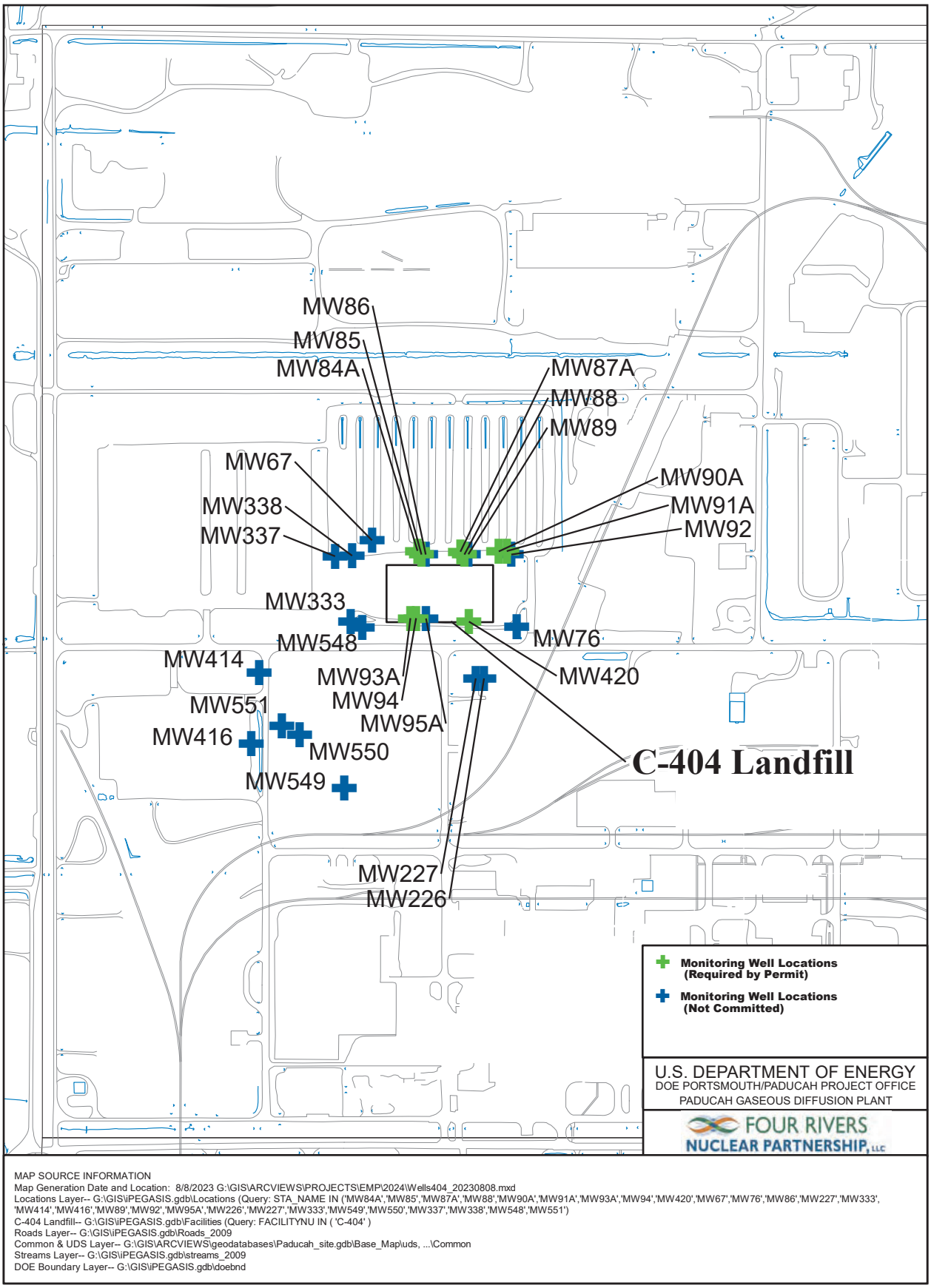

Figure C.2. Groundwater Monitoring Wells near C-404 Landfill

C-746-K Landfill Monitoring

Frequency: Semiannually

Driver: *Record of Decision for Waste Area Groups 1 and 7 for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1470&D2, September 1997: Even though the Record of Decision (ROD) for Waste Area Groups 1 and 7 was a Surface Water Operable Unit decision document, sampling of MWs is noted in the ROD. The ROD also allows for annual evaluation of the program with documentation in the *Sampling and Analysis Plan Addendum*, KY/ER-2, which previously was superseded by the EMP.

Reported: CERCLA Five-Year Review, Semiannual FFA Progress Report, and the ASER

Rationale: To evaluate the potential impact of historical waste disposal activities at the C-746-K Landfill on groundwater quality.

Comments: In the event a well becomes dry while purging, no sample will be taken; however, it should be recorded that no sample was collected because the well was dry. Starting in 2005, the frequency was reduced from quarterly to semiannually.

Sampling frequencies and sampling parameters were not modified for this sampling program for FY 2026.

Tables C.8 and C.9 provide a listing of landfill wells and analytical parameters, respectively. Locations are shown on Figure C.3.

Table C.8. C-746-K Landfill Wells (3)

MW300	MW302	MW344

Table C.9. C-746-K Landfill Semiannual Analytical Parameters

Field Parameters				
	Barometric Pressure	Dissolved Oxygen	Eh[a] (approx)	Temperature
	Conductivity	Ferrous Iron (Fe^{+2})	pH	Turbidity
	Depth to Water			
Volatiles				
8260D	1,1,1-Trichloroethane	Benzene	*cis*-1,2-Dichloroethene	Toluene
	1,1,2-Trichloroethane	Bromodichloromethane	Dimethylbenzene, Total[b]	*trans*-1,2-Dichloroethene
	1,1-Dichloroethane	Carbon Tetrachloride	Ethylbenzene	Trichloroethene
	1,1-Dichloroethene	Chloroform	Tetrachloroethene	Vinyl Chloride
	1,2-Dichloroethane			
Anions				
9056A	Chloride	Nitrate as Nitrogen	Sulfate	
Metals				
6020B	Aluminum	Calcium	Nickel	Barium, Dissolved
	Arsenic	Iron	Potassium	Beryllium, Dissolved
	Barium	Lead	Sodium	Cadmium, Dissolved
	Beryllium	Magnesium	Uranium	Lead, Dissolved
	Cadmium	Manganese	Arsenic, Dissolved	Uranium, Dissolved
Radionuclides				
9310	Alpha Activity	Beta Activity		
Tc-02-RC M	Technetium-99			
Wet Chemistry				
310.1	Alkalinity			

[a] Oxidation-reduction potential calibrated as Eh.
[b] Xylenes

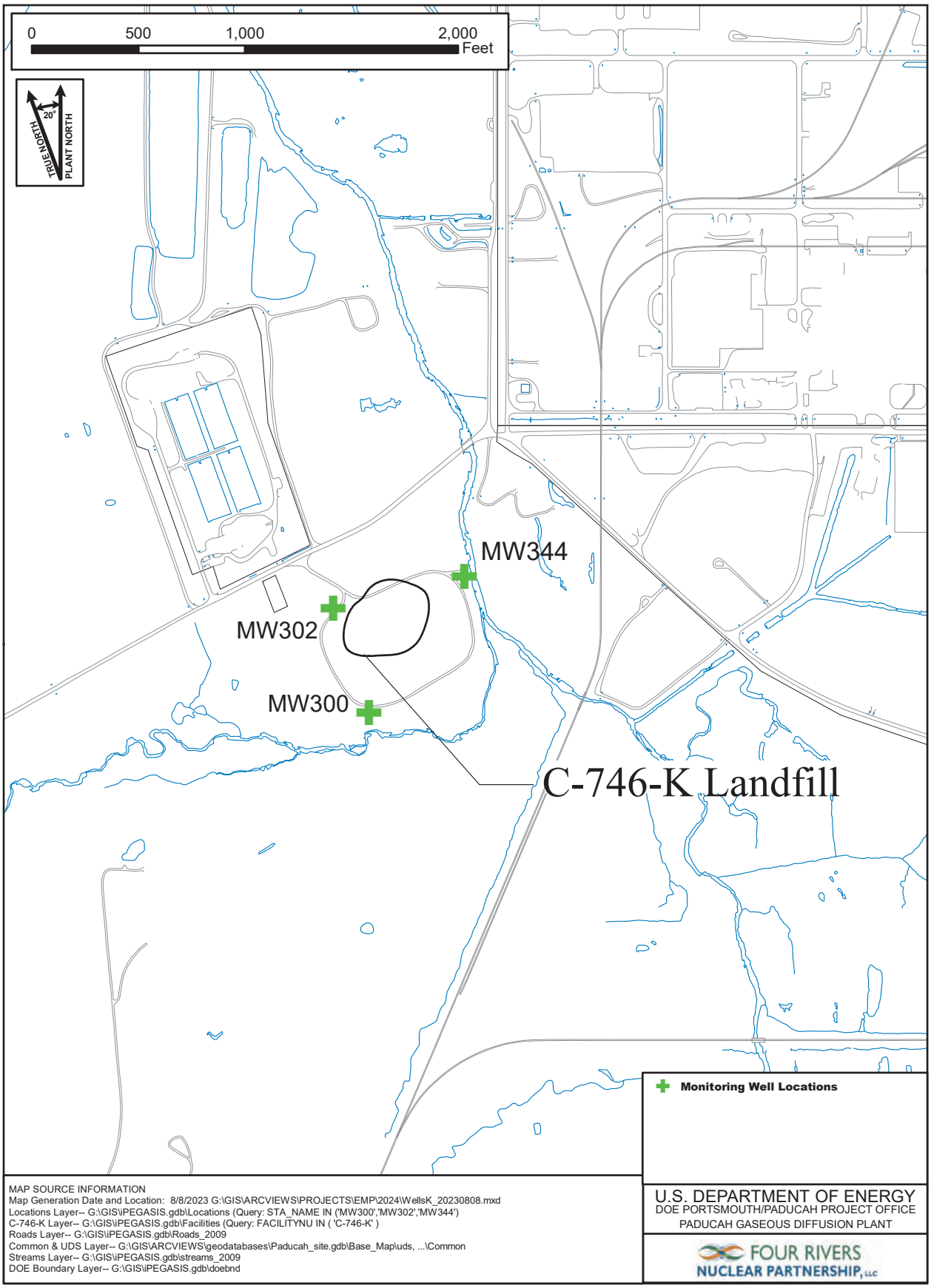

Figure C.3. Groundwater Monitoring Wells near C-746-K Landfill

C.2.2 NORTHEAST PLUME OPERATION AND MAINTENANCE PROGRAM

Northeast Plume Monitoring

Frequency: Quarterly and Semiannually

Driver: The MWs are required to be sampled by the *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021 (DOE 2021), and by the *Remedial Action Work Plan for the Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1, July 2018.

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, *DOE/LX/07-2426&D2*, July 2020, the Operation and Maintenance Plan for the Northeast Plume was revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP. The following is the revised plan.

- *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021

Reported: CERCLA Five-Year Review, Semiannual FFA Progress Report and ASER

Rationale: To monitor the nature and extent of groundwater contamination and to evaluate any trends in water quality that may affect contaminant migration.

Comments: The extraction wells (EWs) (or other operational samples) are not sampled under the groundwater program as part of the EM Program. They are sampled as specified under the Operation and Maintenance Plan for the Northeast Plume.

The Northeast Plume EW system has undergone an optimization. New EWs have been installed in new locations closer to the site due to the decreasing concentration of contaminants at their locations. This optimization program included two new EWs, EW234 and EW235 (began operations in October 2017), and 22 piezometers and MWs. Sampling frequencies and sampling parameters required by the *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021, and the *Remedial Action Work Plan for the Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1, July 2018, are included in Table C.10 and Table C.11. The EWs (and other operational samples) are not sampled under the groundwater program as part of the EM Program. They are sampled as specified under the Operation and Maintenance Plan listed above for the Northeast Plume. Locations are shown on Figure C.4.

Sampling frequencies were modified in FY 2026 to sample MW255 and MW256 on a semiannual frequency. Sampling parameters were not modified for the sampling program for FY 2026.

Table C.10 provides a list of MWs, and Table C.11 provides the analytical parameters for these MWs. Locations are shown on Figure C.4.

Table C.10. Northeast Plume Optimization Wells (36)

Quarterly Wells (34)			
MW124	MW283	MW495	MW530
MW126	MW288	MW496	MW531
MW144	MW291	MW524	MW533
MW145	MW292	MW525	MW536
MW155	MW293A	MW526	MW537
MW156	MW341	MW527	MW538
MW163	MW478	MW528	MW539
MW258	MW479	MW529	MW556
MW260	MW480		
Semiannual Wells (2)			
MW255	MW256		

Table C.11. Northeast Plume Optimization Quarterly and Semiannual Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Volatiles				
8260D	1,1-Dichloroethene	Trichloroethene		
Radionuclides				
Tc-02-RC M	Technetium-99			

[a] **Oxidation-reduction potential calibrated as Eh.**

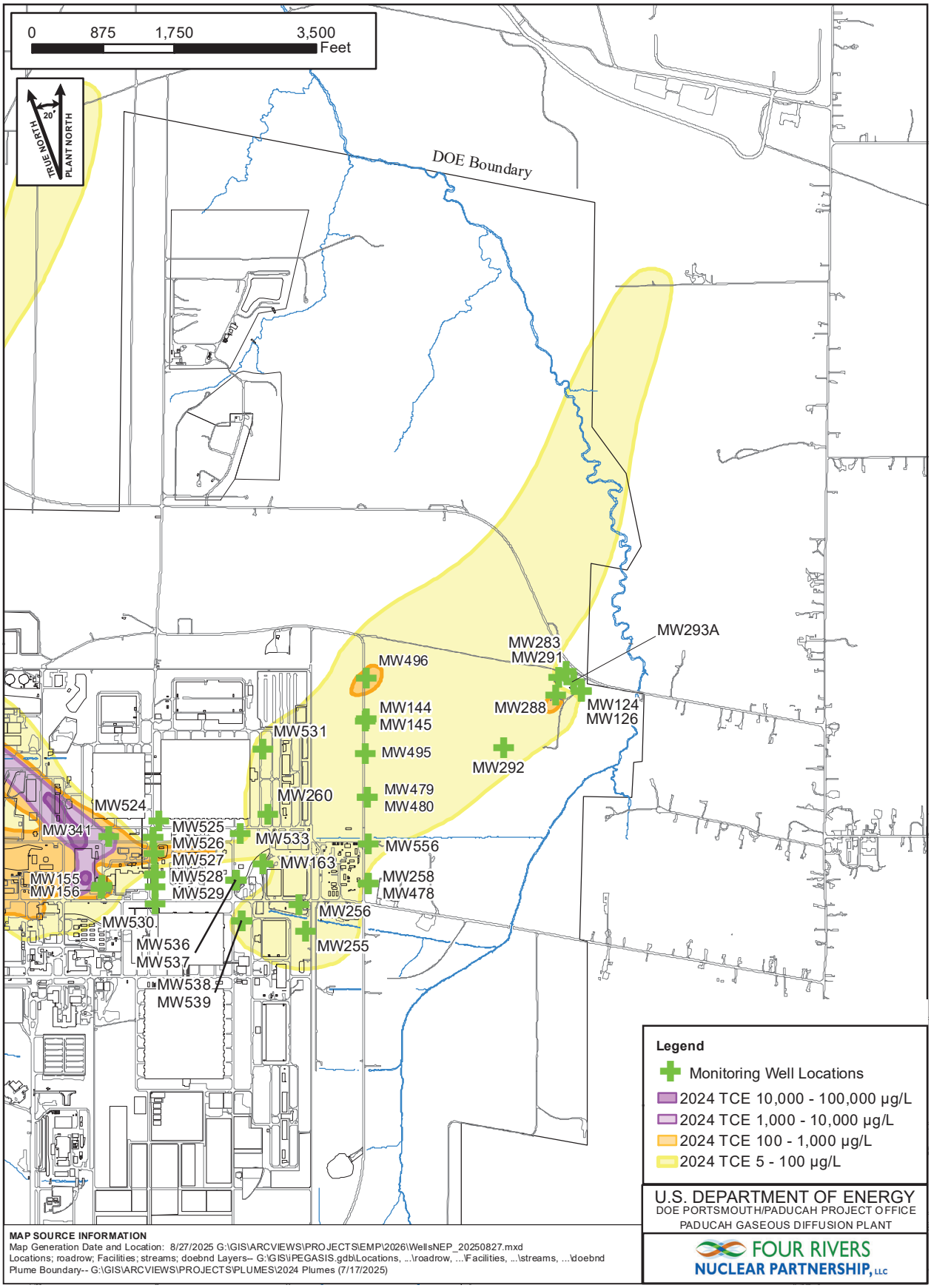

Figure C.4. Northeast Plume Monitoring Wells

C.2.3 NORTHWEST PLUME OPERATION AND MAINTENANCE PROGRAM

Northwest Plume Monitoring

Frequency: Quarterly and Semiannually

Driver: The MWs are required to be sampled by the *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2469&D2, October 2021 (DOE 2021b).

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, *DOE/LX/07-2426&D2*, July 2020, the Operation and Maintenance Plan for the Northwest Plume was revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP. The following is the revised plan.

- *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2469&D2, October 2021

Reported: CERCLA Five-Year Review, Semiannual FFA Progress Report, and the ASER

Rationale: To determine the effectiveness of the optimization of Northwest Plume operations, monitor the nature and extent of groundwater contamination, and evaluate any trends in water quality that may affect contaminant migration.

Comments: The EWs (or other operational samples) are not sampled under the groundwater program as part of the EM Program. They are sampled as specified under the Operation and Maintenance Plan for the Northwest Plume.

The sampling frequency for MW460 within the Operation and Maintenance Plan is semiannual; however, the frequency of sampling was increased to quarterly in FY 2018 in order to evaluate trends in TCE concentrations along the Northwest Plume.

The sampling frequency for MW339, MW340, MW455, and MW456 within the Operation and Maintenance Plan is semiannual; however, the frequency of sampling was increased to quarterly in FY 2023 in order to evaluate trends in TCE and Tc-99 concentrations along the Northwest Plume.

Table C.12 provides a listing of MWs, and Table C.13 provides the analytical parameters for these MWs. Locations are shown on Figure C.5.

Table C.12. Northwest Plume Optimization Wells (33)

Semiannual Wells (28)				
MW63	MW243	MW428	MW461	MW501
MW65	MW244	MW429A	MW462	MW502
MW66	MW245	MW430	MW497	MW503
MW165A	MW248	MW457	MW498	MW504
MW173	MW250	MW458	MW499	
MW242	MW355	MW459	MW500	
Quarterly Wells (5)				
MW339	MW340	MW455	MW456	MW460

Table C.13. Northwest Plume Optimization Quarterly and Semiannual Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Volatiles				
8260D	1,1,1-Trichloroethane	Benzene	*cis*-1,2-Dichloroethene	Toluene
	1,1,2-Trichloroethane	Bromodichloromethane	Dimethylbenzene, Total[b]	*trans*-1,2-Dichloroethene
	1,1-Dichloroethane	Carbon Tetrachloride	Ethylbenzene	Trichloroethene
	1,1-Dichloroethene	Chloroform	Tetrachloroethene	Vinyl Chloride
	1,2-Dichloroethane			
Radionuclides				
9310	Alpha Activity	Beta Activity		
Tc-02-RC M	Technetium-99			

[a] Oxidation-reduction potential calibrated as Eh.
[b] Xylenes

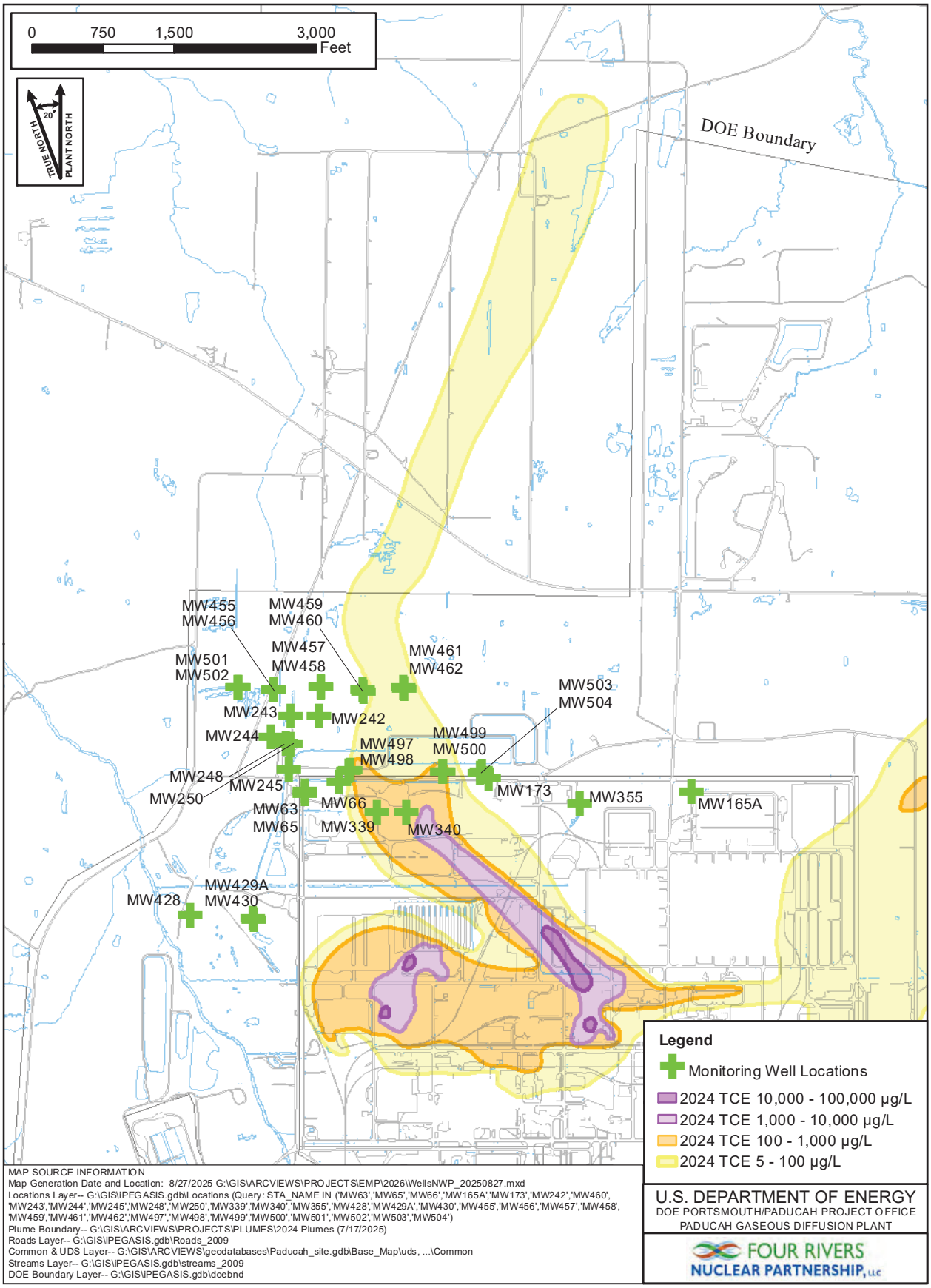

Figure C.5. Northwest Plume Monitoring Wells

C.2.4 C-400 MONITORING WELLS

C-400 Wells

Frequency: Semiannually and Annually

Driver: MWs are required to be sampled by the *Record of Decision for Interim Remedial Action for the Groundwater Operable Unit for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2150&D2/R2, July 2005.

Reported: ASER

Rationale: These MWs will provide a meaningful tool for evaluating the downgradient dissolved-phase contamination in the Northwest Plume and the efficacy of the C-400 Interim Remedial Action. These MWs also were sampled under the *Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2433&D2/R1, March 2020. The results of continued monitoring in all MWs will support the upcoming remedial action(s) at C-400.

Comments: As part of the C-400 monitoring program optimization, routine sampling conducted at MW505, MW506, MW507, MW557, MW558, MW559, MW560, MW561, MW562, MW564, MW565, MW566, MW567, MW568, MW569, MW572, MW573, and MW574, will be transitioned from a quarterly to an annual frequency. In addition, analysis of technetium-99 (Tc-99) will be discontinued for MW505, MW506, MW507, and MW560. Routine sampling conducted at MW178, MW405-PRT5, MW406-PRT5, MW407-PRT4, MW408-PRT5, MW563, MW570, and MW571 will be transitioned from a quarterly to a semiannual frequency. In addition, analysis of Tc-99 will be discontinued for MW406-PRT5, MW407-PRT4, and MW408-PRT5. Routine sampling conducted at MW175 and MW342 will be transitioned from a semiannual to an annual frequency . Routine sampling conducted at MW155, MW156, and MW341 will be discontinued and removed from the C-400 monitoring program. Data collected under the Northeast Plume Operation and Maintenance Program is adequate for future monitoring of these wells. All modifications made to the C-400 monitoring program are supported by consistent TCE and Tc-99 data trends which reflect stable and/or declining contaminant levels and are consistent with DOE guidance for optimizing long-term monitoring strategies.

Table C.14 provides a listing of the C-400 MWs, and Table C.15 provides the analytical parameters for these MWs. Locations are shown on Figure C.6.

Table C.14. C-400 Monitoring Wells (34)

Annual Wells (20)		
MW175	MW559	MW567
MW342	MW560[a]	MW568
MW505[a]	MW561	MW569
MW506[a]	MW562	MW572
MW507[a]	MW564	MW573
MW557	MW565	MW574
MW558	MW566	
Semiannual Wells (14[b])		
MW178	MW421-PRT3	MW424-PRT2
MW343	MW422-PRT1	MW424-PRT3
MW405-PRT5	MW422-PRT2	MW425-PRT1
MW406-PRT5[a]	MW422-PRT3	MW425-PRT2
MW407-PRT4[a]	MW423-PRT1	MW425-PRT3
MW408-PRT5[a]	MW423-PRT2	MW563
MW421-PRT1	MW423-PRT3	MW570
MW421-PRT2	MW424-PRT1	MW571

[a] Tc-99 will not be analyzed for these wells.
[b] Fourteen monitoring well locations corresponds to 24 unique samples due to sampling of five multiport MWs.

Table C.15. C-400 Monitoring Wells Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water[a]	Eh[b] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Anions				
9056A	Chloride			
Volatiles				
8260D	1,1-Dichloroethene	*trans*-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride
	cis-1,2-Dichloroethene			
Radionuclides				
Tc-02-RC M	Technetium-99			

[a] As applicable, depth to water measurements cannot be obtained for multiport MWs.
[b] Oxidation-reduction potential calibrated as Eh.

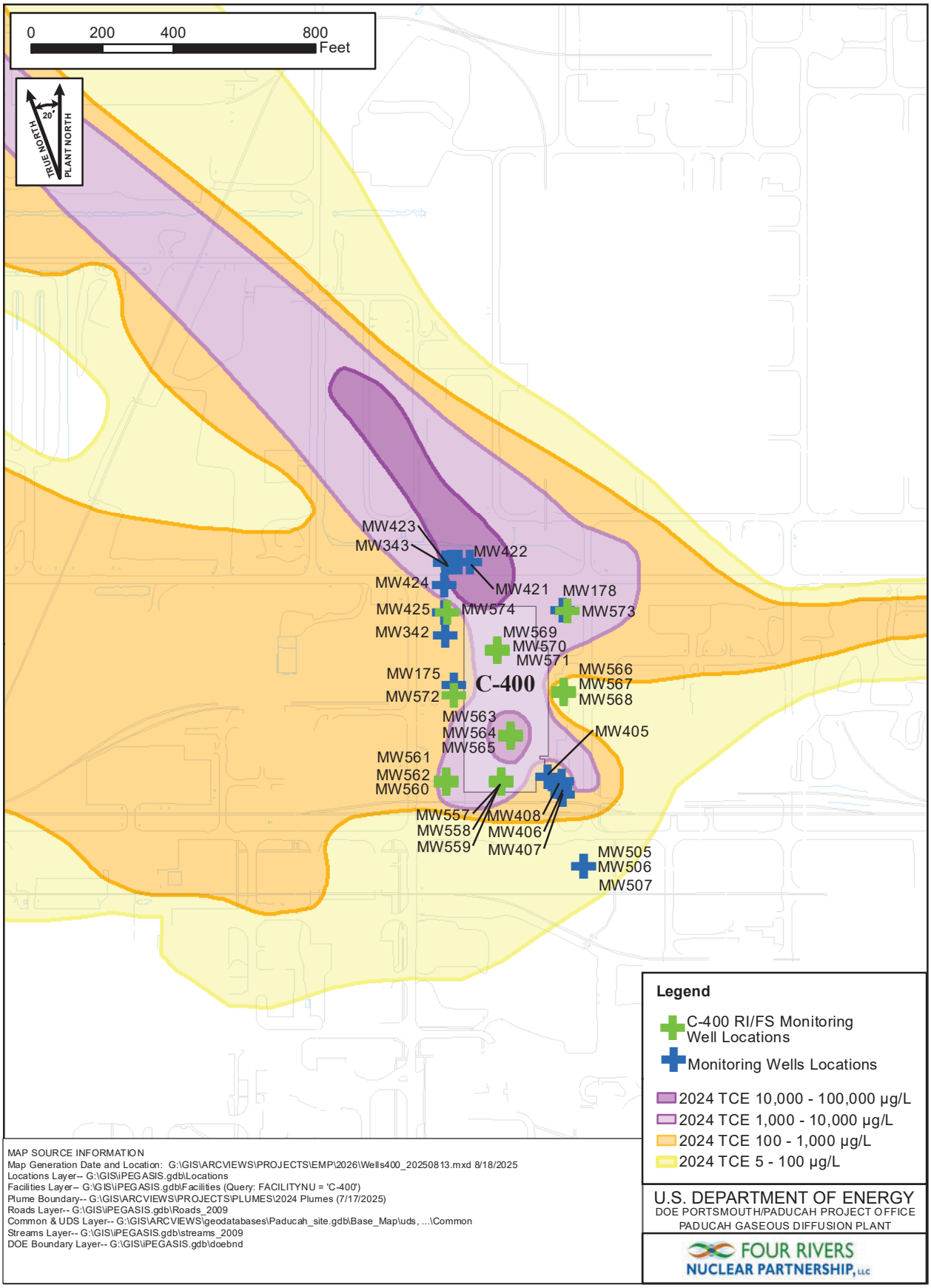

Figure C.6. C-400 Monitoring Wells with TCE Plume Shown

C.2.5 SWMU 1 MONITORING WELLS

SWMU 1 Wells

Frequency: Semiannually

Driver: The MWs are required to be sampled by the *Operation and Maintenance and Environmental Monitoring Plan for Solid Waste Management Units 1 and 211-A Remedial Actions for Volatile Organic Compound Sources to the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-2501&D2, April 2024.

Reported: ASER and CERCLA Five-Year Review

Rationale: To monitor the progress of contaminant reduction in the RGA groundwater following soil mixing.

Comments: Sampling frequencies and parameters were not modified for this sampling program for FY 2026.

Table C.16 provides a listing of MWs, and Table C.17 provides the analytical parameters. Locations are shown on Figure C.7.

Table C.16. SWMU 1 Wells (7)

Semiannual Wells (7)						
MW161	MW542	MW543	MW544	MW545	MW546	MW547

Table C.17. SWMU 1 Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Volatiles				
8260D	1,1-Dichloroethene	*trans*-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride
	cis-1,2-Dichloroethene			

[a] Oxidation-reduction potential calibrated as Eh.

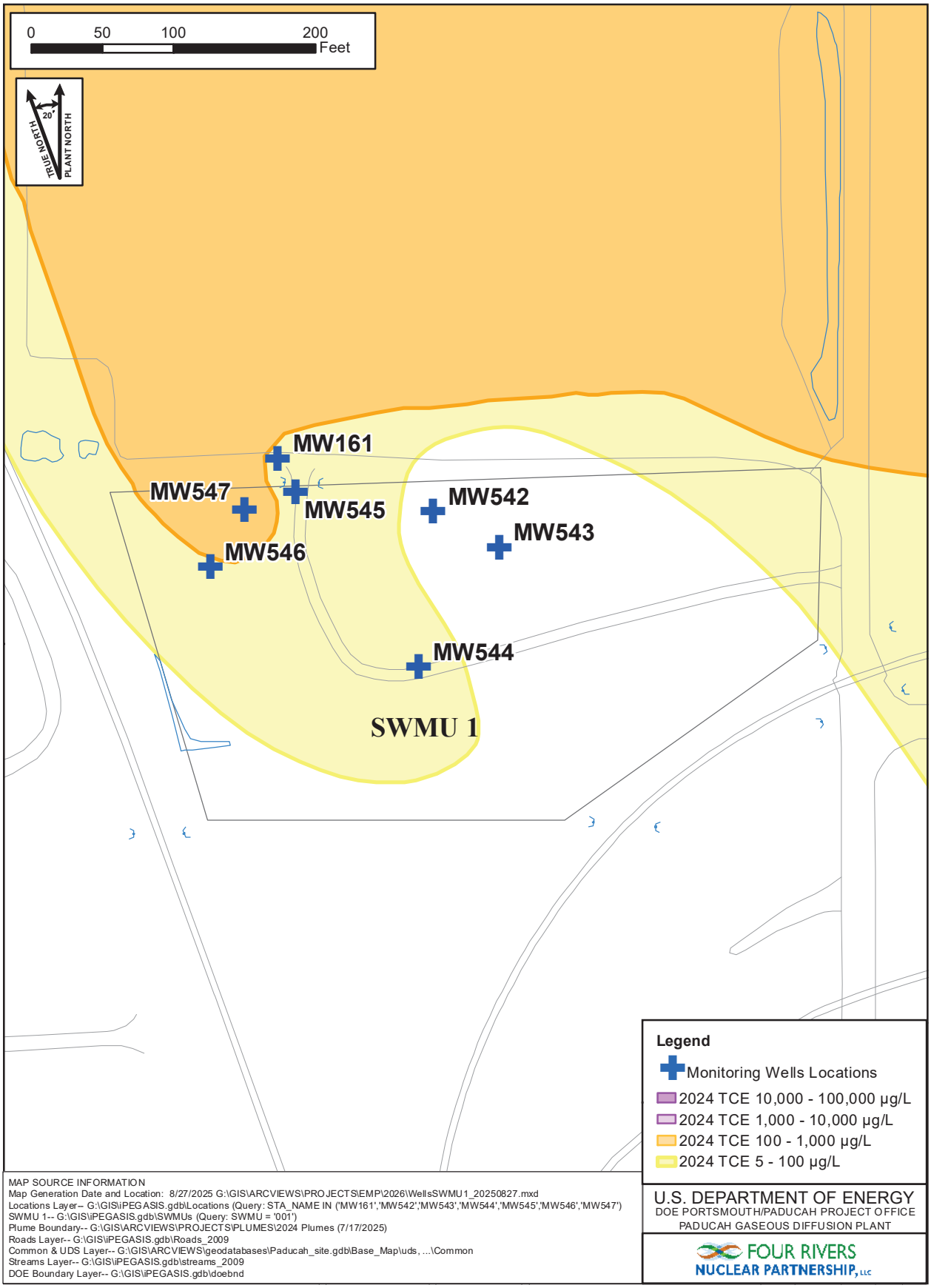

Figure C.7. SWMU 1 Monitoring Wells with TCE Plume Shown

C.2.6 SWMU 211-A PERFORMANCE AND LONG-TERM MONITORING WELLS

SWMU 211-A Wells

Frequency: Semiannually

Driver: The MWs are required to be sampled by the *Operation and Maintenance and Environmental Monitoring Plan for Solid Waste Management Units 1 and 211-A Remedial Actions for Volatile Organic Compound Sources to the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-2501&D2, April 2024.

Reported: CERCLA Five-Year Review and ASER

Rationale: MW sampling will be conducted to assess the performance of the remedial action. Post-implementation sampling and analysis is intended to achieve three main goals:

1. Assess the passive ongoing bioremediation in the subsurface;

2. Assess the zero-valent iron for continued volatile organic compound (VOC) reduction; and

3. Assess continued reduction of TCE and degradation products such that VOC migration from contaminated subsurface soils in the treatment areas of SWMU 211-A do not result in the exceedance of MCLs in the RGA over time as enhanced in situ bioremediation degrades TCE in the upper continental recharge system.

Comments: Sampling of SWMU 211-A performance and long-term wells began near the end of the second quarter of FY 2024. Performance and long-term MWs will be sampled semiannually from FY 2024 to FY 2028. Beginning in FY 2029, performance MWs will be sampled semiannually and long-term MWs will be sampled annually.

Table C.18 and Table C.19 provide a listing of performance MWs and long-term MWs, respectively. Table C.20 provides the analytical parameters. Performance and long-term MW locations are shown on Figure C.8.

Table C.18. SWMU 211-A Performance Wells (18)

Semiannual Wells (18)					
PW001	PW004	PW007	PW010	PW013	PW016
PW002	PW005	PW008	PW011	PW014	PW017
PW003	PW006	PW009	PW012	PW015	PW018

Table C.19. SWMU 211-A Long-Term Wells (10)

Semiannual Wells (10)				
MW203*	MW576	MW578	MW580	MW582
MW575	MW577	MW579	MW581	MW586

* MW203 is also sampled in support of Environmental Surveillance Monitoring for Tc-99 only.

Table C.20. SWMU 211-A Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Volatiles				
8260D	1,1,1-Trichloroethane	2-Butanone	Chlorobenzene	Methylene Chloride
	1,1,2,2-Tetrachloroethane	2-Chloroethyl vinyl ether	Chloroethane	o-Xylene
	1,1,2-Trichloroethane	2-Hexanone	Chloroform	Styrene
	1,1-Dichloroethane	4-Methyl-2-pentanone	Chloromethane	tert-Butyl methyl ether
	1,1-Dichloroethene[b]	Acetone	*cis*-1,2-Dichloroethene[b]	Tetrachloroethene
	1,2,3-Trichlorobenzene	Acrolein	*cis*-1,3-Dichloropropene	Toluene
	1,2,4-Trichlorobenzene	Acrylonitrile	Cyclohexane	*trans*-1,2-Dichloroethene[b]
	1,2-Dibromo-3-chloropropane	Benzene	Dibromochloromethane	*trans*-1,3-Dichloropropene
	1,2-Dibromoethane	Bromochloromethane	Dichlorodifluoromethane	Trichloroethene[b]
	1,2-Dichlorobenzene	Bromodichloromethane	Ethylbenzene	Trichlorofluoromethane
	1,2-Dichloroethane	Bromoform	Isopropylbenzene	Trichlorotrifluoroethane
	1,2-Dichloropropane	Bromomethane	m,p-Xylene	Vinyl Chloride[b]
	1,3-Dichlorobenzene	Carbon disulfide	Methyl acetate	Xylenes, Total
	1,4-Dichlorobenzene	Carbon tetrachloride	Methylcyclohexane	
Dissolved Gases				
RSK-175M	Methane[c]	Ethane[c]	Ethene[c]	
Wet Chemistry				
9060A	Total Organic Carbon[c]			
Bacteria[d]				
qPCR[e]	*Dehalococcoides* spp. 16S rRNA		*Dehalococcoides* spp. tceA	
	Dehalococcoides spp. bvcA		*Dehalococcoides* spp. vcrA	

[a] Oxidation-reduction potential calibrated as Eh.
[b] Long-term MWs will be analyzed for these volatile parameters and field parameters only.
[c] Analytical parameters for performance MWs only.
[d] Analytical parameters for performance MWs: PW002, PW003, PW017, and PW018 only.
[e] qPCR is quantitative polymerase chain reaction.

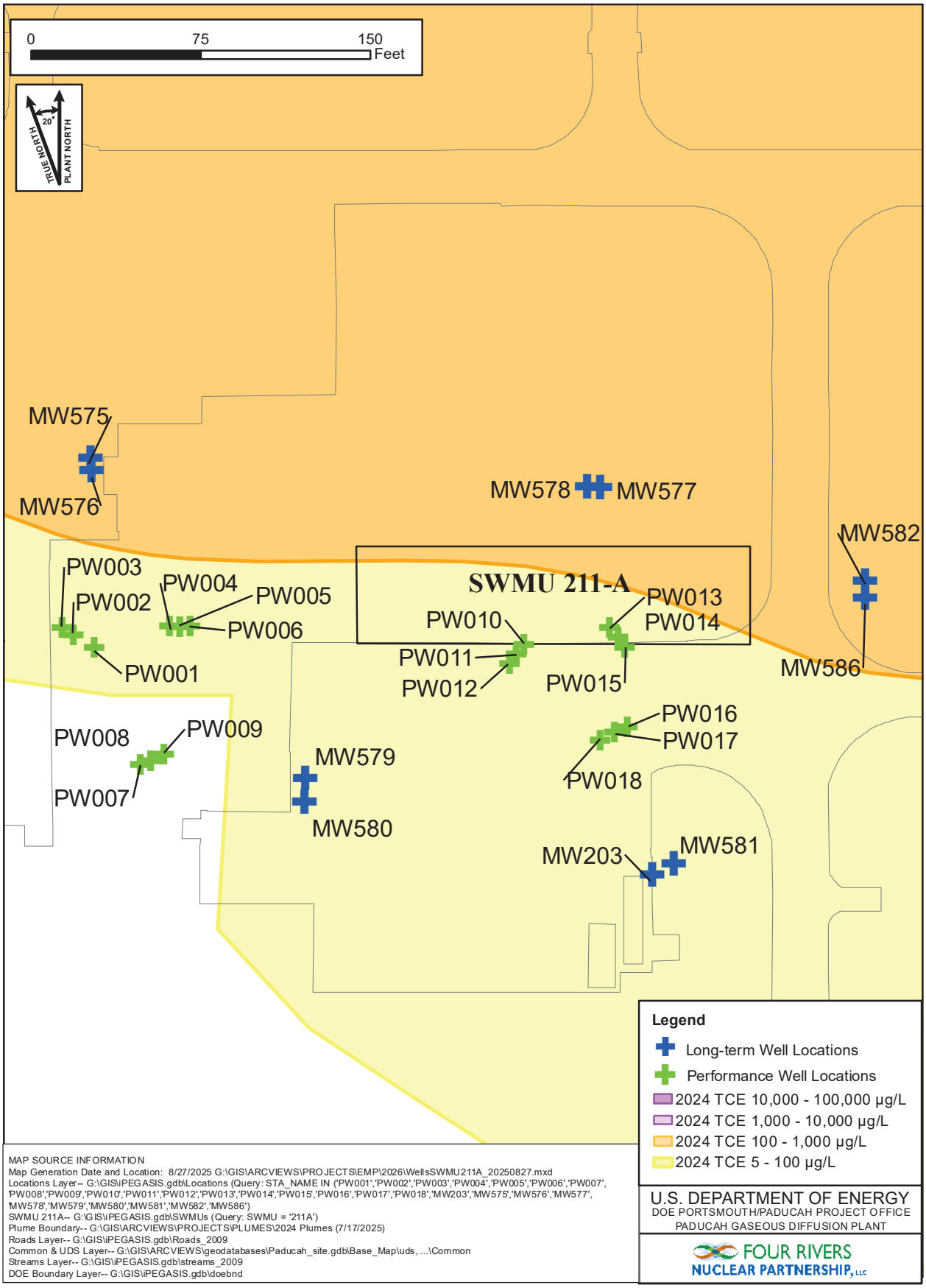

Figure C.8. SWMU 211-A Long-term and Performance Monitoring Wells with TCE Plume Shown

C.2.7 WATER POLICY BOUNDARY MONITORING PROGRAM

Frequency: Quarterly and Annually

Driver: The *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1201&D2, June 1994 stipulated the need to ensure that residential landowners were provided with water whose well water is contaminated by Paducah Gaseous Diffusion Plant (PGDP) sources. The Action Memorandum provided the sampling strategy only at the time the document was prepared and referred future sampling to the Sampling and Analysis Plan Addendum, which previously was superseded by the EMP.

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, *DOE/LX/07-2426&D2*, July 2020, the Operation and Maintenance Plans for the Northeast and Northwest Plumes were revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP. The following are the revised plans.

- *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021

- *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2469&D2, October 2021

Reported: Residential well data will be reported to the landowner and may be reported in the CERCLA Five-Year Review, FFA Semiannual Report, and ASER. MW data for those MWs located on private property also will be reported to the landowner. MWs, regardless if located on private property or on DOE property, will be reported in the CERCLA Five-Year Review, FFA Semiannual Report, and ASER.

Rationale: A group of residential wells and MWs were chosen to confirm plume migration paths of the Northwest and Northeast Plumes, near the boundaries of the Water Policy Box. Because of the predominant northern flow of groundwater from the site, the concentration of selected wells is more toward the west and east of the site, as opposed to south.

Reviews of the data generated through this program may warrant changes to the Water Policy Box [see Figure C.9 (northwest wells) and Figure C.10 (northeast wells)].

Comments: The Water Policy Boundary Monitoring Program was introduced in FY 2013 under this format. Sampling of the residential wells and MWs stated below were previously a part of other programs contained in prior years' EMPs. In order to better capture the objectives stated above, this program was defined as a unique sampling program.

The Water Policy Boundary Monitoring Program is evaluating the extent of TCE and groundwater flow trends near the east and west boundaries of the Water Policy Box. Manual water level measurements and pressure transducer measurements in specific MWs will be used to measure the potentiometric surface and seasonal changes in the

potentiometric surface. MWs planned for pressure transducer deployment are included in Appendix B.

Tc-99 was removed from the list of sampling parameters for all wells under this program in FY 2019, except MW432, based on monitoring results and conceptual site models indicating that Tc-99 is not present at levels of concern in the areas of residential wells. However, based on the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, *DOE/LX/07-2426&D2*, July 2020, and *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2469&D2, October 2021, Tc-99 is analyzed for wells in the Northwest Plume portion of the Water Policy Box as noted in Table C.21, with the exception of those residential wells noted for TCE analysis only.

A Water Policy Box reduction evaluation report was submitted to DOE in 2021 with the recommendation to continue with the current Water Policy monitoring program.

As part of the Groundwater Strategy project and the Water Policy Box evaluation, residential wells along Bethel Church Road and Ogden Landing Road were evaluated to determine if they were able to be sampled. Residential wells that are accessible are sampled for TCE only.

In order for samples to be collected from the residential and MWs in this program, license agreements have to be in place with the property owners.

In FY 2019, the analytical method for uranium isotopes was changed from alpha spectroscopy to inductively coupled plasma mass spectroscopy in order to obtain a lower detection limit.

In FY 2022, vinyl chloride was detected above the MCL in residential well R40 samples collected by KDWM Agreement in Principle and DOE. Multiple sampling events were conducted at R40 in FY 2022 and the pump and tubing were replaced in the well. After the pump and tubing were replaced and additional samples were collected, vinyl chloride was not detected above the MCL. In order to continue evaluating conditions at the well, R40 will continue to be sampled quarterly for TCE and degradation products in FY 2026.

MW20 will continue to be sampled quarterly in FY 2026 to support further assessment of the west side of the Northwest Plume.

Table C.21 provides a list of water policy northwestern wells. Table C.22 provides the analytical parameters for the water policy northwestern wells. Table C.23 provides a listing of water policy northeastern wells. Table C.24 provides the analytical parameters for the northeastern wells.

Table C.21. Water Policy Northwestern Wells (23)

Quarterly (21)						
R2	R26	MW20	MW146	MW201	MW427	MW435
R13	R53	MW106A	MW194	MW202	MW432	MW441
R14	R245	MW134	MW199	MW426	MW433	MW452
Quarterly (2)						
R10[a]	R40[a]					

[a] These residential wells will only be sampled for TCE.

Table C.22. Water Policy Northwestern Quarterly Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water[a]	Eh[b] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	
Volatiles				
8260D	Trichloroethene			
Radionuclides				
Tc-02-RC M	Technetium-99			
C1345-08M	Uranium-234	Uranium-235	Uranium-238	

[a] As applicable.
[b] Oxidation-reduction potential calibrated as Eh.

Table C.23. Water Policy Boundary Northeastern Wells (7)p

Annually (7)			
R9	R21	R90	R302
R20	R83	R114	

Table C.24. Water Policy Northeastern Annual Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water[a]	Eh[b] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	
Volatiles				
8260D	Trichloroethene			
Radionuclides				
C1345-08M	Uranium-234	Uranium-235	Uranium-238	

[a] As applicable.
[b] Oxidation-reduction potential calibrated as Eh.

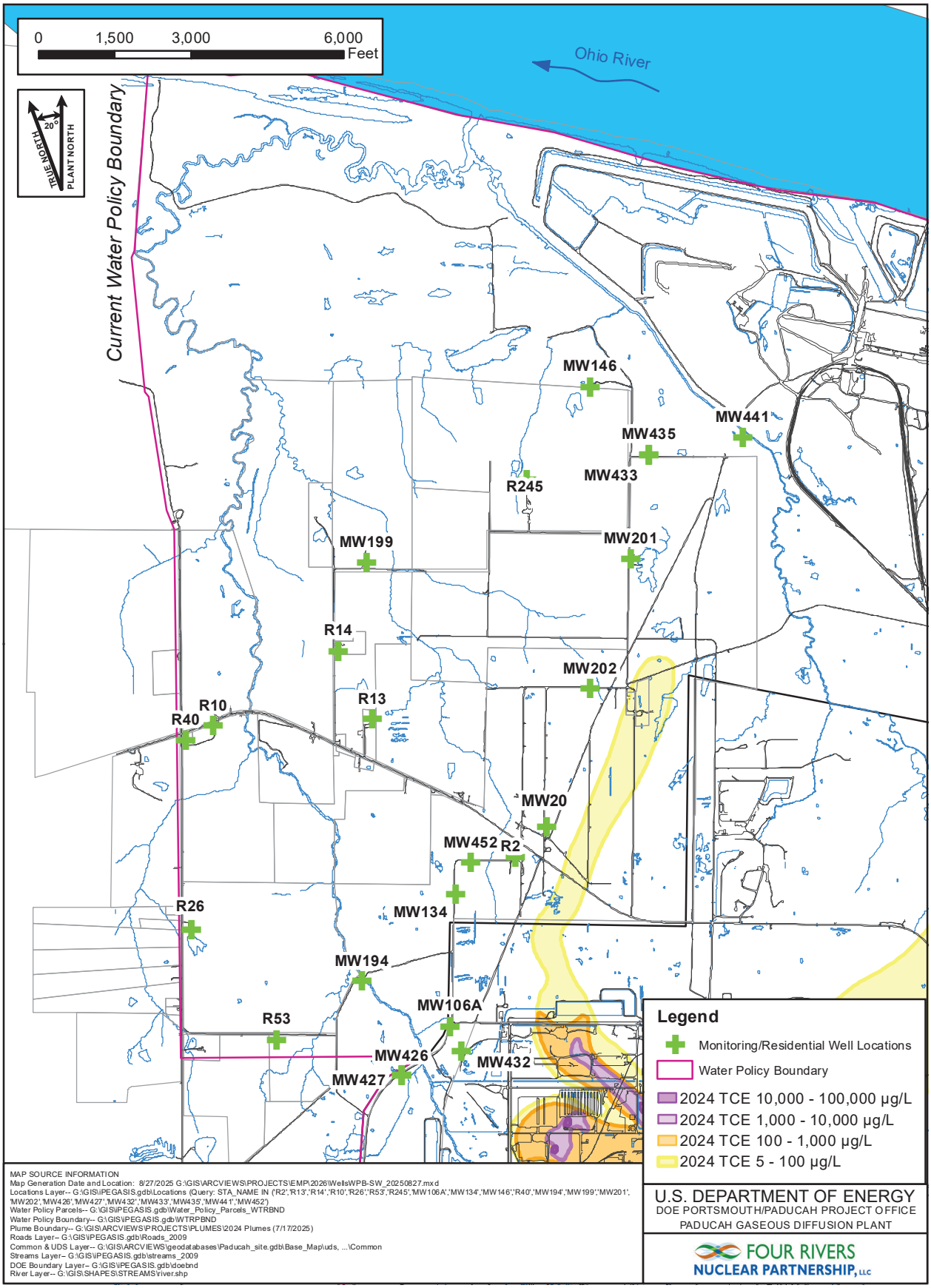

Figure C.9. Water Policy Boundary Monitoring Wells Northwest with TCE Plume Shown

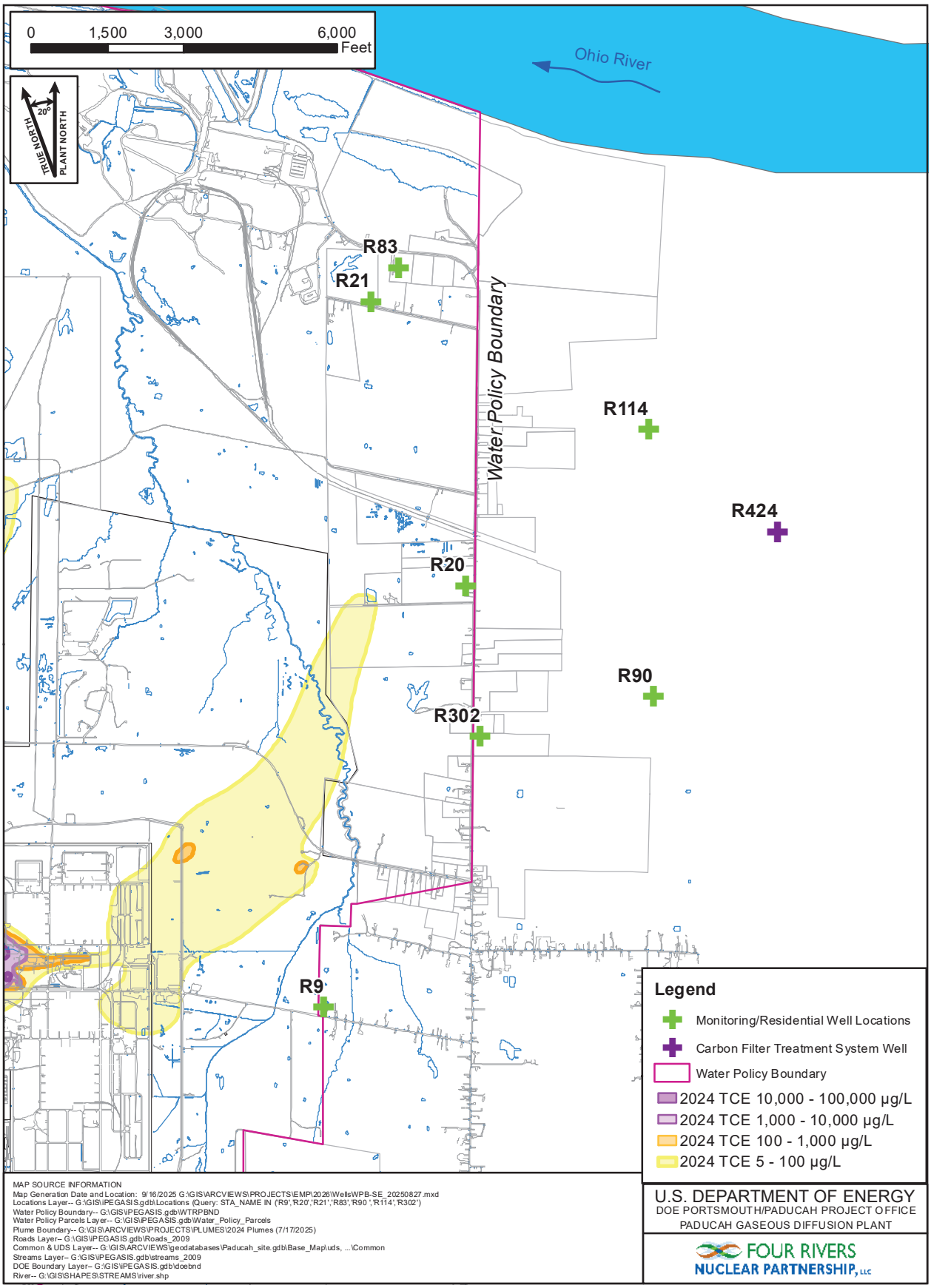

Figure C.10. Water Policy Boundary Monitoring Wells, Northeast with TCE Plume Shown

C.2.8 CARBON FILTER TREATMENT SYSTEM

Frequency: Semiannually (one before treatment sample and one after treatment sample per each semiannual event)

Driver: License agreement with landowner

Reported: Letter to landowner on a semiannual basis

Comments: DOE is maintaining a treatment system for one landowner who is outside the Water Policy Box. A license agreement with the landowner stipulates the terms of this arrangement.

Sampling will be conducted for Tc-99 and TCE because they are contaminants of potential concern in groundwater from DOE activities. Based on reviews of the groundwater modeling and historical data, the groundwater at this location is not impacted by site operations. Based on these conditions, Tc-99 sampling frequency was reduced from monthly to semiannual to verify the Tc-99 is below reporting limits. A review of the FY 2021 Tc-99 data did not indicate a need for increased radionuclide analysis; therefore, no changes in sample strategy were made.

Tables C.25 and C.26 identify carbon filter treatment system well and carbon filter treatment system analytical parameters, respectively. Location is shown on Figure C.10.

Table C.25. Carbon Filtration System (1[a])

R424-PRT1[b]	R424-PRT3[c]

[a] One location corresponds to two unique samples.
[b] R424-PRT1 is direct groundwater.
[c] R424-PRT3 is after ultraviolet light and carbon filter.

Table C.26. Carbon Filtration System Analytical Parameters

Field Parameters[a]				
	Conductivity	Eh[b] (approx)	pH	Temperature
	Dissolved Oxygen			
Volatiles				
8260D	Trichloroethene			
Radionuclides				
Tc-02-RC M	Technetium-99			
Wet Chemistry				
SM 9223	Total Coliform			

[a] Field parameters will only be measured for R424-PRT1 samples.
[b] Oxidation-reduction potential calibrated as Eh.

C.2.9 ENVIRONMENTAL SURVEILLANCE GROUNDWATER MONITORING PROGRAM

Environmental Surveillance Monitoring

Frequency: Biennially, Annually, and Semiannually

Driver: Paducah FFA, *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021 (DOE 2021b); and *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2469&D2, October 2021 (DOE 2021a)

Reported: ASER

Rationale: Monitoring is conducted to determine the nature and extent of groundwater contamination and groundwater quality. Sampling of these MWs is conducted in support of the Paducah FFA Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Investigation; Resource Conservation and Recovery Act Facility Investigations (RFIs).

Comments: The program was modified in FY 2011 to focus on sampling key MWs annually and reduce sampling of other MWs to a biennial basis. The biennial grouping of MWs was sampled in FY 2025; therefore, they will not be sampled in FY 2026.

The MWs to be monitored annually were selected based on their location within the plumes. Some MWs are key for early detection of plume migration; others are key for ongoing CERCLA decisions.

Per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, *DOE/LX/07-2426&D2*, July 2020, the *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021, was revised to incorporate elements of Water Policy boundary monitoring conducted under the EMP. MW100, MW150, MW409, MW410, MW411, MW473, MW474, MW475, and MW476 are sampled in support of the Environmental Surveillance program and in support of Water Policy boundary monitoring.

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at MW403 will be transitioned from a quarterly to an annual frequency. In addition, analysis of Tc-99 will be discontinued for MW403. Routine sampling conducted at MW132, MW354, and MW431 will be transitioned from a quarterly to a semiannual frequency. In addition, analysis of Tc-99 will be discontinued for MW354 and MW431.

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at MW197, MW326, MW327, and MW330 will be transitioned from a semiannual to an annual frequency. In addition, analysis of Tc-99 will be discontinued for MW326. Routine sampling conducted at MW98, MW102, MW133, MW135, and MW239 will be transitioned from a semiannual to a biennial frequency. Routine sampling conducted at MW549, MW550, and MW551 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-404 landfill monitoring program is adequate for future monitoring of these wells.

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at MW71, MW99, MW139, MW150, MW191, MW203, MW253A, MW345, MW346, MW347, MW440, MW445, MW447, MW448, MW463, MW464, MW469, MW470, MW471, MW472, and MW477 will be transitioned from an annual to a biennial frequency. In addition, analysis of Tc-99 will be discontinued for MW71, MW191, MW440, MW445, MW447, and MW448. Analytical parameters for MW203 will be reduced to include Tc-99 analysis only. Analysis of Tc-99 will be discontinued for MW68, MW187, MW236, MW240, MW418, MW419, MW450, MW488, MW491, and MW492. Routine sampling conducted at MW161 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the SWMU 1 MW program is adequate for future monitoring of this well.

As part of the Environmental Surveillance Groundwater Monitoring Program optimization, routine sampling conducted at MW404, MW481, and MW482 will be transitioned from a biennial to an annual frequency. In addition, analysis of Tc-99 will be discontinued for MW404, MW481, and MW482. Analysis of Tc-99 will be discontinued for MW193, MW328, MW329, MW442, MW443, MW444, MW451, and MW489. Analytical parameters for MW341 will be reduced to include uranium analysis only. Routine sampling conducted at MW343, MW405, MW406, MW407, and MW408 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-400 MWs program is adequate for future monitoring of these wells. Routine sampling conducted at MW67, MW76, MW86, MW89, MW92, MW95A, MW226, MW227, MW414, and MW416 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the C-404 landfill monitoring program is adequate for future monitoring of these wells. Routine sampling conducted at MW106A, MW146, MW201, MW202, MW432, MW435, and MW452 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the Water Policy Boundary Monitoring Program is adequate for future monitoring of these wells. Routine sampling conducted at MW163, MW260, MW479, MW480, MW495, and MW496 will be discontinued and removed from the Environmental Surveillance Groundwater Monitoring Program. Data collected under the Northeast Plume Operation and Maintenance Program is adequate for future monitoring of these wells.

All modifications made to the Environmental Surveillance Groundwater Monitoring Program are supported by consistent TCE and Tc-99 data trends which reflect stable and/or declining contaminant levels and are consistent with DOE guidance for optimizing long-term monitoring strategies.

Tables C.27 and C.28 identify MWs and analytical parameters, respectively. Locations are shown on Figure C.11.

Table C.27. Environmental Surveillance Wells (105)

Biennial (44)					
MW71[a,d]	MW174	MW333	MW417	MW466[d]	MW478
MW98	MW191[d]	MW337	MW439[d]	MW467[d]	MW493
MW99[d]	MW193[d]	MW338	MW440[d]	MW468[d]	MW494
MW102[e]	MW203[h]	MW341[i]	MW445[d]	MW469[d]	MW548[b]
MW133[e]	MW205	MW345	MW447[d]	MW470[d]	**Background (1)**
MW135	MW262	MW346	MW463[d]	MW471[d]	MW103
MW139	MW328[d]	MW347	MW464[d]	MW472[d]	
MW168	MW329[d]	MW415	MW465[d]	MW477[d]	
Biennial Private Property (18)					
MW148[d]	MW253A[d]	MW448[d]	MW475[d,f]	MW489[d]	
MW149[d]	MW442[d]	MW451[d]	MW476[d,f]	MW490	
MW200	MW443[d]	MW473[d,f]	MW485[d]		**Background (1)**
MW239[e]	MW444[d]	MW474[d,f]	MW487[d]		MW150[f]
Annual (19)					
MW68[a,d]	MW186	MW261	MW330	MW418[d]	MW482[d]
MW100[d,f]	MW187[d]	MW326[d]	MW403-PRT3[d]	MW419[d]	MW491[d]
MW169	MW197	MW327	MW404-PRT4[d]	MW481[d]	MW492[d]
MW182					
Annual Private Property (10)					
MW125	MW240[d]	MW450[d]	MW454	MW484[d]	
MW236[d]	MW252[d]	MW453	MW483[d]	MW488[d]	
Semiannual (7)					
MW120[e]	MW132	MW247[e]	MW354[d]	MW356[e]	MW431[d]
MW122[e]					
Semiannual Private Property (5)					
MW121[e]	MW409[c,f]	MW410[c,f]	MW411[c,f]	MW486A[d]	

Shading indicates MWs are not scheduled to be sampled this FY. Sampling of these wells is planned to resume in FY 2027.
[a] Sampling will occur at the same time as the semiannual CY sampling event for MW505, MW506, and MW507, which are under the C-400 MW sampling program.
[b] SWMU 4 MWs.
[c] These three wells will be sampled for TCE only to evaluate Northeast Plume migration.
[d] These wells will not be sampled for Tc-99.
[e] If these McNairy MWs produce enough water for sampling, samples will also be collected for uranium.
[f] These MWs also are sampled in support of Water Policy boundary monitoring.
[g] MWs located on private property or Kentucky Department of Fish and Wildlife Resources property.
[h] Tc-99 analysis only.
[i] Uranium analysis only.

Table C.28. Environmental Surveillance Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	Temperature
	Conductivity	Dissolved Oxygen	pH	Turbidity
Volatiles				
8260D	1,1,1-Trichloroethane	Benzene	*cis*-1,2-Dichloroethene	Toluene
	1,1,2-Trichloroethane	Bromodichloromethane	Dimethylbenzene, Total[b]	*trans*-1,2-Dichloroethene
	1,1-Dichloroethane	Carbon Tetrachloride	Ethylbenzene	Trichloroethene
	1,1-Dichloroethene	Chloroform	Tetrachloroethene	Vinyl Chloride
	1,2-Dichloroethane			
Metals				
6020B	Uranium[c]			
Radionuclides				
Tc-02-RC M	Technetium-99			

[a] Oxidation-reduction potential calibrated as Eh.
[b] Xylenes
[c] Uranium analysis is only required on the eight McNairy MWs labeled with an "e" footnote in Table C.27.

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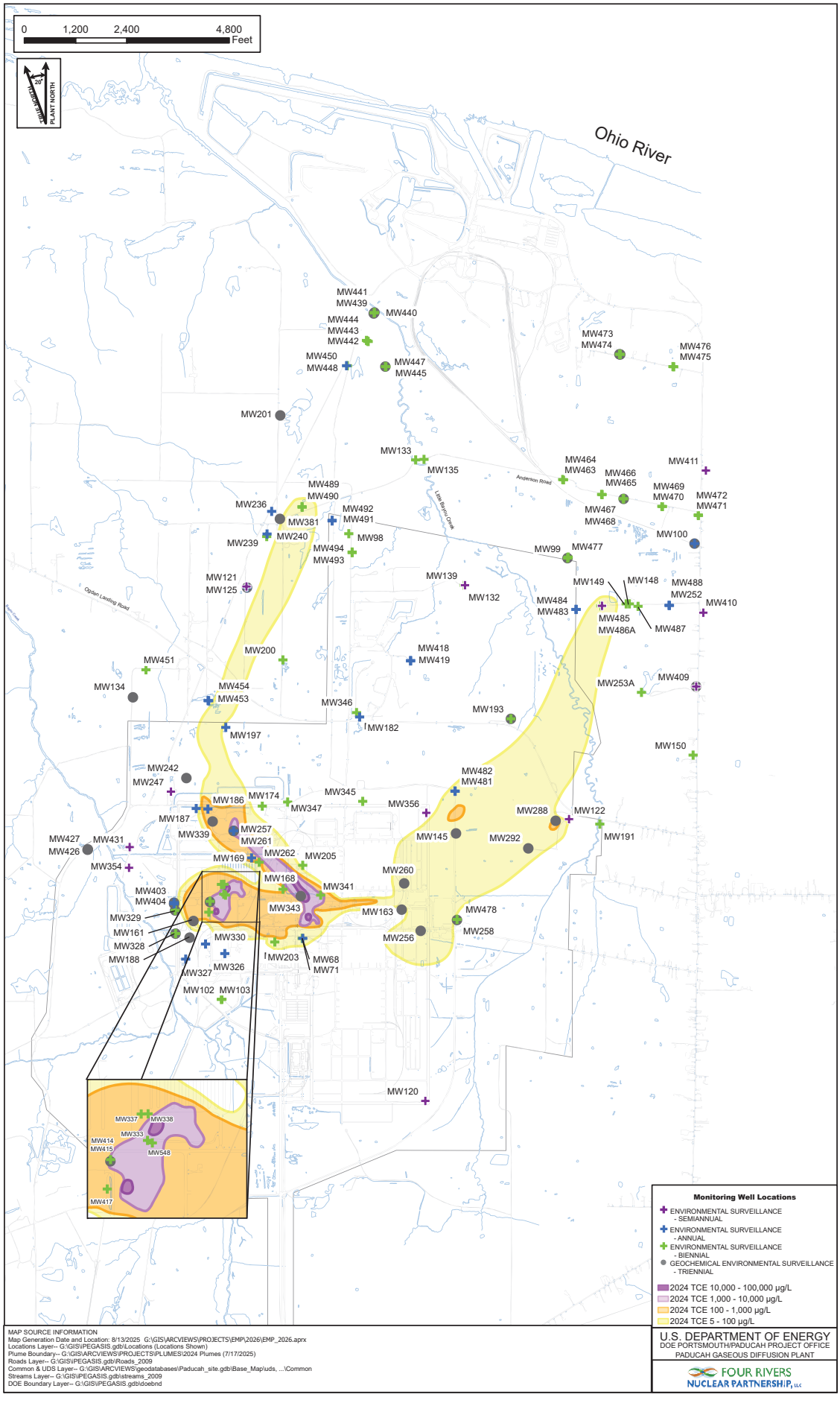

Figure C.11. Environmental Surveillance Groundwater Monitoring Wells with TCE Plume Shown

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Geochemical Environmental Surveillance Monitoring

Frequency: Triennially

Driver: Paducah FFA

Reported: ASER

Rationale: Monitor the extent of groundwater contamination and groundwater quality. Sampling of these MWs is conducted in support of the Paducah FFA CERCLA Investigation and RFIs.

Comments: The program was modified in FY 2011 to reduce sampling from an annual basis to a triennial basis. The MWs were sampled in FY 2025; therefore, they will not be sampled in FY 2026.

Tables C.29 and C.30 show the MWs and analytical parameters, respectively. Monitoring locations are shown on Figure C.11.

Table C.29. Geochemical Environmental Surveillance Wells (37)

Triennial (30)				
MW99	MW193	MW261	MW343	MW426
MW100	MW242	MW288	MW403-PRT3	MW427
MW145	MW256	MW292	MW404-PRT3	MW439
MW161	MW257	MW328	MW404-PRT4	MW441
MW163	MW258	MW329	MW404-PRT5	MW447
MW188	MW260	MW339	MW414	MW468
Triennial Private Property (7)*				
MW125	MW201	MW409	MW473	MW474
MW134	MW381			

Shading indicates MWs are not scheduled to be sampled this FY.
*MWs located on private property or Kentucky Department of Fish and Wildlife Resources property.

Table C.30. Geochemical Environmental Surveillance Triennial Analytical Parameters

Field Parameters				
	Barometric Pressure	Depth to Water	Eh[a] (approx)	pH
	Conductivity	Dissolved Oxygen	Ferrous Iron (Fe+2)	Temperature
Anions				
9056A	Chloride	Nitrate as Nitrogen	o-Phosphate as Phosphorous	Sulfate
	Fluoride			
Dissolved Gases				
RSK-175M	Methane	Ethane	Ethene	
Metals				
6010D	Silica			
6020B	Aluminum	Calcium	Magnesium	Silver
	Antimony	Chromium	Manganese	Selenium
	Arsenic	Cobalt	Molybdenum	Sodium
	Barium	Copper	Nickel	Zinc
	Beryllium	Iron	Potassium	Uranium
	Cadmium	Lead		
Wet Chemistry				
160.1	Total Dissolved Solids			
310.1	Alkalinity			
9060A	Total Organic Carbon			

[a] Oxidation-reduction potential calibrated as Eh.

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C.3. SURFACE WATER, SEDIMENT, AND WATERSHED BIOLOGICAL MONITORING

C.3.1 EFFLUENT WATERSHED MONITORING PROGRAM

C-746-S, C-746-T, and C-746-U Landfills Surface Water

Frequency: **Quarterly**

Driver: Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045, Technical Attachment 24, which includes the surface water monitoring plans.

Reported: Quarterly C-746-S&T and C-746-U Landfills Compliance Monitoring Reports and the ASER

Rationale: Monitor rain runoff from the C-746-S, C-746-T, and C-746-U Landfills.

Comments: Sampling frequencies and sampling parameters were not modified for this sampling program for FY 2026 because it is permit driven.

Surface water sampling is performed and reported collectively for the C-746-S and C-746-T Landfills.

Tables C.31 and C.32 show landfill surface water locations and landfill surface water parameters, respectively. Monitoring locations are shown on Figure C.12.

Table C.31. Landfill Surface Water Monitoring Locations (6)

C-746-S&T		
L135	L136	L154*
C-746-U		
L150	L154*	L351

*L154 is reported in the Compliance Monitoring Reports for both the C-746-U and C-746-S&T Landfills.

Table C.32. Landfill Surface Water Monitoring Analytical Parameters

Field Parameters			
	Conductivity	pH	
Anions			
300.0	Chloride	Sulfate	
Metals			
200.8	Iron	Sodium	Uranium
Radionuclides			
9310	Alpha Activity	Beta Activity	
Wet Chemistry			
160.1	Total Dissolved Solids		
160.2	Total Suspended Solids		
SM 2540B	Total Solids		
410.4	Chemical Oxygen Demand		
9060A	Total Organic Carbon		

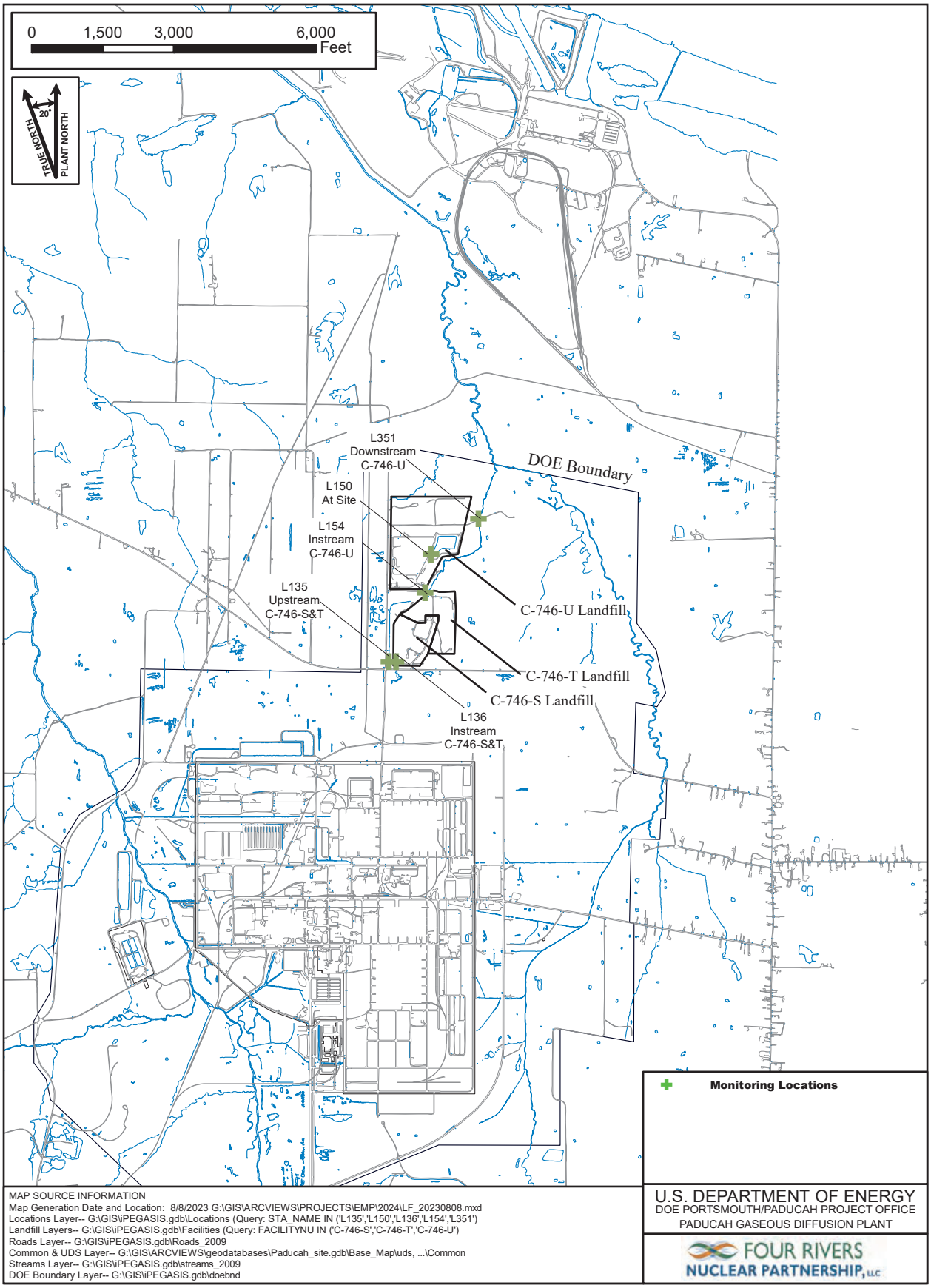

Figure C.12. Landfill Surface Water Monitoring Locations

Kentucky Pollutant Discharge Elimination System Outfall Sampling

Frequency: Weekly, Monthly, and Quarterly

Driver: Kentucky Pollutant Discharge Elimination System (KPDES) permit for PGDP, permit number KY0004049, was issued by the Kentucky Division of Water (KDOW) to DOE, Fluor Federal Services, Inc., Paducah Deactivation Project (FPDP), and Mid-America Conversion Services, LLC, and became effective September 1, 2017. A permit dated October 12, 2017, changed the co-permittee from FPDP to FRNP. This permit expired on August 30, 2022, but was administratively continued while KDOW processed the KPDES permit renewal application. KDOW issued the new KPDES permit in December 2022, and the new permit became effective on February 1, 2023. The current permit expires on January 31, 2028.

Reported: Monthly and Quarterly Discharge Monitoring Reports and ASER

Rationale: Monitor effluent and surface water runoff as it is discharged to the receiving streams and tributaries.

Comments: Table C.33 shows the KPDES outfall sampling locations, frequency of sampling, and parameters required by permit KY0004049. Locations are shown on Figure C.13.

CERCLA Outfall Sampling

Frequency: Weekly and Quarterly

Driver: Sampling of this outfall is required by the *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1, November 2021, and the *Remedial Action Work Plan for the Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1, July 2018.

Reported: Semiannual FFA Progress Report and ASER

Rationale: Monitor effluent from the Northeast Plume containment system.

Comments: Table C.34 shows the frequency of sampling and parameters required for this CERCLA outfall (C001).

Sampling frequencies and sampling parameters were not modified for this sampling program for FY 2026.

Table C.33. KY0004049 Permit KPDES Outfall Sampling Locations, Frequency, and Parameters

Frequency of Sampling at KPDES Locations D—Daily; W—Weekly; M—Monthly; Q—Quarterly																
Analysis	**Method**	**K001**	**K002**	**K004**	**K006**	**K008**	**K009**	**K010**	**K011**	**K012**	**K013**	**K015**	**K016**	**K017**	**K019[a]**	**K020**
Flow	Field	D	M	2/M[b]	M	M	M	M	M	M	M	M	M	M	M	M
Total Residual Chlorine	Field	W			M	M										
Temperature	Field	W	M			M										
pH	Field	W	M		M	M	M	M	M	M	M	M	M	M	M	M
Total Suspended Solids	SM 2540 D	W	M	2/M	M	M	M	M	M	M	M	M	M	M	M	M
Oil & Grease	1664A	W	M		M	M	M	M	M	M	M	M	M	M	M	M
PCBs	608.3	W	M			M	M	M	M	M	M	M	M	M	M	M
Trichloroethene	624.1	W	M			M	M	M	M	M	M	M	M	M	M	M
Total Phosphorus	365.4	W			M	M	M					M	M	M		
Alpha Activity	9310	W	M			M	M	M	M	M	M	M	M	M	M	M
Beta Activity	9310	W	M			M	M	M	M	M	M	M	M	M	M	M
Uranium	200.8	W	M			M	M	M	M	M	M	M	M	M	M	M
Copper	200.8		M													
Zinc	200.8										M			M		
Technetium-99	Tc-02-RC M	Q	M			M	M	M	M	M	M	M	M	M	M	M
Hardness—Total as $CaCO_3$	SM 2340 C		M								M			M		
Biochemical Oxygen Demand (BOD_5)	SM 5210 B			2/M												
Mercury	1631E					M										
Acute Toxicity[c]	2000.0/2002.0													Q		
Chronic Toxicity[d]	1000.0/1002.0	Q														

[a] K019 is sampled when the C-746-U Landfill sedimentation pond is discharged through the outfall.

[b] Per the KPDES permit, flow is measured from grab samples collected at K004. Pursuant to the Water Treatment Registration, Public Water System No. 0732457, for sewage discharge in operating a sewage treatment plant, monthly flow information is documented by the Utilities organization and is reported to KDOW.

[c] Acute toxicity sampling requires two discrete grab samples collected approximately 12 hours apart. A different lab method is used for each species.

[d] Chronic toxicity sampling requires three 24-hour composite samples. A different lab method is used for each species.

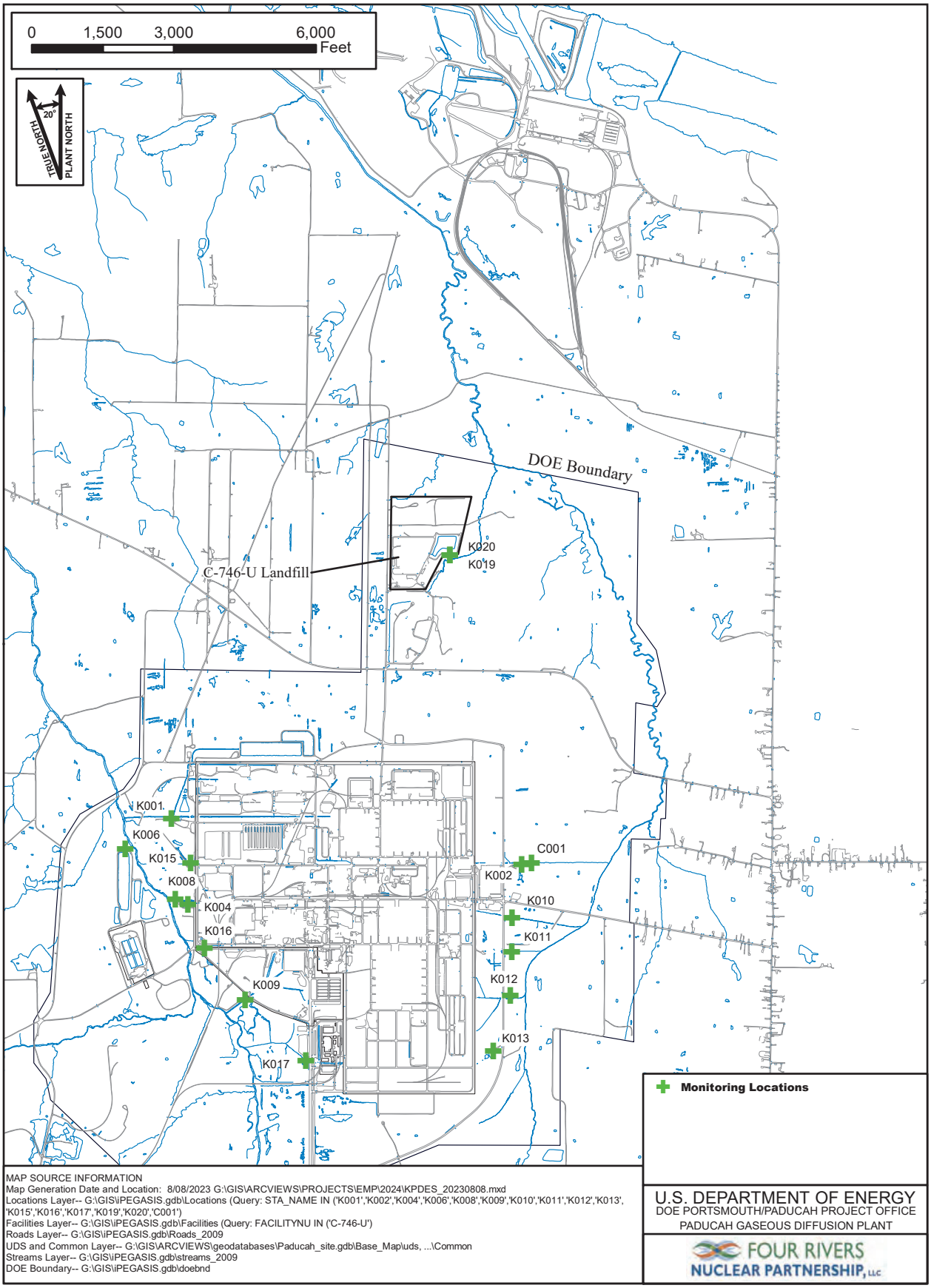

Figure C.13. KPDES and CERCLA Outfall Sampling Locations

Table C.34. C001 Outfall Sampling Frequency and Parameters

Analysis	Method	Frequency of Sampling at C001 Outfall W—Weekly; Q—Quarterly
Flow	Field	W
pH	Field	W
Temperature	Field	W
Total Residual Chlorine	Field	W
Total Suspended Solids	160.2	W
Oil & Grease	1664A	W
Trichloroethene	624.1	W
1,1-Dichloroethene	624.1	W
Chronic Toxicity[a]	1000.0/1002.0	Q
Technetium-99	Tc-02-RC M[b]	Q

[a] Chronic toxicity sampling requires three 24-hour composite samples. A different lab method is used for each species.
[b] Technetium-99 is required under the Remedial Action Work Plan for the Northeast Plume.

C.3.2 ENVIRONMENTAL RADIATION PROTECTION PROGRAM—EFFLUENT AND SURFACE WATER RUNOFF

Frequency: Monthly

Driver: DOE Order 458.1

Reported: ASER

Rationale: Monitor effluent and surface water runoff for radiological constituents as it is discharged to the receiving streams and tributaries.

Comments: DOE O 458.1 Chg 5 (AdminChg), went into effect on January 30, 2025, and was implemented in FY 2025. DOE Order 458.1 requires compliance in accordance with DOE-STD-1196-2022, *Derived Concentration Technical Standard*. DOE Order 458.1 also requires that settleable solids on liquid discharges do not exceed limits set forth in DOE Order 458.1, Attachment 1 2.g.(4). Settleable solids are analyzed for the Environmental Radiation Protection Program (ERPP) outfall locations, with the exception of Outfall 020. Parameters required to determine alpha and beta activity on settleable solids per Section 6.10.7 of DOE-HDBK-1216-2015 Change Notice 1 are noted in Table C.35. These results will be compared to the sediment background data to evaluate if the radionuclide concentration exceeds the standard.

Table C.35 lists the sampling locations, frequencies, and parameters. Locations are shown on Figure C.14.

Table C.35. ERPP Effluent and Surface Water Runoff

Analytical Parameters (M—Monthly)															
Analysis	**Method**	**K001 ERPP**	**K002 ERPP**	**K004 ERPP**	**K008 ERPP**	**K009 ERPP**	**K010 ERPP**	**K011 ERPP**	**K012 ERPP**	**K013 ERPP**	**K015 ERPP**	**K016 ERPP**	**K017 ERPP**	**K019 ERPP**	**K020 ERPP**
Alpha activity	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Beta activity	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Americium-241	Am-05-RC M	M		M	M	M	M	M	M		M	M			
Cesium-137	901.1			M	M						M	M			
Neptunium-237	1475-00 M	M		M	M	M	M	M	M		M	M			
Plutonium-238	Pu-11-RC M	M		M	M	M	M	M	M		M	M			
Plutonium-239/240	Pu-11-RC M	M		M	M	M	M	M	M		M	M			
Tc-99	Tc-02-RC M	M		M											
Thorium-230	Th-01-RC M	M		M	M	M	M	M	M		M	M			
Uranium-234	U-02-RC M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Uranium-235	U-02-RC M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Uranium-238	U-02-RC M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
*Non-Settleable Solids (NSS)	SM 2540 D	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Total Suspended Solids (TSS)	SM 2540 D	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Settleable Solids	SM 2540 F	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Gross Alpha (TSS)	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Gross Beta (TSS)	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Gross Alpha (NSS)	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	
*Gross Beta (NSS)	9310	M	M	M	M	M	M	M	M	M	M	M	M	M	

NOTE: Samples are being collected from locations near the outfalls listed in KPDES permit KY0004049.

*Results are used to determine the alpha and beta activity on settleable solids per Section 6.10.7 of DOE-HDBK-1216-2015 Change Notice 1. The alpha and beta activity on settleable solids will be calculated by the project.

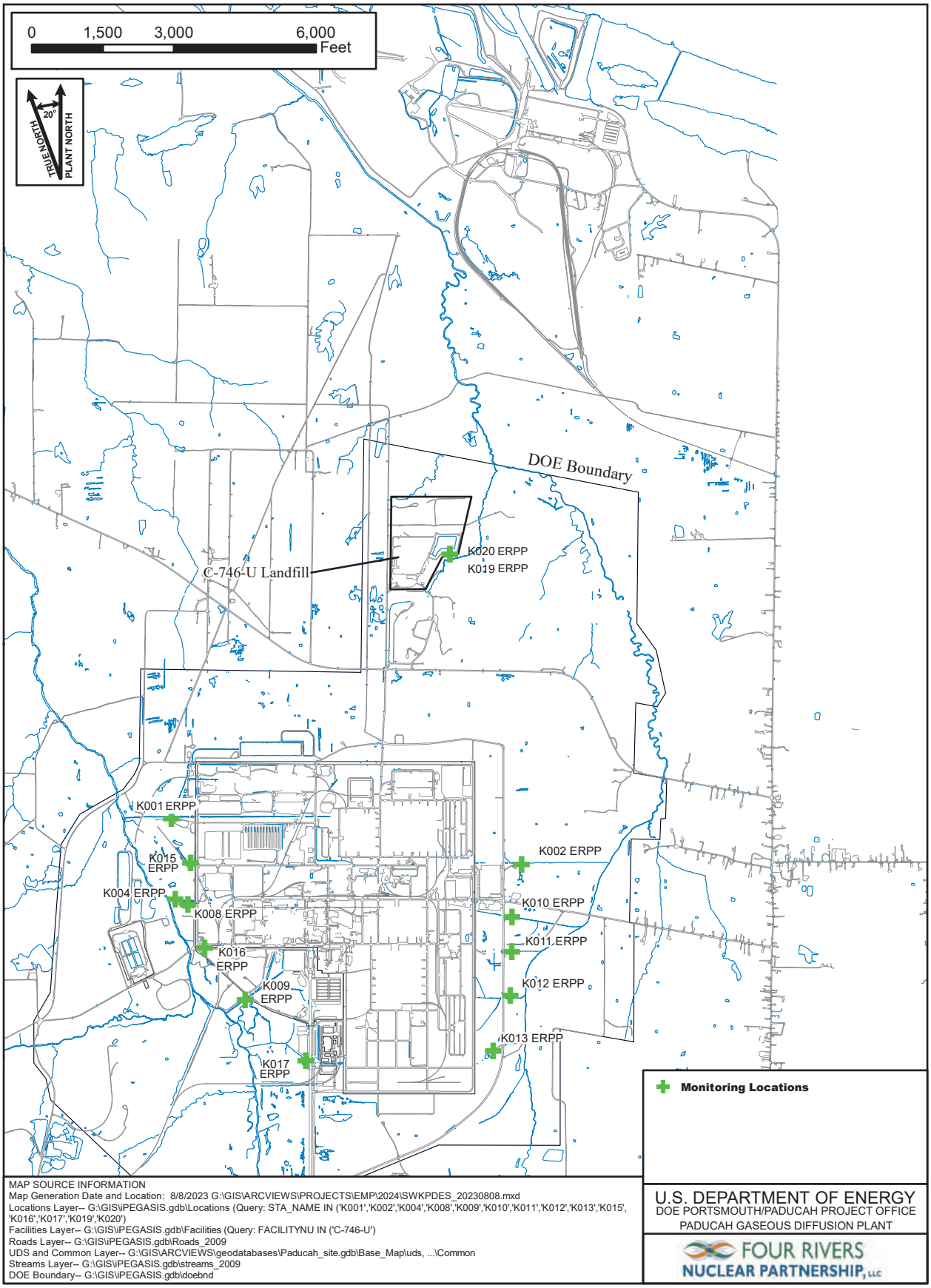

Figure C.14. Surface Water Monitoring Locations near KPDES Outfalls

C.3.3 C-613 NORTHWEST STORM WATER CONTROL FACILITY

C-613 Sediment Basin—Storm Water

Frequency: Quarterly

Driver: Quarterly sampling is required by the *Operation and Maintenance Plan for the Northwest Storm Water Control Facility at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2044&D1/R4, September 2009.

Reported: Reported to KDWM via electronic mail.

Rationale: Prior to a discharge event, the pH and TSS is measured to prevent a discharge that would cause the effluent monitored at KPDES Outfall 001 to exceed regulatory limits. Operational monitoring is not covered under the EM Program but is managed by the operations manager or designee. As specified in the Operation and Maintenance Plan, a sample is to be collected each quarter to confirm the pH and TSS field measurements.

Comments: Table C.36 provides a listing of the analytical parameters. Location of the C-613 Sediment Basin is shown on Figure C.15.

Sampling frequencies and sampling parameters were not modified for this sampling program for FY 2026.

Table C.36. C-613 Sediment Basin Quarterly Analytical Parameters

Field Parameters		
	pH	Turbidity
Wet Chemistry		
160.2	Total Suspended Solids	

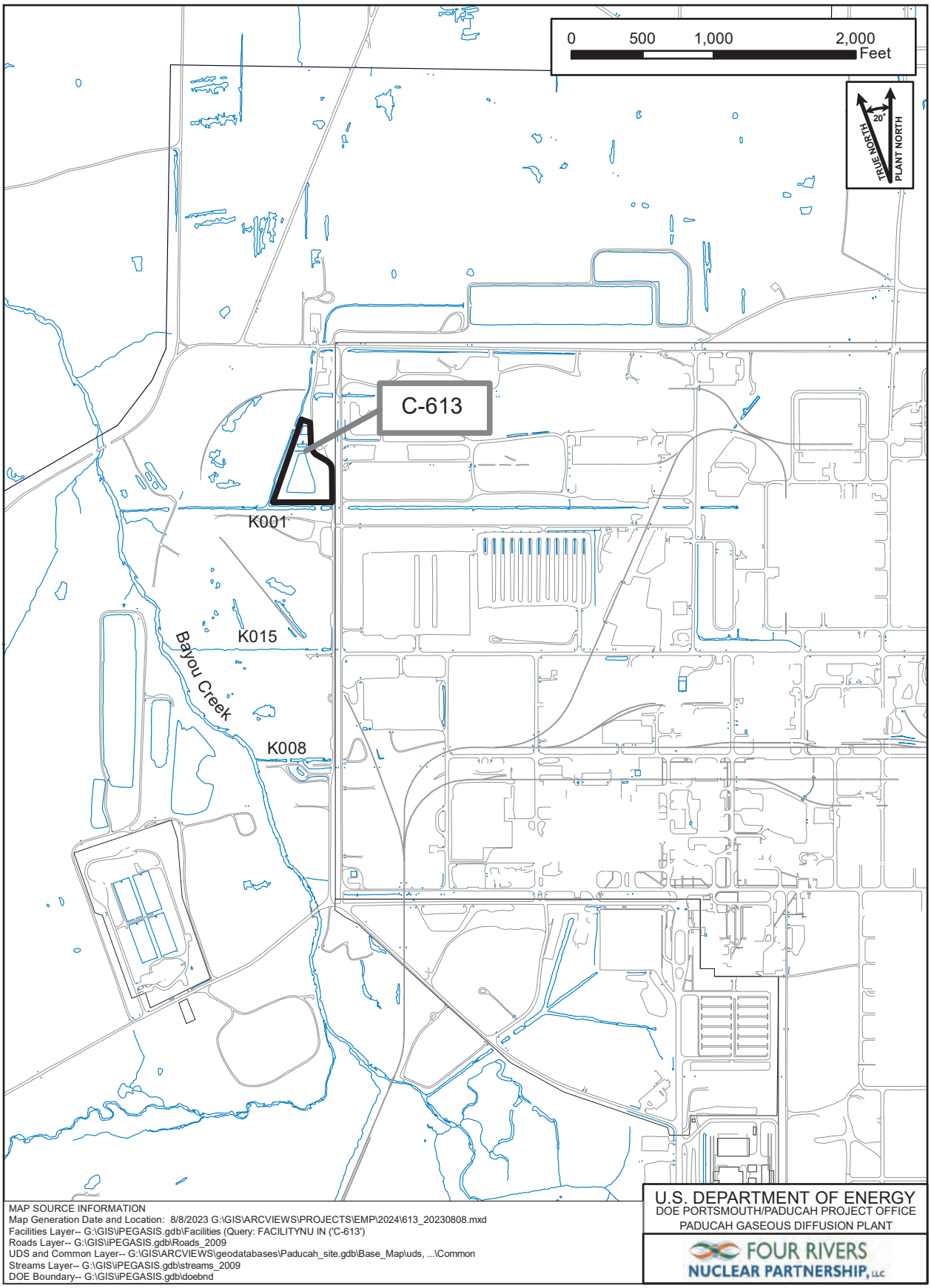

Figure C.15. C-613 Sediment Basin

C.3.4 ENVIRONMENTAL SURVEILLANCE WATERSHED MONITORING PROGRAM

Surface Water Monitoring

Frequency: Quarterly and Annually

Driver: *Record of Decision for Waste Area Groups 1 and 7 for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1470&D2, September 1997, requires monitoring of surface water locations near the C-746-K Landfill. DOE Order 458.1 requires radiological monitoring.

Reported: ASER

Rationale: To monitor potential contamination released into Bayou Creek and Little Bayou Creek surface water from plant operations.

Comments: DOE Order 458.1 requires that environmental surveillance be performed in accordance with DOE-HDBK-1216-2015 Change Notice 1. Sampling locations were selected to determine site-specific radiation exposure pathway analysis. Locations were prioritized for areas of public access, introduction of plant effluents to the environment and verification of the effectiveness of PGDP effluent monitoring.

Background location L1 was chosen to support data comparisons of data generated as part of this program, as well as the ERPP Effluent and Surface Water Runoff program outlined in Section C.3.2.

Settleable solids are analyzed for the background and public water sources locations. Parameters required to determine alpha and beta activity on settleable solids per Section 6.10.7 of DOE-HDBK-1216-2015 Change Notice 1 are noted in Table C.36. These results will be compared to the sediment background data to evaluate if the radionuclide concentration exceeds the standard.

The previous KPDES permit required that 19 in-stream surface water locations be sampled quarterly for PCBs and TCE. The current KPDES permit, permit number KY0004049, does not require this sampling; therefore, this sampling program was modified in FY 2018 to include only locations near C-746-K Landfill (C746K-5 and C746KTB1A) and a seep location (LBCSP5) in Little Bayou Creek. The sampling of surface water near the C-746-K Landfill meets the requirements of the ROD listed above and will be analyzed for volatiles and metals. The seep location will be monitored for TCE and is being sampled for continued evaluation of trends in groundwater upwelling at this location. The surface water monitoring program will be evaluated for FY 2026 to determine if any changes are needed. L14 was added to the quarterly ERPP sampling program in FY 2018 to include monitoring upstream of the C-746-S&T and C-746-U Landfills. During sampling in FY 2018, it was determined that the sample should be collected downstream of L14 in order to obtain enough flow to collect a sample. The location is L14DWN.

In support of the Watershed Monitoring Program, quarterly walkdowns of a portion of Little Bayou Creek will be performed. If any new seeps are found, samples will be collected and analyzed for TCE only.

Table C.37 details the surface water and seep monitoring locations. Tables C.38 and C.39 detail the surface water and seep monitoring analytical parameters.

Table C.37. Surface Water and Seep Quarterly Monitoring Locations (3)

Surface Water (2)	Seep (1)
C746K-5	LBCSP5*
746KTB1A	

*Unable to obtain flow rates.

Table C.38. Surface Water Monitoring Quarterly Analytical Parameters

Field Parameters				
	Alkalinity	Dissolved Oxygen	pH	Temperature
	Conductivity	Flow*		
Metals				
200.8	Aluminum	Cadmium	Magnesium	Sodium
	Arsenic	Calcium	Manganese	Uranium
	Barium	Iron	Nickel	
	Beryllium	Lead	Potassium	
Volatiles				
624.1	1,1-Dichloroethene	*trans*-1,2-Dichloroethene	Trichloroethene	Vinyl Chloride
	cis-1,2-Dichloroethene			

*See Table C.37 for locations where flow rates are not collected.

Table C.39. Seep Monitoring Quarterly Analytical Parameters

Field Parameters				
	Conductivity	Dissolved Oxygen	pH	Temperature
Volatiles				
624.1	Trichloroethene			

Table C.40 lists the ERPP surface water monitoring locations and sampling frequencies. Sampling to support the ERPP will be conducted on a quarterly basis, except for locations L1 and L30, which will be sampled annually. Tables C.41 through C.44 detail the ERPP surface water monitoring analytical parameters by location. Monitoring locations are also shown on Figure C.16.

Table C.40. ERPP Surface Water Monitoring Locations (8)

Quarterly (6)		
L10	L241	L11
L14DWN[a]	L5	L29A[b]
Annual (2)		
L1[b]	L30	

[a] L14DWN is from the North-South Diversion Ditch.
[b] L1 and L29A are background locations.

Table C.41. ERPP Surface Water Monitoring Analytical Parameters for L10, L14DWN, and L241

Radionuclides				
9310	Alpha Activity	Beta Activity		
Tc-02-RC M	Technetium-99			
U-02-RC M	Total Uranium	Uranium-234	Uranium-235	Uranium-238

Table C.42. ERPP Surface Water Monitoring Analytical Parameters for L5

Radionuclides				
9310	Alpha Activity	Beta Activity		
901.1	Cesium-137	Potassium-40	Thorium-234	
1475-00 M	Neptunium-237			
Pu-11-RC M	Plutonium-238	Plutonium-239/240		
Tc-02-RC M	Technetium-99			
U-02-RC M	Total Uranium	Uranium-234	Uranium-235	Uranium-238

Table C.43. ERPP Surface Water Monitoring Analytical Parameters for L11

Radionuclides				
9310	Alpha Activity	Beta Activity		
Th-01-RC M	Thorium-230			
Tc-02-RC M	Technetium-99			
U-02-RC M	Total Uranium	Uranium-234	Uranium-235	Uranium-238

Table C.44. ERPP Surface Water Monitoring Analytical Parameters for L29A, L1, and L30

Radionuclides				
9310	Alpha Activity	Beta Activity		
901.1	Cesium-137			
Am-05-RC M	Americium-241			
1475-00 M	Neptunium-237			
Pu-11-RC M	Plutonium-238	Plutonium-239/240		
Th-01-RC M	Thorium-230			
Tc-02-RC M	Technetium-99			
U-02-RC M	Total Uranium	Uranium-234	Uranium-235	Uranium-238
Wet Chemistry				
SM 2540D	Non-Settleable Solids (NSS)*	Total Suspended Solids (TSS)*		
SM 2540F	Settleable Solids*			
Radionuclides				
9310	Gross Alpha (NSS)*	Gross Beta (NSS)*	Gross Alpha (TSS)*	Gross Beta (TSS)*

*Results are used to determine the alpha and beta activity on settleable solids per Section 6.10.7 of DOE-HDBK-1216-2015 Change Notice 1. The alpha and beta activity on settleable solids will be calculated by the EM project.

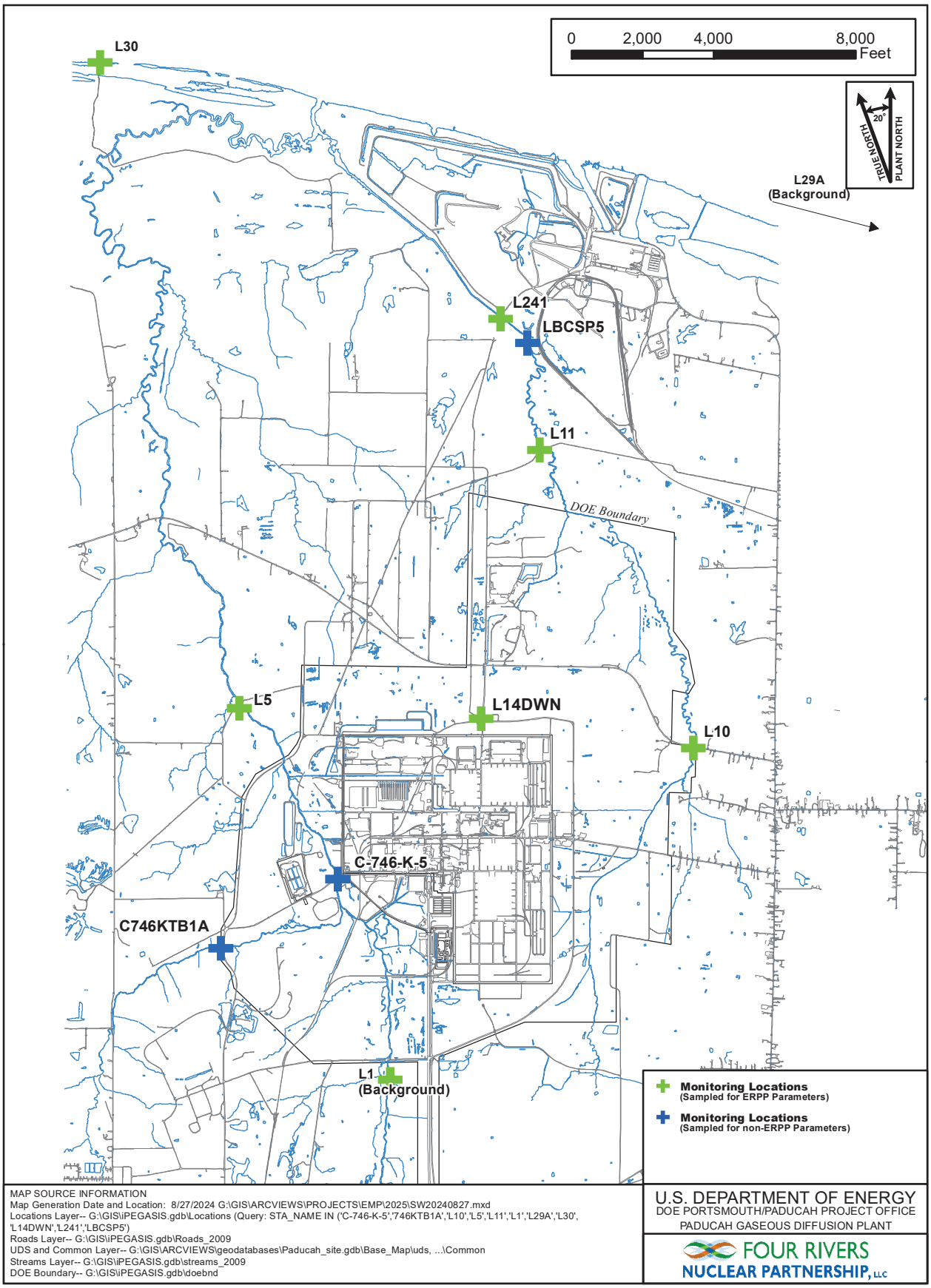

Figure C.16. Surface Water and Seep Monitoring Locations

Sediment Monitoring

Frequency: Semiannually and Annually (ERPP)

Driver: Acquisition of PCB data for future "Impaired Waters of Kentucky" discussions. DOE Order 458.1 requires radiological monitoring. This radiological monitoring will be conducted on an annual basis.

Reported: ASER

Rationale: Monitor potential contamination released into Bayou Creek and Little Bayou Creek sediments from historical plant operations.

Comments: DOE Order 458.1 requires that environmental surveillance of sediment be performed in accordance with DOE-HDBK-1216-2015 Change Notice 1. Sampling locations were selected to determine site-specific radiation exposure pathway analysis and to provide an indication of the accumulation of undissolved radionuclides in the aquatic environment. Locations were prioritized for areas of public access, introduction of plant effluents to the environment, and verification of the effectiveness of the Paducah Site effluent monitoring. Sampling for radionuclides will occur annually.

During FY 2022, the background sediment location along Massac Creek, S28, was no longer safely accessible due to road construction and design changes to the highway that provided access for sampling. A new background location, S29, was established along Massac Creek to replace S28.

Tables C.45 and C.46 detail sediment monitoring locations and analytical parameters, respectively. Monitoring locations are shown on Figure C.17.

Table C.45. Sediment Monitoring Locations (14)

C612	S1	S31
C616	S2	S32
746KTB2	S20*	S33
K001	S27	S34
L194	S29*	

* Background location

Table C.46. Sediment Monitoring Semiannual Analytical Parameters*

PCBs				
8082A	PCB, Total	PCB-1221	PCB-1242	PCB-1254
	PCB-1016	PCB-1232	PCB-1248	PCB-1260

*Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.

Tables C.47 and C.48 detail the sediment monitoring locations and analytical parameters driven by the ERPP. The previous KPDES Permit required that 14 locations be sampled semiannually for PCBs. The current KPDES Permit, Permit No. KY0004049, no longer requires this sampling; however, these locations will continue to be sampled semiannually for PCBs in FY 2026 to evaluate action levels for PCBs in sediment. Monitoring locations are also shown on Figure C.17.

Table C.47. ERPP Sediment Monitoring Locations (6)

Locations		
S1	S20*	S33
S2	S27	S34

* Background location.

Table C.48. ERPP Sediment Monitoring Analytical Parameters*

Radionuclides				
9310	Alpha Activity	Beta Activity		
HASL300 4.5.2.3	Cesium-137			
Am-05-RC M	Americium-241			
1475-00 M	Neptunium-237			
Pu-11-RC M	Plutonium-238	Plutonium-239/240		
Th-01-RC M	Thorium-230			
Tc-02-RC M	Technetium-99			
U-02-RC M	Total Uranium	Uranium-234	Uranium-235	Uranium-238

*Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.

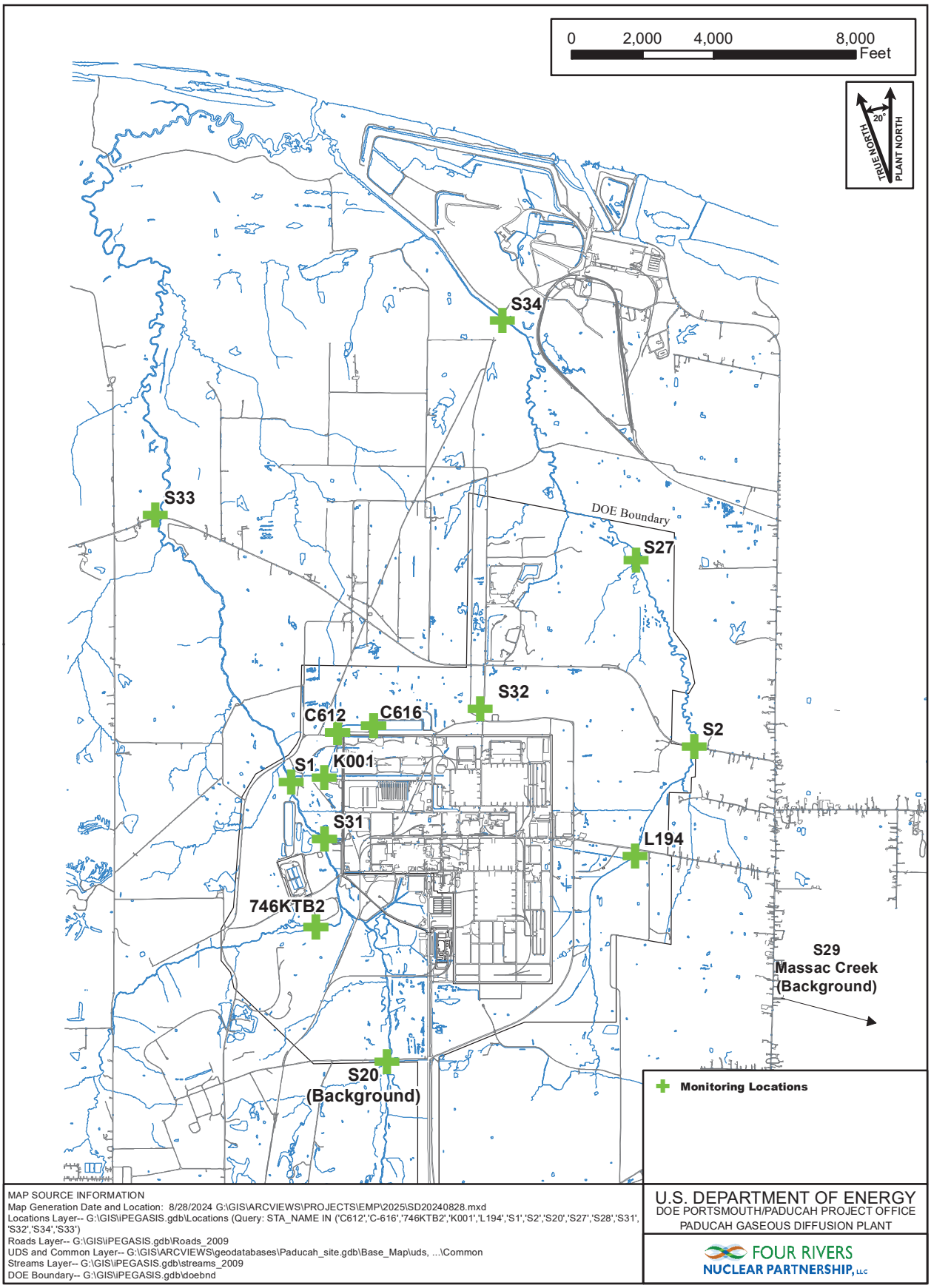

Figure C.17. Sediment and ERPP Sediment Monitoring Locations

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C.4. LANDFILL LEACHATE SAMPLING

C-746-S and C-746-U Landfills Leachate Monitoring

Frequency: Annually

Driver: Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045, issued by KDWM.

Reported: Quarterly Compliance Operating Reports, as required by the applicable solid waste landfill permit and the ASER

Rationale: Solid Waste Landfill Permit SW07300014, SW07300015, SW07300045.

Comments: Leachate sampling is performed and reported collectively for the C-746-S Landfill.

Sampling frequencies and sampling parameters were not modified for this sampling program in FY 2026 because it is permit driven.

Annual leachate parameters for C-746-S and C-746-U Landfills are presented in Table C.49.

Table C.49. C-746-S and C-746-U Landfills Annual Leachate Monitoring Analytical Parameters

Field Parameters					
	Conductivity	Dissolved Oxygen	Eh[a] (approx)	pH	Temperature
Volatiles					
8260D	1,1,1,2-Tetrachloroethane	1,2-Dichlorpropane	Bromodichloromethane	*cis*-1,3-Dichloropropene	trans-1,2-Dichloroethene
	1,1,1-Trichloroethane	1,4-Dichlorobenzene	Bromoform	Dibromochloromethane	*trans*-1,3-Dichloropropene
	1,1,2,2-Tetrachloroethane	2-Butanone	Bromomethane	Dibromomethane	*trans*-1,4-Dichloro-2-Butene
	1,1,2-Trichloroethane	2-Hexanone	Carbon Disulfide	Dimethylbenzene, Total[b]	Trichloroethene
	1,1-Dichloroethane	4-Methyl-2-pentanone	Carbon Tetrachloride	Ethylbenzene	Trichlorofluoromethane
	1,1-Dichloroethene	Acetone	Chlorobenzene	Iodomethane	Vinyl Acetate
	1,2,3-Trichloropropane	Acrolein	Chloroethane	Methylene Chloride	Vinyl Chloride
	1,2-Dibromoethane	Acrylonitrile	Chloroform	Styrene	
	1,2-Dichlorobenzene	Benzene	Chloromethane	Tetrachloroethene	
	1,2-Dichloroethane	Bromochloromethane	cis-1,2-Dichloroethene	Toluene	
8011	1,2-Dibromo-3-chloropropane				
Anions					
9056A	Bromide	Chloride	Fluoride	Nitrate as Nitrogen	Sulfate
300.0	Iodide				
Metals					
6020B	Aluminum	Copper	Silver	Antimony, Dissolved	Selenium, Dissolved
	Antimony	Iron	Sodium	Arsenic, Dissolved	Silver, Dissolved
	Arsenic	Lead	Tantalum	Barium, Dissolved	Tin, Dissolved
	Barium	Magnesium	Thallium	Cadmium, Dissolved	Titanium, Dissolved
	Beryllium	Manganese	Tin[c]	Chromium, Dissolved	Uranium, Dissolved
	Boron	Molybdenum	Titanium[c]	Cobalt, Dissolved	Vanadium, Dissolved
	Cadmium	Nickel	Uranium	Copper, Dissolved	Zinc, Dissolved
	Calcium	Potassium	Vanadium	Lead, Dissolved	
	Chromium	Rhodium	Zinc	Manganese, Dissolved	
	Cobalt	Selenium		Nickel, Dissolved	
7470A	Mercury				
PCBs					
8082A	PCB, Total	PCB-1221	PCB-1242	PCB-1254	PCB-1268
	PCB-1016	PCB-1232	PCB-1248	PCB-1260	
Radionuclides					
9310	Alpha Activity	Beta Activity	Dissolved Alpha[c]	Dissolved Beta[c]	
901.1	Cesium-137[c]	Thorium-234[c]	Cesium-137, Dissolved[c]	Cobalt-60, Dissolved[c]	Thorium-234, Dissolved[c]
	Cobalt-60[c]				
AN-1418	Radium-226				
904.0M	Radium-228[d]				
905.0M	Strontium-90				
906.0M	Tritium				
Am-05-RC M	Americium-241[c]	Americium, Dissolved[c]			
1475-00 M	Neptunium-237[c]	Neptunium, Dissolved[c]			
Pu-11-RC M	Plutonium-239/240[c]	Plutonium-239/240, Dissolved[c]			
Th-01-RC M	Thorium-230	Thorium-232[d]	Thorium-230, Dissolved[c]		
U-02-RC M	Total Uranium	Uranium-234[c]	Uranium-235[c]	Uranium-238[c]	
	Total Uranium, Dissolved[c]	Uranium-234, Dissolved[c]	Uranium-235, Dissolved[c]	Uranium-238, Dissolved[c]	
Tc-02-RC M	Technetium-99	Technetium-99, Dissolved[c]			
Wet Chemistry					
130.2	Hardness - Total as CaCO3[c]				
160.1	Total Dissolved Solids				
160.2	Total Suspended Solids				
365.4	Phosphorus[c]				
410.4	Chemical Oxygen Demand				
1664A	Oil and Grease[c]				
9012B	Cyanide				
9020B	Total Organic Halides				
9060A	Total Organic Carbon				
SM 5210B	Carbonaceous Biochemical Oxygen Demand[c]				

[a] Oxidation-reduction potential calibrated as Eh.

[b] Xylenes

[c] Permit does not require analysis of this parameter. The parameter is analyzed in support of leachate treatment and discharge to KPDES Outfalls 004 and 008 at the C-615 Wastewater Treatment Facility.

[d] Permit does not require analysis of radium-228 and thorium-232. These parameters are analyzed in support of demonstrating compliance with DOE Order 458.1 for the C-746-U Landfill.

C-404 Low-Level Radioactive Waste Burial Ground Leachate Monitoring

Frequency: As needed

Driver: The leachate parameters are required to be sampled per the Hazardous Waste Management Facility Permit, Number KY8-890-008-982.

Reported: C-404 Semiannual Groundwater Report and the ASER

Rationale: Hazardous Waste Management Facility Permit, KY8-890-008-982

Comments: Sampling frequencies and sampling parameters were not modified for this sampling program in FY 2026 because it is permit driven.

Leachate analytical parameters for C-404 Landfill are presented in Table C.50.

Table C.50. C-404 Landfill Leachate Monitoring Analytical Parameters

Field Parameters				
	Conductivity	Eh[a] (approx)	pH	Temperature
	Dissolved Oxygen			
Anions				
9056A	Fluoride			
Metals				
6020B	Arsenic	Chromium	Lead	Silver
	Barium	Copper	Nickel	Uranium
	Cadmium	Iron	Selenium	Zinc
7470A	Mercury			
PCBs[b]				
8082A	PCB, Total	PCB-1221	PCB-1242	PCB-1254
	PCB-1016	PCB-1232	PCB-1248	PCB-1260
Volatiles				
8260D	Trichloroethene			
Radionuclides				
901.1	Cesium-137[c]			
1475-00 M	Neptunium-237			
Pu-11-RC M	Plutonium-239/240			
Th-01-RC M	Thorium-230			
U-02-RC M	Uranium-234	Uranium-235	Uranium-238	
Tc-02-RC M	Technetium-99			
Wet Chemistry				
350.1	Ammonia as Nitrogen			

[a] Oxidation-reduction potential calibrated as Eh.
[b] PCBs are not required by the Hazardous Waste Management Facility Permit for disposal purposes.
[c] Cesium is not required by the Hazardous Waste Management Facility Permit but is requested per management decision.

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C.5. EXTERNAL GAMMA AND NEUTRON RADIOLOGICAL MONITORING

Frequency: Collected continuously and analyzed quarterly; external gamma dosimeters at 67 monitoring locations and neutron dosimeters at seven monitoring locations are changed quarterly for external radiation monitoring.

Driver: DOE Order 458.1

Reported: ASER

Rationale: Monitor the effective dose from site operations in order to ensure operational limits are not exceeded.

Comments: Three new environmental dosimeter locations (EDL-98, EDL-99, and EDL-100) have been added to the environmental dosimeter surveillance network outside the Property Protection Area and inside the DOE boundary on the east side of the Paducah Site. These locations are shown in Figure C.18. Table C.51 provides a listing of dosimeters. Figure C.18 shows environmental dosimeter monitoring locations. EDLs within Parcel 1 are scheduled to be removed once the land transfer has been finalized.

Table C.51. Environmental Dosimeters (67)

EDL-1	EDL-22	EDL-61	EDL-75	EDL-90
EDL-2	EDL-25	EDL-62	EDL-76	EDL-91
EDL-3	EDL-30	EDL-63	EDL-77	EDL-92
EDL-4	EDL-35	EDL-64	EDL-78	EDL-93
EDL-5	EDL-37	EDL-65	EDL-79	EDL-94
EDL-6	EDL-38	EDL-66	EDL-80	EDL-95
EDL-7	EDL-40	EDL-67	EDL-81	EDL-96
EDL-9	EDL-46	EDL-68	EDL-82	EDL-97
EDL-12	EDL-50	EDL-69	EDL-83	EDL-98
EDL-13	EDL-52	EDL-70	EDL-84	EDL-99
EDL-14	EDL-53	EDL-71	EDL-86	EDL-100
EDL-15	EDL-58	EDL-72	EDL-87	
EDL-16	EDL-59	EDL-73	EDL-88	
EDL-19	EDL-60	EDL-74	EDL-89	

EDL = environmental dosimeter location

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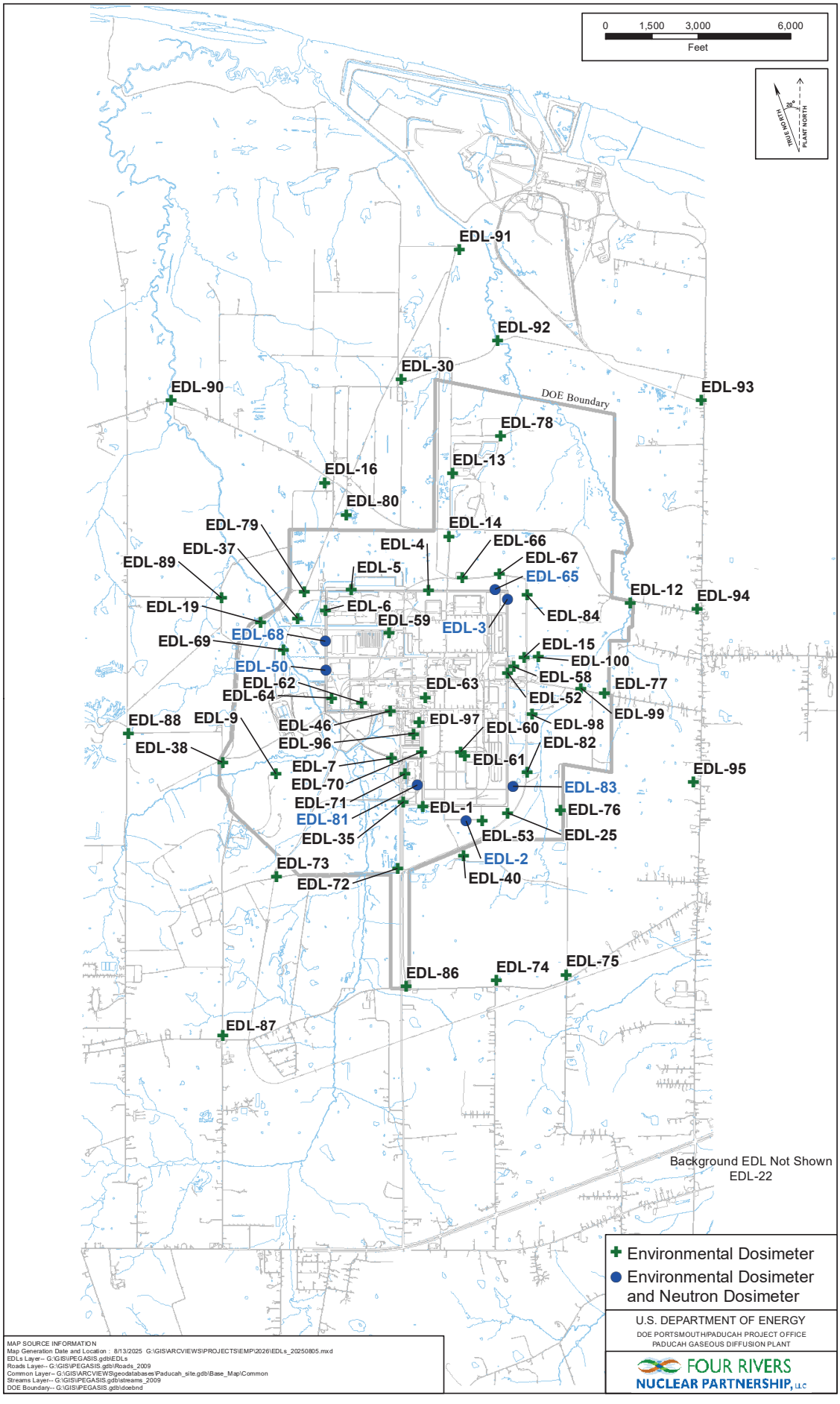

Figure C.18. Environmental Dosimeter Locations

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C.6. AMBIENT AIR MONITORING

Frequency: Weekly and Quarterly

Driver: *National Emission Standards for Hazardous Air Pollutants Management Plan for Emission of Radionuclides for the U.S. Department of Energy Operations at the Paducah Site, Paducah, Kentucky*, CP2-EC-0002, October 2019 (NESHAP)

Reported: NESHAP Annual Report and ASER

Rationale: Monitor radionuclide emissions from Paducah Site activities.

Comments: Ambient air is monitored to verify the concentrations of radionuclides from all sources, including fugitive and diffuse. The ambient air monitoring network is comprised of nine air monitoring stations surrounding the site, including one background location.

Sampling frequencies and sampling parameters were not modified for this sampling program for FY 2026.

Location identifications are found in Table C.52. Filter samples are collected on a weekly basis and analyzed for gross alpha and beta, as shown in Table C.53. The laboratory retains the filter and compiles all of the weekly samples for each quarterly period. At the end of each quarter, the filters are compiled and analyzed for the isotopes defined in the quarterly analysis table, C.54. Locations are shown on Figure C.19.

Table C.52. Ambient Air Monitoring Locations (9)

AMDBCP*	AMD002	AMD612
AMD57	AMDNE	AMD746S
AMD012	AMD015	AMD746U

* AMDBCP is a background location.

Table C.53. Ambient Air Monitoring Weekly Analytical Parameters

Radionuclides		
9310	Alpha Activity	Beta Activity

Table C.54. Ambient Air Monitoring Quarterly Analytical Parameters

Radionuclides			
HASL300 4.5.2.3	Thorium-234	Uranium-238	
Am-05-RC M	Americium-241		
1475-00 M	Neptunium-237		
Pu-11-RC M	Plutonium-238	Plutonium-239/240	
U-02-RC M	Uranium-234	Uranium-235	Uranium-238
Tc-02-RC M	Technetium-99		

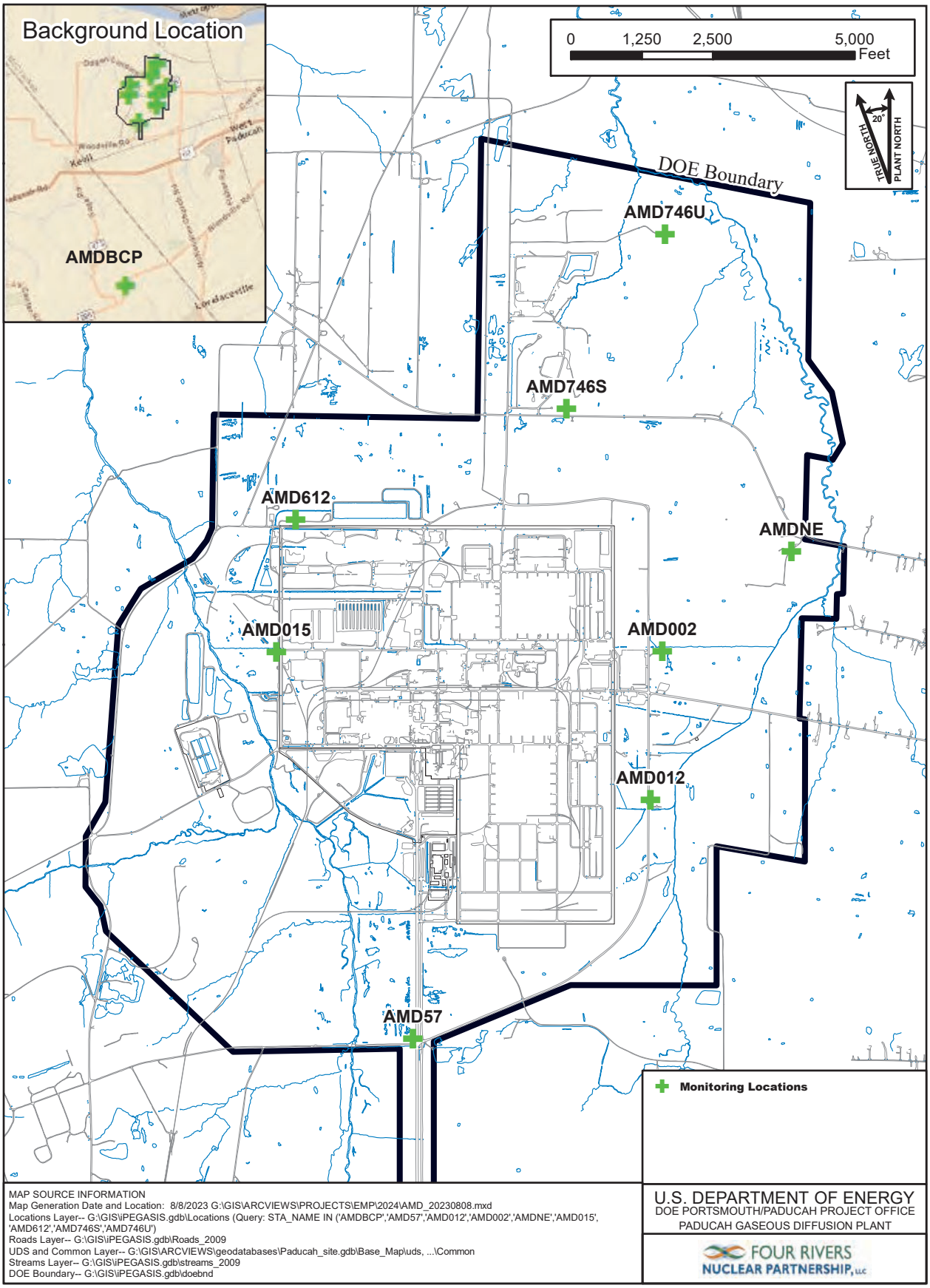

Figure C.19. DOE Ambient Air Monitoring Stations

APPENDIX D

ENVIRONMENTAL MONITORING QUALITY ASSURANCE PROJECT PLAN

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CONTENTS

QAPP WORKSHEETS

ACRONYMS

CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
COPC	chemical (or radionuclide) of potential concern
CPAP	contractor performance assurance program
CRQL	contract-required quantitation limit
CVAA	cold vapor atomic absorption
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DQI	Data Quality Indicator
DQO	data quality objective
ECD	electron capture detector
EM	environmental monitoring
EMP	Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
FID	flame ionization detector
FRNP	Four Rivers Nuclear Partnership, LLC
GC	gas chromatography
GC-MS	gas chromatography mass spectrometer
ICP-AES	inductively coupled plasma atomic emission spectroscopy
ICP-MS	inductively coupled plasma mass spectrometer
ICP-OES	inductively coupled optical emission spectroscopy
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
LCS	laboratory control sample
LRGA	Lower Regional Gravel Aquifer
MCL	maximum contaminant level
MDA	minimum detectable activity
MDL	method detection limit
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
MW	monitoring well
N/A	not applicable
NAL	no action level
NDIRD	nondispersive infrared detector
O	Order
OREIS	Oak Ridge Environmental Information System
PEGASIS	PPPO Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
PM	project manager
PPPO	Portsmouth/Paducah Project Office
PQL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

QSM	Quality Systems Manual
RPD	relative percent difference
SMO	sample management office
SOP	standard operating procedure
SVOC	semivolatile organic compound
TPD	training position description
UCRS	Upper Continental Recharge System
UPS	United Parcel Service
URGA	Upper Regional Gravel Aquifer
UFP	Uniform Federal Policy
VOC	volatile organic compound

INTRODUCTION

The Environmental Monitoring (EM) Quality Assurance Project Plan (QAPP) has been prepared by Four Rivers Nuclear Partnership, LLC, (FRNP) based on the updated programmatic QAPP, DOE/LX/07-2502&D1, *Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan*, May 2024, which was developed in alignment with the *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP Manual) guidelines for QAPPs, March 2005, as updated by the *Optimized UFP-QAPP Worksheets* guidance, March 2012.

This EM QAPP is Appendix D to the *Environmental Monitoring Plan Fiscal Year 2026 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR12. It describes the project-specific quality assurance (QA) activities that will be conducted to support ongoing monitoring programs of varying media (e.g., groundwater, surface water, and sediment) at the site.

This EM QAPP does the following:

- Refers to the standard operating procedures (SOPs) already developed for the site and in place;
- Identifies analytical limits, units of reporting, and methods requested by each program; these values will be used to procure laboratory services. If the laboratory cannot meet the limits, units, or methods specified in the QAPP, the project manager (PM) and/or compliance organization will be contacted so a determination can be made if the proposed conditions are acceptable to meet current project objectives. If the conditions are found to be acceptable, the Sample Management Office (SMO) will document the acceptance with rationale;
- Identifies analytical limits and methods that may be required by a given project [e.g., permits, maximum contaminant level (MCL), etc.];
- Incorporates the *Paducah Gaseous Diffusion Plant Data Management Plan*, DOE/LX/07-2498&D1; and
- Standardizes data validation processes by linking the process to SOPs (see Worksheet #21).

This document supports the EM plan and procedures *Quality Assured Data*, CP3-ES-5003, and *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0063.

This QAPP focuses on providing fixed laboratory methods, although Appendix C of the Environmental Monitoring Plan (EMP) identifies field measurements requested on each of the programs. Field methods [e.g., x-ray fluorescence, colorimetric methods for polychlorinated biphenyls (PCBs), and radionuclide surveys] that may be implemented in support of the programs within this EMP are not covered in either of the discussion of the EMP or within this QAPP.[1]

[1] Project-specific QAPPs contain information concerning implemented field methods. FRNP's Radiological Control Manual (CP2-RP-0002) sets requirements associated with the use and calibration of survey instruments, survey documentation, survey review, and training.

This QAPP does not cover the analysis of the environmental dosimeters for gamma and neutron emissions although the program is detailed with sample locations in Appendix C of the EMP. The analysis of the environmental dosimeters is discussed in CP5-ES-0103, *Reference Guide for Environmental Radiation Protection*. Additionally, samples collected in the ambient air monitoring program are not covered in this QAPP. QA information regarding the ambient air monitoring program is provided in CP2-EC-0002, *National Emission Standards for Hazardous Air Pollutants Management Plan for Emission of Radionuclides for the U.S. Department of Energy Operations at the Paducah Site, Paducah, Kentucky* and CP2-ES-0107, *Ambient Air Data Evaluation Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

Worksheets #10 and #17 are not included in this QAPP. Based on the programmatic QAPP, completion of these worksheets in project-specific QAPPs is at the discretion of the project. Considering the information is already included in the body of the EMP, the decision was made to not include these worksheets in this QAPP.

Worksheets #12 and #15 were adapted from the programmatic QAPP. Only those worksheets containing parameters required under the EMP and identified in the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health*, DOE/LX/07-0107&D2/R15/V1 (herein known as RMD) as contaminants of concern (COCs) at the site were included in this QAPP.

This QAPP provides limited information on some analyses considered as miscellaneous tests. Miscellaneous tests are defined in Worksheet #23. Samples for these analyses are collected using SOPs employed by the sampling staff and quality assurance standards specified in procedures such as CP3-ES-5003, *Quality Assured Data*. They are not listed in Worksheets #12 and #15 because they are not considered COCs at the site. These parameters are requested by programs within Appendix C of the EMP because they are indicators of overall water quality or, in some instances, are required as conditions of permits (e.g., toxicity, ferrous iron, and coliform).

Title: QAPP for Environmental Monitoring Plan FY 2026, Paducah Gaseous Diffusion Plant
Revision Number: 0
Revision Date: 10/2025

QAPP Worksheets #1 and #2. Title and Approval Page

Site Name/Project Name: Paducah Gaseous Diffusion Plant/Environmental Monitoring
Site Location: Paducah, Kentucky
Site Number/Code: KY8890008982
Contractor Name: FRNP
Contractor Number: Contract No. DE-EM0004895
Contract Title: Paducah Gaseous Diffusion Plant Paducah Deactivation and Remediation Project
Work Assignment Number: Not Applicable (N/A)

Document Title: *Environmental Monitoring Quality Assurance Project Plan*

Lead Organization: U.S. Department of Energy (DOE)

Preparer's Name and Organizational Affiliation: Brett Smothers, Four Rivers Nuclear Partnership, LLC

Preparer's Address, Telephone Number, and Email Address: 5511 Hobbs Road, Kevil, KY, 42053, Phone (270) 441-6613, brett.smothers@pad.pppo.gov

Preparation Date (Month/Year): 10/2025

Document Control Number: CP2-ES-0006/FR12, Appendix D

FRNP Environmental Services Director	BRUCE FORD (Affiliate) Digitally signed by BRUCE FORD (Affiliate) Date: 2025.10.13 09:09:35 -05'00' Signature Bruce Ford	Date:
FRNP Environmental Monitoring Manager	BRETT SMOTHERS (Affiliate) Digitally signed by BRETT SMOTHERS (Affiliate) Date: 2025.10.08 09:53:53 -05'00' Signature Brett Smothers	Date:
FRNP Environmental Stewardship Manager	KATRINA HALL (Affiliate) Digitally signed by KATRINA HALL (Affiliate) Date: 2025.10.13 06:33:21 -05'00' Signature Katrina Hall	Date:
FRNP Sample Management Office Manager	JAIME MORROW (Affiliate) Digitally signed by JAIME MORROW (Affiliate) Date: 2025.10.13 07:31:17 -05'00' Signature Jaime Morrow	Date:
FRNP Quality Assurance/Quality Control Program Manager	JENNIE FREELS (Affiliate) Digitally signed by JENNIE FREELS (Affiliate) Date: 2025.10.08 15:11:55 -05'00' Signature Jennie Freels	Date:

QAPP Worksheets #1 and #2. Title and Approval Page (Continued)

1. Identify guidance used to prepare QAPP:

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

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

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

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

   Intergovernmental Data Quality Task Force, March 2012. *Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets*, 42 pages.

   Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, *Volume 1 Human Health*, DOE/LX/07-0107&D2/R15/V1.

   Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, DOE/LX/07-2502&D1.

2. Identify regulatory program: The EMP is not submitted to regulatory agencies for review or approval; however, many of the sampling programs defined within the EMP are required by regulatory decision documents, permits or DOE Orders (O); therefore, those regulatory programs are pertinent. They include the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707; Kentucky Department for Environmental Protection (KDEP) (Kentucky Division of Waste Management, Kentucky Division of Water); and DOE Orders.

3. Identify approval entity: DOE

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

5. List dates of scoping sessions that were held: July 1, 2025—Data Quality Objective (DQO) Session

QAPP Worksheets #1 and #2. Title and Approved Page (Continued)

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

Title:	Approval Date(s):
Paducah Gaseous Diffusion Plant Data Management Plan, DOE/LX/07-2458&D2	September 2021
Paducah Gaseous Diffusion Plant Data Management Plan, DOE/LX/07-2498&D1	February 2024
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2409&D1	February 2017
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2421&D1	April 2018
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2439&D1	April 2019
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2446&D1	April 2020
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2459&D1	April 2021
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2479&D1	March 2022
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2490&D1	April 2023
Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan, Paducah, Kentucky, DOE/LX/07-2502&D1	May 2024

QAPP Worksheets #1 and #2. Title and Approved Page (Continued)

7. List organizational partners (stakeholders) and connection with lead organization:

   U.S. Environmental Protection Agency (EPA) Region 4 [Federal Facility Agreement (FFA) member]; KDEP (regulates hazardous and solid waste landfills, effluent discharge permits, FFA member)

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

9. Table 1 provides a crosswalk of required QAPP elements.

   This QAPP includes 26 combined worksheets that are required based on UFP-QAPP guidance, as updated by the optimized worksheet guidance (37 total worksheets). Worksheets #10 and #17 have been omitted because the problem definitions are described in detail within the body of the EMP, of which this QAPP is an appendix. Each of these worksheets has been reviewed to ensure the accuracy of the information presented in this QAPP.

Table 1. Crosswalk: UFP-QAPP Workbook to 2106-G-05-QAPP

Optimized UFP-QAPP Worksheets		CIO 2106-G-05 QAPP Guidance Section	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks and Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC Summary	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Require
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

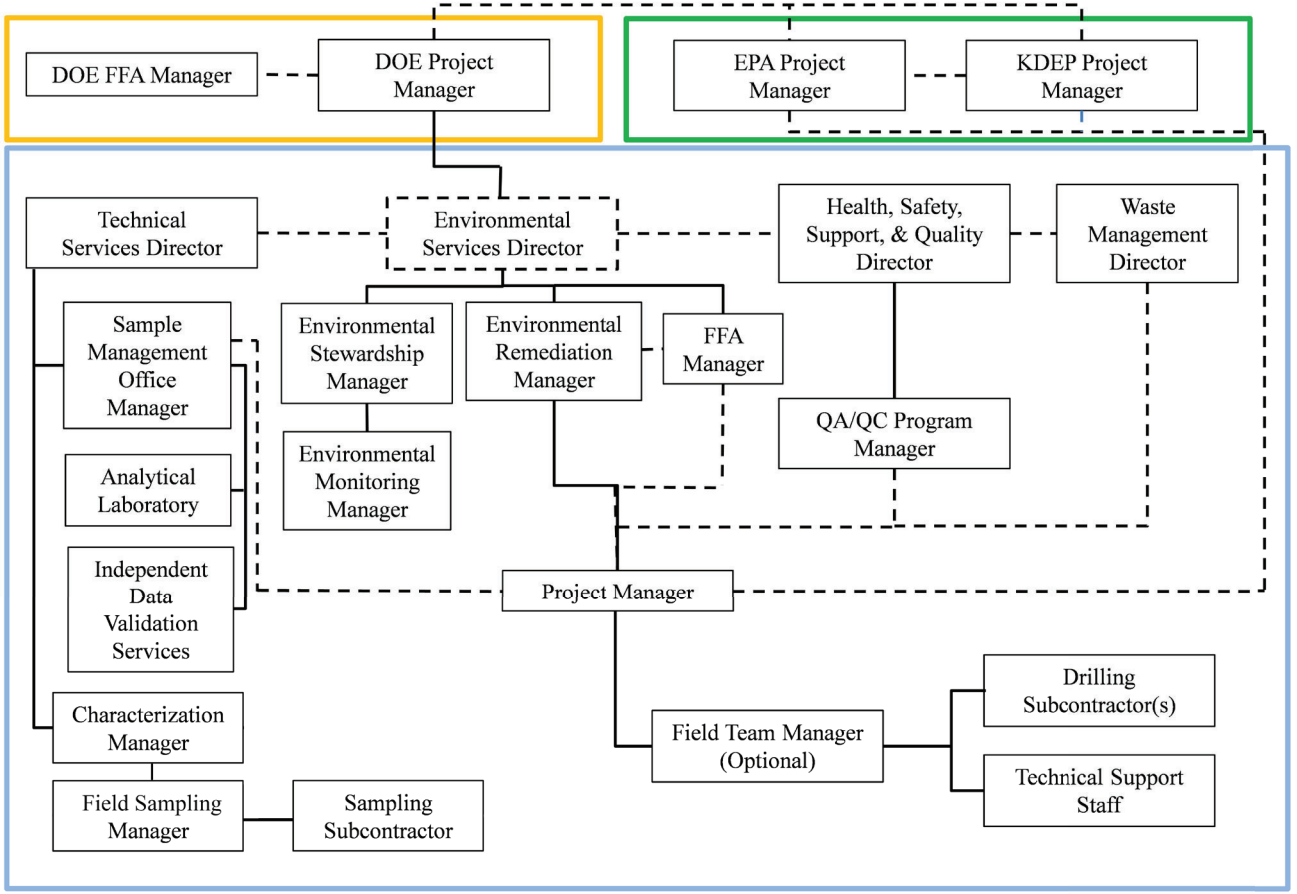
QAPP Worksheets #3 and #5.
Project Organization and QAPP Distribution

Distribution is based on the position title. A change in the individual within an organization will not trigger a resubmittal of the QAPP. DOE may choose to update this worksheet and submit page changes to the document holders. Alternatively, as with other changes to the approved project-specific QAPP, personnel changes may be tracked and included as an attachment to the QAPP. Managers are responsible for distribution to their staffs.

Controlled copies of the QAPP will be distributed according to the distribution list below. This list will be updated, as needed, and kept by the FRNP Records Management Department. Each person receiving a controlled copy also will receive any updates/revisions. If uncontrolled copies are distributed, it will be the responsibility of the person distributing the uncontrolled copy to provide updates/revisions.

Position Title	Organization	QAPP Recipients	Current Telephone Number	Current Email Address	Document Control Number
Paducah Site Lead	DOE	April Ladd	(270) 441-6843	april.ladd@pppo.gov	1
PM	DOE	Angus MacKelvey	(270) 349-7526	angus.mackelvey@pppo.gov	2
FFA Manager	DOE	April Ladd	(270) 441-6843	april.ladd@pppo.gov	3
Environmental Services Director	FRNP	Bruce Ford	(270) 441-5357	bruce.ford@pad.pppo.gov	4
Environmental Stewardship Manager	FRNP	Katrina Hall	(270) 441-5204	katrina.hall@pad.pppo.gov	5
Environmental Radiation Protection	FRNP	Kevin Funke	(270) 557-8009	kevin.funke@pad.pppo.gov	6
FFA Manager	FRNP	Megan Mulry	(270) 441-5705	megan.mulry@pad.pppo.gov	7
QA/Quality Control (QC) Program Manager	FRNP	Jennie Freels	(270) 441-5407	jennie.freels@pad.pppo.gov	8
SMO Manager	FRNP	Jaime Morrow	(270) 441-5508	jaime.morrow@pad.pppo.gov	9
Environmental Monitoring Manager	FRNP	Brett Smothers	(270) 441-6613	brett.smothers@pad.pppo.gov	10
Field Sampling Manager	FRNP	Chris Skinner	(270) 441-5675	chris.skinner@pad.pppo.gov	11

QAPP Worksheets #3 and #5. (Continued)
Project Organization and QAPP Distribution



Note: DOE personnel are in Orange Box, Regulatory personnel are in Green Box, and DOE Prime Contractor personnel are in Blue Box.

QAPP Worksheets #4, #7, and #8.
Personnel Qualifications and Sign-Off Sheet

ORGANIZATION: Four Rivers Nuclear Partnership, LLC

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date*
Bruce Ford	Environmental Services Director	> 4 years relevant work experience	No specialized training or certification. See Training Position Description (TPD).	
Brett Smothers	Environmental Monitoring Manager	> 4 years relevant work experience	No specialized training or certification. See TPD.	
Katrina Hall	Environmental Stewardship Manager	> 4 years relevant work experience	No specialized training or certification. See TPD.	
Jaime Morrow	SMO Manager	> 4 years relevant work experience	No specialized training or certification. See TPD.	
Chris Skinner	Field Sampling Manager	> 4 years relevant work experience	No specialized training or certification. See TPD.	
Matthew Richardson	Data Validator	Bachelor degree plus relevant experience	No specialized training or certification.	Follows FRNP data validation plans
Kevin Funke	Environmental Radiation Protection	> 4 years relevant work experience	No specialized training or certification. See TPD.	

ORGANIZATION: Laboratory

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date*
Laboratory PM	Analytical Laboratory PM	> 4 years relevant work experience	No specialized training or certification. See TPD.	Follows the laboratory statement of work and adheres to requirements in the current U.S. Department of Defense (DoD)/DOE Quality Systems Manual (QSM) for Environmental Laboratories when applicable

*Signature indicates personnel have read and agree to implement this QAPP as written.

QAPP Worksheet #6.
Communication Pathways

NOTE: Formal communication across company or regulatory boundaries occurs via letter. Other forms of communication, such as email, telephone calls, meetings, etc., will occur throughout the project. Regular project communication among DOE, the Site Contractor, and the regulatory agencies concerning project progress is expected. Deviations from the EMP/QAPP will be communicated upward through the chain of command to regulatory agencies using communication tools commensurate with the issue.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	DOE, EPA, KDEP	DOE PM: Angus MacKelvey EPA Remedial PM: Brian Begley, KDEP PM: April Webb	angus.mackelvey@pppo.gov begley.brian@epa.gov april.webb@ky.gov	Formal communication among DOE, EPA, and KDEP.
Field progress reports	FRNP	FRNP Environmental Services Director: Bruce Ford	bruce.ford@pad.pppo.gov	Formal communication between DOE and contractor for the Environmental Monitoring Project.
Stop work due to safety issues	FRNP	FRNP Environmental Services Director: Bruce Ford and FRNP Health, Safety, Support, and Quality Director: Duke Moscon	bruce.ford@pad.pppo.gov duke.moscon@pad.pppo.gov	FRNP will communicate work stoppages to DOE PM as required by procedure.
QAPP changes during project execution	FRNP	FRNP Environmental Services Director: Bruce Ford and FRNP Quality Assurance/Quality Control Program Manager: Jennie Freels	bruce.ford@pad.pppo.gov jennie.freels@pad.pppo.gov	Obtain approval from DOE PM. Submit QAPP amendments to DOE, KDEP, and EPA.
Field corrective actions	FRNP	FRNP Environmental Services Director: Bruce Ford	bruce.ford@pad.pppo.gov	Field corrective actions will need to be approved by FRNP Project Director and communicated to the DOE, EPA, and KDEP PMs.
Analytical laboratory interface	FRNP	FRNP SMO Manager: Jaime Morrow	jaime.morrow@pad.pppo.gov	Communication between FRNP and analytical laboratory.

QAPP Worksheet #6. (Continued)
Communication Pathways

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Laboratory quality control variances	Contracted Laboratory	Laboratory PM: Valerie Davis (GEL), Jason McDonald (EMSL)	vsd@gel.com jmcdonald@emsl.com	Notify FRNP SMO. FRNP SMO will notify FRNP PM to determine corrective actions.
Analytical corrective actions	Contracted Laboratory, FRNP	Laboratory PM: Valerie Davis (GEL), Jason McDonald (EMSL), FRNP SMO Manager: Jaime Morrow	vsd@gel.com jmcdonald@emsl.com jaime.morrow@pad.pppo.gov	Notify FRNP SMO. FRNP SMO will notify the project.
Data verification issues (e.g., incomplete records)	A2RGC, LLC, FRNP	Data Validator: Matthew Richardson, FRNP SMO Manager: Jaime Morrow	mrichardson@geosyntec.com jaime.morrow@pad.pppo.gov	Data verification issues will be reported to the FRNP SMO.
Data validation issues (e.g., noncompliance with procedures)	A2RGC, LLC, FRNP	Data Validator: Matthew Richardson, FRNP SMO Manager: Jaime Morrow	mrichardson@geosyntec.com jaime.morrow@pad.pppo.gov	Issues with data quality will be reported to the FRNP SMO.

NOTE: This QAPP is position-based with names of the current positions presented. In the event the contractor changes and the position titles change, DOE will notify EPA and KDEP of the change.

QAPP Worksheet #9.
Project Planning Session Summary

Project scoping is the key to the success of any project and is part of the systematic planning process. The preparation of this QAPP included review of past documents produced and planning meetings to establish the objectives of the project. It was determined that a formal DQO session was needed for the FY 2026 EMP. The worksheet identifies participants who discussed the sampling strategy in the DQO session held on July 1, 2025.

Name of Project: Environmental Monitoring Plan Fiscal Year 2026
Date of Session: July 1, 2025
Scoping Session Purpose: Identify sampling strategies of EM programs

Position Title	Affiliation	Name	Phone #	Email Address	Project Role
Environmental Protection Specialist	DOE	Angus MacKelvey	(270) 349-7526	angus.mackelvey@pppo.gov	PM
Scientist	Enterprise Technical Assistance Services, Inc.	Jennifer Johnson	(270) 832-0319	jennifer.johnson@pppo.gov	Subject Matter Expert
Senior Radiation Protection Specialist	DOE	Joshua Koster	(270) 816-6790	joshua.koster@pppo.gov	Subject Matter Expert
Environmental Stewardship Manager	FRNP	Katrina Hall	(270) 441-5204	katrina.hall@pad.pppo.gov	Environmental Stewardship Manager
Environmental Monitoring Manager	FRNP	Brett Smothers	(270) 441-6613	brett.smothers@pad.pppo.gov	Environmental Monitoring Manager

QAPP Worksheet #9. (Continued)
Project Planning Session Summary

Notes/comments: Discussed proposed changes to sampling programs in Appendix C for FY 2026 EMP and that the draft EMP would be submitted to DOE for review by September 1, 2025.

Consensus decisions made: Submit draft FY 2026 EMP by August 27, 2025, for DOE review and comment.

Action items:

Action	Responsible Party	Due Date
Submit draft FY 2026 EMP	Brett Smothers	9/1/2025

QAPP Worksheet #11.
Project/Data Quality Objectives

Step 1. State the Problem:

Problem Statement: Determine environmental monitoring requirements set forth by the following drivers:

DOE O 458.1, Chg 5 (Admin Chg), *Radiation Protection of the Public and the Environment*
DOE-HDBK-1216-2015 Change Notice 1, *Environmental Radiological Effluent Monitoring and Environmental Surveillance*
Kentucky Permits
CERCLA Actions
FFA

Problem Approach:

- The planning team will review plans, regulations, DOE Orders, and permits to determine monitoring requirements.
- Planning Team: DOE and FRNP
- Determine Resources:
  - Schedule: Implement FY 2026 EMP, October 1, 2025
  - Budget: Based upon scope
  - Personnel: FRNP

Step 2: Identify the Goal of the Study

Obtain data to:

- Demonstrate compliance (effluent, rad dose, etc.)
- Demonstrate effectiveness of chosen remedy (Pump & Treat, etc.)
- Provide for modeling efforts (groundwater surveillance)
- Identify potential adverse environmental impacts; supporting Integrated Safety Management System through an Environmental Management System

Data required to be reported via permits or other regulatory decision documents will be reported as required (Appendix C of the EMP lists applicable reports).

QAPP Worksheet #11.
Project/Data Quality Objectives

Step 3. Identify Information Inputs:

Identify Information Inputs (What Information Do We Need)

- Permit or decision document specifies parameters and frequency for demonstration of compliance and remedy effectiveness
- Models and historical data sets provide for data needs

Step 4. Identify the Boundaries of the Study:

Permits, chosen remedies, and modeling are ongoing until permit modifications or final remedies are chosen or demonstrated.

Data needs to meet the measurement quality objective and data quality indicators established by the systematic planning process consistent with procedures and plans *Quality Assured Data*, CP3-ES-5003, and *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0063.

Step 5. Develop the Analytical Approach:

Identify methods, parameters, project action limits, method detection limits (MDLs), sample locations, sample frequencies.

Sampling locations and frequencies, along with required list of method and analytes, is specified by program within Appendix C of the EMP. Both field screening and on-site and off-site laboratory analyses are used for data collection.

Step 6. Specify Performance or Acceptance Criteria:

Data needs to meet the measurement quality objective and data quality indicators established by the systematic planning process consistent with procedures and plans *Quality Assured Data*, CP3-ES-5003, and *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0063.

Obtained data may:

- Provide data for use in the Annual Site Environmental Report
- Identify DOE operations pollutant contributions
- Provide ancillary data that may be required to assess the consequences of a spill or release

QAPP Worksheet #11. (Continued)
Project/Data Quality Objectives

- Identify significant changes in sample analytical results
- Support or supplement data needs for CERCLA actions
- Provide a mechanism for long-term data collection needs under the FFA

EMP does not address reports or modeling development or a show of noncompliance. Example: An exceedance at a Kentucky Pollutant Discharge Elimination System (KPDES) outfall does not indicate an objective within the EMP was not met.

Step 7. Develop the Detailed Plan for Obtaining Data:

- Procedures and Plans
- Analytical Methods
- Statements of Work
- DOE Consolidated Audit Program (DOECAP) Laboratories
- *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0063
- Paducah Project Environmental Measurements System (PEMS), Paducah Oak Ridge Environmental Information System (OREIS), Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System (PEGASIS)

QAPP Worksheet #12-A.
Measurement Performance Criteria (PCBs, Sediment)

Matrix	Sediment
Analytical Group[a]	PCBs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	SW-846-8082 See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 35%	Field Duplicates	S
		Accuracy	RPD—≤ 40%	Dual column analysis	A
		Accuracy/Bias	% recovery[e]	Laboratory Sample Spikes[f]	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[g]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference
Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[f] Laboratory only spikes LCS/MS/MSDs with Aroclors 1016 and 1260, which is consistent with DoD/DOE QSM and method.
[g] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-B.
Measurement Performance Criteria (Radionuclides, Sediment)

Matrix	Sediment
Analytical Group[a]	Radionuclides (total uranium[b], uranium-234, uranium-235, uranium-238)
Concentration Level	Low

Sampling Procedure[c]	Analytical Method/SOP[d,e]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	Alpha spectroscopy[f] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[g]	Laboratory Sample Spikes[h]	A
		Accuracy/Bias Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[i]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference
Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.
[a] If information varies within an analytical group, separate by individual analyte.
[b] The total uranium listed represents the total of the uranium isotopes that is analyzed by alpha spectroscopy.
[c] Reference number from QAPP Worksheet #21.
[d] Reference number from QAPP Worksheet #23.
[e] Appendix C contains the version of the analytical method to be used.
[f] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.
[g] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[h] For uranium isotopes reported by alpha spectroscopy, MS/MSD is not required, which is consistent with DoD/DOE QSM.
[i] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinsate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-C.
Measurement Performance Criteria (Radionuclides, Sediment)

Matrix	Sediment
Analytical Group[a]	Radionuclides (americium-241, neptunium-237, plutonium-238, plutonium-239/240, thorium-230)
Concentration Level	Low

Sampling Procedure[b]	**Analytical Method/SOP**[c,d]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria (MPC)**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
See Worksheet #21	Alpha spectroscopy[e] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[f]	Laboratory Sample Spikes[g]	A
		Accuracy/Bias Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[h]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference
Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.
[f] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[g] For radionuclides reported by alpha spectroscopy, MS/MSD is not required consistent with DoD/DOE QSM.
[h] Completeness is calculated by two methods:
- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-D.
Measurement Performance Criteria (Radionuclides, Sediment)

Matrix	Sediment
Analytical Group[a]	Radionuclides (cesium-137)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	Gamma spectroscopy[e] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 50%	Field Duplicates	S
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[f]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference
Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.
[f] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-E.
Measurement Performance Criteria (Radionuclides, Sediment)

Matrix	Sediment
Analytical Group[a]	Radionuclides (technetium-99)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	Liquid scintillation[e] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 50%	Field Duplicates	S
		Accuracy/Bias	% recovery[f]	Laboratory Sample Spikes[g]	A
		Accuracy/Bias Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[h]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference
Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.
[f] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[g] For radionuclides reported by liquid scintillation, MS/MSD is not required consistent with DoD/DOE QSM.
[h] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-F.
Measurement Performance Criteria (VOCs, Water)

Matrix	Water
Analytical Group[a]	Volatile Organic Compounds (VOCs)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	SW-846-8260 and EPA-624.1 See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[e]	Laboratory Sample Spikes	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Trip Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[f]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[f] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-G.
Measurement Performance Criteria (Metals, Water)

Matrix	Water
Analytical Group[a]	Metals (all except mercury)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	EPA-200.8/ SW-846-6010/6020 See Worksheet #23	Precision—Lab	RPD—≤ 20%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[e]	Laboratory Sample Spikes	A
		Accuracy/Bias	RPD = 80-120%	Interference Check Sample	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[f]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[f] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-H.
Measurement Performance Criteria (Mercury, Water)

Matrix	Water
Analytical Group[a]	Metals (Mercury)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	SW-846-7470 and EPA 1613E See Worksheet #23	Precision—Lab	RPD—≤ 20%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[e]	Laboratory Sample Spikes	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[f]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[f] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-I.
Measurement Performance Criteria (PCBs, Water)

Matrix	Water
Analytical Group[a]	PCBs
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	SW-846-8082 and EPA-608.3 See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy	RPD—≤ 40%	Dual column analysis	A
		Accuracy/Bias	% recovery[e]	Laboratory Sample Spikes[f]	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[g]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference
[a] If information varies within an analytical group, separate by individual analyte.
[b] Reference number from QAPP Worksheet #21.
[c] Reference number from QAPP Worksheet #23.
[d] Appendix C contains the version of the analytical method to be used.
[e] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.
[f] Laboratory only spikes LCS/MS/MSDs with Aroclors 1016 and 1260 consistent with DoD/DOE QSM and methods.
[g] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-J.
Measurement Performance Criteria (Radionuclides, Water)

Matrix	Water
Analytical Group[a]	Radionuclides (americium-241, neptunium-237, plutonium-238, plutonium-239/240, thorium-230, total uranium,[b] uranium-234, uranium-235, uranium-238)
Concentration Level	Low

Sampling Procedure[c]	**Analytical Method/SOP**[d,e]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria (MPC)**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
See Worksheet #21	Alpha spectroscopy[f] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[g]	Laboratory Sample Spikes[h]	A
		Accuracy/Bias Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[i]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference

[a] If information varies within an analytical group, separate by individual analyte.

[b] The total uranium listed represents the total of the uranium isotopes that is analyzed by alpha spectroscopy.

[c] Reference number from QAPP Worksheet #21.

[d] Reference number from QAPP Worksheet #23.

[e] Appendix C contains the version of the analytical method to be used.

[f] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.

[g] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

[h] For radionuclides reported by alpha spectroscopy, MS/MSD is not required consistent with DoD/DOE QSM.

[i] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-K.
Measurement Performance Criteria (Radionuclides, Water)

Matrix	Water
Analytical Group[a]	Radionuclides (cesium-137)
Concentration Level	Low

Sampling Procedure[b]	**Analytical Method/SOP**[c,d]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria (MPC)**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
See Worksheet #21	Gamma spectroscopy[e] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[f]	90%	Data completeness check	S&A

MDA = minimum detectable activity; RPD = relative percent difference

[a] If information varies within an analytical group, separate by individual analyte.

[b] Reference number from QAPP Worksheet #21.

[c] Reference number from QAPP Worksheet #23.

[d] Appendix C contains the version of the analytical method to be used.

[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.

[f] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-L.
Measurement Performance Criteria (Radionuclides, Water)

Matrix	Water
Analytical Group[a]	Radionuclides (technetium-99)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	Liquid scintillation[e] See Worksheet #23	Precision—Lab	RPD—≤ 25%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[f]	Laboratory Sample Spikes[g]	A
		Accuracy/Bias Contamination	No target compounds > MDA	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > MDA	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > MDA	Equipment Rinseate Blanks	S
		Completeness[h]	90%	Data completeness check	S&A

MDA = minimum detectable activity
RPD = relative percent difference

[a] If information varies within an analytical group, separate by individual analyte.

[b] Reference number from QAPP Worksheet #21.

[c] Reference number from QAPP Worksheet #23.

[d] Appendix C contains the version of the analytical method to be used.

[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.

[f] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

[g] For radionuclides reported by liquid scintillation, MS/MSD is not required consistent with DoD/DOE QSM.

[h] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #12-M.
Measurement Performance Criteria (Radionuclides, Water)

Matrix	Water
Analytical Group[a]	Radionuclides/Water Policy (uranium-234, uranium-235, uranium-238)
Concentration Level	Low

Sampling Procedure[b]	Analytical Method/SOP[c,d]	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
See Worksheet #21	Inductively coupled plasma-mass spectroscopy[e] See Worksheet #23	Precision—Lab	RPD—≤ 20%	Laboratory Duplicates	A
		Precision	RPD—≤ 25%	Field Duplicates	S
		Accuracy/Bias	% recovery[f]	Laboratory Sample Spikes	A
		Accuracy/Bias Contamination	No target compounds > PQL	Method Blanks/Instrument Blanks	A
		Accuracy/Bias Contamination	No target compounds > PQL	Field Blanks	S
		Accuracy/Bias Contamination	No target compounds > PQL	Equipment Rinseate Blanks	S
		Completeness[g]	90%	Data completeness check	S&A

PQL = practical quantitation limit; RPD = relative percent difference

[a] If information varies within an analytical group, separate by individual analyte.

[b] Reference number from QAPP Worksheet #21.

[c] Reference number from QAPP Worksheet #23.

[d] Appendix C contains the version of the analytical method to be used.

[e] Appendix C of the EMP references the analytical laboratory's SOP; however, for the purpose of the QAPP, general analytical methodology is denoted to document the preferred analytical method should another laboratory be utilized.

[f] Percent recovery is laboratory-specific, calculated from studies performed every six months. Percent recovery ranges will be provided in the laboratory data packages based on the most current study.

[g] Completeness is calculated by two methods:

- Field completeness is calculated by dividing the actual number of samples collected (excluding field blanks, equipment rinseate blanks, and trip blanks) by the number of samples planned and then multiplied by 100 to obtain the percentage.
- Analytical completeness is calculated by dividing the number of valid analytical results reported by the number of analytical results requested and then multiplied by 100 to obtain the percentage.

QAPP Worksheet #13.
Secondary Data Uses and Limitations

Secondary Data Type	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Factors Affecting Reliability and Limitations on Data Use
OREIS Database	Various	Various	Data will be used to determine the nature and extent of sediment, surface water, and groundwater contamination.	Data have been verified, assessed, and validated (if validation is required). Rejected data will not be used if there is sufficient time to resample and obtain a result that will not be rejected during validation.
Historical Documentation	Various	Various	Information will be used as guidance on related project work.	Information from historical documents will be limited to the available documentation as it relates to a specific project. Use of historical data may be limited based on how long ago the data were collected and whether site conditions have changed since data collection.

NOTE: OREIS is the repository for Paducah Gaseous Diffusion Plant (PGDP) environmental and waste characterization analytical results. OREIS is a limited access database. Environmental data are downloaded from OREIS to PEGASIS periodically (usually on a quarterly basis). The general public can access data in PEGASIS.

QAPP Worksheets #14 and #16.
Project Tasks & Schedule

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Routine sampling conducted throughout the fiscal year	FRNP	October 1, 2025	September 30, 2026	See Appendix C of the EMP for deliverable information	See Appendix C of the EMP for deliverable information.

QAPP Worksheet #15.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

The application of Worksheet #15 should be evaluated via a graded approach because the sampling dictated within the EMP is with the objective of monitoring and not as a site investigation or remediation effort wherein an "action limit" may appropriately describe the objective of the sampling efforts.

For example, Worksheets #15-A through #15-F pertain to the parameters of groundwater; however, trichloroethene (TCE) detected in a groundwater well located in the close proximity to the DOE boundary that had never shown TCE may have a differing response action than a response to the exact same TCE concentration in a well located within the groundwater plume which has shown TCE at or above that concentration since monitoring commenced in the 1990s. A better approach would be comparing the data sets to the historical data for the specific locations in question.

Worksheets #15-A through #15-I combine groundwater and surface water information. Laboratory methods for groundwater and surface water typically do not vary. Action limits between the two may differ. For example, the laboratory will use the same method for the requested analytes on a groundwater sample as they do on a surface water sample regardless of if it was collected from a groundwater MW or from an effluent outfall location. But, response actions to the same concentration for a given parameter may or may not differ between the two samples because it would be dependent upon the program under which it is monitored and the location from where the samples were collected. Therefore, the matrices for "water" in the following spreadsheets are shown with groundwater being the primary driver with the exception of the last worksheet, Worksheet #15-I, which specifically addresses the surface water samples required by KPDES permit that have a permit limit associated with the parameter excluding toxicity. The action limits included in worksheets #15-A through #15-I are well below MCL or derived concentration technical standard values. These action limits were included in the Programmatic QAPP for those projects that perform routine monitoring. These limits will allow those projects to evaluate trends at lower concentrations successfully.

QAPP Worksheet #15-A.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (VOCs, Water)

Matrix: Water
Analyte Group: VOCs

VOC	Chemical Abstracts Service (CAS) Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (µg/L)	MDL (µg/L)
1,1,1-Trichloroethane	71-55-6	200/801	MCL/NAL	Yes	1	0.333
1,1,1,2-Tetrachloroethane	79-34-5	N/A	N/A	No	1	0.333
1,1,2,2-Tetrachloroethane	79-34-5	N/A	N/A	No	1	0.333
1,1,2-Trichloroethane	79-00-5	5.00/0.0415	MCL/NAL	Yes	1	0.333
1,1-Dichloroethane	75-34-3	N/A/2.75	MCL/NAL	No	1	0.333
1,1-Dichloroethene	75-35-4	7.0/28.5	MCL/NAL	Yes	1	0.333
1,2,3-Trichlorobenzene	87-61-6	N/A	N/A	No	1	0.333
1,2,3-Trichloropropane	96-18-4	N/A	N/A	No	1	0.333
1,2,4-Trichlorobenzene	120-82-1	N/A	N/A	No	1	0.333
1,2-Dibromoethane	106-93-4	N/A	N/A	No	1	0.333
1,2-Dichlorobenzene	95-50-1	N/A	N/A	No	1	0.333
1,2-Dichloroethane	107-06-2	N/A/0.171	MCL/NAL	Yes	1	0.333
1,2-Dichloropropane	78-87-5	N/A	N/A	No	1	0.333
1,3-Dichlorobenzene	541-73-1	N/A	N/A	No	1	0.333
1,4-Dichlorobenzene	106-46-7	N/A	N/A	No	1	0.333
2-Butanone	78-93-3	N/A	N/A	No	5	1.667
2-Chloroethyl vinyl ether	110-75-8	N/A	N/A	No	5	1.667
2-Hexanone	591-78-6	N/A	N/A	No	5	1.667
4-Methyl-2-pentanone	108-10-1	N/A	N/A	No	5	1.667
Acetone	67-64-1	N/A	N/A	No	5	1.744
Acrolein	107-02-8	N/A	N/A	No	5	1.667
Acrylonitrile	107-13-1	0.052/0.0523	Tapwater[d]/NAL	Yes	5	1.667
Benzene	71-43-2	5.0/0.455	MCL/NAL	Yes	1	0.333

Matrix: Water
Analyte Group: VOCs

VOC	Chemical Abstracts Service (CAS) Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (µg/L)	MDL (µg/L)
Bromochloromethane	74-97-5	N/A	N/A	No	1	0.333
Bromodichloromethane	75-27-4	80.0[f]/0.134	MCL/NAL	Yes	1	0.333
Bromoform	75-25-2	N/A	N/A	No	1	0.333
Bromomethane	74-83-9	N/A	N/A	No	1	0.337
Carbon Disulfide	75-15-0	N/A	N/A	No	5	1.667
Carbon Tetrachloride	56-23-5	5.0/0.455	MCL/NAL	Yes	1	0.333
Chlorobenzene	108-90-7	N/A	N/A	No	1	0.333
Chloroethane	75-00-3	N/A	N/A	No	1	0.333
Chloroform	67-66-3	80/0.221	MCL/NAL	Yes	1	0.333
Chloromethane	74-87-3	N/A	N/A	No	1	0.333
cis-1,2-Dichloroethene	156-59-2	70/2.52	MCL/NAL	Yes	1	0.333
cis-1,3-Dichloropropene	10061-01-5	N/A	N/A	No	1	0.333
Cyclohexane	110-82-7	N/A	N/A	No	1	0.333
Dibromochloromethane	124-48-1	N/A	N/A	No	1	0.333
Dibromomethane	74-95-3	N/A	N/A	No	1	0.333
Dichlorodifluoromethane	75-71-8	N/A/19.7	MCL/NAL	No	1	0.355
Ethylbenzene	100-41-4	700/1.50	MCL/NAL	Yes	1	0.333
Iodomethane	74-88-4	N/A	N/A	No	5	1.667
Isopropylbenzene	98-82-8	N/A	N/A	No	1	0.333
Methyl acetate	79-20-9	N/A	N/A	No	5	1.667
Methylcyclohexane	108-87-2	N/A	N/A	No	1	0.333
Methylene chloride	75-09-2	N/A	N/A	No	5	0.5
Styrene	100-42-5	N/A	N/A	No	1	0.333
tert-Butyl methyl ether	1634-04-4	N/A	N/A	No	1	0.333
Tetrachloroethene	127-18-4	5.0/4.06	MCL/NAL	Yes	1	0.333
Toluene	108-88-3	1000/110	MCL/NAL	No	1	0.333
trans-1,2-Dichloroethene	156-60-5	100/6.78	MCL/NAL	Yes	1	0.333
trans-1,3-Dichloropropene	10061-02-6	N/A	N/A	No	1	0.333

Matrix: Water
Analyte Group: VOCs

VOC	Chemical Abstracts Service (CAS) Number	Project Action Limit/NAL (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (µg/L)	MDL (µg/L)
trans-1,4-Dichloro-2-Butene	110-57-6	N/A	N/A	No	5	1.667
Trichloroethene	79-01-6	5.0/0.283	MCL/NAL	Yes	1	0.333
Trichlorofluoromethane	75-69-4	N/A	N/A	No	1	0.333
Trichlorotrifluoroethane	76-13-1	N/A/1020	MCL/NAL	No	5	1.667
Vinyl Acetate	108-05-4	N/A	N/A	No	5	1.667
Vinyl Chloride	75-01-4	2.0/0.0188	MCL/NAL	Yes	1	0.333
Xylenes, Total	1330-20-7	10,000/19.3	MCL/NAL	Yes	3	1
o-Xylene	95-47-6	19/19.3	Tapwater[d]/NAL	Yes	1	0.333
m,p-Xylene	179601-23-1	19/19.3[e]	Tapwater[d]/NAL	Yes	2	0.667

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MCL = maximum contaminant level (see EPA Regional Screening Levels https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
MDL = method detection limit
NAL = no action level for child resident scenario taken from the RMD
PQL = practical quantitation limit
VOC = volatile organic compound

[a] This QAPP references the MCLs (if available) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario.
[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from chemicals of potential concern retained as COCs in risk assessments previously performed at PGDP.
[c] The analytical laboratory may not be able to meet the NALs established by the RMD and MCLs reproduced in the RMD. For cases where the PQL is above the PAL/NAL, FRNP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] Tapwater—Source: EPA regional screening levels, Tapwater Supporting Table (Target Risk = 1E-6, Hazard Quotient = 0.1) May 2024 (see EPA Regional Screening Levels https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).
[e] Project action limit for m-Xylene used.
[f] MCL is for the sum of the concentrations for trihalomethanes.

QAPP Worksheet #15-B.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Metals, Water)

Matrix: Water
Analytical Group: Metals

Metal	CAS Number	Project Action Limit/NAL (mg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (mg/L)	MDL (mg/L)
Aluminum	7429-90-5	2.0/2.00	Tapwater[d]/NAL	Yes	0.05	0.0193
Antimony	7440-36-0	0.0060/0.000779	MCL/NAL	Yes	0.003	0.001
Arsenic	7440-38-2	0.010/0.0000517	MCL/NAL	Yes	0.005	0.002
Barium	7440-39-3	2.0/0.377	MCL/NAL	Yes	0.004	0.00067
Beryllium	7440-41-7	0.0040/0.00246	MCL/NAL	Yes	0.0005	0.0002
Boron	7440-42-8	0.40/0.399	Tapwater[d]/NAL	Yes	0.015	0.0052
Cadmium	7440-43-9	0.0050/0.000184	MCL/NAL	Yes	0.001	0.0003
Chromium (total)	7440-47-3	0.10/2.25[e]	MCL/NAL	Yes	0.01	0.003
Cobalt	7440-48-4	0.0006/0.000601	Tapwater[d]/NAL	Yes	0.002	0.0003
Copper	7440-50-8	1.3/0.0799	MCL/NAL	Yes	0.002	0.0003
Iron	7439-89-6	1.4/1.40	Tapwater[d]/NAL	Yes	0.1	0.033
Lead	7439-92-1	0.015/0.015	MCL[f]/NAL	Yes	0.002	0.0005
Manganese	7439-96-5	0.043/0.0434	Tapwater[d]/NAL	Yes	0.005	0.001

QAPP Worksheet #15-B. (Continued)
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Water
Analytical Group: Metals

Metal	CAS Number	Project Action Limit/NAL (mg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (mg/L)	MDL (mg/L)
Mercury	7439-97-6	0.0020/0.000566[g]	MCL/NAL	Yes	0.0002	0.000067
Molybdenum	7439-98-7	0.010/0.00998	Tapwater[d]/NAL	Yes	0.001	0.0002
Nickel	7440-02-0	0.039/0.0392[g]	Tapwater[d]/NAL	Yes	0.002	0.0006
Selenium	7782-49-2	0.050/0.00998	MCL/NAL	Yes	0.005	0.002
Silver	7440-22-4	0.0094/0.00941	Tapwater[d]/NAL	Yes	0.001	0.0003
Thallium	7440-28-0	0.0020/0.000020[g]	MCL/NAL	Yes	0.002	0.0006
Uranium	7440-61-1	0.030/0.000399[g]	MCL/NAL	Yes	0.0002	0.000067
Vanadium	7440-62-2	0.0086/0.00864	Tapwater[d]/NAL	Yes	0.02	0.0033
Zinc	7440-66-6	0.60/0.600	Tapwater[d]/NAL	Yes	0.02	0.0033

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MCL = maximum contaminant level
MDL = method detection limit
NAL = no action level for child resident scenario from the RMD
PQL = practical quantitation limit

[a] This QAPP references the MCLs (or EPA screening level for tapwater if no MCL) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario.
[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.
[c] The analytical laboratory may not be able to meet the NALs established by the RMD and MCLs reproduced in the RMD. For cases where the PQL is above the PAL/NAL, FRNP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.
[d] Tapwater-Source: EPA regional screening levels, Tapwater Supporting Table (Target Risk = 1E-6, Hazard Quotient = 0.1) May 2024 (see EPA Regional Screening Levels https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).
[e] An NAL is not available for chromium (total); therefore, the NAL for chromium III was used.
[f] The MCL established by the EPA for lead is based on a treatment technique action level of 0.015 mg/L.
[g] The PAL/NAL values were derived for metal salts; the CAS number is presented for the elemental form.

QAPP Worksheet #15-C.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (PCBs, Water)

Matrix: Water
Analytical Group: PCBs

PCB	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQLs (µg/L)	MDLs (µg/L)
Total PCBs	1336-36-3	0.50/0.0436	MCL/NAL	Yes	0.1	0.0333
Aroclor-1016	12674-11-2	0.50[d]/0.140	MCL/NAL	Yes	0.1	0.0333
Aroclor-1221	11104-28-2	0.50[d]/0.00471	MCL/NAL	Yes	0.1	0.0333
Aroclor-1232	11141-16-5	0.50[d]/0.00471	MCL/NAL	Yes	0.1	0.0333
Aroclor-1242	53469-21-9	0.50[d]/0.00785	MCL/NAL	Yes	0.1	0.0333
Aroclor-1248	12672-29-6	0.50[d]/0.00785	MCL/NAL	Yes	0.1	0.0333
Aroclor-1254	11097-69-1	0.50[d]/0.00785	MCL/NAL	Yes	0.1	0.0333
Aroclor-1260	11096-82-5	0.50[d]/0.00785	MCL/NAL	Yes	0.1	0.0333

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the RMD
PCB = polychlorinated biphenyl
PQL = practical quantitation limit

[a] This QAPP references the MCLs (if available) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.

[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.

[c] The analytical laboratory may not be able to meet the NALs established by the RMD and MCLs reproduced in the RMD. For cases where the PQL is above the PAL/NAL, FRNP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.

[d] MCL for Total PCBs.

QAPP Worksheet #15-D.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Radionuclides, Water)

Matrix: Water
Analytical Group: Radionuclides

Radionuclide	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c] MDAs (pCi//L)
Americium-241	14596-10-2	0.0677	NAL	Yes	1
Cesium-137[f]	10045-97-3	1.71	NAL	Yes	10 (75[d])
Neptunium-237[f]	13994-20-2	0.0783	NAL	Yes	1 (8[d])
Plutonium-238	13981-16-3	0.0156	NAL	Yes	1 (4[d])
Plutonium-239	15117-48-3	0.0603	NAL	Yes	1 (4[d])
Plutonium-240	14119-33-6	0.0318	NAL	Yes	1 (4[d])
Technetium-99	14133-76-7	4 mrem/year-dose[e], 900/19.0	MCL/NAL	Yes	25 (50[d])
Thorium-230	14269-63-7	0.0166	NAL	Yes	1 (4[d])
Thorium-232	7440-29-1	0.0363	NAL	Yes	1
Uranium-234[f]	13966-29-5	10.24/0.0162	MCL[g]/NAL	Yes	1 (17[d])
Uranium-235[f]	15117-96-1	6/0.0714	MCL[g]/NAL	Yes	1 (18[d])
Uranium-238[f]	7440-61-1	9.99/0.0158	MCL[g]/NAL	Yes	1 (19[d])

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDA = minimum detectable activity
NAL = no action level for child resident scenario from the RMD

[a] This QAPP references the MCLs (if available) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.
[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.
[c] Radionuclide parameters will be reported per laboratory SOPs and the DoD/DOE QSM.
[d] The value in parentheses reflects MDAs requested under the Environmental Radiation Protection Program.
[e] The value derived by the EPA from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/sites/default/files/2015-06/documents/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *Federal Register*, http://nepis.epa.gov (document number 570-Z-91-049 [search term: 570Z91049]).
[f] PAL/NAL was derived considering the contribution from short-lived decay products.
[g] Based on RMD.

QAPP Worksheet #15-E.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Radionuclides, Water)

Matrix: Water

Analytical Group: Radionuclides/Water Policy

Radionuclide	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]
					MDAs (µg/L)
Uranium-234	13966-29-5	30/0.399	MCL[d]/NAL[d]	Yes	0.005
Uranium-235	15117-96-1	30/0.399	MCL[d]/NAL[d]	Yes	0.5
Uranium-238	7440-61-1	30/0.399	MCL[d]/NAL[d]	Yes	3

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the RMD

[a] This QAPP references the MCLs (if available) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario.
[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.
[c] The analytical laboratory analyzes these parameters by inductively coupled plasma mass spectroscopy. Radionuclide parameters will be reported per laboratory SOPs and the DoD/DOE QSM.
[d] MCL and NAL for Total Uranium.

QAPP Worksheet #15-F.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (PCBs, Sediment)

Matrix: Sediment
Analytical Group: PCBs

PCB	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific[c]	
					PQL (µg/kg)	MDL (µg/kg)
Total PCBs	1336-36-3	78.8	NAL	Yes	3.3	1.099
Aroclor 1016	12674-11-2	206	NAL	Yes	3.3	1.099
Aroclor 1221	11104-28-2	75.2	NAL	Yes	3.3	1.099
Aroclor 1232	11141-16-5	70.8	NAL	Yes	3.3	1.099
Aroclor 1242	53469-21-9	79.1	NAL	Yes	3.3	1.099
Aroclor 1248	12672-29-6	78.8	NAL	Yes	3.3	1.099
Aroclor 1254	11097-69-1	58.8	NAL	Yes	3.3	1.099
Aroclor 1260	11096-82-5	80.3	NAL	Yes	3.3	1.099

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDL = method detection limit
NAL = no action level for child resident scenario from the RMD
PQL = practical quantitation limit
PCBs = polychlorinated biphenyls

Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.

[a] This QAPP references the MCLs (if available) to support project planning and identify whether lower reporting limits may be needed for some constituents. The worksheet also lists the NALs established by the RMD for the child resident scenario. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process.

[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.

[c] The analytical laboratory may not be able to meet the NALs established by the RMD and MCLs reproduced in the RMD. For cases where the PQL is above the PAL/NAL, FRNP will have the laboratory report to the MDL, qualifying the result as estimated. Standard practices for qualifying data will apply for any result reported below the laboratory PQL.

QAPP Worksheet #15-G.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (Radionuclides, Sediment)

Matrix: Sediment
Analytical Group: Radionuclides

Radionuclide	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference[a]	Site COPC?[b]	Laboratory-Specific
					MDA (pCi/g)
Americium-241	14596-10-2	0.0455	NAL	Yes	1
Cesium-137[c]	10045-97-3	0.0395	NAL	Yes	0.1
Neptunium-237[c]	13994-20-2	0.0466	NAL	Yes	1
Plutonium-238	13981-16-3	0.0110	NAL	Yes	1
Plutonium-239	15117-48-3	0.0397	NAL	Yes	1
Plutonium-240	14119-33-6	0.00854	NAL	Yes	1
Technetium-99	14133-76-7	112	NAL	Yes	5
Thorium-230	14269-63-7	0.0111	NAL	Yes	1
Uranium-234	13966-29-5	0.0111	NAL	Yes	1
Uranium-235[c]	15117-96-1	0.0401	NAL	Yes	1
Uranium-238[c]	7440-61-1	0.0109	NAL	Yes	1

CAS = Chemical Abstracts Service
COPC = chemical (or radionuclide) of potential concern
MDA = minimum detectable activity
NAL = no action level for child resident scenario from the RMD

Analytical laboratory results will be reported on a dry weight basis, as applicable, unless specified otherwise.

[a] This QAPP references the NALs established by the RMD and MCLs reproduced in the RMD to support project planning and identify whether lower reporting limits may be needed for some constituents. In some cases, the laboratories may not be able to reach detection limits below the NAL. In these cases, the project team will address this issue in the decision process within the project-specific QAPP.
[b] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.
[c] PAL/NAL was derived considering the contribution from short-lived decay products.

QAPP Worksheet #15-H.
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (KPDES Parameters, Surface Water)

Matrix: Surface Water
Analyte Group: KPDES permit

KPDES Parameters with Permit Limits	CAS Number	Project Action Limit	Outfall	Site COPC?[a]	Laboratory-Specific	
					PQL	MDL
Total Suspended Solids[b]	N/A	30 mg/L	Outfall 001, Outfall 002, Outfall 004, Outfall 006, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	No	5 mg/L	1 mg/L
Oil & Grease	N/A	10 mg/L	Outfall 001, Outfall 002, Outfall 006, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	No	7 mg/L	3.5 mg/L
Aroclor-1016	12674-11-2	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Aroclor-1221	11104-28-2	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Aroclor-1232	11141-16-5	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Aroclor-1242	53469-21-9	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L

QAPP Worksheet #15-H. (Continued)
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (KPDES Parameters, Surface Water)

Matrix: Surface Water
Analyte Group: KPDES permit

KPDES Parameters with Permit Limits	CAS Number	Project Action Limit	Outfall	Site COPC?[a]	Laboratory-Specific	
					PQL	MDL
Aroclor-1248	12672-29-6	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Aroclor-1254	11097-69-1	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Aroclor-1260	11096-82-5	500 ng/L	Outfall 001, Outfall 002, Outfall 008, Outfall 009, Outfall 010, Outfall 011, Outfall 012, Outfall 013, Outfall 015, Outfall 016, Outfall 017, Outfall 019, Outfall 020	Yes	0.1 µg/L	0.0333 µg/L
Zinc	7440-66-6	119 µg/L	Outfall 013	Yes	20 µg/L	3.5 µg/L
Biochemical Oxygen Demand[b]	N/A	30 mg/L	Outfall 004	No	2 mg/L	1 mg/L
Mercury	7439-97-6	0.051 µg/L	Outfall 008	Yes	0.005 µg/L	0.002 µg/L

[a] Analytes marked with COPC are from Table 2.1 of the RMD and represent the list of chemicals, compounds, and radionuclides compiled from COPCs retained as COCs in risk assessments previously performed at PGDP.
[b] Total Suspended Solids and Biochemical Oxygen Demand do not have MS/MSD analysis requirement per the methods.

QAPP Worksheet #18.
Sampling Locations and Methods

Worksheet #18 provides information pertaining to sampling planned for this project.

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group[a]	Concentration Level[b]	Number of Samples (Identify Field Duplicate %)	Sampling SOP Reference[c]	Rationale for Sampling Location
Sitewide (see Appendix C of the EMP for specific locations)	Sediment	Surface (Creek Bed Samples)	See Appendix C of the EMP	Varies by location and analyte	See Appendix C of the EMP (Minimum of 5%)	See Worksheet #21	See Appendix C of the EMP
	Surface Water	Surface Water in Creeks and Effluent Discharge	See Appendix C of the EMP	Varies by location and analyte	See Appendix C of the EMP (Minimum of 5%)	See Worksheet #21	See Appendix C of the EMP
	Groundwater	UCRS, URGA, LRGA	See Appendix C of the EMP	Varies by location and analyte	See Appendix C of the EMP (Minimum of 5%)	See Worksheet #21	See Appendix C of the EMP

SOP = standard operating procedure
N/A = not applicable
UCRS = Upper Continental Recharge System
URGA = Upper Regional Gravel Aquifer
LRGA = Lower Regional Gravel Aquifer

[a] See Analytical SOP References Table (Worksheet #23).
[b] If historic data provide information on anticipated concentration, that information will be populated on this sheet.
[c] See Field SOP References Table (Worksheet #21).

QAPP Worksheets #19 and #30.
Sample Containers, Preservation, and Hold Times

Laboratory: GEL Laboratories, LLC, 2040 Savage Road, Charleston, SC 29407, Valerie Davis, vsd@gel.com, (843) 556-8171

EMSL Analytical, 200 Route 130 North, Cinnaminson, NJ 08077, Jason McDonald, jmcdonald@emsl.com, (843) 628-3130

List any required accreditations/certifications (requirement dependent upon analysis performed): DOECAP, KPDES Wastewater Laboratory Certification. The laboratories supporting the Environmental Monitoring program hold different certifications.

Back-up Laboratory: N/A

Sample Delivery Method: Direct Delivery or Overnight/Federal Express or UPS (United Parcel Service) in accordance with the on-site transportation plan or U.S. Department of Transportation requirements.

Analyte/ Analyte Group	Matrix	Method/SOP	Accreditation Expiration Date	Container(s) (number, size, & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
VOCs[a]	Water	See Worksheet #23	6/2027	3 × 40 mL glass VOA vial	HCl pH < 2, 0–6°C, no headspace	N/A	14 days	28 days
Metals/ Radionuclides by ICP-MS	Water	See Worksheet #23	6/2027	1 L plastic	HNO_3 pH < 2	N/A	180 days	28 days
Mercury	Water	See Worksheet #23	6/2027	N/A	HNO_3 pH < 2	N/A	28 days	28 days
Anions	Water	See Worksheet #23	6/2027	125 mL plastic	0–6°C	N/A	28 days (2 days for nitrate)	28 days
PCBs	Water	EPA-608.3	6/2027	2 × 1 L amber glass	0–6°C	7 days	40 days	28 days

QAPP Worksheets #19 and #30. (Continued)
Sample Containers, Preservation, and Hold Times

Analyte/ Analyte Group	Matrix	Method/SOP	Accreditation Expiration Date	Container(s) (number, size, & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
PCBs	Water	SW846-8082	6/2027	2 × 1 L amber glass	0–6°C	N/A	N/A[b]	28 days
Radionuclides	Water	See Worksheet #23	6/2027	3 × 1 L plastic	HNO_3 pH < 2[c]	N/A	180 days	28 days
Metals by ICP-OES	Water	See Worksheet #23	6/2027	1 L plastic	HNO_3 pH < 2	N/A	180 days	28 days
Dissolved Gases	Water	See Worksheet #23	6/2027	3 × 40 mL glass VOA vial	0–6°C, HCl to pH < 2	N/A	14 days	28 days
Total Organic Carbon	Water	See Worksheet #23	6/2027	250 mL amber glass	0–6°C, H_2SO_4 to pH < 2, zero headspace	N/A	28 days	28 days
DHC Bacteria	Water	See Worksheet #23	1/2026[d]	1 L poly bottle with screw cap	Cool < 4°C	N/A	48 hours	28 days
PCBs	Sediment	See Worksheet #23	6/2027	250 mL wide-mouth amber glass	0–6°C	N/A	N/A[b]	28 days
Radionuclides	Sediment	See Worksheet #23	6/2027	500 mL wide-mouth plastic straight side	None	N/A	180 days	28 days

NOTE: Sample volume and container requirements will be specified by the laboratory. This table includes standard requirements for routine analytical groups.
HCl = hydrochloric acid; HNO_3 = nitric acid
ICP-MS = inductively coupled plasma mass spectrometer
ICP-OES = inductively coupled plasma optical emission spectrometry
[a] For C-746-S&T and C-746-U Landfills groundwater samples, VOCs are collected in unpreserved vials with a 7-day holding time due to acrolein and acrylonitrile.
[b] A 45-day holding time is an expectation of the laboratory; however, since SW-846 does not indicate a holding time for PCBs, any data that exceeds the 45 days will be identified, but not qualified.
[c] Check with specific laboratory conducting analyses to ensure that acidification will not interfere with laboratory procedures.
[d] Indicates the next FRNP Approved Suppliers List review date.

QAPP Worksheet #20.
Field Quality Control Sample Summary Table

This worksheet provides a summary of the types of samples to be collected and analyzed for the project.

Matrix	Analyte/ Analytical Group	Field Samples	Field Duplicates	Matrix Spikes (MS)	Matrix Spike Duplicates (MSD)	Field Blanks	Equipment Blanks	Trip Blanks	Other	Total # of Analyses
Sediment	PCBs	See Appendix C of EMP	5%	5%	5%	5%	5%	N/A	N/A	See Appendix C of EMP
Sediment	Radionuclides	See Appendix C of EMP	5%	5%*	5%*	5%	5%	N/A	N/A	See Appendix C of EMP
Water	VOCs	See Appendix C of EMP	5%	5%	5%	5%	5%	1 per day or 1 per cooler containing VOC samples	N/A	See Appendix C of EMP
Water	Metals	See Appendix C of EMP	5%	5%	5%	5%	5%	N/A	N/A	See Appendix C of EMP
Water	PCBs	See Appendix C of EMP	5%	5%	5%	5%	5%	N/A	N/A	See Appendix C of EMP
Water	Radionuclides	See Appendix C of EMP	5%	5%*	5%*	5%	5%	N/A	N/A	See Appendix C of EMP

QAPP Worksheet #20. (Continued)
Field Quality Control Sample Summary Table

Matrix	Analyte/ Analytical Group	Field Samples	Field Duplicates	Matrix Spikes (MS)	Matrix Spike Duplicates (MSD)	Field Blanks	Equipment Blanks	Trip Blanks	Other	Total # of Analyses
Water	Dissolved Gases	See Appendix C of EMP	5%	5%	5%	5%	5%	N/A	N/A	See Appendix C of EMP
Water	Total Organic Carbon	See Appendix C of EMP	5%	5%	5%	5%	5%	N/A	N/A	See Appendix C of EMP
Water	DHC Bacteria	See Appendix C of EMP	5%	N/A	N/A	N/A	N/A	N/A	N/A	See Appendix C of EMP

*MS/MSDs are not required for alpha spectroscopy, gamma spectroscopy, and/or liquid scintillation methods consistent with DoD/DOE QSM.
DHC = *Dehalococcoides ethenogens* N/A = not applicable
PCB = polychlorinated biphenyl SVOC = semivolatile organic compound
VOC = volatile organic compound

QAPP Worksheet #21.
Project Sampling SOP References Table

SOPs to be used on this project are summarized below.

Reference Number	Title and Number[a] Revision Date	Originating Organization[b]	Equipment Type	Modified for Project Work? (Y/N)	Comments
1	CP3-ES-0043, *Temperature Control for Sample Storage* (6/2/2025)	Contractor	Sampling	N	N/A
2	CP2-WM-0001, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Waste Management Plan* (6/12/2024)	Contractor	N/A	N	N/A
3	CP2-ES-0026, *Wet Chemistry and Miscellaneous Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (12/13/2022)	Contractor	N/A	N	N/A
4	CP2-ES-0811, *Pesticide and PCB Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (12/13/2022)	Contractor	N/A	N	N/A
5	CP4-ES-1001, *Transmitting Data to the Paducah Oak Ridge Environmental Information System* (10/5/2022)	Contractor	N/A	N	N/A
6	CP2-ES-0063, *Environmental Monitoring Data Management Implementation Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (12/10/2024)	Contractor	N/A	N	N/A
7	CP4-ES-2100, *Groundwater Level Measurement* (12/4/2024)	Contractor	Sampling	N	N/A
8	CP4-ES-2101, *Groundwater Sampling* (7/7/2025)	Contractor	Sampling	N	N/A
9	CP3-ES-2203, *Surface Water Sampling* (7/7/2025)	Contractor	Sampling	N	N/A
10	CP4-ES-2302, *Collection of Sediment Samples Associated with Surface Water* (5/30/2023)	Contractor	Sampling	N	N/A
11	CP3-ES-0074, *Monitoring Well Inspection and Maintenance* (6/5/2025)	Contractor	Sampling	N	N/A
12	CP3-ES-2700, *Sample and Miscellaneous Data Forms* (5/15/2024)	Contractor	N/A	N	N/A

QAPP Worksheet #21. (Continued)
Project Sampling SOP References Table

Reference Number	Title and Number[a] Revision Date	Originating Organization[b]	Equipment Type	Modified for Project Work? (Y/N)	Comments
13	CP4-ES-2702, *Decontamination of Sampling Equipment and Devices* (10/2/2024)	Contractor	Sampling	N	N/A
14	CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation* (1/11/2023)[c]	Contractor	N/A	N	N/A
15	CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals* (10/31/2024)	Contractor	N/A	N	N/A
16	CP3-ES-5003, *Quality Assured Data* (8/20/2025)	Contractor	N/A	N	N/A
17	CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling* (6/25/2025)	Contractor	N/A	N	N/A
18	CP3-ES-5007, *Data Management Coordination* (6/25/2025)	Contractor	N/A	N	N/A
19	CP2-ES-5102, *Radiochemical Analysis Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (12/13/2017)	Contractor	N/A	N	N/A
20	CP2-ES-5105, *Volatile and Semivolatile Analyses Data Verification and Validation for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (7/7/2025)	Contractor	N/A	N	N/A
21	CP2-ES-5107, *Inorganic Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (10/16/2024)	Contractor	N/A	N	N/A
22	CP3-ES-1003, *Developing, Implementing, and Maintaining Data Management Plans* (10/4/2022)	Contractor	N/A	N	N/A
23	CP4-ES-1002, *Submitting, Reviewing, and Dispositioning Changes to the Environmental Databases* (10/5/2022)	Contractor	N/A	N	N/A

[a] SOPs are posted to the FRNP intranet website. External FFA parties can access this site using remote access with privileges upon approval. It is understood that SOPs are contractor specific.
[b] The work will be conducted by FRNP staff or a subcontractor. In either case, the most current version of the SOPs listed will be followed.
[c] The Hazardous Waste Management Facility Permit defines a duplicate as being collected from a single sample collection container or sample mixing container. This SOP defines a duplicate as being collected using the same procedural requirements as the original sample. Duplicates collected from MWs at the C-404 Landfill under the permit will be collected as prescribed in the permit and as prescribed in this SOP.

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

The following is the field equipment to be used on the project.

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Water Quality Meter	Calibrate at the beginning of the day	Performed monthly and as needed	Measure solutions with known values (National Institute for Standards and Technology traceable buffers and conductivity calibration solutions)	Upon receipt, successful operation	Daily before each use	Per manufacturer's specifications	Recalibrate or service as necessary	Field Sampling Manager	Manufacturer's specifications
Colorimeter (for total residual chlorine and ferrous iron)	Accuracy check at the beginning of each day. Return to manufacturer annually for calibration	As needed	Measure with standard solution	Upon receipt, successful operation	Check daily before each use	Within range of manufacturer's standard	Service by manufacturer or replace	Field Sampling Manager	Manufacturer's specifications
Titrator (for total residual chlorine)	Accuracy check at the beginning of each day	As needed	Measure with standard solution	Upon receipt, successful operation	Weekly	With range of manufacturer's standard	Service by manufacturer or replace	Field Sampling Manager	Manufacturer's specifications
Electron Water Level Meter	N/A	None	Check daily before each use	Upon receipt, successful operation	Check daily before each use	Pass/Fail	Return to rental company for replacement	Field Sampling Manager	Manufacturer's specifications
Hach® flow meter	Calibrate to readings on flume annually	Quarterly or as needed	Measure against flume	Upon receipt, successful operation	Weekly as needed	Pass/Fail	Service by manufacturer or replace	Field Sampling Manager	Manufacturer's specifications

QAPP Worksheet #22. (Continued)
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment*	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Pressure Transducer (Data Logger typically used for water level measurement in monitoring wells)	Return to manufacturer annually for calibration	Return to manufacturer for maintenance, as needed	Compare water level reading against reading from electronic water level meter	Upon receipt, successful operation	Before each use, as needed	Per manufacturer's specifications	Return to manufacturer for repair or replacement	Field Sampling Manager	CP4-ES-2100, *Groundwater Level Measurement*/ Manufacturer's specifications

*Additional equipment may be needed; additional equipment will follow manufacturer's specifications for calibration, maintenance, inspection, and testing. Calibration data will be documented per applicable procedure.

QAPP Worksheet #23.
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group/Matrix	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SW846-8260/ EPA-624.1	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC-MS)	Definitive	VOA (Unless noted below)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-8011	1,2-Dibromoethane and 1,2-Dibromo-3-Chloropropane by Microextraction and Gas Chromatography	Definitive	VOA (1,2-Dibromo-3-chloropropane)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-9056/ EPA-300.0	Determination of Inorganic Anions by Ion Chromatography	Definitive	Anions/Water	Per SOP	GEL Laboratories, Charleston, SC	N
RSKSOP-175 Modified	Sample Preparation and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibration Technique	Definitive	Dissolved Gases (Ethene, Ethane, Methane)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-410.4	Determination of Chemical Oxygen Demand by Semi-Automated Colorimetry	Definitive	Miscellaneous (Chemical Oxygen Demand)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-350.1	Determination of Ammonia Nitrogen by Semi-Automated Colorimetry	Definitive	Miscellaneous (Ammonia as Nitrogen)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-9010/ SW846-9012B	Total and Amenable Cyanide	Definitive	Miscellaneous (Cyanide)/Water	Per SOP	GEL Laboratories, Charleston, SC	N

QAPP Worksheet #23. (Continued)
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group/Matrix	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SM 5210B	Standard Method for Biochemical Oxygen Demand	Definitive	Miscellaneous (Carbonaceous Biological Oxygen Demand)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-130.2/SM 2340C	Hardness	Definitive	Miscellaneous (Hardness)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-9060A	Total Organic Carbon	Definitive	Miscellaneous [Total Organic Carbon (TOC)]/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-160.1	Total Dissolved Solids	Definitive	Miscellaneous (Total Dissolved Solids)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-160.2/ SM 2540D	Total Suspended Solids	Definitive	Miscellaneous (Total Suspended Solids)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
SM 2540B	Solids in Water	Definitive	Miscellaneous (Total Solids)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-365.4	Phosphorous, Total	Definitive	Miscellaneous (Total Phosphorous)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N

QAPP Worksheet #23. (Continued)
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group/Matrix	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
EPA-1631E	Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry	Definitive	Metals/Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-9020	Total Organic Halides (TOX)	Definitive	Miscellaneous (Total Organic Halides)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-310.1	Alkalinity	Definitive	Miscellaneous (Alkalinity)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-1664A	Determination of Oil and Grease and Total Petroleum Hydrocarbons in Waste Water	Definitive	Miscellaneous (Oil and Grease)/Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-6020/ EPA-200.8/ICP-MS	Inductively Coupled Plasma-Mass Spectrometry	Definitive	Metals (Unless noted below)/Water, Radionuclides (Uranium-234, Uranium-235, Uranium-238)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-7470	Cold Vapor Atomic Absorption	Definitive	Metals (Mercury)/Water	Per SOP	GEL Laboratories, Charleston, SC	N

QAPP Worksheet #23. (Continued)
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group/Matrix	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SW846-8082/ EPA-608.3	Polychlorinated Biphenyls (PCBs) by Gas Chromatography	Definitive	PCBs/Sediment and Water	Per SOP	GEL Laboratories, Charleston, SC	N
SW846-9310/ EPA-900.0	Gross Alpha and Gross Beta	Definitive	Radionuclides/ Sediment and Water	Per SOP	GEL Laboratories, Charleston, SC	N
EPA-906.0	Tritium in Drinking Water	Definitive	Radionuclides/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
Gamma Spec**	Gamma Spectrometry	Definitive	Radionuclides (Cesium-137)/ Sediment and Water	Per SOP	GEL Laboratories, Charleston, SC	N
Gas Flow Proportional**	Gas Flow Proportional	Definitive	Radionuclides (Strontium-90)/ Water	Per SOP	GEL Laboratories, Charleston, SC	N
Liquid Scintillation**	Tc-99 by Liquid Scintillation	Definitive	Radionuclides/ Sediment and Water	Per SOP	GEL Laboratories, Charleston, SC	N
Alpha Spec**	Alpha Spectrometry	Definitive	Radionuclides (Americium-241, Thorium-230, Uranium-234, Uranium-235, Uranium-238, Neptunium-237, Plutonium-238, Plutonium-239/ 240)/Sediment and Water	Per SOP	GEL Laboratories, Charleston, SC	N

QAPP Worksheet #23. (Continued)
Analytical SOP References Table

Reference Number*	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group/Matrix	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SW846-6010/EPA-200.8/ICP-OES	Inductively Coupled Plasma-Optical Emission Spectroscopy	Definitive	Metals/Water	Per SOP	GEL Laboratories, Charleston, SC	N
qPCR for DHC Bacteria and key functional genes	DHC Bacteria	Screening	Bacteria/Water	Per SOP	EMSL Analytical, Cinnaminson, NJ	N

*Information will be based on laboratory used. Analysis will be by the most recent revision.
**Analytical methods for radiochemistry parameters are laboratory specific.
ICP-OES = inductively coupled plasma optical emission spectrometer

QAPP Worksheet #24.
Analytical Instrument Calibration Information

Laboratories used by FRNP are participants in DOECAP. In the fall of 2017, DOECAP began providing certification of environmental laboratories through third party organizations. If not in DOECAP, laboratories are audited by contractors for compliance with DOE quality assurance program requirements. As such, laboratory equipment and instruments used for quantitative measurements are calibrated in accordance with the laboratory's formal calibration program as summarized in the SOPs. The laboratory is responsible for maintaining instrument calibration information per their QA Plan including control charts established for all instrumentation.

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

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference*
GC-MS	Replace/clean ion source; clean injector, replace injector liner, replace/clip capillary column, flush/replace tubing on purge and trap; replace trap	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
GC	ECD maintenance; replace/clip capillary column	QC standards	ECD, FID, injector, injector liner, column, column flow	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Section Manager	See Worksheet #23
ICP-MS and ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	QC standards	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Area Supervisor	See Worksheet #23
Spectrophotometer	Flush/replace tubing	QC standards	Tubing	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity of remove from service	Laboratory Manager	See Worksheet #23
TOC Analyzer (NDIRD)	Replace sample tubing, clean sample boat, replace syringe	QC standards	Tubing, sample boat, syringe	As needed	Must meet initial and/or continuing calibration criteria	Repeat maintenance activity or remove from service	Laboratory Manager	See Worksheet #23
CVAA	Replace tubing, check instrument lines and connections, check windows in cell, ensure lamp is operational	QC standards	Instrument lines and connections, windows, and lamp	As needed	Must meet initial and/or continuing calibrations criteria	Repeat maintenance activity or remove from service	Laboratory Manager	See Worksheet #23

*The laboratory is responsible for maintaining instrument and equipment maintenance, testing, and inspection information per their QA Plan. This information is audited. Laboratory(s) contracted will participate in DOECAP, with the exception of the laboratory used to support acute and chronic toxicity analysis in support of the KPDES permit. This laboratory is a KPDES Wastewater Laboratory certified by the Commonwealth of Kentucky and provides the required information to FRNP to be included on the approved suppliers list. Field survey/sampling instrumentation will be maintained, tested, and inspected according to manufacturer's instructions.

CVAA = cold vapor atomic absorption; ECD = electron capture detector; FID = flame ionization detector; GC = gas chromatography; GC-MS = gas chromatography-mass spectrometer; ICP-AES = inductively coupled plasma atomic; emission spectroscopy; ICP-MS = inductively coupled plasma mass spectrometer; NDIRD = nondispersive infrared detector; QC = quality control; TOC = total organic carbon

QAPP Worksheets #26 and #27.
Sample Handling, Custody, and Disposal

Sampling Organization: Sampling Teams/DOE Prime Contractor and Subcontractors

Laboratory: See Worksheets #19 and #30

Method of sample delivery (shipper/carrier): Direct Delivery or Overnight/Federal Express or UPS in accordance with the on-site transportation plan or U.S. Department of Transportation requirements.

Number of days from reporting until sample disposal: 3 months

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	Sampling Team/DOE Prime Contractor and Subcontractors	CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*
Chain of custody form completion	Sampling Team/DOE Prime Contractor and Subcontractors	CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*
Packaging	Sampling Team/DOE Prime Contractor and Subcontractors	CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*
Shipping coordination	Sampling Team, SMO/DOE Prime Contractor, and Subcontractors	CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*; and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*
Sample receipt, inspection, & log-in	Sample Management/Contracted Laboratory	Contracted Laboratory SOP
Sample custody and storage	Sample Management/Contracted Laboratory	Contracted Laboratory SOP
Sample disposal	Sample Management/Contracted Laboratory	Contracted Laboratory SOP

QAPP Worksheet #28-A.
QC Samples Table (Aqueous)

Matrix: Aqueous Samples
Analytical Group/Concentration Level: VOCs, Metals, PCBs, RADs
Sampling SOP: See Worksheet #21
Analytical Method/SOP Reference: See Worksheet #23
Sampler's Name/Field Sampling Organization: GEO Consultants
Analytical Organization: See Worksheet #23
No. of Sample Locations: See Appendix C of the EMP

QC Sample	Frequency/Number[a]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field blank	Minimum 5%	≤ CRQL[b]	Verify results; reanalyze	Laboratory should alert project	Contamination—Accuracy/bias	See data validation plans
Trip blank	1 per cooler containing VOC samples	≤ CRQL[b]	Verify results; reanalyze		Contamination—Accuracy/bias	See data validation plans
Equipment blank	Minimum 5%	≤ CRQL[b]	Verify results; reanalyze		Contamination—Accuracy/bias	See data validation plans
Spiked field samples (MS and/or MSD)	1 per analytical batch[c]	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy/Precision	See data validation plans
Laboratory spiked blanks [laboratory control sample (LCS)]	1 per analytical batch[d]	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Contamination—Accuracy/bias	See data validation plans

QAPP Worksheet #28-A. (Continued)
QC Samples Table (Aqueous)

QC Sample	Frequency/Number[a]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples	Laboratory should alert project	Accuracy	See data validation plans
Surrogate standards	All samples, blanks, and QA (or QC) samples	See data validation plans CP2-ES-0811, -5105	Check calculations and instrument; reanalyze affected samples		Accuracy	See data validation plans
Internal standards	All samples and standards	See data validation plans CP2-ES-5105 and 5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See data validation plans
Field duplicate[e]	Minimum 5%	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Data reviewer will place qualifiers on samples affected	Project	Homogeneity/ Precision	Specific RPD defined for each group in Worksheet 12.
Laboratory duplicate	Per laboratory procedure	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See data validation plans
Tracers/Carriers	Each sample tested by a radiochemical separations method	See data validation plan CP2-ES-5102	Check calculations and instrument; reanalyze affected samples	Laboratory analyst	Accuracy	See data validation plans

[a] The number of QC samples is listed on Worksheet #20.
[b] Unless dictated by project-specific parameters, ≤ contract-required quantitation limit (CRQL).
[c] MS/MSDs will be spiked with all reported analytes per the DoD/DOE QSM with exception of PCBs (Aroclors 1016 and 1260 only). MS/MSDs will not be required consistent with DoD/DOE QSM for alpha spec, gamma spec, and liquid scintillation methods (RADs).
[d] LCS will be spiked with all reported analytes per the DoD/DOE QSM with exception of PCBs (Aroclors 1016 and 1260 only).
[e] The Hazardous Waste Management Facility Permit defines a duplicate as being collected from a single sample collection container or sample mixing container. CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation*, defines a duplicate as being collected using the same procedural requirements as the original sample. Duplicates collected from MWs at the C-404 Landfill under the permit will be collected as prescribed in the permit and as prescribed in the SOP.

QAPP Worksheet #28-B.
QC Samples Table (Sediment)

Matrix: Sediments
Analytical Group/Concentration Level: VOCs, Metals, PCBs, RADs
Sampling SOP: See Worksheet #21
Analytical Method/SOP Reference: See Worksheet #23
Sampler's Name/Field Sampling Organization: GEO Consultants
Analytical Organization: GEL Laboratories
No. of Sample Locations: See Appendix C of the EMP

QC Sample	Frequency/Number[a]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field blank	Minimum 5%	≤ CRQL[b]	Verify results; reanalyze	Laboratory should alert project	Contamination—Accuracy/bias	See data validation plans
Trip blank	1 per cooler containing VOC samples	≤ CRQL[b]	Verify results; reanalyze		Contamination—Accuracy/bias	See data validation plans
Equipment blank	Minimum 5%	≤ CRQL[b]	Verify results; reanalyze		Contamination—Accuracy/bias	See data validation plans
Spiked field samples (MS and/or MSD)	1 per analytical batch[c]	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy/Precision	See data validation plans
Laboratory spiked blanks (LCS)	1 per analytical batch[d]	See data validation plans CP2-ES-0026, -0811, -5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples		Contamination—Accuracy/Bias	See data validation plans

QAPP Worksheet #28-B. (Continued)
QC Samples Table (Sediment)

QC Sample	Frequency/Number[a]	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Check calculations and instrument; reanalyze affected samples	Laboratory should alert project	Accuracy	See data validation plans
Surrogate Standards	All samples, blanks, and QA (or QC) samples	See data validation plans CP2-ES-0811, -5105	Check calculations and instrument; reanalyze affected samples		Accuracy	See data validation plans
Internal standards	All sample blanks and QA samples	See data validation plans CP2-ES-5102, -5107	Check calculations and instrument; reanalyze affected samples		Accuracy	See data validation plans
Field duplicate	Minimum 5%	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Data reviewer will place qualifiers on samples affected	Project	Homogeneity/ Precision	Specific RPD defined for each group in Worksheet #12
Laboratory duplicate	Per laboratory procedure	See data validation plans CP2-ES-0026, -0811, 5102, -5105, -5107	Verify results re-prepare and reanalyze	Laboratory analyst	Precision	See data validation plans
Tracers/Carriers	Each sample tested by a radiochemical separations method	See data validation plan CP2-ES-5102	Check calculations and instrument; reanalyze affected samples	Laboratory analyst	Accuracy	See data validation plans

[a] The number of QC samples is listed on Worksheet #20.
[b] Unless dictated by project-specific parameters, ≤ CRQL.
[c] MS/MSDs will be spiked with all reported analytes per the DoD/DOE QSM with exception of PCBs (Aroclors 1016 and 1260 only). MS/MSDs will not be required consistent with DoD/DOE QSM for alpha spec, gamma spec, and liquid scintillation methods (RADs).
[d] LCS will be spiked with all reported analytes per the DoD/DOE QSM with the exception of PCBs (Aroclors 1016 and 1260 only).

QAPP Worksheet #29.
Project Documents and Records Table

This worksheet describes how information will be collected, verified, and stored. Its purpose is to support data completeness, data integrity, and ease of retrieval.

Sample Collection and Field Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Sample Data Forms	Sampling Team	Sampling Team	Project File
Chain-of-Custody Forms	Sampling Team	Sampling Team	Project File
Equipment Calibration Forms	Sampling Team	Sampling Team	Project File
Deviations	PM	Project Director	Project File
Corrective Action Reports	PM	Project Director	Project File
Correspondence	PM	Project Director	Project File

Project Assessments			
Record	**Generation**	**Verification**	**Storage location/archival**
Field Audit Checklists	PM	Project Director	Project File
Data Verification/Validation Checklists	SMO/Data Validator	SMO	Project File
Data Validation Report	Data Validator	SMO	Project File
Data Assessment Review Checklist and Comment Form	SMO/Data Reviewer/Project Reviewer	SMO	Project File

Laboratory Records			
Record	**Generation**	**Verification**	**Storage location/archival**
Level IV Laboratory Data Packages	Laboratory Staff	Laboratory PM	Project File
Electronic Data Deliverables	Laboratory Staff	Laboratory PM	Project File

QAPP Worksheets #31, #32, and #33.
Assessments and Corrective Action

This worksheet is used to document responsibilities for conducting project assessments, responding to assessment findings and implementing corrective action. Appropriately scheduled assessments (e.g., field sampling technical systems audits at the beginning of sampling) allow management to implement corrective action in a timely manner, thereby correcting nonconformances and minimizing their impact on DQOs/project quality objectives. Assessment checklists should be included in the QAPP or referenced.

Assessments:

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Date	Assessment Deliverable	Deliverable Due Date
Field Sampling	Field Sampling Manager/ FRNP	Annually	To be Determined	As described in CP3-QA-1003, *Management and Self-Assessment*	As described in CP3-QA-1003, *Management and Self-Assessment*
Off-site Laboratory Technical Systems Audit	Laboratory Manager/Technical Director	Annually	Annually/Ongoing	Internal Audit Report	Per Individual Laboratory QA Manual
Management Review	Project Director/ FRNP	Interim management review following site mobilization; final management review upon completion of fieldwork	Annually	As described in CP3-QA-1003, *Management and Self-Assessment*	As described in CP3-QA-1003, *Management and Self-Assessment*

QAPP Worksheets #31, #32, and #33. (Continued)
Assessments and Corrective Action

Assessment Response and Corrective Action:

Assessment Type	Responsibility for responding to assessment findings	Assessment Response Documentation	Time Frame for Response	Responsibility for Implementing Corrective Action	Responsible for monitoring Corrective Action implementation
Field Sampling	Field Sampling Manager/FRNP	Field Sampling Corrective Action Response	24 hours from receipt of memorandum	Field Sampling Manager/FRNP	Contractor Performance Assurance Program (CPAP) Manager/FRNP
Off-site Laboratory Technical Systems Audit	Laboratory Manager/Technical Director	Internal Audit Report Deficiency Memorandum	7 days following receipt of proficiency testing deficiency report and before analysis field samples	Laboratory Technical Director	QA Manager/FRNP
Management Review	Project Director/ FRNP	Management Response	As described in CP3-QA-1003, *Management and Self-Assessment*	As assigned in Management Response	CPAP Manager/FRNP

QAPP Worksheet #34.
Data Verification and Validation Inputs

This worksheet is used to list the inputs that will be used during data verification and validation. Data verification is a check that specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, and the QAPP. Records subject to verification and validation are listed below.

Item	Description	Verification (Completeness)	Validation (Conformance to Specifications)
Planning Documents/Records			
1	Approved QAPP	X	X
2	Contract	X	X
3	Field SOPs	X	X
4	Laboratory SOWs	X	X
Field Records			
5	Sample data forms	X	X
6	Chain-of-Custody forms	X	X
7	Sampling diagrams/surveys (if provided)	X	X
8	Relevant correspondence	X	X
9	Change orders/deviations	X	X

QAPP Worksheet #34. (Continued)
Data Verification and Validation Inputs

Item	Description	Verification (Completeness)	Validation (Conformance to Specifications)
Analytical Data Package			
10	Cover sheet (laboratory identifying information)	X	X
11	Case narrative	X	X
12	Internal laboratory chain-of-custody (where applicable)	X	X
13	Sample receipt checklist	X	X
14	Analysis run log	X	X
15	Communication records	X	X
16	Detection limits summary	X	X
17	Standards Traceability	X	X
18	Instrument calibration records	X	X
19	Definition of laboratory qualifiers	X	X
20	Results reporting forms	X	X
21	QC sample results	X	X
22	Corrective action reports	X	X
23	Raw data	X	X
24	Electronic data deliverable	X	X

QAPP Worksheet #35.
Data Verification Procedures

This worksheet documents procedures that will be used to verify project data. Data verification is a completeness check to confirm that required activities were conducted, specified records are present, and the contents of the records are complete.

Records Reviewed	Requirement Documents	Process Description	Responsible Person/Organization
Sample data forms	QAPP, Field SOPs	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Sampling Team/GEO Consultants—Performs daily review SMO/FRNP—Performs review as part of data verification and data assessment
Chain-of-custody forms	QAPP, Field SOPs	Verify the completeness of chain-of-custody records. Examine entries for consistency with the sample data form. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Sampling Team/GEO Consultants—Performs daily review SMO/FRNP—Performs review as part of data verification and data assessment Data Validator/A2RGC, LLC—Performs review as part of data validation

QAPP Worksheet #35. (Continued)
Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person/Organization
Laboratory deliverables	QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Laboratory PM/Contract Laboratory—Performs review before data is released SMO/FRNP—Performs review part of data verification and data assessment Data Validator/A2RGC, LLC—Performs review as part of data validation
Audit reports, corrective action reports	QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	CPAP Manager/FRNP

QAPP Worksheet #36.
Data Validation Procedures

Data Validator: A2RGC, LLC

Data validation plans are listed in Worksheet #21. These plans also are available on the FRNP intranet website. The fixed-base laboratory will provide data in an Electronic Data Deliverable. Ambient air monitoring data from the weekly and quarterly sampling events will be validated to support National Emission Standards for Hazardous Air Pollutants reporting. Also, groundwater data from the quarterly sampling events at the C-746-U and C-746-S&T Landfills and the semiannual sampling events at the C-404 Landfill will be validated. The groundwater data to be validated was chosen because groundwater comprises the majority of the media collected by the Environmental Monitoring Program. Additionally, the landfill requirements encompass the majority of all types of analyses specified within the Environmental Monitoring Program. Therefore, these programs are considered an adequate representation of Environmental Monitoring data targeted for data validation.

QAPP Worksheet #37.
Data Usability Assessment

This worksheet documents procedures that will be used to perform the data usability assessment. The data usability assessment is performed at the conclusion of data collection activities, using the outputs from data verification and data validation. It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and, like the systematic planning process, involves participation by key members of the project team. The data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Identify personnel (organization and position/title) responsible for participating in the data usability assessment:

Project Reviewer

Describe how the usability assessment will be documented:

Data usability will be documented through validation reports as well as through the data assessment review checklist and comment form included in the data assessment packages. Data assessment packages will be created, which will include data assessment comments/questions and laboratory comments. Data verification and assessment queries indicating any historical outliers will be included in the data assessment packages.

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

Field and analytical data are verified and assessed per procedure CP3-ES-5003, *Quality Assured Data*. Data assessment packages will be created per this procedure. Data assessment packages will include field and analytical data, chains-of-custody, data verification and assessment queries, and other project-specific information needed for personnel to review the package adequately. Data assessment packages will be reviewed to document any issues pertaining to the data and to indicate if DQOs of the project were met. For data selected for validation, the following plans are used: CP2-ES-0026, CP2-ES-0811, CP2-ES-5102, CP2-ES-5105, and CP2-ES-5107.

PARCCS parameters (precision, accuracy, representativeness, comparability, completeness, and sensitivity) will be evaluated per procedure CP3-ES-5003, *Quality Assured Data*. This information will be included in the data assessment packages for review by Project Reviewer. Data assessment also will include documentation of QC exceedances, trends, and/or bias in the data set. Data assessment will document any statistics used.

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