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

November 26, 2024

Mr. David Ruckstuhl, Prime Contracts Manager
Four Rivers Nuclear Partnership, LLC
5511 Hobbs Road
Kevil, Kentucky 42053

PPPO-02-10030224-25A

Dear Mr. Ruckstuhl:

DE-EM0004895: APPROVAL OF DELIVERABLE NO. 351, REMEDIAL ACTION WORK PLAN FOR THE 2024 OPTIMIZATION OF THE NORTHWEST PLUME INTERIM REMEDIAL ACTION, DOE/LX/07-2509&D1

Reference: Letter from M. Redfield to J. Stokes, "Four Rivers Nuclear Partnership, LLC—Deliverable No. 351—*Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2509&D1," (FRNP-25-8890), dated November 21, 2024

The U.S. Department of Energy reviewed and approves the *Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2509&D1.

If you have any questions or require additional information, please contact Tom Reed at (859) 397-7003.

Sincerely,

MARCIA FULTZ
Digitally signed by MARCIA FULTZ
Date: 2024.11.26 07:33:22 -05'00'

Marcia D. Fultz
Contracting Officer
Portsmouth/Paducah Project Office

cc:
abigail.parish@pppo.gov, PPPO
april.ladd@pppo.gov, PPPO
bruce.ford@pad.pppo.gov, FRNP
bryan.clayton@pad.pppo.gov, FRNP
cory.hicks@pad.pppo.gov, FRNP
david.ruckstuhl@pad.pppo.gov, FRNP
frnpcorrespondence@pad.pppo.gov
jennifer.stokes@pppo.gov, PPPO
joel.bradburne@pppo.gov, PPPO
kelly.layne@pppo.gov, PPPO
marie.holland@pppo.gov, ETAS
megan.mulry@pad.pppo.gov, FRNP
mona.dockery@pad.pppo.gov, FRNP
myrna.redfield@pad.pppo.gov, FRNP
pad.rmc@pad.pppo.gov
reinhard.knerr@pppo.gov, PPPO
tammy.stapleton@pad.pppo.gov, FRNP
tom.reed@pppo.gov, PPPO

CERTIFICATION

Document Identification: ***Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2509&D1, dated November 2024**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Four Rivers Nuclear Partnership, LLC

CHRISTOPHER LUCAS (Affiliate) Digitally signed by CHRISTOPHER LUCAS (Affiliate) Date: 2024.11.21 09:46:10 -06'00'

Myrna E. Redfield, Program Manager/Date Signed
Four Rivers Nuclear Partnership, LLC

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

U.S. Department of Energy

APRIL LADD Digitally signed by APRIL LADD Date: 2024.11.26 09:07:19 -06'00'

April Ladd, Paducah Site Lead/Date Signed
Portsmouth/Paducah Project Office
U.S. Department of Energy

DOE/LX/07-2509&D1
Primary Document

Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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Primary Document

Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—November 2024

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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PREFACE

This *Remedial Action Work Plan for the 2024 Optimization of the Northwest Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2509&D1, was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The objectives of this plan are to (1) describe the purpose and scope of the changes to the Northwest Plume interim remedial action as a result of the planned optimization, (2) identify the project organization, (3) present the project working schedule, and (4) identify other key project documents and plans that are to be developed.

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FIGURES

TABLES

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
DMIP	data management implementation plan
DNAPL	dense nonaqueous-phase liquid
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
EPA	U.S. Environmental Protection Agency
ER	environmental remediation
ESD	explanation of significant differences
EW	extraction well
FFA	Federal Facility Agreement
HAP	hazardous air pollutant
HASP	health and safety plan
IRA	interim remedial action
JHA	job hazard analysis
KAR	*Kentucky Administrative Regulations*
KEEC	Kentucky Energy and Environment Cabinet
KPDES	Kentucky Pollutant Discharge Elimination System
KRS	*Kentucky Revised Statutes*
LDR	land disposal restriction
LLW	low-level waste
MW	monitoring well
O	order
O&M	operation and maintenance
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RFD	Request for Disposal
RGA	Regional Gravel Aquifer
ROD	record of decision
RWP	radiological work permit
SMO	sample management office
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TRU	transuranic waste
TSDF	treatment, storage, and disposal facility
VOC	volatile organic compound
WAC	waste acceptance criteria
WMC	waste management coordinator
WMP	waste management plan

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EXECUTIVE SUMMARY

The Paducah Gaseous Diffusion Plant (PGDP) is an inactive uranium enrichment facility owned by the U.S. Department of Energy (DOE) and formerly leased and operated by the United States Enrichment Corporation from 1993 until 2013. DOE is conducting environmental remediation activities at PGDP in compliance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Commonwealth of Kentucky laws and regulations that have been deemed to be applicable or relevant and appropriate requirements (ARARs). PGDP was placed on the National Priorities List in 1994 and DOE, U.S. Environmental Protection Agency (EPA), and the Kentucky Natural Resources and Environmental Protection Cabinet[1] entered into a Federal Facility Agreement (FFA) in 1998 (EPA 1998).

The Northwest Plume interim remedial action (IRA) of PGDP is a CERCLA action documented in a 1993 record of decision (ROD) located in the Administrative Record (DOE 1993), https://eic.pad.pppo.gov/Search.aspx?accession=I-00113-0010. The post-decision Administrative Record is located at the Environmental Information Center or may be reviewed electronically by pressing control and clicking: https://eic.pad.pppo.gov/Search.aspx and selecting (PD) (NWP-PT-PD) Post-decision File for Northwest Plume Pump-and-Treat IRA in the index dropdown box.

Since initiation of operations in 1995, the scope of the Northwest Plume IRA has been the following:

1. To extract groundwater from the Northwest Plume using extraction wells (EWs) that are located north of the PGDP industrial facility (Figure ES-1);

2. To convey the contaminated groundwater to the current C-612[2] Northwest Plume Groundwater System treatment facility where the contaminated water is sand filtered to remove suspended materials, air stripped to remove trichloroethene (TCE), and filtered through ion exchange resin beds to remove technetium-99;

3. To discharge the treated water via pipeline to a ditch leading to the Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001 that releases the treated water to Bayou Creek; and

4. To pass vapor phase flow from the air stripper through activated carbon beds to remove volatilized TCE before being released to the atmosphere.

In 1996, an explanation of significant differences (ESD) was issued that provided changes to the ROD including: (1) elimination of the activated carbon filters, (2) reversal of the sequence of two treatment units (ion exchange unit and air stripper), and (3) elimination of the iron filings treatability study (DOE 1996). The 1996 ESD provided a discussion of the circumstances and the need for these modifications. It also informed the public of the significant differences from the original remedy selected in the ROD. The Northwest Plume IRA was optimized in a 2010 ESD by installing two additional EWs near the high concentration core of the Northwest Plume and located just adjacent to the northern fence of the PGDP industrial area (DOE 2010). The well locations were chosen to increase the mass of contaminant being removed and treated by the Northwest Plume IRA.

[1] The Kentucky Natural Resources and Environmental Protection Cabinet became the Kentucky Energy and Environment Cabinet during the 2018 Kentucky General Assembly.
[2] References to the current C-612 treatment system refers to the C-612 treatment system prior to the completion of the 2024 optimization of the Northwest Plume IRA.

This 2024 optimization of the remedial action work plan of the Northwest Plume IRA was developed to further optimize the contaminant mass being removed from the Northwest Plume by increasing extraction from the area of the C-400 Complex (Figure ES-1). The optimization was documented in the Administrative Record with a *Memorandum to File: Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, NWP-PT-PD, August 2024. In this 2024 optimization, additional EWs are to be installed closer to the C-400 Complex. The C-400 Complex has been identified as the primary source of TCE contamination to the Northwest Plume (DOE 2023).

Several evaluations supported the need for the 2010 optimization. The information in these early references also support the need for continued optimization of EWs to effectively remove larger quantities of contaminant mass. Those evaluations include the following:

- *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2067&D2 (DOE 2003);

- Paducah 2006 sitewide remedy review (DOE 2006);

- *U.S. Department of Energy Office of Environmental Management Paducah Gaseous Diffusion Plant Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007).

For this 2024 optimization, the *CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (Fourth Synchronized Five-Year Review)*, DOE/LX/07-2426&D2 (DOE 2019) provided a recommendation supporting a change to optimize the Northwest Plume IRA remedy. The Northwest Plume IRA was implemented to initiate hydraulic control of the high TCE concentration core of the Northwest Plume (DOE 1993). The 2018 Five-Year Review noted that increases in TCE levels in a downgradient monitoring well (MW) may indicate bypass of the current EWs (DOE 2019). The document included a recommendation for an evaluation of EW placement and pumping rates to optimize the capture of the Northwest Plume. The 2018 Five-Year Review is available in the General Reference Compendium, stored in the Environmental Information Center (DOE 2019).

The *CY 2023 Five-Year Review for Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (Fifth Synchronized Five-Year Review)*, DOE/LX/07-2492&D2/R1 (DOE 2019), also contained a recommendation. It recommended evaluating the installation of additional EWs near the C-400 Complex, consistent with the groundwater flow modeling assessment completed as part of the remedial action work plan for Northeast Plume IRA (DOE 2018).

The *Remedial Investigation Report for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2474&D2 (DOE 2023), provided information that supports further optimizing the Northwest Plume IRA remedy. The remedial investigation collected Regional Gravel Aquifer (RGA) and upper McNairy Formation groundwater samples containing high concentrations of TCE that defined source zones for TCE contamination (DOE 2023). The C-400 Complex EWs will be upgradient and to the south of the current Northwest Plume EWs (Figure ES-1). The placement of one or more EWs closer to the TCE source zone will further increase contaminant mass removal, further enhance capture closer to the source area(s), and further increase control of plume migration. The current Northwest Plume EWs will continue to pump along with the new EWs near the C-400 Complex.

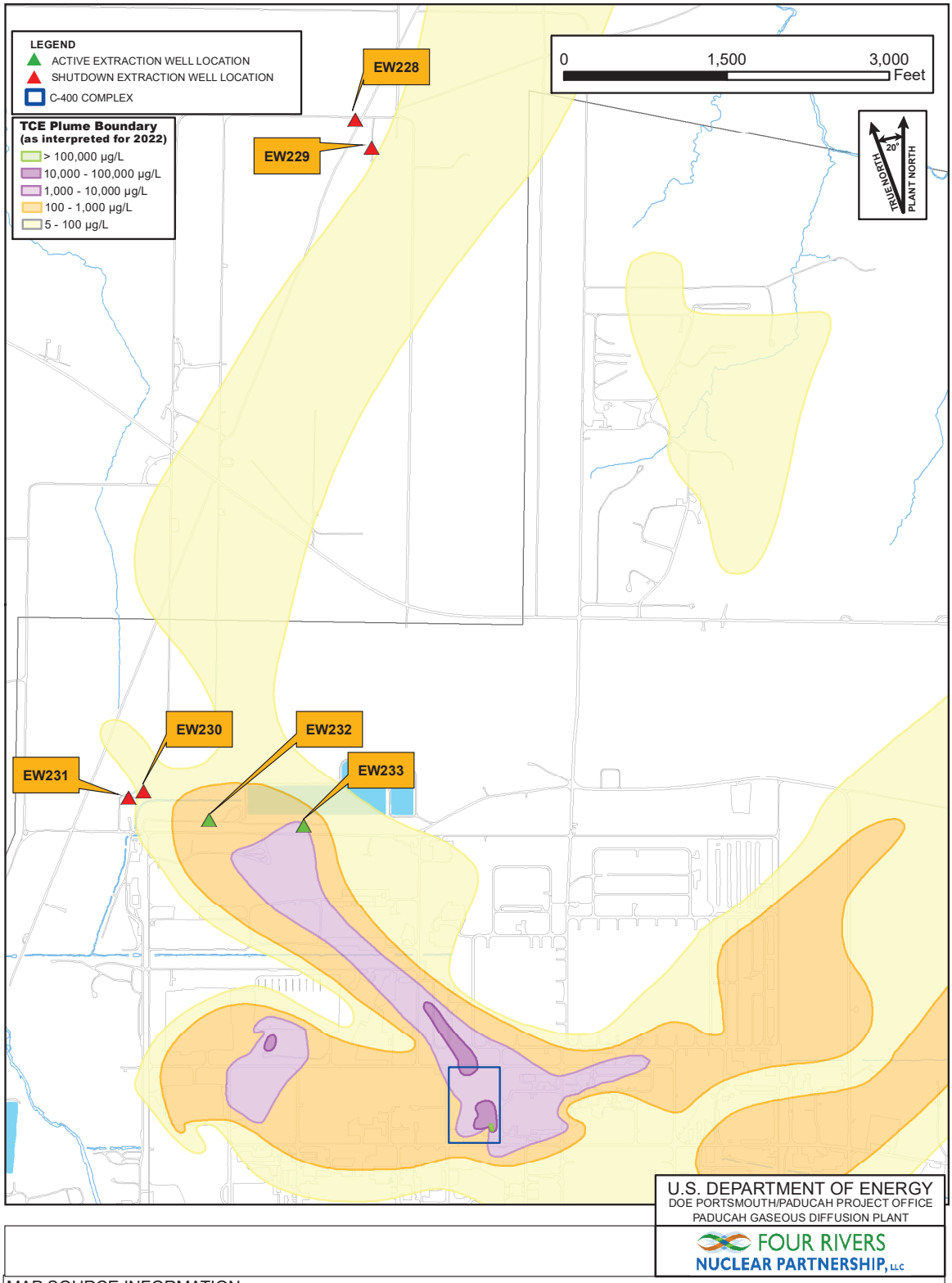

Figure ES-1. Location of Active and Shutdown Extraction Wells Associated with the Northwest Plume IRA and Relative to the C-400 Complex Area (FRNP 2023)

Groundwater flow modeling included in the *Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1, also provides technical support for modifying the Northwest Plume IRA (DOE 2018). Groundwater modeling results summarized in Appendix C of the remedial action work plan indicate that a C-400 area EW is required to prevent dissolved TCE contamination located at the C-400 Complex from migrating toward the optimized Northeast Plume EWs (DOE 2018).

For this 2024 optimization of the Northwest Plume EWs, additional groundwater modeling will be performed with the purposes of identifying:

- The quantity and locations of new EWs needed to optimize TCE mass extraction from the Northwest Plume near the C-400 Complex area.

- Optimized pumping rates in each EW, balanced with continued optimization of the current Northeast Plume and Northwest Plume wellfields.

- Migration paths of Tc-99 and high concentration TCE to the area of the Northeast Plume.

The results of the field investigation and data collection planned in *Addendum to the Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex* will be used for groundwater modeling to determine the new EW locations and will be documented in an engineering design for the project. In addition to the data points listed in the paragraph above, the modeling will determine the extraction rates and general screen depths and other associated parameters. Additional adjustment of the extraction rates may be conducted and documented in a future operation and maintenance plan revision/addendum to support the operation of the 2024 C-400 Complex EWs. The quantity of new EWs needed to optimize the TCE mass removal is not currently known; however, based on historical modeling, it is expected that one or more wells will be required (DOE 2023). The current operating Northwest Plume IRA EWs will continue to operate along with the new C-400 EWs.

The current C-612 treatment facility will require an upgrade or the addition of new treatment equipment to increase the total treatment volume capacity and contaminant removal capacity to allow the additional water from the C-400 Complex EWs to be treated. The current C-612 treatment facility's best available treatment operational configuration will not be significantly changed with the upgrade. The current C-612 system was analyzed in *C-612 System Optimization through Multiple Flow Scenarios* (DOE 2024c) and it was determined that insufficient excess capacity is available for treating the 2024 optimization volume. The treatment approach may include utilizing modular treatment units with similar treatment capabilities to supplement current C-612 capabilities. The modular treatment units may be used to treat the groundwater volume from only the C-400 Complex EWs or from a combination of the existing EWs and the C-400 Complex EWs. The decision of which equipment and configuration provides the most efficient and economical approach to treatment will be determined in the engineering design. Regardless, the entire treatment capacity provided by the equipment will be considered the Northwest Plume IRA Treatment System with all treated water flowing through the point of compliance and discharging at the KPDES Outfall 001. Depending on parameters such as well location and needed pumping rates as determined by modeling, extraction rates in EW232 and EW233 may be modified to make the contaminant capture and mass removal as efficient as possible.

The original EWs, EW228, EW229, EW230, and EW231, were shut down by the 2010 optimization. EW228 and EW229 were taken out-of-service and will remain out-of-service after this 2024 optimization. EW230 and EW231 were placed in standby. The currently used south wells, EW232 and EW233, will continue to extract RGA groundwater from their area near the north PGDP industrial fence line and utilize

the current C-612 treatment facility for treatment. The O&M plan for the Northwest Plume IRA will be revised as needed during optimization.

The optimized Northwest Plume IRA will include installation of up to 10 new MWs to support analyses of contaminant levels and flow conditions near the C-400 Complex EWs during operation. The design and location of the MWs will be determined along with the C-400 Complex EWs parameters during engineering design.

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1. INTRODUCTION

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in private water wells north of the Paducah Gaseous Diffusion Plant (PGDP). After further investigation, the principal contaminants of concern were trichloroethene (TCE) and technetium-99 (Tc-99). Contaminated groundwater emanating from the northwestern portion of the PGDP industrial facility is referred to as the Northwest Plume, and an interim remedial action (IRA) was identified in the early 1990s in response to contaminants of concern associated with the Northwest Plume.

The Northwest Plume IRA is a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) action documented in a 1993 record of decision (ROD) located in the Administrative Record (DOE 1993). As stated in the Declaration for the ROD, "the primary objective of this interim remedial action is to implement a first-phase remedial action, as an interim action to initiate control of the source and mitigate the spread of contamination of the Northwest Plume." Also, stated in the ROD in the Summary of Site Risks Section is, "The principal goals of this interim action are to decrease the risk by mitigating the spread of the high concentration portion of the Northwest Plume, retarding the migration of the contaminants emanating from the source area, and to provide mass removal of the contaminants of concern contained in the Northwest Plume."

The Northwest Plume IRA construction was completed in 1995. Normal operations began in August 1995, and the system has been operating since then. From the start of operations until 2010, the system consisted of four extraction wells (EWs). The system was optimized in 2010 with two new EWs (EW-232 and EW-233, Figure ES-1) that were installed and were located nearer to the high concentration portions of the Northwest Plume. The existing EWs, EW228 and EW229, were taken-out-of-service in 2010 and EW230 and EW231 were placed in standby at that time.

This 2024 optimization of the Northwest Plume IRA remedial action work plan (RAWP) is intended to provide background information; identify scope optimization elements; define the project organization; identify project plans and procedures; and present project planning schedule for optimization of the Northwest Plume IRA.

1.1 PURPOSE OF THE INTERIM REMEDIAL ACTION OPTIMIZATION

The purpose of the 2024 Northwest Plume IRA optimization project is to continue to increase TCE mass removal, to enhance control of the Northwest Plume migration from the PGDP industrial facility, and to reduce contaminant migration off-site. This 2024 optimization action was initiated in response to recommendations documented in the following documents:

- *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2067&D2 (DOE 2003);
- Paducah 2006 Sitewide remedy review (DOE 2006);
- *U.S. Department of Energy Office of Environmental Management Paducah Gaseous Diffusion Plant Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007);
- *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0117&D2 (DOE 2009);

- *CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (Fourth Synchronized Five-Year Review)*, DOE/LX/07-2426&D2 (DOE 2019);

- *Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1 (DOE 2018);

- *Remedial Investigation Report for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2474&D2 (DOE 2023);

- *Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, NWP-PT-PD, August 2024, (DOE 2024a); and

- CY 2023 *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (Fifth Synchronized Five-Year Review),* DOE/LX/07-2492&D2/R1 (DOE 2024b).

1.2 SCOPE OF THE INTERIM REMEDIAL ACTION OPTIMIZATION

The Northwest Plume IRA system 2024 optimization will include the following major activities:

- Design and installation of new EWs near the northside of the C-400 Complex (Figure 1) capable of pumping up to 100 gal per minute (gpm). The actual total number of EWs needed and their extraction rates will not be known until the C-400 RI Addendum data is collected and modeled. Based on this data, additional EWs will be added.

- Design and installation of piping and various leak detection monitoring stations for conveying extracted groundwater;

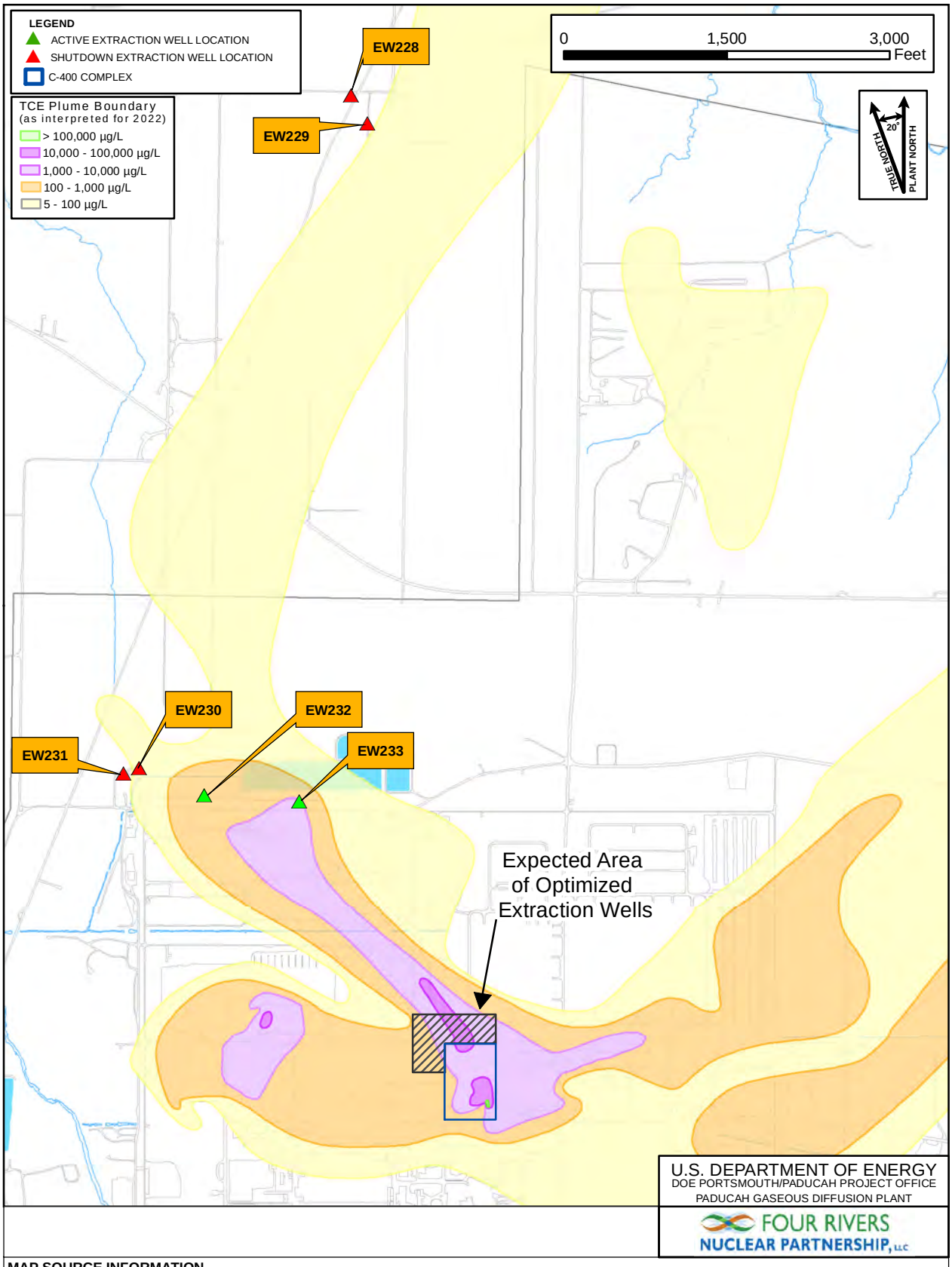
- Design and construction, as needed, of an overhead electrical feeder system to provide electrical power to the EWs;

- Design, construction, testing, and operation of Northwest Plume IRA treatment system will contain the same treatment train as the original treatment system for the IRA of air stripping, ion exchange, and vapor-phase activated carbon;

- Engineering design will plan for further optimization of the treatment system through potential upgrades that will ensure that the remedial action will remain protective;

- Installation and development of up to 10 additional monitoring wells (MWs);

- The original Northwest Plume IRA EWs, EW228, EW229 will remain shut down and out-of-service and EW230, and EW231, will remain shut down and in stand-by.



MAP SOURCE INFORMATION
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Plume Boundary: G:\GIS\ARCVIEWS\PROJECTS\PLUMES\2022 Plumes (5/9/2023);
Extraction Well Locations: G:\gis\iPEGASIS.gdb\Locations (for those shown)
Expected Area of Optimized Extraction Wells-- G:\GIS\ARCVIEWS\PROJECTS\NW Plume\MEMO\Area_OptimizedExtractionWells.shp

Figure 1. Expected Area of Optimized Extraction Well Locations

The currently used EWs, EW232 and EW233, will continue to extract Regional Gravel Aquifer (RGA) groundwater from the area near the north PGDP industrial fence line and utilize the current C-612 treatment facility for treatment until after this 2024 optimization project. Changes to the Northwest Plume IRA treatment system operation will be documented in a post-construction report for this 2024 optimization process and addressed in the revision of the operation and maintenance (O&M) plan.

The treatment facility upgrades and additions will increase the total treatment volume capacity and contaminant removal efficiency of the Northwest Plume IRA treatment system; however, the configuration of the treatment system will not be significantly changed. During the equipment update, the existing facility may also undergo modifications to update the nontreatment equipment, as needed; however, the general configuration of the treatment equipment and the treatment train will not be modified. The equipment for the modular treatment system, if selected during engineering design, will be designed to allow for the increase in extraction volume from the operating EWs.

2. REMEDIAL ACTION APPROACH

The DOE deactivation and remediation contractor has overall contractor responsibility for the planning, design, procurement, construction, and testing and then the follow-on O&M, waste management, and waste disposal associated with the implementation of this 2024 optimization of the RAWP for the Northwest Plume IRA. The major activities for this 2024 optimization of the Northwest Plume IRA are outlined in this section.

Table 1 is a general list of activities governed by plans and procedures. Plans and procedures referenced in the table are those followed by the current DOE Deactivation and Remediation contractor. The most current versions of applicable contractor procedures are to be used. This RAWP, along with the procedures that are referenced by this RAWP, will be readily available in the field to project personnel, including subcontractors, either in hard copy or in electronic format. If electronic files are provided, a computer will be available for accessing the documents within a reasonable distance of the work site.

Table 1. General Activities Governed by Plans and Procedures

Activity	Applicable Procedure
Accident/Incident Reporting	CP3-OP-2024, *Initial Incident/Event Reporting*
Analytical Laboratory Interface	CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*
Calibration of Measuring and Test Equipment	CP4-ER-0020, *Control and Use of Pressure-Related Measuring and Test Equipment for the Northwest and Northeast Plume Operations*
Chain-of-Custody and Sample Data Forms	CP3-ES-2708, *Chain-of-Custody Forms, Field Sample Logs, Sample Labels, and Custody Seals* CP3-ES-2700, *Sample and Miscellaneous Data Forms*
Collection of Samples	CP4-ES-0040, *Composite Sampling* CP4-ES-2101, *Groundwater Sampling* CP4-ES-2300, *Collection of Soil Samples* CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation* CP4-HS-2000, *Industrial Hygiene Sampling*
Conducting Assessments	CP3-QA-1003, *Management and Self Assessments*
Control of Sample Temperature	CP3-ES-0043, *Temperature Control for Sample Storage*
Graded Approach	CP3-QA-1001, *Graded Approach*
Handling, Transporting, and Relocating Waste Containers	CP2-WM-0661, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project, Transportation Safety Document for On-Site Transport*

Table 1. General Activities Governed by Plans and Procedures (Continued)

Activity	Applicable Procedure
Data Verification and Validation	CP2-ES-0026, *Wet Chemistry and Miscellaneous Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP2-ES-0811, *Pesticide and PCB Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP2-ES-5102, *Radiochemical Analysis Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP2-ES-5103, *Polychlorinated Dibenzodioxins/Polychlorinated Dibenzofurans Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP2-ES-5105, *Volatile and Semivolatile Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP2-ES-5107, *Inorganic Analyses Data Verification and Validation Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
Decontamination of Sampling Equipment	CP4-ES-2702, *Decontamination of Sampling Equipment and Devices* CP4-ER-2701, *Large Equipment Decontamination*
Document Control	CP3-OP-0002, *Developing and Maintaining Performance Documents*
Evaluations for Suspect/Counterfeit Items	CP3-QA-1006, *Suspect/Counterfeit Items*
Fall Prevention	CP3-HS-2014, *Fall Prevention and Protection*
Field Logbooks	CP4-ES-6000, *Logbooks*
Health and Safety Plan	CP2-ER-0140, *Health and Safety Plan for the Southwest Plume Remedial Actions at Four Rivers Nuclear Partnership, LLC, Project, Paducah, Kentucky*
Hoisting and Rigging Operations	CP3-SM-0051, *Hoisting and Rigging*
Issue Management (includes corrective action)	CP3-QA-3001, *Issues Management*
Lithologic Logging	CP4-ES-2303, *Borehole Logging*
Powered Industrial Trucks	CP3-SM-0020, *Administrative Controls for Powered Industrial Trucks*
Quality Assured Data	CP3-ES-5003, *Quality Assured Data*
Quality Assurance (QA) Program	CP2-QA-1000, *Quality Assurance Program Description for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
Radiation Protection	CP2-RP-0001*, Four Rivers Nuclear Partnership, LLC, Radiation Protection Program for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
Records Management	CP2-RD-0001, *Records Management Plan for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP3-RA-4002, *Administrative Record Process* CP2-OP-1102, *Performance Document Program at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* CP3-OP-0025, *Document Control Process*
Revisions to Procedures or Work Packages	CP3-OP-0002*, Developing and Maintaining Performance Documents* CP2-SM-1000, *Activity Level Work Planning and Control Program for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
Shipping Samples	CP3-WM-3028, *Off-Site Shipping*
Suspend/Stop Work	CP3-HS-2009, *Stop/Suspend Work*
Temperature Extremes	CP3-HS-2000, *Temperature Extremes*
Training	CP2-TR-0100, *Training Program for the Paducah Gaseous Diffusion Plant Paducah, Kentucky* CP3-TR-0102, *Conduct of Training* CP2-TR-0102, *Paducah Deactivation and Remediation Project Training Implementation Matrix* CP3-OP-0208, *Required Reading/Crew Briefing*

Table 1. General Activities Governed by Plans and Procedures (Continued)

Activity	Applicable Procedure
Transmission of Data	CP4-ES-1001, *Transmitting Data to the Paducah Oak Ridge Environmental Information System*
Vendor/Supplier QA Program	CP3-QA-2001, *Approved Supplier Selection, Evaluation, Approved Supplier Maintenance*
Waste Acceptance Criteria	CP2-WM-0011, *Waste Acceptance Criteria for the Treatment, Storage, and Disposal Facilities at the Paducah U.S. Department of Energy Site*
Waste Management and Disposition	CP3-WM-0016, *Waste Handling and Storage in DOE Waste Storage Facilities* CP3-WM-0437, *Waste Characterization and Profiling* CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*

2.1 OPTIMIZATION MODELING APPROACH AND ASSUMPTIONS

Optimization modeling was performed in 2018 and was included in Appendix C of the *Remedial Action Work Plan for Optimization of the Northeast Plume Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1280&D2/R3/A1 (DOE 2018). The modeling provides technical support to this RAWP by identifying the increased effectiveness of an EW located closer to the source area(s) (e.g., C-400 Complex) as compared to the current Northwest Plume IRA EWs. The modeling identified that an EW pumping a minimum of 80 gpm and located near the north side of the C-400 Complex could control the dissolved volatile contamination emanating from the close proximity of the C-400 Complex. Additional support modeling was performed during the development of the C-400 Complex Operable Unit remedial investigation (DOE/LX/07-2474&D2, Appendix B—see Fate and Transport Modeling). This modeling was performed using the 2016 sitewide groundwater flow model (DOE 2017). In this assessment, both wet and dry season scenarios were evaluated, with the wet scenario having water levels 5 ft higher than the dry scenario. Capture particles were placed in the C-400 Complex model at top, middle, and bottom layers. Two EWs, each screened in model layer 1 and model layer 3 and fully-penetrating, were able to provide complete particle capture with 15 gpm per well in the dry season and 20 gpm per well in the wet season (see Figures 2 and 3).

Utilizing the information generated from the groundwater data and groundwater modeling when completed during engineering design, it is expected that optimization will include the design and installation of one or more new EWs capable of each pumping up to 100 gpm and be located near the C-400 Complex.

The C-400 Remedial Investigation Addendum field effort is being performed in late 2024. The addendum field effort will provide TCE concentrations in an area north of the C-400 Complex area. This additional data collection will be utilized during engineering design to further evaluate capture zones, required pumping rates, and their impacts in the RGA at the C-400 Complex such that no negative impacts will result from the new extraction locations and rates.

2.2 WELLFIELD AND SYSTEM DESIGN

2.2.1 Key Design Changes and Assumptions

The Northwest Plume IRA 2024 optimization will implement the following design changes and assumptions:

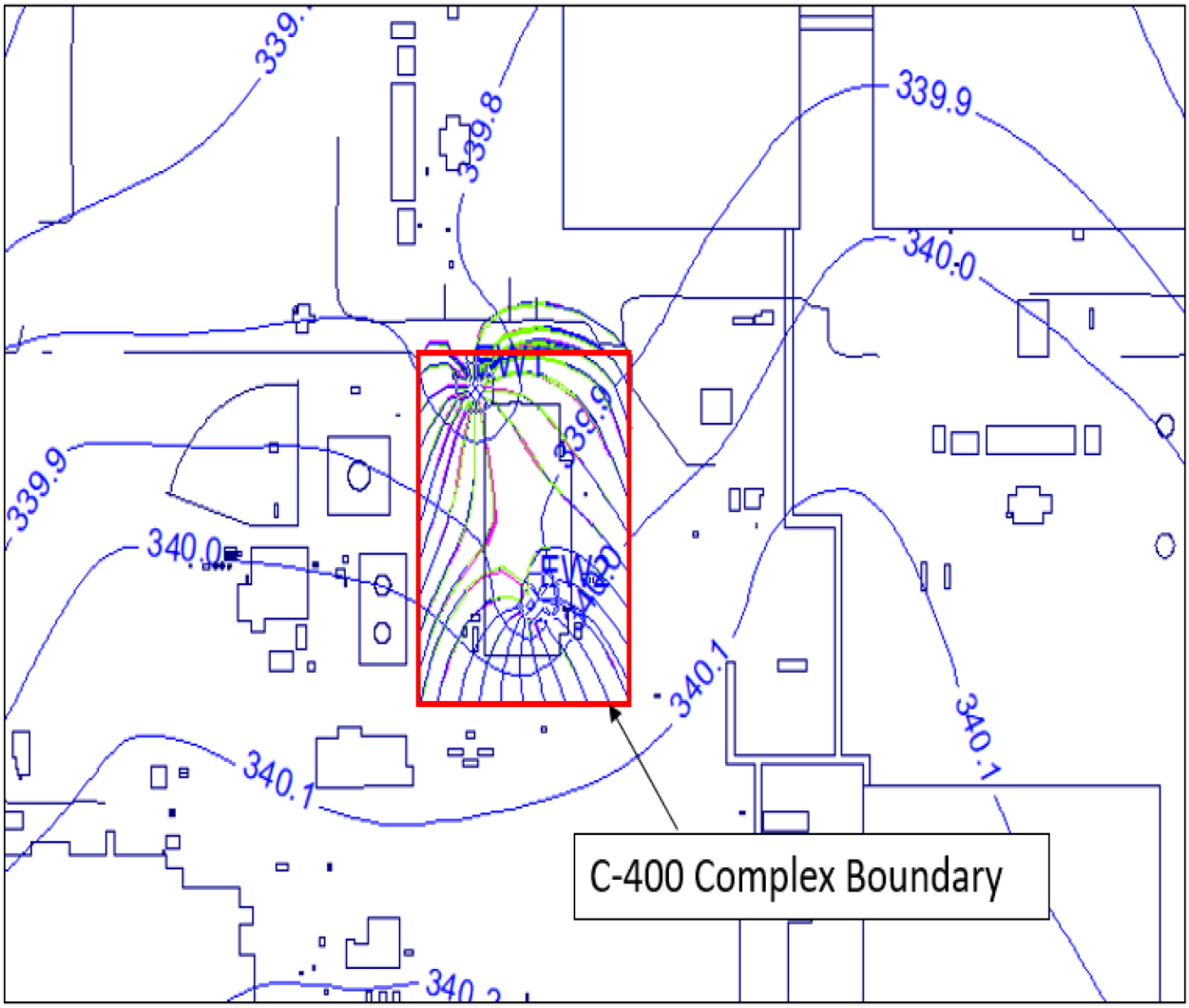

Figure 2. C-400 Complex Boundary Particle Tracks (Potentiometric Contours and Particle Tracks Simulated during Wet Conditions—Run 44)

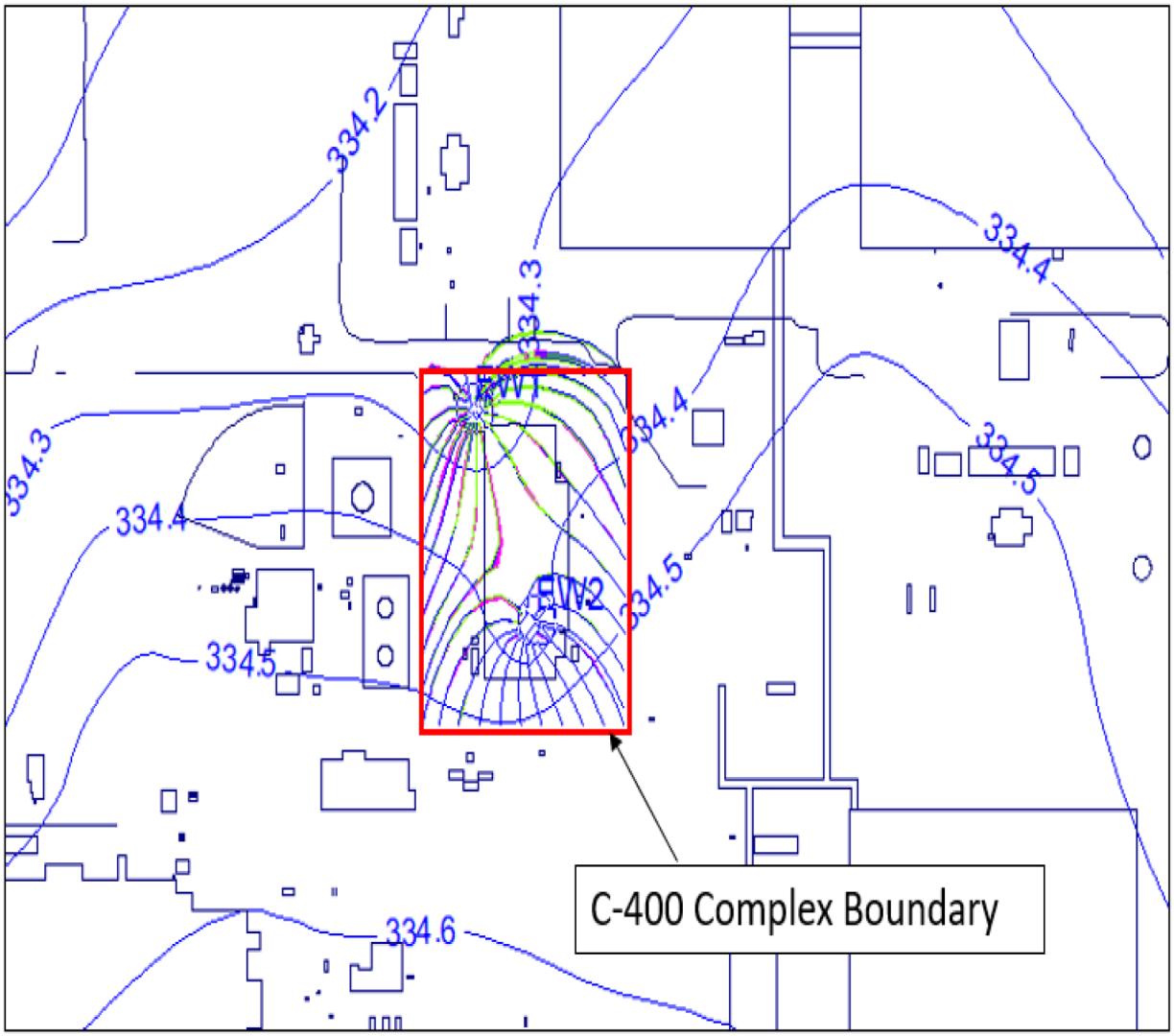

Figure 3. C-400 Complex Boundary Particle Tracks (Potentiometric Contours and Particle Tracks Simulated during Dry Conditions—Run 42)

- It is expected that one or more EWs located near the C-400 Complex will be required. The actual quantity of EWs, locations, screen locations, extraction rates, and general construction information will be determined using the data collected in the C-400 Complex investigation during engineering design.

- The existing 2010 optimized Northwest Plume IRA EWs, EW232 and EW233, will continue producing groundwater and the current C-612 treatment facility will continue to operate during construction of the 2024 optimization components of the Northwest Plume IRA.

- The new C-400 EWs will utilize the Northwest Plume IRA treatment system to process the extracted contaminated groundwater.

- Groundwater will be treated by the Northwest Plume IRA treatment system and then released flowing through Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 001 to be consistent with the 1993 ROD.

- The previously used EWs, EW228, EW229, were shut down and taken out-of-service. EW230 and EW231 were taken off-line and will continue to be in standby condition until the Federal Facility Agreement (FFA) parties agree the EWs are no longer necessary.

- The previously used pipelines, power sources, electronic controls, and power distribution system for the four initial EWs will not be abandoned as part of implementing this 2024 optimization RAWP.

- New electrical power connections will be installed for the new C-400 EWs and the Northwest Plume IRA treatment system.

- The 2024 Northwest Plume IRA C-400 EWs volumetric flow rate will not be determined/limited by the total treatment capacity (upgraded current C-612 capacity and modular/mobile treatment plant), but will be determined by the groundwater modeling component of the engineering design. The extraction rates will be determined utilizing the following considerations:

    — Extraction rates should not cause migration or entrain dense nonaqueous-phase liquid (DNAPL)

    — Extraction rates should reduce contaminant migration from Northwest Plume to the Northeast Plume EWs

- The new EWs to be installed during the optimization process are identified as part of the engineering design.

- The treatment range for the extracted groundwater will be based on the optimized flowrate for the new wells and with the specified treatment technologies and design capabilities of reducing influent contaminant concentration to target levels:

    — TCE or combination of VOC concentration of 20,000 parts per billion (ppb) (expected C-400 EW maximum) to meet the effluent discharge goal of 5 ppb.

    — Tc-99 activity of 3,250 pCi/L (expected C-400 EWs maximum) to 900 pCi/L via ion exchange resin.

    — Vapor phase treatment via activated carbon with a 95% reduction in hazardous air pollutants (HAPs)/VOCs, except vinyl chloride.

- The treatment goals as contained in the 1993 ROD are 5 ppb for TCE and 900 pCi/L for Tc-99.

- The Northwest Plume IRA treatment system will be determined in the engineering design by identifying the best approach/equipment for affecting the 2024 optimization. The treatment system will be composed of the current C-612 treatment facility with upgrades as identified and selected. This may include mobile, skid mounted, or semi-trailer mounted treatment unit(s) that include a high efficiency air stripper, air blower, effluent pump, influent bag filters, ion exchange vessels, vapor phase carbon, and process control system enclosed in a heated, weather proof enclosure, if needed.

- The Northwest Plume IRA treatment system will allow for additional treatment components (e.g. liquid-phase carbon, ion exchange vessels) as a potential upgrade with reduced reconfiguration of existing equipment.

- The Northwest Plume IRA treatment equipment will include the use of in-line separate phase DNAPL knock-out tanks to reduce the possibility of separate phase DNAPL contamination from entering the treatment system from the C-400 Complex area.

- The engineering design for the optimized Northwest Plume IRA treatment system will include vapor phase air modeling for the equipment and ARARs.

- Following the 2024 optimization, the Northwest Plume IRA treatment system will allow for upgrades, which includes additional treatment units that utilize liquid-phase activated carbon with minimal reconfiguration, as indicated in the *Memorandum to File: Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2024a).

- New electrical power lines, pipelines, communication, and process controls will be constructed in support of the new C-400 EWs.

- Wellfield design will be based on modeling results to be performed following the collection of the C-400 Remedial Investigation Addendum sampling and on geotechnical data (grain size analyses and lithologic logs) gathered from the C-400 Complex Remedial Investigation boreholes installed in proximity to the C-400 Complex area.

- No backup generator will be included because power interruptions are expected to be of limited frequency and duration such that contaminant mass not captured during the interruption will be minimal.

- No wetlands are expected to be impacted as a result of the new EWs or treatment equipment.

- The Northwest Plume IRA 2024 optimization activities will be constructed and performed in accordance with Northwest Plume IRA ROD and as altered by the 1996 and 2010 explanation of significant differences (ESD) and the 2024 *Memorandum to File: Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

2.2.2 Wellfield Design

The C-400 Remedial Investigation Addendum data collection will be performed at the beginning of FY 2025. The collection of additional RGA groundwater data will provide contaminant location and concentration information just downgradient of the C-400 Complex in the RGA where the C-400 Complex optimization EWs will be located. This additional data will be used along with existing information to perform groundwater modeling to provide the quantity and best locations for the C-400 Complex EWs while avoiding placing the wells in locations that could mobilize DNAPL. This modeling will also evaluate and provide information for placement of well screens to maximize the removal of dissolved contaminant mass. The modeling will also determine the expected groundwater pumping rates to be used, such that gradients that could mobilize DNAPL are not induced in the RGA. The key parameters will be developed during engineering design.

Because pumping at the EWs may result in changes to groundwater flow direction that impact contaminant migration from source areas, DOE will evaluate the RGA flow conditions and contaminant concentrations that result from the groundwater extraction upon start-up. This information will be incorporated into the applicable CERCLA Five-Year Review Reports. The FFA parties may utilize this information to consider

adjustments to EW pumping rates and other actions to minimize potential impacts, if necessary, for the optimized Northwest Plume interim action.

2.3 START-UP AND INTEGRATED TESTING

The current C-612 Northwest Plume IRA Groundwater System generally will continue to operate during construction of the 2024 optimization system components using the existing EWs (EW-232 and EW-233) and treatment system equipment currently in place. There will be short periods of downtime during tie-in of utilities and communication cables, and operating equipment to the existing system. These short periods of downtime for the existing system will be tracked and reported in the FFA semiannual report.

The groundwater produced from the 2024 optimization EWs and existing operational EWs will be treated by the Northwest Plume IRA treatment system. This system will be composed of upgraded existing equipment or new modular treatment units with similar treatment capabilities and best available treatment operational configuration that will not be significantly changed with the upgrade or new construction. This is necessary as the current C-612 system was analyzed in *C-612 System Optimization through Multiple Flow Scenarios* (DOE 2024c), and it was determined that insufficient excess capacity is available for treating the additional volume projected from the optimization EWs. The entire treatment capacity provided by the upgraded or new equipment will be considered the Northwest Plume IRA Treatment System with all treated water going through KPDES Outfall 001.

After construction is complete, each equipment unit will be operationally tested, calibrated, and incorporated into the logic control system as part of construction acceptance activities. An integrated system test will be performed on the treatment system to test the logic control system interlocks and effectiveness prior to starting routine operations. The details of the start-up and testing plan will be developed during engineering design. The C-400 EWs and the associated equipment will undergo the start-up, integrated testing, and construction acceptance testing prior to initiation of continuous operation. Using this approach, it is expected that the current Northwest Plume IRA system will experience some intermittent downtimes due to tie-ins, programming, and testing prior to combining the treatment equipment operation.

2.4 OPERATIONS AND MAINTENANCE

Upon successful completion of the integrated testing, the new EWs will be routinely operated at a combined rate that will be determined by the groundwater modeling and engineering design development. A revised O&M plan and operating procedures will be generated from the current C-612/Northwest Plume IRA O&M plan and will incorporate the interaction of the equipment within the Northwest Plume IRA treatment system prior to start-up. The U.S. Environmental Protection Agency (EPA) and The Kentucky Energy and Environment Cabinet (KEEC) will have an opportunity to review the revisions to the O&M plan prior to start-up of the new wells for continuous routine operations.

2.5 MONITORING

The revised O&M plan (See Section 2.4) will document sampling and analysis requirements. It is currently expected that the newly installed MWs will be sampled quarterly for the first year and then will be sampled on a frequency consistent with the other MWs associated with Northwest Plume IRA. As part of the optimization of the Northwest Plume IRA, a groundwater monitoring program will be included in PGDP Environmental Monitoring Plan, CP2-ES-0006, Section C.2.3 Northwest Plume Operation and Maintenance Program. The intent of the program is to provide data to support an ongoing analysis of the

contaminant types and levels and operational performance of the treatment units and associated equipment for the optimized Northwest Plume IRA. This data also will assist in monitoring impacts that the C-400 Complex EWs have on groundwater flow and contaminant sources.

2.6 WASTE MANAGEMENT AND DISPOSITION

Waste generated during drilling and construction activities will be managed and dispositioned in accordance with the waste management plan (WMP) and ARARs. Waste characterization will be performed using analytical results from waste sample analyses described in Section 7 and from process knowledge where applicable.

3. PROJECT ORGANIZATION

The roles and responsibilities of the project team members are described below.

DOE Project Manager—Serves as the point of contact with regulatory agencies, and directs the overall completion of the remedial action in accordance with the approved RAWP.

Prime Contractor Project Manager—Serves as the primary point of contact with DOE to implement the optimization IRA. Performs work in accordance with the baseline scope and approved plans, and schedules and directs the day-to-day activities of Contractor personnel as well as associated subcontractors supporting the project completion.

Quality Assurance Manager—Provides oversight and resources to ensure that all work is completed in accordance with the Quality Assurance Project Plan. Supports the development, implementation, and maintenance of the Quality Assurance (QA) Program. Verifies implementation of work is consistent with QA Rule; 10 *CFR* 830, Subpart A; DOE Order (O) 414.1D; and applicable NQA-1 Consensus Standard.

Field Superintendent—Oversees all field activities and verifies that field operations follow approved and established work plans, work controls, and applicable procedures.

Industrial Safety Specialist—Assists in the development of the health and safety plan (HASP) and job hazard analysis (JHA), verifies implementation of Worker Safety and Health Program and Integrated Safety Management Systems, and the development of work control documentation for implementing the remedial action. The industrial safety specialist provides oversight for safety and health compliance performance.

Environmental Compliance Representative—Oversees implementation of the Environmental Management Systems and associated regulatory requirements. The environmental compliance representative provides direct support to the prime contractor project manager.

Waste Management Coordinator (WMC)—Coordinates management of all waste according to PGDP facility requirements and the WMP. WMC responsibilities include coordinating daily activities with field personnel, overseeing daily waste generation and waste management operations and completion of necessary forms and maintaining a waste management logbook.

Field Technical Staff—Provides direct support to the field superintendent concerning technical aspects of the project.

Subcontractors—Provide equipment and expertise during drilling and construction, EW and MW installation, treatment facility connections, and pipeline construction.

Training of project personnel will be in accordance with training matrices developed for this project as part of the PGDP work control process.

4. PROJECT SCHEDULE

The project schedule includes activities through initiation of periodic sampling. Additional optimization activities (installation of EWs, transfer pipelines, production pump, and installation of the additional MWs) will be performed prior to the initiation of periodic sampling. A generalized project planning schedule is shown in Table 2.[3]

Table 2. Project Planning Schedule

Activity	Target Date	Comments
Memorandum to File: Northwest Plume		
Memorandum Signed	9/12/2024	
C-400 Remedial Investigation Report Addendum Investigation Report		
Submittal of D1 to EPA/KY	6/25/2025/To be determined (TBD)	
2024 Optimization of Northwest Plume IRA Remedial Action Work Plan		
Submittal of D1 to EPA/KY	11/29/2024	
Submittal of D2 to EPA/KY	TBD	

5. HEALTH AND SAFETY PLAN

The 2024 optimization of the Northwest Plume IRA project will incorporate by reference the HASP requirements from CP2-ER-0140, *Health and Safety Plan for the Southwest Plume Remedial Actions at Four Rivers Nuclear Partnership, LLC, Project, Paducah, Kentucky*, for performance of this optimization effort. The CP2-ER-0140 Southwest Plume remedial actions HASP will be applicable, as written, with the following exception: replace references to the Southwest Plume with 2024 optimization of the Northwest Plume IRA project.

6. ENVIRONMENTAL COMPLIANCE PLAN

Environmental regulatory compliance will be facilitated during the implementation of this optimization project by adhering to ARARs. The 2024 optimized interim remedy, which will continue to capture and remove TCE and Tc-99 from within the high concentration area of the Northwest Plume, still meets the threshold criteria of CERCLA Section 121 and the NCP. The remedy continues to be protective of human

[3] Projected schedules for completion of activities set forth herein are estimates provided for informational purposes only and are not considered to be enforceable elements of the remedial action or this document. The enforceable milestones for performance of activities included as part of the remedial action are set forth in accordance with requirements of the FFA (EPA 1998). Any additional milestones, timetables, or deadlines for activities included as part of the remedial action will be identified and established independent of this RAWP, in accordance with existing FFA protocols.

health and the environment and complies with ARARs. The 2024 optimization of this IRA includes: (1) ARARs in the 1993 ROD, (2) ARARs identified in the 1996 ESD, and (3) the additional ARARs identified in the 2010 ESD. Those will remain in place for the 2024 optimized IRA. No additional ARARs are planned to be added to the remedial action for this optimization. The discharge pertaining to discharge through KPDES Outfall 001 will be continued as part of this 2024 optimization.

6.1 WITHDRAWAL OF PUBLIC WATERS

The 2024 optimization of the Northwest Plume IRA project, a CERCLA action, includes the installation of new EWs for the purpose of extracting contaminated groundwater from the Northwest Plume near the C-400 Building Complex. The wells will be installed in accordance with ARARs identified in the approved 2010 ESD, as well as those identified in the original ROD signed July 26, 1993, for the IRA and consistent with *Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, NWP-PT-PD, August 2024.

The general proposed locations of the new EWs, are shown on Figure 1. The location of the currently used EWs, EW232 and EW233, also are shown also in Figure ES-1. Installation of the new wells and commencement of water withdrawal will be in accordance with the planning schedule shown in Section 4. Withdrawal rates will be measured by flow meters installed at each EW. The combined quantity and combined groundwater extraction rate from EW232, EW233, and the new C-400 EWs is not currently known, but is not expected to exceed 400 gpm (or 576,000 gal per day).

6.2 AIR EMISSIONS

VOCs stripped from the treated groundwater will be treated by vapor phase activated carbon before the vapor phase will be emitted to the atmosphere. The emissions of VOC will comply with the identified ARAR contained in the original 1993 ROD, as maintained under 401 *KAR* § 63:021. Compliance with this ARAR will be demonstrated by air dispersion modeling and by manufacturer's testing of vapor phase carbon treatment units as determined during the engineering design following the completion of the C-400 Remedial Investigation Addendum fieldwork.

The currently operating treatment system for extracted contaminated groundwater includes an air-stripping unit that removes VOCs to the extent practicable prior to offgassing emissions through a process vent into the ambient air. After optimization, the Northwest Plume IRA treatment system will incorporate similar offgas treatment. DOE has calculated that remediation materials at the Paducah Site currently do not exceed the regulatory threshold for applicability; however, upon initiation of the removal of HAPs (including VOCs such as TCE) from the additional EWs proposed for the NWP optimization project, remediation materials removed at the Paducah Site may exceed 1 Mg/year. If operation of the additional EWs does not cause an exceedance of 1 Mg/year threshold, as documented by DOE, then VOC emissions should continue to be limited from the Northwest Plume IRA treatment system process vents with control devices (such as an activated carbon filter or an air stripper) consistent with Subpart GGGGG regulations. If operation of the additional EWs causes an exceedance of the 1 Mg/year threshold, then the parties agree that DOE will issue an ESD that identifies additional Subpart GGGGG and Kentucky's equivalent requirements as applicable requirements, which includes any specified reductions or limits to VOC emissions and the implementation of further work practice standards for process vents.

6.3 WELL CONSTRUCTION VARIANCE REQUEST

A variance from 401 *KAR* 6:350 § 3(3)(a) will be requested by the subcontracted and Kentucky-licensed well driller. The variance request will be to allow the use of a thread lubricant during construction of EWs and MWs. Supporting information for the requested variance will be included with the licensed driller's variance application.

6.4 POST-RECORD OF DECISION DOCUMENTATION

The 2024 optimization of the Northwest Plume IRA has been documented by the Memorandum to File titled: *Nonsignificant Change for the Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, September 12, 2024. The document has been placed in the PGDP Administrative Record at the Northwest Plume Post-Decision file, NWP-PT-PD.

6.4.1 Semiannual Progress Reports

Semiannual reports are prepared and issued to DOE within 30 days of the end of each six-month period, summarizing the data generated by activities associated with the Northwest Plume IRA. DOE submits progress reports to the Kentucky Department for Environmental Protection and EPA pursuant to a requirement contained in the PGDP FFA. For this project, effluent discharge and other information will be summarized in the Northwest Plume IRA portion of the periodic report, which may include TCE concentrations, maintenance performed, down time, TCE removed, effluent discharges, and other relevant information.

7. WASTE MANAGEMENT

This WMP provides information for the management and final disposition of waste material that will be generated as a result of the 2024 optimization of the Northwest Plume IRA project. The project includes the installation of a yet to be determined number of EWs and up to 10 MWs, construction of buried transfer lines to convey contaminated groundwater. The Northwest Plume IRA treatment system will be constructed as part of the optimization project and will remove the TCE contamination via air stripping and remove Tc-99 using ion exchange equipment and resin. The vapor phase from the air stripper will be treated with activated carbon.

This WMP addresses the management of waste from the point of generation through final disposition. The 2024 optimization of the Northwest Plume IRA project is part of the DOE prime contractor's environmental remediation (ER) program, and the DOE prime contractor shall be responsible for all waste management activities. Standard practices and procedures (latest approved version) outlined in this WMP pertaining to the generation, handling, transportation, and storage of waste will comply with ARARs, DOE Orders, Resource Conservation and Recovery Act (RCRA), and Toxic Substance Control Act requirements.

An electronic or paper copy of this WMP will be available during fieldwork. The DOE prime contractor's ER WMC will be responsible for implementing procedures and requirements of this WMP for the generated wastes.

The WMP for the 2024 optimization of the Northwest Plume IRA project underscores the following objectives:

- Management of project waste in a manner that is protective of human health and the environment;
- Minimization of waste generation as feasible;
- Compliance with federal, state, and DOE requirements; and
- Selection of storage and disposal alternatives.

Waste generated will be stored in CERCLA on-site waste storage areas (e.g., C-752-C, C-760, C-761, or other CERCLA storage facility as available), or within an approved RCRA area of contamination during the characterization period prior to disposal. CERCLA on-site waste storage areas will be operated in compliance with applicable or relevant and appropriate waste storage requirements. Wastewater will be transferred to storage pending characterization and treatment. All waste management activities must comply with this WMP; applicable procedures; the C-746-U Contained Landfill waste acceptance criteria (WAC) (*Waste Acceptance Criteria for the Treatment, Storage, and Disposal Facilities at the Paducah U.S. Department of Energy Site,* CP2-WM-0011); *Hazardous Waste Facility Operating Permit*—Permit No. KY8-890-008-982; and the WAC for off-site treatment, storage, and disposal facilities (TSDFs) designated to receive waste. The decision has not been made as to the final TSDF that will be used for the 2024 optimization-generated wastes. Potential off-site TSDFs that may be used include, but are not limited to, Energy*Solutions*, Nevada National Security Site, Perma-Fix, and Waste Control Specialists.

During the course of this optimization project, additional PGDP and DOE waste management requirements may be identified. Necessary revisions to the WMP will ensure the inclusion of these additional requirements into the daily activities of waste management personnel. DOE will inform the FFA parties of any substantive changes to the WMP. The criteria for document changes will be those found in the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant* (EPA 1998).

7.1 WASTE GENERATION AND PLANNING

7.1.1 Waste Generation

A variety of waste may be generated during this project, including soil cuttings and water from drilling activities in the Upper Continental Recharge System and RGA; dewatered soil and water from wastewater filtration activities; personal protective equipment (PPE); sample residual (used sample bottles, etc.); grout; and construction and sanitary trash. Excavated soil waste also will be generated from construction activities. The waste generated from field-related activities has the potential to contain contaminants related to known or suspected past operations; therefore, this waste will be stored and disposed of in accordance with ARARs. Waste that is likely to have either hazardous or radiological contamination typically will be stored on-site in containers in CERCLA waste storage areas in accordance with procedures, during the characterization period and prior to treatment/disposal. The generation, storage, and movement of waste during a CERCLA project and storing it on-site does not trigger the administrative RCRA storage or disposal requirements.

On-site waste storage areas will be managed in accordance with ARARs, including RCRA Hazardous Waste Storage Standards. Among the substantive RCRA requirements are compatible containers in good condition, regular inspections, containment to control spills or leaks, and characterization of run-on and run-off, either by process knowledge or by sampling. Final disposition of the materials will depend on final characterization. Table 3 summarizes estimated quantities and container types expected to be generated per unit of construction in performing this project. Because the final number of EWs, MWs, length of conveyance pipelines, and the overall size of the treatment system is not currently known a total estimate of different wastes is not feasible. By developing a waste-specific volume based on an applicable quantity of construction, the overall total of a given waste type will be identified during engineering design.

Table 3. Estimation of Waste Per Specific Unit of Construction

Waste Stream	Volume	Container Type and Quantity	Disposition Facility	Processing Required[a]
Soil and Other Solid Media Associated with constructing one 4-inch × 95 ft deep MW (8-inch Borehole, 25% Swell) (Cuttings, Drill Tool Decontamination Solids, Lithologic Core, Dewatered Soils)	1.6 yd^3/well	Roll-off/intermodal boxes—TBD	C-746-U or off-site facility	None or off-site land disposal restriction (LDR) treatment[b]
Soil and Other Solid Media Associated with constructing one 8-inch × 95 ft deep EW (16-inch Borehole, 25% Swell) (Cuttings, Drill Tool Decontamination Solids, Lithologic Core, Dewatered Soils)	6.1 yd^3/well	Roll-off/intermodal boxes—TBD	C-746-U or off-site facility	None or off-site LDR treatment[b]
Soil Generated from Constructing EW Vault (10 ft × 4 ft × 4 ft + 3 ft × 2 ft × 2 ft sump with 1.25% swell factor)	8.0 yd^3/EW	Roll-off/intermodal boxes—TBD	C-746-U or off-site facility	None or off-site LDR treatment[b]
Soil Generated from Conveyance Pipeline (1 ft length × 1.5 ft wide × 3 ft depth with 25% Swell). Assume all soil to waste with no refill.	0.04 yd^3/ft	Roll-off/intermodal boxes—TBD	C-746-U or off-site facility	None or off-site LDR treatment[b]
Well Development Water per EW	100,000 gal/well	Mobile, Portable Containers—TBD	C-612 (Current)	C-752-C solids removal
Decontamination Water per Well (EW and MW)	50 gal/well	Mobile, Portable Containers—TBD	C-612 (Current)	C-752-C solids removal
Well Development Water per MW	1,000 gal/well	Mobile, Portable Containers—TBD	C-612 (Current)	C-752-C solids removal
Mobilization and Demobilization Water	1,000 gal/project	Mobile, Portable Containers—TBD	C-612 (Current)	C-752-C solids removal
PPE for Each Workday of Activities	4 ft^3/work day	1A2X Drums—TBD	C-746-U or off-site facility	None or off-site LDR treatment
Grout/Concrete	0.1 yd^3/ MW	1A2X Drums—TBD	C-746-U or off-site facility	None or off-site LDR treatment
Soil Generated per Well Pad (4.5 ft × 4.5 ft × 3 ft, 25% swell)	3 yd^3/pad	Roll-off/intermodal boxes—TBD	C-746-U or off-site facility	None or off-site LDR treatment[b]

[a] Wastewater will undergo further processing, as necessary, at current C-612 Northwest Plume treatment facility or it also may be processed at C-752-A or C-752-C waste management facilities prior to release.
[b] Waste not meeting the definition of hazardous waste at the point of generation and meeting the requirements of the WAC may be disposed of in the C-746-U Landfill with no further treatment. Waste meeting the definition of hazardous waste at the point of generation must be treated to LDR standards prior to landfill.

A comprehensive waste-tracking system capable of maintaining an accurate inventory of waste generated will be used during the project. To prevent inappropriate disposal of waste, all generation, storage, and characterization information must be included in the tracking system. Specifically, the waste inventory must include the following information:

- Generation date
- Request for disposal (RFD) number
- Waste origination location
- Waste matrix (solid, liquid)
- Waste description (soil, PPE, etc.)
- Quantity
- Storage location
- Sampling status
- Sampling results status
- Date of disposal

7.1.2 Soil from Drilling and Construction Activities

Solid waste drilling cuttings and excavated soil will be generated from installation of the new EWs, MWs, and pipeline construction. Drill cuttings from the RGA, drill cuttings from boreholes in the industrial facility of PGDP, and soils excavated in the industrial facility of PGDP will be containerized as they are generated, labeled, and managed on-site according to the substantive requirements of RCRA, until they either are determined not to be RCRA waste, as provided in Section 7.9.1, or dispositioned to an appropriate disposal facility in accordance with ARARs.

Waste minimization also will be facilitated by not containerizing material known to originate from clean areas. Wastes will be stored at CERCLA storage areas and will be managed in accordance with ARARs, including substantive RCRA requirements. The solid waste will be sampled and analyzed as described in Section 7.9 for proper waste determination.

7.1.3 Personal Protective Equipment

PPE will be worn as specified in the HASP, JHA, industrial hygiene work permit, or by personnel performing the field tasks. While site personnel use procedures and best management practices to minimize opportunities for contacting contaminated media and equipment, it is likely that some PPE or related debris (e.g., plastic sheeting) will come into contact with contaminated materials during the remediation process.

Process knowledge, visual inspections, or direct sampling will be used to characterize PPE and any related debris. Based on the results of the characterization, any PPE or the related debris determined by site personnel to be contaminated by a listed waste or exhibiting a RCRA characteristic will be managed as hazardous waste, decontaminated, or a no longer contaminated-with determination will be made pursuant to Section 7.9. In cases where site personnel conclude, based on the above characterization process or process knowledge, that the PPE or related debris has not been contaminated by a listed waste or does not exhibit a characteristic, then the materials will not be considered a RCRA hazardous waste.

7.1.4 Grout

Bentonite grout is used to seal new well casing in place. There is a potential for grout to become waste due to test pours, spillage, or leftover material in a batch following a pour for well completion. Grout mixed, but placed on or in the subsurface will be packaged separately from other waste streams and managed as nonhazardous material.

7.1.5 Well Installation/Development/Decontamination/Sample Residual Water

Drilling technology (dual rotary, sonic, auger, etc.) as available will be used to drill the EWs and MWs. The selection of the specific drilling type will be made during the subcontractor procurement phase and when rig availability and borehole specification/requirements are clearer.

Newly installed EWs, piezometers, and MWs will be developed to remove fine material from the formation around the well screen. This process will generate water with high suspended solids content. Well development water may be processed at the drill site for suspended solids and may be stored in dual wall holding tanks until verified that it meets the appropriate acceptance/discharge criteria for suspended solids before transfer to the current C-612 treatment facility and discharged through KPDES Outfall 001. Additional wastewater with suspended solids will be generated as a result of drilling equipment decontamination activities and during mobilization and demobilization activities.

Wastewaters generated during drilling and well development, and decontamination activities may be processed through particulate filters at the drill site or accumulated and stored on-site until it can be processed for removal of suspended solids, as necessary. The solids will be classified according to the results of water and soil analyses. The filtered water will be pumped to dual wall holding tanks until verification that it meets the appropriate acceptance criteria for suspended solids before transfer to the on-site current C-612 Northwest Plume IRA Groundwater System. Potential contaminants of concern in this filtered wastewater will be consistent with those in the Northwest Plume groundwater.

Wastewaters generated during drilling, well development, and decontamination activities that have undergone wastewater treatment and meets the discharge limits shall be considered to "no longer contain" listed-hazardous waste (e.g., TCE), as discussed in Section 7.9.1. This treated wastewater may be directly discharged to permitted KPDES Outfall 001, on-site ditches that flow to permitted KPDES Outfall 001, or to the Northwest Plume IRA treatment system.

7.1.6 Miscellaneous Noncontaminated/Clean Trash

DOE has implemented waste management activities for the segregation of clean trash (i.e., trash that is not chemically or radiologically contaminated). Examples of clean trash are office paper, aluminum cans, packaging materials, glass bottles not used to store potentially hazardous chemicals, aluminum foil, and food items. During implementation of this WMP, clean trash will be segregated according to those guidelines and then collected and recycled/disposed of by the WMC when it has been approved for removal.

7.2 WASTE CHARACTERIZATION

Waste characterization will be performed based on sample analyses, evaluation of existing data, or process knowledge. Refer to Section 7.9 of this document for more information on waste characterization sampling.

7.3 CONTAINERS, ABSORBENT, AND DRUM LINERS

WAC approved absorbent will be used as necessary to ensure there are no free liquids in the waste being disposed of in the C-746-U Landfill. Table 3 summarizes container types and estimated quantities of containers that would be used per unit of the construction item.

7.4 WASTE MANAGEMENT ROLES AND RESPONSIBILITIES

7.4.1 Waste Management Tracking Responsibilities

Waste generated during remediation activities at PGDP is tracked using a system capable of maintaining an up-to-date inventory of waste. The inventory database is used to store data that will facilitate determination of management, storage, treatment, and disposal requirements for the waste.

7.4.2 Waste Management Coordinator

The WMC will ensure that all waste activities are conducted in accordance with PGDP facility requirements and this WMP. Responsibilities of the WMC include coordinating activities with field personnel generating waste, overseeing daily waste management operations and associated paperwork, and maintaining a waste management logbook that contains a history of generated waste and the current status of individual waste containers. Designated waste operators also may complete the waste management logbook.

The WMC will ensure that procurement and inspection of waste equipment, material, or services critical for shipments of waste to on-site storage and to off-site TSDFs are conducted in accordance with appropriate procedures. In addition, the WMC will ensure that wastes are packaged and managed in accordance with applicable requirements (e.g., the WAC for the landfill).

Additional responsibilities of the WMC include the following:

- Maintaining an adequate supply of waste packaging labels;
- Maintaining drum inventories at sites;
- Interfacing with all necessary personnel;
- Preparing RFDs;
- Tracking generated waste;
- Ensuring that drums or other waste containers are properly labeled;
- Coordinating waste recycling, disposal, or transfers;
- Sampling waste containers to characterize wastes;
- Coordinating pollution prevention and waste minimization activities;
- Transferring characterization data to DOE prime contractor's data manager; and
- Ensuring that temporary project waste storage areas are properly established, maintained, and closed.

Waste item container logs will be used to document each addition of waste to containers.

The WMC and waste operators will perform the majority of waste handling activities. These activities will involve coordination with the DOE prime contractor IRA project manager or designee who will perform periodic inspections to verify that drums are labeled in accordance with the WMP guidelines.

The WMC will be responsible for ensuring characterization sampling of the waste is in accordance with the procedures outlined in this plan. When sampling is complete, the WMC will transfer the waste into the waste holding area established for this project, if necessary.

The WMC or designee will complete all chain-of-custody forms relating to the shipment of waste characterization samples. The chain-of-custody forms, along with the associated samples, will be transferred to the personnel responsible for packaging and delivery of the samples.

The WMC or designee will inspect the decontamination facility to ensure that decontamination waste generation is minimized to the extent possible and that the transfer of liquids to the waste holding area is

arranged such that the work schedule is not delayed. If improper waste-handling activities are observed, the WMC will notify the DOE prime contractor project manager and temporarily stop decontamination activities. All activities not in compliance with the WMP will be identified and corrected before decontamination activities continue.

7.4.3 Coordination with Field Crews

The WMC will be responsible for daily coordination with project field crews involved in activities that generate waste. The WMC will inspect work sites to oversee the waste collection and will verify that procedures used by the field crews comply with the WMP guidelines. Deficiencies will be documented in the waste management logbook, and appropriate direction will be given to the field crews. Site visits will be documented in the field logbook.

7.4.4 Coordination with Treatment, Storage, and Disposal Facilities

The waste streams generated on the 2024 optimization of the Northwest Plume IRA project will be managed and disposed of in a variety of ways depending on characterization and classification. Waste will be temporarily stored on-site as previously discussed. Waste that is to be shipped to an off-site TSDF must be done so in accordance with applicable DOE contractor procedures and U.S. Department of Transportation requirements.

7.4.5 Waste Management Training

The WMC and other project personnel with assigned waste management responsibilities will be trained and qualified in accordance with the approved project training matrix.

7.5 TRANSPORTATION OF WASTE

The areas where the optimization of the Northwest Plume IRA activities will be conducted are on DOE property. Transportation of waste on DOE property will be conducted in accordance with applicable DOE, PGDP, and DOE Contractor policies and procedures. In the event that it becomes necessary to transport known or suspected hazardous waste over public roads, coordination will be initiated with PGDP Security, as necessary, which may result in the temporary closing of roads. Off-site transportation/disposal of waste will be made in accordance with the substantive and administrative requisites of applicable regulations.

7.6 SAMPLE SCREENING

7.6.1 Screening of Analytical Samples

During the course of the 2024 optimization of the Northwest Plume IRA field activities, screening of waste samples will be performed to protect the health and safety of on-site personnel and to ensure compliance with regulatory requirements.

7.6.2 Field Screening

Field screening for health and safety will be conducted during project field activities and sample collection. The field screening to be performed will incorporate the use of instrumentation to monitor for organic vapors, as well as radiation meters capable of detecting alpha and beta/gamma radioactivity. An elevated

reading from field monitoring may be cause for reevaluation of current waste classification, labeling, and handling activities.

7.6.3 On-Site Laboratory Radiation Screening

An off-site fixed-base laboratory will analyze all waste characterization samples. All samples to be shipped off-site for laboratory analysis will be screened for radiation by a radiological technician and will receive approval before off-site shipment.

7.7 WASTE MINIMIZATION

Waste minimization requirements that will be implemented, as appropriate, including those established by the 1984 Hazardous and Solid Waste Amendments of RCRA; DOE O 5400.1 *General Environmental Protection*, 5400.3 *Hazardous and Radioactive Mixed Waste*, 435.1 *Radioactive Waste Management*, and 458.1 *Radiation Protection of the Public and the Environment;* and requirements specified in this project WMP and procedures concerning waste generation, tracking, and reduction techniques will be followed.

To support the DOE contractor's commitment to waste reduction, an effort will be made during field activities to minimize waste generation, largely through ensuring that potentially contaminated waste material is localized and is not allowed to come into contact with clean material. Such an event could create more contaminated waste. Waste minimization also will be facilitated by not containerizing material known to originate from clean areas, such as above the RGA and outside the industrial facility of PGDP.

Solid wastes such as anticontamination coveralls and packaging materials will be segregated. An attempt will be made to separate visibly soiled coveralls from clean coveralls. In some instances, partially soiled coveralls can be cut up and segregated. Other solid waste will not be allowed to contact potentially contaminated soil waste. Efforts will be made to keep anticontamination coveralls clean, reuse clean coveralls, and use coveralls only when necessary. Proper waste handling and spill control techniques will help minimize waste, particularly around decontamination areas where water must be containerized.

7.8 HEALTH AND SAFETY ISSUES RELATED TO WASTE ACTIVITIES

Waste management activities will be conducted in compliance with health and safety procedures documented in the HASP, JHA, or industrial hygiene work permit.

7.9 WASTE SAMPLING AND ANALYSIS PLAN

This section of the plan describes sampling to support analysis and characterization of waste generated from the optimization efforts that include installation of EWs, piezometers, and MWs, and construction waste. Solid waste will be generated from drilling and excavating, while aqueous liquids (groundwater, well purge and development water, and sample residuals water) also will be generated during drilling. The project team will perform sampling and sample management in accordance with contractor-approved procedures and work instructions. Procedures related to the sample collection and additional procedures are referenced in Section 2, Table 1.

Wastes generated from sites that are potentially contaminated, like the RGA near the C-400 Complex will be characterized to classify the waste for proper handling, record keeping, transfer, storage, and disposal. Waste analyses will be performed using the EPA approved procedures, as applicable. Analyses required for

hazardous waste classification will reference EPA SW-846 or other EPA-approved methods, as required. The analyses will be performed by a DOE Sample Management Office (SMO)-contracted laboratory. Wastewater analyses will reference the applicable analytical requirements in PGDP's KPDES permit, Clean Water Act, or Safe Drinking Water Act. QA/quality control (QC) requirements and data management requirements, as specified in Sections 7.9 and 7.10 of this document, will be followed for waste characterization sampling activities.

Characterization requirements and guidance are provided in the site WAC, CP3-WM-0437, *Waste Characterization and Profiling*, and CP3-WM-1037, *Generation and Temporary Storage of Waste Materials.* Section 7.9.2 lists the analytical testing methods that will be used for analysis. The WMC will coordinate with the DOE contractor Northwest Plume IRA optimization project manager and DOE contractor SMO group for required analyses and guidance on collection and transfer of characterization samples to a SMO-approved fixed-base laboratory that has been audited under DOE Consolidated Audit Program (DOECAP).

7.9.1 Contained-In/Contaminated-With Determinations

The Northwest Plume groundwater is contaminated with certain VOCs that originated from disposal of spent solvents. As a result, the TCE contamination in the Northwest Plume has been declared a RCRA listed-hazardous waste (code F001, F002, U228). Under the EPA "contained-in" policy, environmental media, such as groundwater, must be managed as hazardous waste if they "contain" listed-hazardous waste. EPA guidance, *Management of Remediation Waste under RCRA*, recommends that "contained-in" determinations use conservative, health-based standards to develop site-specific health-based levels of hazardous constituents below which contaminated environmental media would be considered to no longer contain hazardous waste (EPA 1998). Consequently, per the EPA's contained-in policy, the Northwest Plume groundwater is considered to contain the RCRA listed-hazardous waste. Management of such groundwater must comply with the RCRA ARARs for hazardous waste identified in the original interim ROD (DOE 1993) unless the groundwater is determined to contain TCE below the health-based level. The site-specific health-based level for TCE in groundwater at PGDP has been established at 30 ppb, which is based on Kentucky ambient water quality criteria for protection of human health for consumption of fish [401 *KAR* 10:031 § 6(1)]. Groundwater contaminated with TCE generated from the Northwest Plume project at or below 30 ppb will be considered to no longer contain the RCRA listed-hazardous waste (F001, F002, U228). Groundwater that meets the health-based level for TCE also shall be deemed to no longer contain 1,1,1-trichloroethane (TCA). Degradation products (*cis*-1,2-DCE; *trans*-1,2-DCE; or vinyl chloride) associated with TCE may be present in groundwater, and any treatment process used for the TCE-contaminated groundwater also would be effective in treating/reducing the concentrations of the degradation products.

Most of the contaminated groundwater extracted for treatment exceeds this site-specific health-based level; thus, it must be managed as RCRA listed-hazardous waste. Consequently, certain solid wastes generated from treatment units that treat groundwater containing TCE above 30 ppb are considered RCRA hazardous waste due to the derived-from rule at 40 *CFR* § 261.3(c) and (d) (401 *KAR* 39:060 § 3). The treated groundwater that is discharged into the receiving surface water body (e.g., Bayou Creek) through the KPDES outfall (001) will comply with identified Clean Water Act and Kentucky water quality standards identified as ARARs and will be below the 30 ppb TCE. Pursuant to 40 *CFR* § 261.4(a)(2) (401 *KAR* 39:060 § 3), point source discharges are excluded from regulation as a hazardous waste. The exclusion applies only to the actual point source discharge and does not exclude industrial wastewaters while they are collected, stored, treated before the discharge, nor does it exclude sludge that is generated by industrial wastewater treatment.

Some of the waste debris, other than PPE, and environmental media such as drill cuttings generated during this project will be characterized and the results compared to health-based standards to determine whether or not any concentrations of TCE and 1,1,1-TCA are above health-based levels listed in Table 4. If the concentrations are below the levels contained in Table 4, then the waste will be deemed not to contain or not to be contaminated with a (RCRA) listed waste (based on TCE/TCA content) for the purposes of management at the site.

Table 4. Health-Based Levels for TCE and 1,1,1-TCA

Constituent	Concentration in solids (ppm)
TCE	39.2
1,1,1-TCA	2,080

Because data from previous sampling events indicate that conditions for C-746-U Landfill disposal potentially will be met, characterization for C-746-U Landfill disposal will be undertaken. LDRs generally apply to media and debris generated from this project that no longer contain or no longer are contaminated with RCRA hazardous waste. The LDR treatment standard for TCE is 6 mg/kg, which is more restrictive than the PGDP contained-in level of 39.2 mg/kg; therefore, the LDR treatment standard also must be satisfied in addition to the contained-in determination in order to place the material in a landfill.

Health-based standards of 39.2 ppm TCE and 2,080 ppm 1,1,1-TCA in solids will be used as the criteria for making contained-in/contaminated-with determinations for environmental media and debris designated for disposal at the C-746-U Landfill. Solid waste disposal at landfills other than C-746-U will be subject to a contained-in/contaminated-with determination that will be approved by the Commonwealth of Kentucky and the state in which the receiving landfill is located. KEEC has agreed to consult with DOE and the state where the off-site facility is located to reach agreement upon the appropriate health-based standard for making such determinations for waste that is be shipped to such a facility.

Aqueous liquids generated during optimization construction (groundwater, well purge and development water, and sample residuals water) contaminated with TCE will be treated at an on-site permitted wastewater treatment facility. Treated effluent below 0.030 mg/L also shall be below the health-based level and considered to “no longer contain” listed-hazardous water (i.e., TCE). Based on the process knowledge of the current C-612 treatment facility’s performance in achieving effluent levels for TCE that are significantly below health-based levels, this treated wastewater may be directly discharged to KPDES Outfall 001 or to on-site ditches that flow to KPDES Outfall 001 without providing KEEC supporting analytical data or contained-in/contaminated-with determinations.

Soil and debris wastes shall be sampled and analyzed in accordance with Section 7.9.2. For soil and debris waste meeting the health-based standards above, DOE shall submit its contained-in determinations and supporting analytical data to the KEEC. The KEEC will review DOE’s determination and supporting analytical data and provide DOE with notification of any concerns the Cabinet has within 30 days. After 30 days, if the Cabinet has not notified DOE of any concerns, DOE may dispose of soil and debris waste at the C-746-U Landfill if it meets the WAC. Soil and debris wastes from this project not meeting the WAC for the C-746-U Landfill will be shipped off-site for disposal at an appropriate facility meeting the necessary regulatory criteria.

7.9.2 Waste Characterization

Waste characterization sampling will be performed in accordance with procedure CP3-WM-0437, *Waste Characterization and Profiling.* Based on sample analyses, existing data, or process knowledge, the waste may be classified into one of the following categories:

- RCRA-listed hazardous waste,
- RCRA characteristic hazardous waste,
- Polychlorinated biphenyl (PCB) waste,
- Transuranic waste (TRU),
- Low-level waste (LLW),
- Mixed waste, or
- Nonhazardous solid waste.

Tables 5, 6, 7, and 8 list the analytical testing methods that will be used for analysis.

Table 5. Toxicity Characteristic Leaching Procedure (TCLP) Parameters for Analysis of Solid Waste

Constituent	Method	TCLP Regulatory Limit (mg/L)	20 Times TCLP Regulatory Limit (mg/kg)
1,1-Dichloroethene	8260	0.7	14
1,2-Dichloroethane	8260	0.5	10
Arsenic	6010/6020	5.0	100
Barium	6010/6020	100.0	2,000
Benzene	8260	0.5	10
Cadmium	6010/6020	1.0	20
Carbon tetrachloride	8260	0.5	10
Chlordane	8081	0.03	0.6
Chlorobenzene	8260	100.0	2,000
Chloroform	8260	6.0	120
Chromium	6010/6020	5.0	100
Lead	6010/6020	5.0	100
Mercury	7470	0.2	4
Methylethylketone	8260	200.0	4,000
Selenium	6010/6020	1.0	20
Silver	6010/6020	5.0	100
Tetrachloroethene	8260	0.7	14
Trichloroethene	8260	0.5	10
Vinyl chloride	8260	0.2	4

Table 6. Analytical Parameters for Radiological and PCB Characterization

Constituent	Method
Total uranium	Mass Spec
Neptunium-237	Alpha Spec
Plutonium-239/240	Alpha Spec
Plutonium-238	Alpha Spec
Thorium-230/232	Alpha Spec
Technetium-99	Liquid Scintillation
Cesium-137	Gamma Spec
PCB	8082

Table 7. Waste Characterization Requirements for Solid Waste

Constituent	Method
TCLP VOCs	SW-846 1311, 8260
TCLP metals	SW-846 1311, 6010/6020/7470
Acetone	8260
Toluene	8260

Table 8. Waste Characterization Requirements for Decontamination, Development, and Purge Water

Parameter	Method	Detection Limit
TCE	EPA 624	0.001 mg/L
1,1,1-TCA	EPA 624	0.001 mg/L
PCBs	EPA 608	varies by Aroclor
Total recoverable metals*	EPA 200.8/245.2	varies by metal
Total suspended solids	EPA 160.2	30 mg/L

*Total recoverable metals: antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, nickel, calcium, silver, tantalum, uranium, zinc, and mercury.

Wastes generated from sites that are potentially contaminated will be characterized to classify the waste for proper handling, record keeping, transfer, storage, and disposal. Waste analyses will be performed using the EPA-approved procedures, as applicable. Analyses required for hazardous waste classification will reference EPA SW-846 or other EPA-approved methods, as required. Wastewater analyses will reference the applicable analytical requirements in the PGDP KPDES permit, the Clean Water Act, or Safe Drinking Water Act. QA/QC requirements and data management requirements will be followed for waste characterization sampling activities. Characterization requirements and guidance are provided in the site WAC and CP3-WM-0437, *Waste Characterization and Profiling*. The WMC will coordinate with the DOE contractor project manager and DOE contractor sample and data management group for required analyses and guidance on collection and transfer of characterization samples to a SMO-approved fixed-base laboratory that has been audited under DOECAP.

7.9.2.1 RCRA-listed hazardous waste

Based on process knowledge and existing historical sample data, the generation of RCRA-listed hazardous waste is expected on this project. The waste is listed-hazardous due to the presence of TCE in the RGA underlying the majority of the area in which the soil borings, EWs, MWs, and construction excavations are to be installed. Waste generated during soil borings (i.e., drilling cuttings, purge water, sample residuals) will be classified as RCRA-listed hazardous wastes with waste codes F001, F002, and U228 if the boring locations are inside the PGDP industrial facility or from the RGA, and if analytical results for the associated soil samples and water samples are above the health-based levels discussed in Table 4. If the concentrations are below the levels contained in Table 4, then the waste will be deemed not to contain or not to be contaminated-with a RCRA-listed waste (based on TCE/TCA content) for the purposes of on-site management. If the WAC is met, the waste will be properly disposed of in the C-746-U-Landfill.

Aqueous liquids that have undergone wastewater treatment and “no longer contain” listed-hazardous waste (i.e., TCE) may be discharged directly to permitted KPDES Outfall 001 or on-site ditches that flow to permitted KPDES Outfall 001.

7.9.2.2 RCRA-characteristic hazardous waste

Based on process knowledge and existing historical sample data, the generation of RCRA characteristic-hazardous waste is possible during this action. Any waste determined to be RCRA characteristic-hazardous

waste will be treated in the same manner as RCRA listed-hazardous waste for handling, storage, and disposal requirements.

7.9.2.3 PCB wastes

Based on process knowledge and existing historical sample data, the generation of PCB-contaminated waste is not expected to be generated on this project.

7.9.2.4 TRU wastes

TRU wastes are those that are contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium that are greater than 100 nanocuries per gram. Although it is possible that TRU elements may be detected in characterization samples collected on this project, it is unlikely that any of the waste generated will be at or above the TRU threshold limit. If TRU waste is generated in performing the optimization work, the waste will be managed as specified in DOE O 435.1, *Radioactive Waste Management*, 458.1, *Radiation Protection of the Public and the Environment,* and 40 *CFR* Part 191.

7.9.2.5 Low-level waste

LLWs are described as any nonhazardous, non-PCB, or non-TRU waste containing radioactivity or other radionuclides in an activity greater than authorized limits or the latest off-site release criteria and are not classified as high-level waste, TRU waste, spent nuclear fuel, or by-product material. LLW may be generated from materials removed from the radiological areas. All wastes from this project have the potential to be classified as LLW. The potential radiological contaminant of concern is Tc-99. Due to varying levels of Tc-99, some work may be performed under a radiological work permit (RWP).

7.9.2.6 Mixed wastes

Mixed waste contains both hazardous waste and source, special nuclear, or byproduct material subject to the Atomic Energy Act of 1954. The generation of mixed waste is possible on this project.

7.9.2.7 Nonhazardous wastes

Waste that does not meet the classification requirements of RCRA hazardous wastes, PCB wastes, LLW, TRU waste, or mixed wastes will be classified as nonhazardous solid waste. Nonhazardous waste will be generated as part of this project. The types of materials expected to be nonhazardous wastes are construction debris, waste concrete, grout, shipping materials, and containers (e.g., boxes, bags).

7.10 SAMPLING AND ANALYSIS OF WASTE

The WMC will be responsible for coordinating the sampling of solid and liquid waste in accordance with this section. During sampling, all appropriate health and safety concerns will be addressed in accordance with Section 5. All samples will be screened for radioactivity based on the RWP and appropriate actions taken to prevent the spread of contamination. Sample materials from different containers will not be mixed unless they are from the same waste stream, and only containers requiring further characterization will be sampled. Samples will be assigned a unique identifier. The following text summarizes the waste characterization requirements and describes the sampling procedures.

7.10.1 Solid Waste

For solid wastes, the "20 times" rule will be used to determine if the waste is characteristically hazardous. That is, if the total soil concentrations of RCRA constituents are less than 20 times TCLP limits in 40 *CFR* § 261.24, then the waste will be considered not to be characteristically hazardous. Where the total soil concentrations of RCRA constituents are greater than 20 times the TCLP limits, TCLP analyses will be performed to confirm the result.

For listed waste determinations for media or debris, the total concentrations of TCE and 1,1,1-TCA will be compared to the approved health-based levels of 39.2 ppm for TCE and 2,080 ppm for 1,1,1-TCA. If total concentrations are detected, but less than 39.2 ppm TCE and 2,080 ppm 1,1,1-TCA, then the waste will be determined to "no longer contain" listed constituents. (The detection limit for TCE and 1,1,1-TCA is 5 ppb.) If the results exceed the health-based levels, the waste will be considered a RCRA-listed hazardous waste and must be managed and disposed of as such.

Solid waste may be containerized in drums, ST-90 boxes, intermodals, or 25-yd^3 roll-off containers during generation. Specific sampling event plans (including parameters, required detection limits, and QC requirements) will be identified when the proposed final waste containers have been presented to the waste characterization organization. Physical sampling will be performed in accordance with approved standard operating procedures.

Additional analyses to meet off-site disposal WAC also may be required and will be specified upon selection of the disposal site.

7.10.2 Aqueous Liquids

Liquid waste generated during drilling, well development, construction, and decontamination activities will be characterized using process knowledge and/or sampling data as appropriate. These liquid wastes will be managed in accordance with ARARs prior to being processed through particulate filters at the drill site or accumulated and stored on-site until they can be processed further at C-752-C for separation of groundwater and soils, as necessary. If filtered, the filtered water will be pumped to dual-wall holding tanks until it is verified that the filtered water meets the appropriate acceptance criteria for suspended solids and then will be transferred to the on-site current C-612 Northwest Plume Groundwater System. Potential contaminants of concern in this filtered wastewater will be assumed to be consistent with those in the Northwest Plume groundwater currently treated by a treatment unit. No additional sampling and analysis is planned prior to treatment by the current C-612 Northwest Plume Groundwater System.

Groundwater generated during drilling, well development, and decontamination activities that has undergone wastewater treatment and "no longer contain" listed-hazardous waste may be discharged directly to permitted KPDES Outfall 001 or on-site ditches that flow to permitted KPDES Outfall 001 or an authorized CERCLA outfall, as appropriate.

Debris (e.g., particulate filters) and media (e.g., soils) separated from the groundwater will be managed as outlined in Section 7.10.1. Any carbon media or other wastewater treatment sludge will be managed based upon the process knowledge and/or analytical data for the influent waste stream in accordance with ARARs.

8. QUALITY ASSURANCE

A QA project plan ensuring the implementation of 2024 optimization of the Northwest Plume IRA post-implementation monitoring/sampling based on guidelines in the Uniform Federal Policy for Quality Assurance Project Plan will be developed as part of the engineering design.

The governing QA documents for implementation of this 2024 optimization of the Northwest Plume IRA include, but are not limited to, the *Quality Assurance Program Description for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-QA-1000, and the *Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan*, DOE/LX/07-2502&D1 (DOE 2024d).

9. DATA MANAGEMENT AND IMPLEMENTATION PLAN

The 2024 optimization of the Northwest Plume IRA will incorporate by reference the data management and implementation plan (DMIP) requirements from the Southwest Plume SWMU 211-A RAWP (DOE 2021). The Southwest Plume RAWP DMIP, Sections 10.2 through 10.8 can be accessed using hyperlink (Control Click): https://eic.pad.pppo.gov/Search.aspx?accession=INF-RECMGMT-PPPO-02-10018761-22B-SWMU 211 A PLUME-2021-12-16

The plan will be implemented as written for scope elements associated with the 2024 optimization of the Northwest Plume IRA project. References to the Southwest Plume SWMU 211-A RAWP project should be replaced with Northwest Plume IRA optimization project.

10. REFERENCES

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