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December 6, 2021

Mr. Brian Begley
Federal Facility Agreement Manager
Division of Waste Management
Kentucky Department for Environmental Protection
300 Sower Boulevard, 2nd Floor
Frankfort, Kentucky 40601

PPPO-02-10012927-22C

Mr. Victor Weeks
Federal Facility Agreement Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Begley and Mr. Weeks:

TRANSMITTAL OF THE OPERATION AND MAINTENANCE PLAN FOR THE NORTHEAST PLUME CONTAINMENT SYSTEM INTERIM REMEDIAL ACTION AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, DOE/LX/07-2470&D1 (PREVIOUSLY DOE/OR/07-1535&D3/R8)

Reference: Letter from T. Duncan to B. Begley and V. Weeks, "Transmittal of the Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1535&D3/R8," (PPPO-02-10008525-21B), dated November 6, 2020

Please find enclosed the subject document. This Northeast Plume Operation and Maintenance Plan is an update to the previous revision, which was submitted to the Kentucky Department for Environmental Protection (KDEP) and the U.S. Environmental Protection Agency (EPA) on November 6, 2020. This version of the document contains updates in response to KDEP's previously submitted comments on the D3/R8 version of the document as well as any additional updates that were determined to be applicable based upon KDEP's comments on the *Operation and Maintenance Plan for the Northwest Plume Groundwater System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-2469&D1.

Also enclosed are a redline version of the document, which highlights changes made to the previous version of the document; and an update to the comment response summary submitted to EPA and KDEP on November 6, 2020.

Please note that a new Portsmouth/Paducah Project Office Lexington document number has been assigned to the document, which replaces the previous Oak Ridge document number.

If you have any questions or require additional information, please contact David Dollins at (270) 441-6819.

Sincerely,

Tracey L. Duncan

Digitally signed by Tracey L. Duncan
Date: 2021.12.06 07:42:55 -06'00'

Tracey Duncan
Federal Facility Agreement Manager
Portsmouth/Paducah Project Office

Enclosures:
1. *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1—Clean
2. *Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2470&D1—Redline
3. Comment Response Summary

Administrative Record File—(NEP PT-PD) Post-decision File for Northeast Plume Pump & Treat IRA

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DOE/LX/07-2470&D1
(Previously DOE/OR/07-1535&D3/R8)
Secondary Document

Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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DOE/LX/07-2470&D1
(Previously DOE/OR/07-1535&D3/R8)
Secondary Document

Operation and Maintenance Plan for the Northeast Plume Containment System Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—November 2021

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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TABLES

FIGURES

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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*
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
EQ	equalization
ESD	Explanation of Significant Differences
EW	extraction well
FFA	Federal Facility Agreement
HASP	health and safety plan
IRA	interim remedial action
ISMS	Integrated Safety Management System
KPDES	Kentucky Pollutant Discharge Elimination System
MOA	Memorandum of Agreement
MW	monitoring well
NEPCS	Northeast Plume Containment System
O&M	operation and maintenance
PGDP	Paducah Gaseous Diffusion Plant
PLC	programmable logic controller
PZ	piezometer
QAPP	Quality Assurance Project Plan
QC	quality control
RAWP	remedial action work plan
RGA	Regional Gravel Aquifer
ROD	record of decision
TU	treatment unit
VFD	variable frequency drive
VOC	volatile organic compound

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EXECUTIVE SUMMARY

This Operation and Maintenance (O&M) Plan has been prepared to serve as a guide and reference for operation of the Northeast Plume Containment System (NEPCS) constructed as an interim remedial action (IRA) at the Northeast Plume at the Paducah Gaseous Diffusion Plant (PGDP). The IRA is consistent with the U.S. Department of Energy's (DOE) *Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2 (DOE 1995) (ROD), which was signed in June 1995, and modified by the *Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1291&D2/R2 (DOE 2016) (ESD). As stated in the ROD, "the primary objective of this interim remedial action is to implement a first-phase remedial action as an interim action to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence."

In August 1988, volatile organic compounds and radionuclides were detected in private wells north of PGDP. In response, DOE and the U.S. Environmental Protection Agency (EPA) entered into an Administrative Consent Order under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). DOE then implemented a PGDP Water Policy to reduce the current risk to potential human exposure (i.e., potentially affected residences and businesses). The CERCLA site investigations discovered trichloroethene (TCE)-contaminated groundwater within the Regional Gravel Aquifer northeast of the plant. This plume is referred to as the Northeast Plume. Additional information detailing the activities that led to the construction of the NEPCS is outlined in the Northeast Plume ROD.

The Northeast Plume ROD initiated an IRA that included installation of the NEPCS, which has been in operation since 1997. The O&M Plan, which was developed and approved to provide the NEPCS operators with background information; program organization; reporting requirements; O&M requirements and guidelines; training requirements; and PGDP emergency response guidelines has been revised several times. In 2020, the O&M Plan was revised per the *Memorandum of Agreement for Resolution of Informal Dispute Concerning U.S. Environmental Protection Agency and Kentucky Department for Environmental Projection [sic] Requirements for Additional Actions or Modifications Regarding the CY 2018 Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-2426&D2* (DOE 2020). This 2021 revision of the O&M plan includes general updates, most notably to eliminate information related to the optimization of the NEPCS that is no longer needed in the O&M Plan. Optimization occurred in 2017 and included the installation of two extraction wells and two treatment units. The ESD and 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 2018a), document the optimization of the NEPCS.

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1. GENERAL NORTHEAST PLUME CONTAINMENT SYSTEM DESCRIPTION

The Northeast Plume Containment System (NEPCS) is designed to recover groundwater contaminated by trichloroethene (TCE) from the Northeast Plume and deliver it to two treatment units (TUs), designated as C-765 and C-765-A, for air stripping. The NEPCS consists of two extraction wells (EWs) (EW234 and EW235), each of which is equipped with a submersible pump, drop pipe, and electrical service. After extraction, water is pumped through transfer lines to the TUs. Each of the EW transfer lines is configured such that each TU is dedicated to one of the EWs and capable of being operated independently. The C-765 TU is operated to treat water extracted from EW234, and the C-765-A TU is operated to treat water extracted from EW235. Each unit consists of bag filters and an air stripper to support groundwater treatment. Bag filters remove suspended solids (if necessary) as a pretreatment to the air stripper, which is designed to remove TCE. The treatment system is contained within a weathertight enclosure and includes a system control panel. The treated groundwater then is discharged to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Outfall 001, located downstream of Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 002.

The components above were installed in 2017 during optimization of the NEPCS and the original NEPCS components [EW331, EW332, equalization (EQ) tank, ancillary piping, system control panel, and power distribution panel] were placed in standby mode. The original components are located at an equipment pad designated as C-614 and were installed pursuant to *Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (ROD), which was signed in June 1995. The original NEPCS components are not utilized as part of the optimized NEPCS but are in standby condition. EW331 and EW332 will be kept in good working condition until the Federal Facility Agreement (FFA) parties agree that maintenance no longer is necessary. The *Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/LX/07-1291&D2/R2* (DOE 2016) and 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 2018a), document the optimization of the NEPCS.

The layout of the optimized transfer piping, treatment system, and discharge piping is detailed in Section 7. Groundwater discharge will be in accordance with applicable or relevant and appropriate requirements (ARARs). A process flow diagram and more detailed system information are contained in Section 7.

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2. DESCRIPTION OF NORMAL OPERATION AND MAINTENANCE

2.1 OPERATION AND MAINTENANCE

The NEPCS is operated and maintained in accordance with this plan and operating procedures applicable to the NEPCS. References herein to any supporting plan or procedure refer to the most recent version of the plan or procedure in effect as of the date of this O&M Plan or to the revised version of such plans and procedures if revised subsequent to the date of this plan. Supporting plans and procedures referenced in this O&M Plan can be found in the procedures folder on the Public Documents website (https://pubdocs.pad.pppo.gov/). The appendix contains a list of plans and procedures developed for the NEPCS and general pump-and treat operations.

Personnel training activities regarding operational work instructions have been completed and documented. New personnel are required to complete system training before performing work at NEPCS. General training requirements regarding health and safety and Paducah Site requirements for work on-site are documented in the training position descriptions and CP2-ER-0067, *Health and Safety Plan for the Paducah Plumes Operations, Paducah, Kentucky* (HASP). Training requirements and personnel training records are maintained by the U.S. Department of Energy (DOE) Prime Contractor training department.

2.2 OVERVIEW OF OPERATIONAL STRATEGY, SYSTEM CONTROL, AND CONDUCT OF OPERATIONS

2.2.1 Operational Strategy

As stated in the Record of Decision (ROD), "the primary objective of this interim remedial action is to implement a first-phase remedial action as an interim action to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence." The *Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1291&D2/R2, (ESD) was developed to document the necessary changes made to optimize the Northeast Plume interim remedial action (IRA) (DOE 2016). The *Memorandum of Agreement for Resolution of Formal Dispute of the Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/LX/07-1291&D2), and 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) (MOA for Resolution) (DOE 2015) signed by the FFA parties on July 31, 2015, states the following:

> The resolution documents the Parties' agreement that an optimization of the existing Northeast (NE) Plume Interim Action (namely relocation of the two extraction wells up-gradient and operation of two treatment units) is warranted to increase trichloroethylene (TCE) mass removal and to enhance control of NE Plume migration at the eastern edge of the PGDP industrial facility. The Parties have reached consensus that the optimized extraction wells installed under the NE Plume Explanation of Significant Differences (ESD) should not cause or contribute to the undesired migration of Technetium-99 (Tc-99) contamination from the source area(s) (e.g., C-400 Building and Northwest (NW) Plume) and that actions (as further described below) may be undertaken to prevent any undesirable expansion of Tc-99 and TCE within the NE Plume.

1. The NE Plume ESD and Remedial Action Work Plan (RAWP) will be revised to include language similar to that found in the 1995 IROD and Draft Final (D2) RAWP for the NE Plume stating that pumping at the optimized extraction wells may result in changes to groundwater flow direction that may impact contaminant (i.e. TCE and/or Tc-99) migration from source areas (e.g. C-400 Building). The NE Plume ESD and RAWP will state that the modified NE Plume interim remedial action will include installation (at a minimum) of five new RGA monitoring wells in a north-south transect approximately 600 feet east of C-400 Building (exact locations to be determined by the FFA parties as part of the finalization of the RAWP). These transect monitoring wells will be used to assess the impact of groundwater extraction wells on contaminant migration from source areas, including impacts to the groundwater divide east of C-400 Building.

Based on EW step test results, EW234 can operate between 100 to 200 gpm, and EW235 can operate between 75 and 150 gpm, with a total system anticipated flow rate of no more than 300 gpm. Adjustments can be made to operate at higher or lower flowrates, as design parameters allow, to achieve the goals of the NEPCS. During system operations, TU process controls monitor system flow rates and adjust pumping speeds to maintain desired flow rates. Further discussions regarding specific NEPCS component operating capabilities are detailed in Section 7. The Northeast Plume Interim Remedial Action includes monitoring wells (MWs) and 8 piezometers (PZs) to evaluate performance and effectiveness of the EWs. MWs will be used to assess the impact of groundwater EWs on contaminant migration from source areas, including impacts to the groundwater divide east of C-400 Building. The MOA for Resolution includes actions that may be undertaken to prevent any undesirable expansion of Tc-99 and TCE within the Northeast Plume.

2.2.2 Overall System Control

The NEPCS is an automated system with failure alarms and interlocks that will shut down the system when required by certain alarm conditions. During normal operations, the system has the capability to operate with minimal operational support. General control of the NEPCS is maintained by locally mounted instruments and controls for each major process operation. Key process variables and controls are linked to system control panels. The system is controlled through these control panels.

2.2.3 Conduct of Operations

Conduct of operations for the NEPCS is governed by the site's Integrated Safety Management System (ISMS) Program. The conduct of operations program ensures that activities and facility operations are managed, organized, and conducted in a manner that assures an appropriate degree of rigor in performance and, therefore, contributes to safe and reliable operations. The program is based on DOE Order 422.1, *Conduct of Operations*.

2.3 OVERVIEW OF TREATMENT TECHNOLOGY (PROCESS THEORY)

The extracted Northeast Plume groundwater, contaminated with volatile organic compounds (VOCs), is treated using air stripping by passing the contaminated groundwater through a shallow tray air stripper. Air stripping is a proven technology for the removal of VOCs from contaminated groundwater through liquid-gas mass transfer. Air is forced upward through the unit as the contaminated groundwater flows downward through the system. The counter current flow of air and water causes TCE to be stripped from the water and transferred to the air stream as a gas, which subsequently is destroyed by ultraviolet light (i.e., sunlight); release of TCE-containing gaseous discharges is discussed in Appendix B, Air Dispersion Analysis, of the RAWP (DOE 2018a).

2.4 OPERATOR CHECKS

NEPCS personnel conduct equipment inspections and system checks of key process variables to record system operational data and ensure effective and safe system operation. As stated in Section 2.2.2, process information can be accessed locally by the system control panels. Such information includes system flow rates, alarm conditions, tank levels, and pump status. Various system component set points also may be adjusted locally or remotely. Other information such as pressure readings, flow totals, and other data can only be obtained by accessing locally mounted instrumentation at the system equipment. Daily system inspections and operational data collection are conducted in accordance with CP4-ER-0017, *Northwest/Northeast Plume Operations Daily Operational Data Collection and Maintenance*.

2.5 SYSTEM MAINTENANCE AND CALIBRATION

NEPCS maintenance (corrective and preventive) and calibration are performed in accordance with equipment manufacturer's recommendations and sound engineering practices. Detailed information on maintenance activities is included in CP2-ER-0046, *Paducah Plume Operations Maintenance, Calibration, and Testing Plan.*

2.6 COMMUNICATION

The following are the current NEPCS communication equipment used by NEPCS personnel:

- Cellular telephones,
- Telephone system, and
- Two-way radios.

NEPCS personnel maintain some form of communication at all times.

The NEPCS utilizes a dedicated automatic telephone dialer (autodialer) for calling designated on-call personnel when system alarm conditions occur. Abnormal operating conditions trigger alarms in the main control system. The autodialer, upon receipt of an alarm signal from the programmable logic controller (PLC), dials on-call personnel and delivers an alarm message. If the autodialer is not answered or if the alarm is not properly acknowledged, it continues to dial the programmed numbers in succession until the alarm is properly acknowledged. NEPCS operations personnel respond to alarm messages and take action as directed by the Pump-and-Treat Operations Manager. The autodialer operates over standard telephone equipment.

Emergency telephone numbers for reporting spills, fires, and other emergencies are provided in the HASP.

2.7 WASTE MANAGEMENT

The NEPCS system generates minimal waste, primarily protective clothing associated with sampling. Waste is handled and disposed of in accordance with CP2-WM-0001, *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Waste Management Plan*, and CP2-ER-0012, *Waste Management Plan for the Paducah Plume Operations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. These waste management plans address the management of minor waste streams produced at the NEPCS from the point of generation until custody is relinquished from the NEPCS. Minor waste streams may include bag filters, personal protective equipment, sampling materials, etc.

The major waste stream is extracted groundwater, which is treated as described in Section 2.3 and then discharged to CERCLA Outfall 001, which is located downstream of KPDES Outfall 002. This discharge will be monitored at the outfall against outfall discharge criteria, as indicated in Table 1.

Table 1. Outfall Discharge Criteria

Effluent Characteristic	Discharge Limitations		
	Yearly Average	Monthly Average	Daily Maximum
Flow (mgd)	N/A	Record	Record
Total suspended solids (mg/L)	N/A	30	60
Oil and grease (mg/L)	N/A	10	15
Total residual chlorine (mg/L)	N/A	0.011	0.019
Temperature (°F)	N/A	N/A	89
Trichloroethene (µg/L)	N/A	30	N/A
Chronic toxicity (TU_c)	N/A	N/A	1.00
pH	N/A	6 (min)	9
1,1-Dichloroethene (µg/L)	N/A	7,100	N/A

This table is excerpted from Table 3 of the ESD (DOE 2016).

3. DESCRIPTION OF POTENTIAL OPERATING PROBLEMS

This section describes shutdown and operational emergency conditions. This section is limited to the major shutdown and operational emergency conditions and is not all-inclusive.

3.1 CAUSES FOR NEPCS SHUTDOWN

The NEPCS will shut down when initiated by an operator or automatically as a result of system alarms. Operator-initiated shutdowns may be performed during situations such as routine maintenance, severe weather, personnel injury, or fire. The system will shut down automatically due to adverse conditions such as electrical failure.

Automatic shutdown of the NEPCS components will occur when certain alarm conditions exist. Table 2 lists probable system condition(s) related to each alarm condition.

Table 2. Alarm Conditions and Probable System Condition(s)

Alarm Condition	Probable System Condition(S)
PLC off-line	Fault(s) in the PLC, Input/Output module, or scanner module.
Low flow from EW	EW pump(s) may have shut off on low or high pressure.
Low or high pressure at the treatment system	System has shut down due to a low or high pressure in the transfer line.
Air stripper basin level high	TU effluent pump may have shut down or the flow rate may be inadequate to maintain preset level in basin. EW pumps will shut off automatically.
Air stripper high differential pressure	Air stripper trays may be collecting sediment from extracted groundwater.
Air stripper blower low pressure	Loss of power, obstruction of intake/effluent.

NOTE: Shutdown of individual components may lead to complete system shutdown.

3.2 RESPONSE AND NOTIFICATION PROCEDURE FOR NEPCS SHUTDOWN

To troubleshoot and correct system problems, personnel follow the appropriate procedures, plans, manufacturer's equipment manuals, and seek any necessary outside technical assistance. NEPCS operators record events, actions taken, and other pertinent information in accordance with CP4-ER-0017, *Northwest/Northeast Plume Daily Operational Data Collection and Maintenance*. The Pump-and-Treat Operations Manager reports required information to the appropriate personnel and/or government agencies. [See Section 6.3.4 of the RAWP (DOE 2018a).]

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4. DESCRIPTION OF ROUTINE MONITORING AND LABORATORY TESTING

4.1 INTRODUCTION

Groundwater and process monitoring is conducted to ensure proper facility operation and compliance with the following documents:

- *Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2 (DOE 1995);

- *Memorandum of Agreement for Resolution of Formal Dispute of the Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/LX/07-1291&D2), and 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)* signed by the FFA parties on July 31, 2015 (DOE 2015);

- *Explanation of Significant Differences to the Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1291&D2/R2 (DOE 2016);

- *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 2018a); and

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

The data quality objective (DQO) process was used by the NEPCS team to ensure collection of data of appropriate quality and quantity to meet the NEPCS objective. DQOs are periodically evaluated and data collection and analysis revised as necessary.

4.2 DATA QUALITY OBJECTIVES

4.2.1 Problem Statement

The problem to be addressed by the Northeast Plume Optimization Project is the presence and continued migration of TCE-contaminated groundwater beyond the plant security fence in concentrations above the maximum contaminant level for TCE.

4.2.2 Principal Study Questions, Decision Rules, and Data Needs

Table 3 outlines the principal study questions, decision rules, and data needs required to effectively monitor the operation of the NEPCS and meet the objectives stated in the ROD, the ESD, RAWP, and Memorandums of Agreement (MOAs).

Table 3. Principal Study Questions, Decision Rules, and Data Needs

	Question/Goal	Decision Rule	Data Needs
1	Is NEPCS retarding the migration of the highest concentration volume of the TCE Groundwater plume?	If field results[a] from MWs and analytical results from groundwater samples indicate that the EWs are not effectively retarding the migration of the highest concentration volume of the plume, then operation of the EW will be reevaluated and adjustments made as necessary.	TCE and Tc-99 samples will be collected from MWs. Water level data and pumping rates will be recorded for the EWs. Water level data will be collected for the MWs.
2	Is the treatment system (air stripper) effectively stripping the TCE from the contaminated groundwater?	If TCE levels in discharge effluents exceed 75% of the 30 µg/l discharge limit (22.5 µg/L), then operational conditions will be investigated and appropriate adjustments made as necessary.	TCE samples will be collected from the air stripper effluent.
3	Is the treatment system affecting environmental performance at CERCLA Outfall 001?	If any pollutant exceeds the criteria listed in Table 1, then the possible contributions to that exceedance by the NEPCS will be investigated and operations will be altered or suspended as necessary.	Data from CERCLA Outfall 001 will be evaluated.
4	What levels of TCE are being discharged into the atmosphere from the groundwater extraction process?	If air emissions of TCE from the NEPCS, as a single source or as a contributor to site emissions, exceed the regulatory guidelines[b], then the operating status will be reviewed and revised as necessary.	Emissions will be calculated based on TCE samples taken from the EWs and air stripper effluent and evaluating associated pump rates.
5	Reserved	Reserved	Reserved
6	Is NEPCS running efficiently in terms of operation and maintenance (O&M)?	If system components are not operating within the manufacturer's specified performance criteria,[c] then system operation will be evaluated.	Operational data will be recorded to include flow rates from pumps; pressure readings; maintenance data; and pipeline and system integrity.
7	Is the risk pathway to residents for NEPCS contaminants eliminated as a result of the current Water Policy Boundary?	If the TCE levels exceed the MCL at the eastern boundary of the Water Policy, then reevaluate the boundary location. Tc-99 is addressed by other questions/goals and decision rules.	TCE samples will be collected from selected MWs and residential wells near the eastern boundary of the Water Policy (see Figure 1).

[a] MW groundwater sampling will be performed under the Environmental Monitoring Plan. Refer to Section 4.4 of this document and Section 2.5 of the RAWP for additional details (DOE 2018a). Field measurements and samples will be collected quarterly as follows:

- Field Measurements—depth to water, dissolved oxygen, pH, specific conductance, temperature, redox, and turbidity.
- Sample analytical parameters—TCE and Tc-99.

[b] Refer to Appendix B, Air Dispersion Analysis of the RAWP, which identifies that the design criteria of the treatment systems is the same as the assumed maximum TCE inlet concentration for air dispersion modeling (1,000 ppb for both) (DOE 2018a). The evaluation performed for this Question/Goal (i.e., comparison of influent TCE concentrations to the assumed maximum TCE inlet concentration for air dispersion modeling [1,000 ppb for both] and any resultant actions taken specific to the NEPCS will be documented in the FFA semiannual progress reports. The FFA semiannual progress reports can be found on the Public Documents website (https://pubdocs.pad.pppo.gov/).

[c] The NEPCS is operated consistent with manufacture's specifications, which are subject to change. All operational parameters are considered and reviewed collectively to determine system efficiency. Operational data collection parameters include pressure, flow rates, tank levels, and others. For details, refer to CP4-ER-0017, Northwest/Northeast Plume Daily Operational Data Collection and Maintenance. This procedure can be found in the procedures folder on the Public Documents website (https://pubdocs.pad.pppo.gov/).

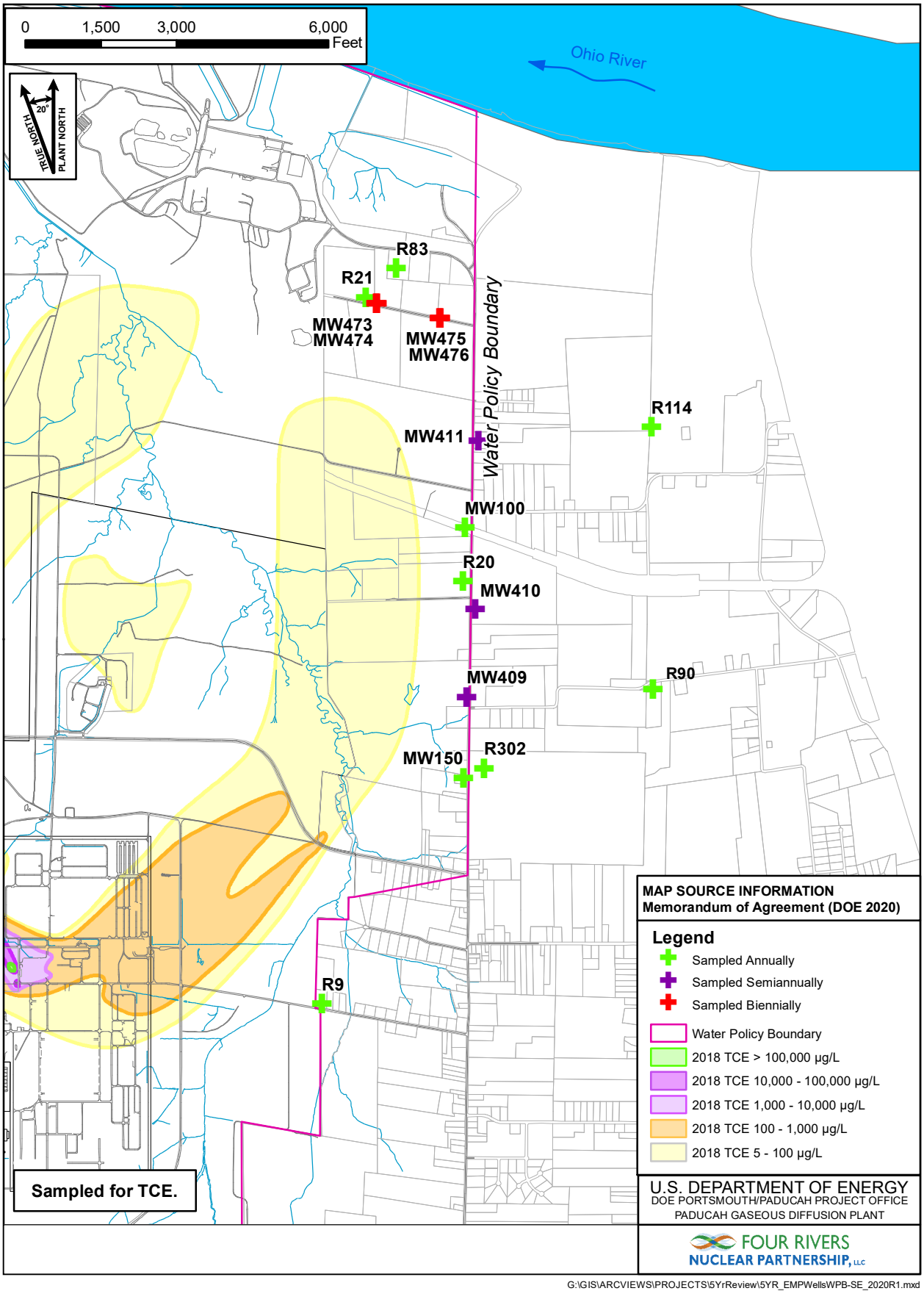

Figure 1. Northeast Water Policy Boundary Monitoring Wells and TCE Plume

4.3 EVALUATION OF EXTRACTION FIELD EFFECTIVENESS

The purpose of the extraction wellfield effectiveness monitoring is to acquire, collect, and maintain an adequate database of the hydrogeological conditions in the Northeast Plume to enable changes to be made in extraction rates that will optimize remediation and containment. This section describes hydraulic and chemical monitoring intended to support an evaluation of the performance of the NEPCS.

The network of MWs provides both hydraulic and chemical performance information that can be used to assess the following:

- Effectiveness of capturing the Northeast Plume contamination by the EW locations; and
- Potential contaminant migration impacts to the Northwest Plume by the Northeast Plume EWs.

The goals of the effectiveness monitoring are to determine TCE mass removal rates and assess TCE capture zone effectiveness. The general approach to hydraulic and chemical monitoring and analysis follows methods described in "A Systematic Approach for Evaluating Capture Zones at Pump and Treat Systems" (EPA 2008). Tc-99 is monitored in the transect wells in accordance with the MOA for Resolution (DOE 2015).

Section 2.5 of the RAWP provides additional details regarding goals of the Northeast Plume monitoring program, the monitoring approach (i.e., hydraulic or chemical monitoring), and identification of the wells and PZs that will be included in each monitoring approach (DOE 2018a).

4.3.1 Hydraulic Monitoring

Hydraulic monitoring is conducted to assess the following:

- Hydraulic performance of the system with regard to capture zone development; gradient manipulation and plume trajectory;

- Effects due to changes in external hydraulic stresses; and

- Potential impacts on adjacent plumes.

Consistent with Section 2.5 of the RAWP, NEPCS synoptic measurements are taken quarterly to characterize flow directions and system performance (DOE 2018a). Water level measurements taken from MWs and PZs will provide continuing data to assess gradient development and potential changes in hydraulic stress over time. MWs and PZs used for hydraulic monitoring are listed in Table 4 and shown in Figure 2.

4.3.2 Chemical Monitoring

Chemical monitoring of NEPCS will focus on several areas within and near the Northeast Plume to achieve the monitoring objectives. The chemical monitoring prescribed in this section is intended to provide a basis for determining if the objectives of the ROD are being met. Table 5 lists the MWs selected for the chemical monitoring and the monitoring frequency for each well. Due to the potential continuing source of TCE to the Northeast Plume from the vicinity of C-400 Building and the Northwest Plume, the chemical monitoring will focus on both upgradient areas and downgradient areas to the EWs (Figure 3).

Table 4. Northeast Plume Groundwater System Hydraulic Monitoring Wells and Piezometers[a]

MW and PZ No.	Completion Interval[b]	Screened Interval (ft above mean sea level)
PZ110	URGA	312.4/302.4
MW145	URGA	293.1/283.1
MW155	LRGA	292.1/287.1
MW163	LRGA	289.8/284.8
MW165A	URGA	315.2/310.2
MW205	URGA	312.2/307.2
MW255	LRGA	292.5/287.8
MW256	LRGA	281.9/277.2
MW258	LRGA	292.0/287.3
MW260	LRGA	289.8/285.1
MW288	LRGA	290.0/280.0
MW292	LRGA	286.1/276.1
MW341	MRGA	302.0/292.0
MW355	LRGA	290.4/285.4
MW480	LRGA	294.1/284.1
MW495	LRGA	278.6/268.6
MW496	LRGA	277.6/267.6
MW524	MRGA	308.7/298.7
MW525	MRGA	310.6/300.6
MW526	MRGA	311.8/301.8
MW528[c]	LRGA	301.4/291.4
MW529	LRGA	298.9/288.9
MW530	LRGA	295.1/285.1
MW531	LRGA	277.3/267.3
PZ532	LRGA	295.7/285.7
MW533	LRGA	292.0/282.0
PZ534	LRGA	293.7/283.7
PZ535	LRGA	290.9/280.9
MW537	LRGA	287.1/277.1
MW539	LRGA	291.4/281.4
PZ540	LRGA	289.5/279.5
PZ541	LRGA	287.0/277.0
PZ553	LRGA	289.2/279.2
PZ554	LRGA	289.2/279.2
PZ555	LRGA	290.1/280.1
MW556	LRGA	288.8/278.8
Background Monitoring Well		
MW200	MRGA	304.6/299.6

[a] Water levels are measured quarterly in all MWs and PZs consistent with the RAWP (DOE 2018a).
[b] Definitions of completion intervals are as follows:
URGA = Upper Regional Gravel Aquifer (RGA)
MRGA = Middle RGA
LRGA = Lower RGA
[c] MW527 and MW528 are collocated wells. Hydraulic monitoring for the area of these collocated wells is provided by MW528. Figure 4 of the RAWP presents locations of MWs and PZs included in the hydraulic monitoring network (DOE 2018a).

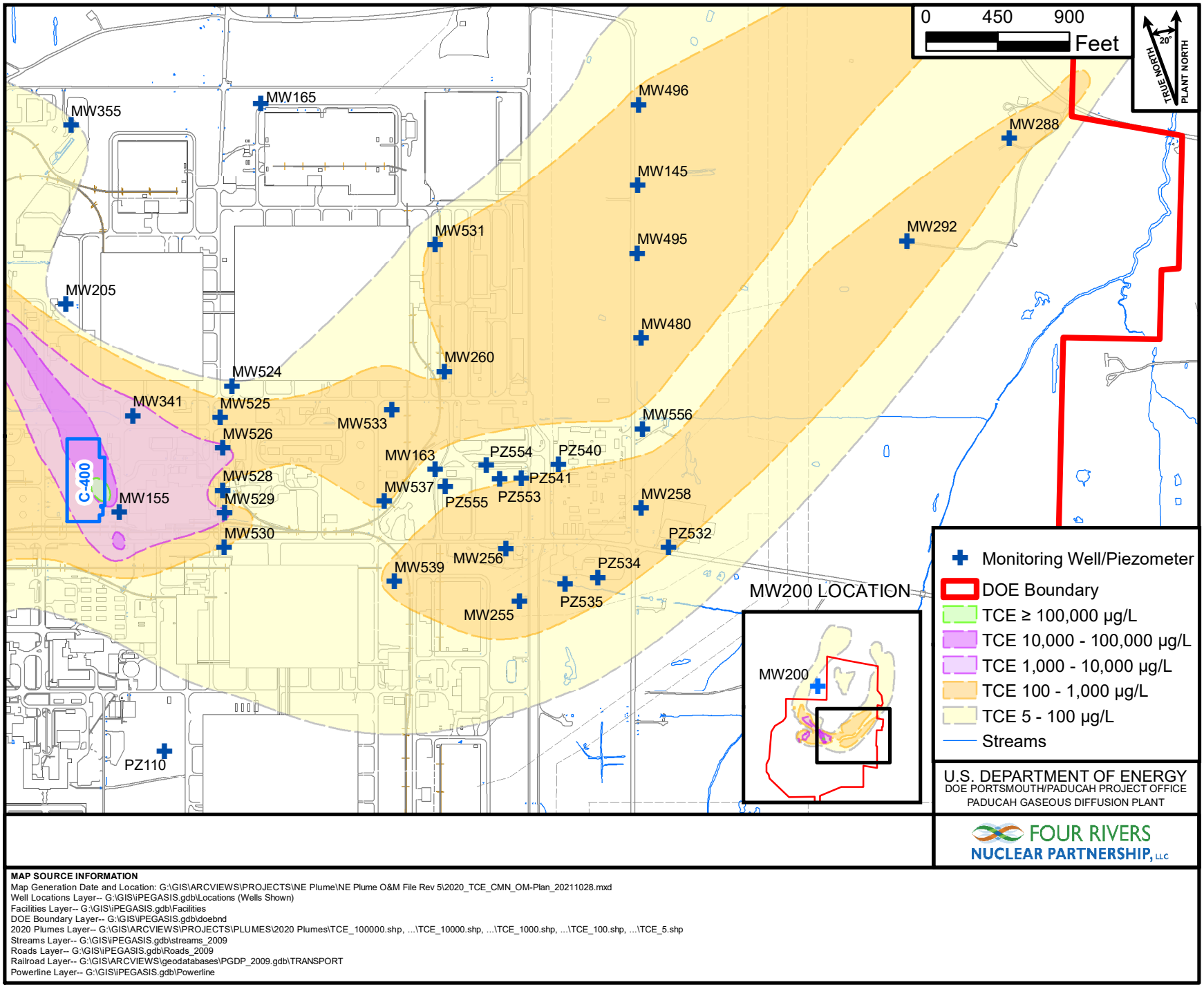

Figure 2. Hydraulic Monitoring Network

Table 5. Northeast Plume Groundwater System
Chemical Monitoring Wells[a]

Monitoring Well ID	Completion Interval[b]	Monitoring Frequency
MW124	LRGA	quarterly
MW126	MRGA	
MW144	LRGA	
MW145	URGA	
MW155	LRGA	
MW156	URGA	
MW163	LRGA	
MW255	LRGA	semiannually
MW256	LRGA	
MW258	LRGA	quarterly
MW260	LRGA	
MW283	LRGA	
MW288	LRGA	
MW291	LRGA	
MW292	LRGA	
MW293A	MRGA	
MW341	MRGA	
MW478	URGA	
MW479	URGA	
MW480	LRGA	
MW495	LRGA	
MW496	LRGA	
MW524	MRGA	
MW525	MRGA	
MW526	MRGA	
MW527	MRGA	
MW528	LRGA	
MW529	LRGA	
MW530	LRGA	
MW531	LRGA	
MW533	LRGA	
MW536	MRGA	
MW537	LRGA	
MW538	MRGA	
MW539	LRGA	
MW556	LRGA	

[a] MWs and monitoring frequencies are consistent with the RAWP (DOE 2018a).
[b] Definitions of completion intervals are as follows:
URGA = Upper RGA
MRGA = Middle RGA
LRGA = Lower RGA

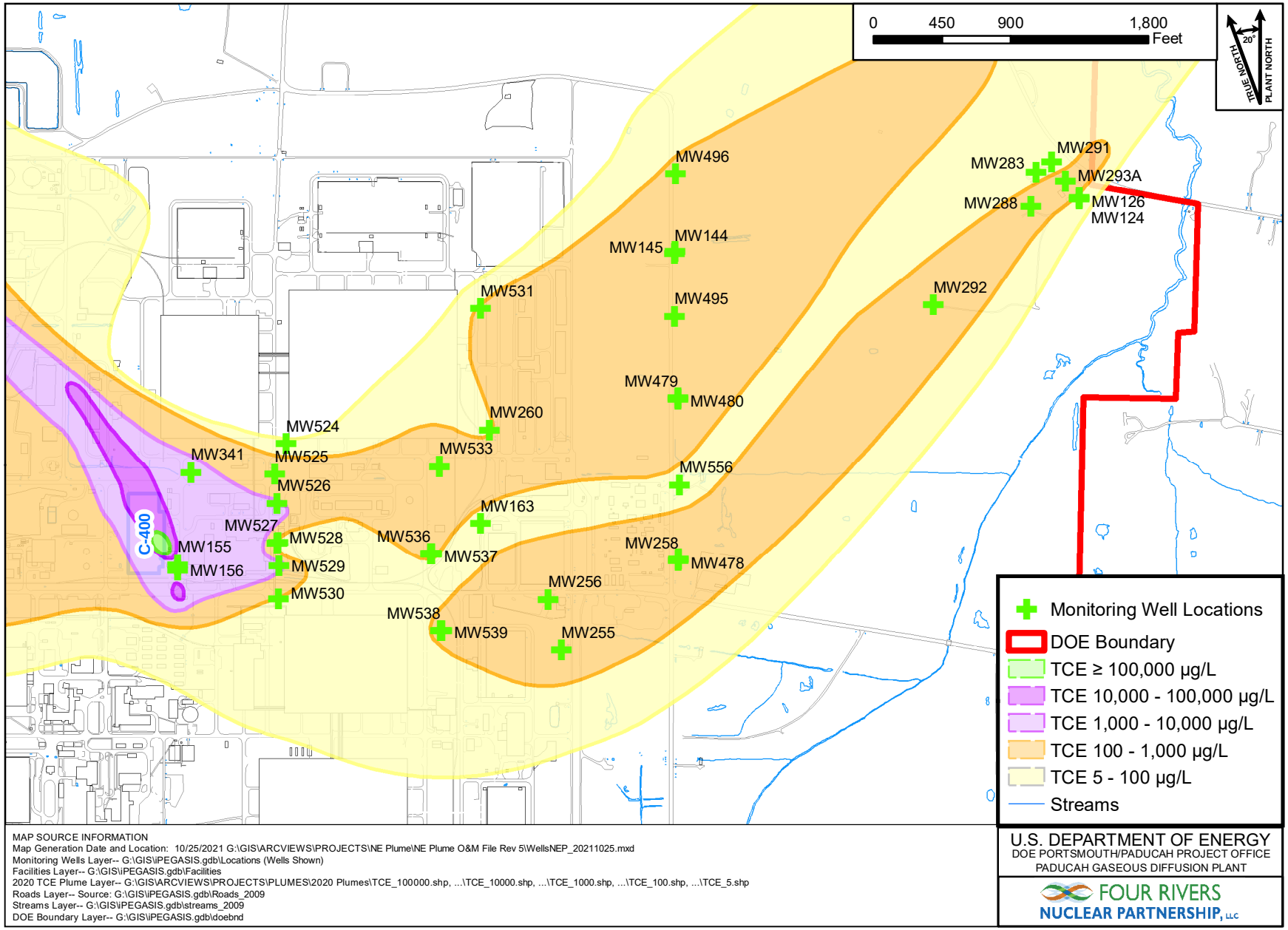

Figure 3. Chemical Monitoring Network

4.3.2.1 Baseline monitoring

Several wells in the chemical monitoring network with a significant sampling history currently are monitored under the Environmental Monitoring Program. Graphs of TCE concentrations in these wells are contained in the FFA semiannual progress reports. These graphs indicate that concentrations are relatively stable over time and trends are readily identifiable.

4.3.2.2 Long-term monitoring

Periodic monitoring of the well network is performed to characterize the Northeast Plume and help determine the effectiveness of system performance. Revisions to future monitoring frequency may be proposed to the FFA parties for discussion and concurrence. If the parties agree to change the monitoring frequency; then the agreement will be documented in an errata to the approved Northeast Plume O&M Plan and other applicable documents.

EWs are sampled monthly at sampling ports under normal operating conditions.

4.4 DATA EVALUATION

This section discusses the methods and techniques that are used in evaluating the effectiveness of the remedial system. Section 2.5 of the RAWP provides additional details regarding goals of the Northeast Plume monitoring program, the monitoring approach (i.e., hydraulic monitoring, chemical monitoring), and identification of MWs and PZs that will be included in each monitoring approach (DOE 2018a).

4.4.1 Hydraulic Data

Hydraulic monitoring is conducted to verify performance of the EW system and the impact of external hydraulic stresses with regard to capture zone development within the Northeast Plume and to measure potential areal impacts on contaminant source zones and adjacent plumes. Measurements of water levels and gradients provide a basis, along with chemical monitoring, for refinement and optimization of system operation. Hydraulic monitoring consists of obtaining quarterly NEPCS synoptic measurements of water levels, and assessing the extent of the capture zone resulting from operation of the optimized Northeast Plume EWs.

4.4.2 Chemical Data

Chemical data will be evaluated to identify TCE and Tc-99 trends for wells in the monitoring network. The results of periodic and long-term contaminant monitoring will be tabulated and provided to stakeholders for review semiannually, as described in Section 4.5. These tables are designed to facilitate observation of trends over time. Graphs showing changes over time also are developed, as needed. TCE mass capture from system operation is calculated based on EW samples and flow rates.

Statistical analyses may be used to compare data sets or to assess trends over time, including calculation of summary statistics and determining the significance of trends. These statistical techniques may include comparative analyses, multivariate comparison, trend analysis, linear regression, variable correlation, and multivariate correlation. These analyses often are problem specific and may or may not be relevant to addressing the objectives of NEPCS effectiveness monitoring. Regardless, the data density from the proposed monitoring network is sufficiently robust to provide the data necessary, should a statistical analysis be required.

Operational adjustments to maximize the efficiency of the remedial systems may be recommended based partially on a review of influent concentrations and mass capture results. The long-term monitoring data will be used to assess potential issues of long-term plume fate that may be related to potential long-term optimization efforts. As part of data evaluation, the monitoring network will be reevaluated periodically to ensure that the objectives of the effectiveness monitoring program are being obtained.

4.5 REPORTING SUMMARY

Section 1.2, Section 6.3.4, and Appendix D, Quality Assurance Project Plan (QAPP) of the RAWP identifies the formal reporting requirements (DOE 2018a). Analysis of chemical data will be presented in FFA Semiannual Progress Reports in accordance with the RAWP (DOE 2018a). The *Federal Facility Agreement Semiannual Progress Report for the Second Half of Fiscal Year 2018, Paducah, Kentucky*, DOE/LX/07-2428/V2, includes a summary of optimization hydraulic monitoring (DOE 2018b). Revisions to future monitoring frequency may be proposed to the FFA parties for discussion and concurrence. If the parties agree to change the monitoring frequency, then the agreement will be documented in an errata to the approved Northeast Plume O&M Plan and other applicable documents.

4.6 SAMPLING, ANALYSIS, AND DATA COLLECTION

To ensure that all DQOs are met, a summary table of sampling, analysis, and data collection was formulated and is presented in Table 6. Figure 4 identifies the location of treatment system components and physical sample locations for the Northeast Plume Optimization Project. The air stripper effluent sample point for performance monitoring of TCE removal efficiency is in the same general location inside both the C-765 (servicing EW234 and shown in Figure 4) and C-765-A (servicing EW235) TUs. Figure 4 identifies that CERCLA Outfall 001 is the sample collection point for compliance with ARARs that occurs prior to comingling with other waters. Refer to Section 6 and Figures 6 and 7 of the RAWP for additional information (DOE 2018a).

Table 6. Summary of Sampling, Analysis, and Data Collection

Decision Rule (refer to Table 3)	Sample point(s)	Parameters	Frequency[a]
#1	EW234 and EW235	Pumping Rates	Daily
		TCE	Monthly
		Water Level	Weekly
	MWs (see Table 5 for MW numbers)	TCE, Tc-99, and Water Level	Quarterly or Semiannually (see Table 5)
#2	Air Stripper Liquid Effluent	TCE	Weekly
#3	CERCLA Outfall	Flow; Total Suspended Solids; Oil and Grease; Total Residual Chlorine; pH; Temperature; TCE; and 1,1-DCE	Weekly
		Chronic Toxicity	Quarterly
#4	EW234 and EW235	Pumping Rates	Daily
		TCE	Monthly
	Air Stripper Liquid Effluent	TCE	Weekly

Table 6. Summary of Sampling, Analysis, and Data Collection (Continued)

Decision Rule (refer to Table 3)	Sample point(s)	Parameters	Frequency[a]
#5	EW234 and EW235	TCE, Tc-99	Monthly
	MWs	TCE, Tc-99	Quarterly
#6	EW234 and EW235	Operational Data	Daily
	TU	Operational Data	Daily
#7	MW100, MW150, R9, R20, R21, R83, R90, R114, R302	TCE	Annually
	MW409, MW410, MW411	TCE	Semiannually
	MW473, MW474, MW475, MW476	TCE	Biennially

NOTE: This table specifies only data needed to establish basis for Decision Rules identified in Table 3. Additional sampling may be required that is identified in the Project Specific QAPP. Sampling may be increased temporarily to support operational troubleshooting. Sampling will be suspended temporarily when the facility is shut down or if other operation conditions exist that would make sampling impractical. Refer to Section 4.3.2.2 for long-term monitoring requirements.

[a] Frequency definitions are as follows:

Daily refers to normally manned operations, excluding weekends, holidays, or days when the facility is shut down.
Weekly—1 sample per calendar week.
Monthly—1 sample per calendar month.
Quarterly—1 sample every 3 months, not to exceed 4 months.
Semiannually—1 sample every 6 months.
Annually—1 sample each fiscal year.

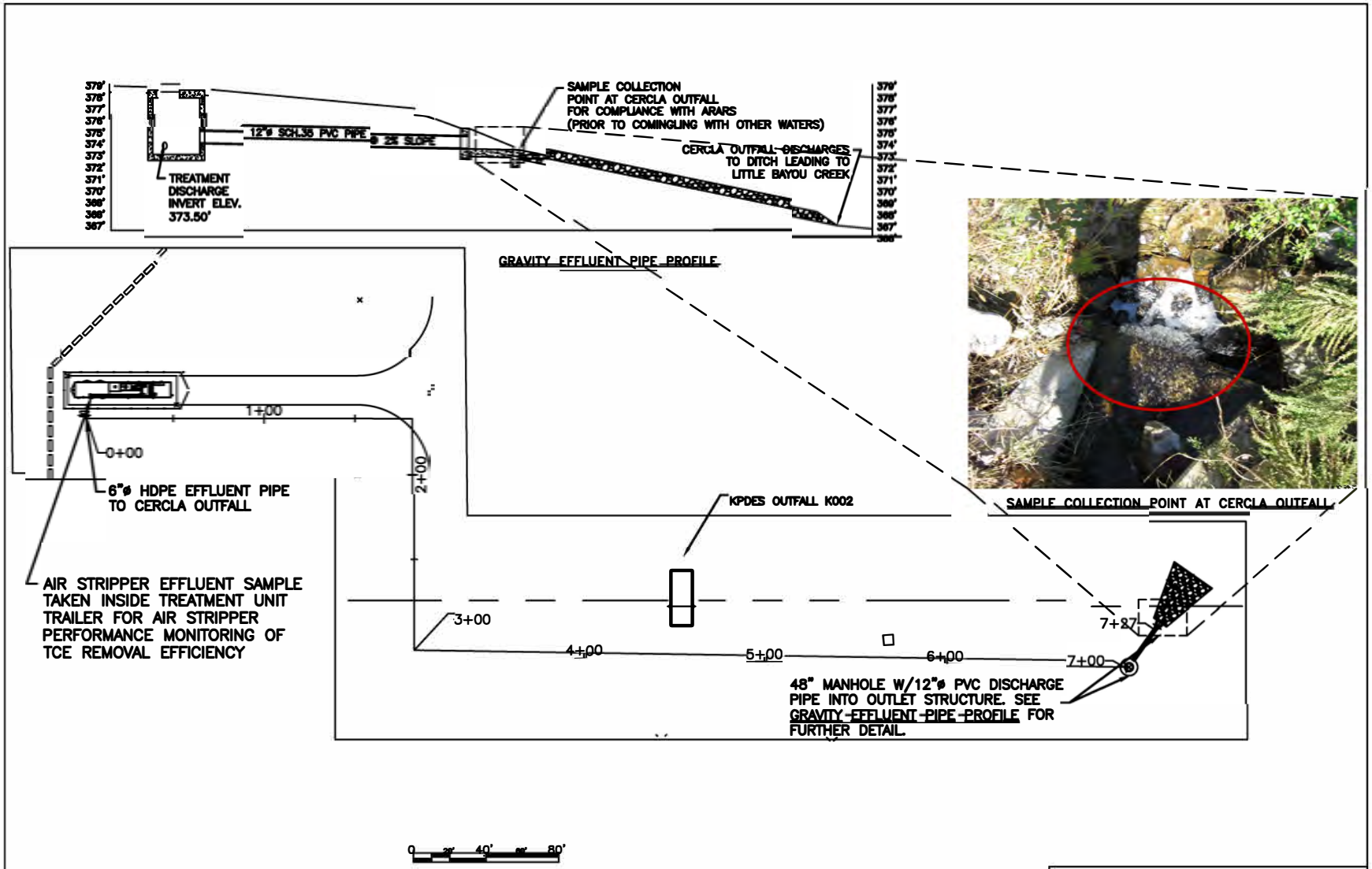

Figure 4. Northeast Plume TU Effluent Drainage to Little Bayou Creek

4.6.1 Quality Assurance and Quality Control

The Northeast Plume Project maintains a quality sample and data management program to verify the integrity of data generated. Each aspect of the monitoring program, from sample collection to data reporting, must comply with quality requirements and assessment standards identified in the Northeast Plume Optimization QAPP (Appendix D of the RAWP) (DOE 2018a).

4.6.2 Sampling and Analysis

Analytical data consist of definitive data based on data needs determined in the project-specified DQOs. TCE, as well as other analyses, satisfy decision rules in Table 3. These analyses are performed using approved U.S. Environmental Protection Agency (EPA) methods under 40 *CFR* § 136, Table 1, or other approved methods that meet the requirements of modified methods discussed in 40 *CFR* § 136.6. (See Appendix D in the project QAPP of the RAWP) (DOE 2018a).

Specific quality control (QC) samples are collected to monitor the effectiveness of the sampling procedures and laboratory methods. QC samples are collected as needed for this project. They include field blanks, duplicates, equipment rinseates, and trip blanks.

4.6.3 Corrective Action Procedures

Project personnel are responsible for identifying conditions adverse to quality and informing the Pump-and-Treat Operations Manager. Corrective action procedures require that conditions adverse to quality be identified and documented, with the appropriate corrective action(s) taken and verified in accordance with CP2-QA-1000, *Quality Assurance Program Description for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky.*

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5. DESCRIPTION OF ALTERNATE OPERATIONS AND MAINTENANCE

The C-614 facility (i.e., EW331 and EW332, EQ tank, transfer pump, and all associated infrastructure) is in standby mode. MW network data collected are evaluated in accordance with the DQOs referenced in Table 3.

Shutdowns of the NEPCS are handled in the quickest possible manner to ensure minimum downtime and prevent adverse effects on equipment. The system is designed so that continuous operation of the NEPCS is possible when only one of the two EWs is functional.

C-614 system components that are placed in standby may require routine maintenance to ensure good working order if EW331 and EW332 are returned to service. Maintenance actions and inspections will be performed in accordance with equipment manufacturer's recommendations and sound engineering practices, as applicable.

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6. HEALTH AND SAFETY PLAN

A HASP was developed for the NEPCS using pertinent information about the site, potential contaminants and hazards that may be encountered, and hazards inherent to routine activities performed during NEPCS operations.

ISMS is implemented into all work performed at NEPCS. The ISMS process integrates environment, safety, and health controls into management and work practices at all levels. This is achieved by the implementation of five safety management functions into all phases of work. These functions consist of defining the scope of work, analyzing hazards, developing and implementing controls, performing work, and providing feedback and continuous improvements. The ISMS is a fundamental element in the safety program for the NEPCS.

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7. DESCRIPTION OF EQUIPMENT

7.1 EQUIPMENT AND PROCESS DESCRIPTION

7.1.1 Plant-Specific Operations

This section provides the process description, design criteria, modes of operation, instrumentation description, and process control for the major components of the NEPCS. A system process flow diagram for NEPCS is presented in Figure 5. Detailed information on system configurations and equipment specifications can be found in the system's "as-built" drawings and manufacturer's equipment manuals.

7.1.2 Groundwater Extraction Wells and Associated Equipment

The NEPCS is comprised of two TUs and two EWs. The C-765 TU is used for EW234 and the C-765-A TU is used for EW235. The location of the two EWs and associated NEPCS equipment relative to the Paducah Gaseous Diffusion Plant (PGDP) is presented in Figure 6. For hydraulic control, EW234 is expected to operate at a range of between approximately 100 to 200 gpm, and EW235 is expected to operate at a range of between approximately 75 to 150 gpm. The groundwater EWs supply influent groundwater for NEPCS TUs. The air stripper for each NEPCS operation trailer is capable of 1-250 gpm operation, but will be limited by the PLC controls to ensure the system flow rate is maintained within the operational capabilities of each system. Each well is housed inside a concrete vault for maintenance and access to the well head. Table 7 provides additional information about the EWs.

Table 7. EW Configuration

Well No.	Total Depth	Screened Interval	Hydrologic Unit Screened
EW234	103.0 ft bgs	80.7 to 95.7 ft bgs	Middle and Lower RGA
EW235	106.0 ft bgs	85.0 to 100.0 ft bgs	Middle and Lower RGA

bgs = below ground surface

The discharge piping from the concrete EW vaults to the NEPCS operation trailers is constructed of high-density polyethylene. Each EW contains an electric-driven centrifugal submersible well pump that pumps groundwater through the discharge piping to the NEPCS TUs. The wellhead piping; sample tap; pressure gauge; and manual flow control valve are located below grade in a secured equipment vault at each well location.

Each groundwater EW pump operates continuously in either a HAND or AUTO mode. When a well pump is in HAND, it supplies water continually to the NEPCS operation trailer until the switch is released. When a well pump is in AUTO, it operates automatically on signals generated by the system PLC.

Each groundwater EW vault drains to a sump and a sump pump. The sump pump is a small, electric-driven submersible pump with the discharge connected to the EW discharge piping. Water collected in the sump is monitored by a float switch; when activated, it pumps any water from the sump into the water discharge piping to be treated at the NEPCS operation trailers.

7.1.3 Control/Instrumentation Description

Main power to the EW pumps is supplied from a local overhead line that supplies power to power distribution panel boards. Each well pump has a local control panel and VFD (variable-frequency drive) for optimum control and adjustment of the groundwater extraction rate. The local control panel has a well pump selector switch, a sump pump selector switch, and indicator lights.

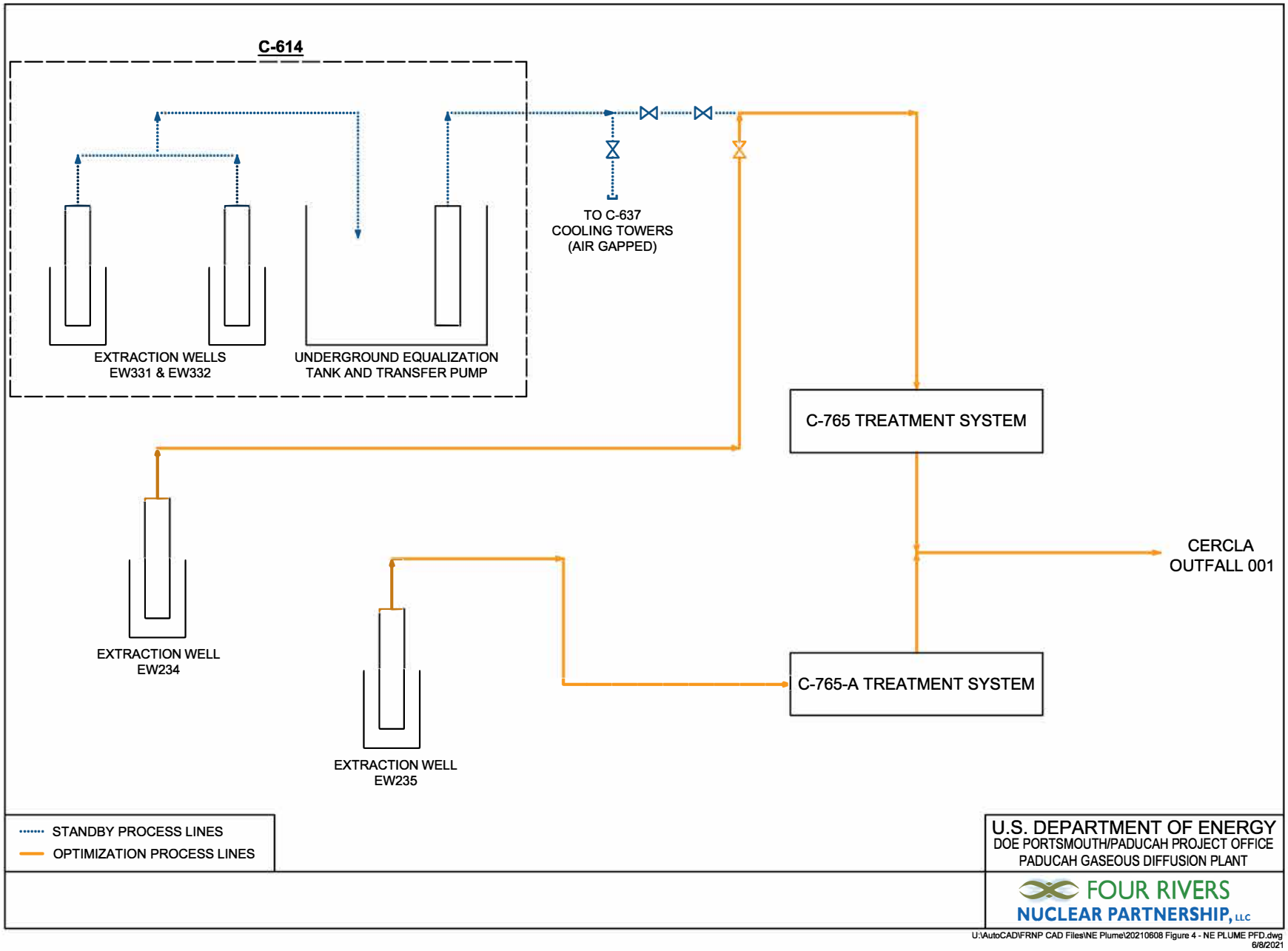

Figure 5. System Process Flow Diagram for NEPCS

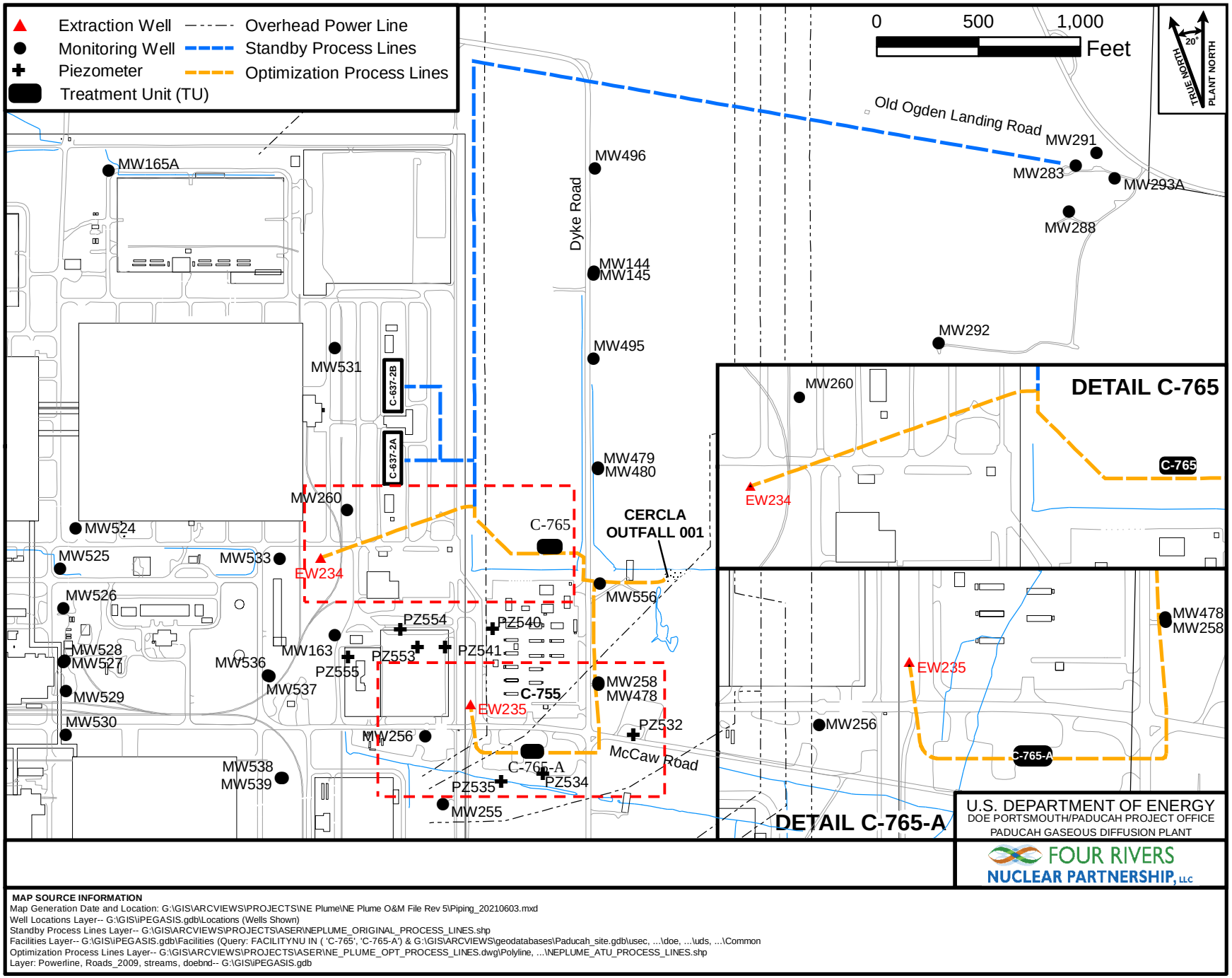

Figure 6. Location of Monitoring Wells, Extraction Wells, and the NEPCS Relative to PGDP

Each well has a manual control valve, pressure gauge, sample tap, and a VFD. Once all alarm conditions have been cleared, the well pumps can be restarted at the PLC.

Additionally, operators can use the PLC to shut down the well pump(s). After shutdown, the pump(s) are restarted at the PLC panel.

The system control panels at the EWs use local control panels utilizing switches and indicator lights while the treatment systems utilize graphical control panels, PLCs, and an autodialer for notifying NEPCS personnel of system shutdown. The control panels display the status of system components and alarm conditions found in Section 3.

7.1.4 Process Control

Groundwater EW flow rates are determined by the system's effects on the site hydrogeology. Groundwater MWs near the EWs are monitored and sampled routinely for contaminant parameters. The frequency of well monitoring is addressed in Section 4. As the results of this monitoring are assessed, the pumping rates from the groundwater EW may be modified to reflect changes in the site hydrogeology.

The flow from each groundwater EW is adjusted using the PLC control of each VFD and system valves as necessary to control each pump discharge and to confirm the flow rate by use of a flowmeter. The flow rate is adjusted to operate within the minimum and maximum design flow for each EW pump, while staying within the design flow rate of the air stripper and the target flowrate for the site hydrogeology.

7.1.5 C-765 Treatment System

The C-765 treatment system is the northern treatment system located north of C-755 complex inside a fence enclosed area to control access to the facility. It is contained within an approximate 8.5-ft by 53-ft weathertight enclosure, which includes bag filters, air stripper, and control panel. EW234 is connected to C-765 TU via Ethernet connection to enable communication between the two components. An inlet set of bag filters removes suspended solids as a pretreatment to the air stripper, which removes TCE. The bag filters are configured in parallel and have a clean bag filter in standby when the online filters begin to plug. Instrumentation is included to monitor the differential pressure across the filters and automatically change to the clean filter(s) before the bag(s) become plugged. The dirty filter bag(s) then is replaced and becomes the standby filter. After sufficient operating experience, bag filters may be taken offline and bypassed if suspended solids concentrations are low enough to meet CERCLA outfall criteria without their use and operational data indicate they are not needed to reduce maintenance on the air stripper trays. Once water has passed through the air stripper, removing TCE from the extracted groundwater, it is pumped from the air stripper basin to the outfall by the system effluent pump. Control of the effluent pump by the PLC is maintained by monitoring the water level in the air stripper basin and adjusting the effluent pump's VFD to maintain a consistent level within each air stripper basin. Additionally, the treatment system enclosure was designed with capacity for future treatment system components, if required, by changing groundwater conditions.

System component status, information, and associated alarms will be monitored via the treatment system control panel. Treated groundwater is discharged into CERCLA Outfall 001. EW331 and EW332 are connected to the C-765 treatment system, but are taken off-line and will remain in standby mode unless the alternative operations and maintenance, discussed in Section 5, are implemented.

7.1.6 C-765-A Treatment System

The C-765-A treatment system is the southern treatment system located south of C-755 complex inside a fence enclosed area to control access to the facility. It is contained within an approximate 8.5-ft by 53-ft weathertight enclosure, which includes bag filters, air stripper, and control panel. EW235 is connected to C-765-A TU via Ethernet connection to enable communication between the two components. An inlet set of bag filters removes suspended solids as a pretreatment to the air stripper, which removes TCE. The bag filters are configured in parallel and have a clean bag filter in standby when the online filters begin to plug. Instrumentation is included to monitor the differential pressure across the filters and automatically change to the clean filter(s) before the bag(s) become plugged. The dirty filter bag(s) then is replaced and becomes the standby filter. After sufficient operating experience, bag filters may be taken offline and bypassed, if suspended solids concentrations are low enough to meet CERCLA outfall criteria without their use and operational data indicate they are not needed to reduce maintenance on the air stripper trays. Once water has passed through the air stripper, removing TCE from the extracted groundwater, it is pumped from the air stripper basin to the outfall by the system effluent pump. Control of the effluent pump by the PLC is maintained by monitoring the water level in the air stripper basin and adjusting the effluent pump's VFD to maintain a consistent level within each air stripper basin. Additionally, the treatment system enclosure was designed with capacity for future treatment system components, if required, by changing groundwater conditions.

System component status, information, and associated alarms will be monitored via the treatment system control panel. Treated groundwater is discharged into CERCLA Outfall 001.

7.2 MONITORING COMPONENTS

A mechanical flow rate/totalizer is installed in each NEPCS TU for recording flow rates and total volume pumped. Trailer effluent concentrations are measured at CERCLA Outfall 001 and for the liquid effluent of each trailer per the requirements of Section 4.

7.3 MAINTENANCE OF SITE EQUIPMENT

Equipment replacement, calibration, and maintenance are performed in accordance with the manufacturers' recommendations. Detailed information on required maintenance and calibration activities are documented in CP2-ER-0046, *Paducah Plume Operations Maintenance, Sampling and Analysis, and Calibration and Testing Plan*.

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8. RECORDS AND REPORTING

8.1 LOGBOOKS AND LABORATORY RECORDS

Records are maintained by NEPCS personnel to document significant information involving NEPCS operations. Information includes routine operation, unusual occurrences, equipment malfunctions, spills, operational data records, and maintenance records.

8.2 DATA MANAGEMENT

To meet regulatory requirements for the acquisition of technically and legally defensible data, a traceable audit trail is established from the implementation of the approved QAPP through the archiving of information in accordance with CP3-ES-5003, *Quality Assured Data*, and CP2-ER-1000, *Data Management Implementation Plan for the Paducah Plumes Operations Paducah Gaseous Diffusion Plant, Paducah, Kentucky.* Each step or variation of the sampling and analytical process is documented. Quality assured data are obtained through appropriate planning, adequate sampling and laboratory QCs, and documented data review.

8.3 PROGRAM REPORTING REQUIREMENTS

Routine O&M of the NEPCS and the MWs includes preparation of various operations and progress reports for submittal to EPA Region 4 and the Kentucky Department for Environmental Protection. In addition, various components of the NEPCS operation may require preparation of special work plans or reports.

8.3.1 NEPCS O&M Plan

This O&M Plan provides the NEPCS operators with background information, program organization, reporting requirements, and O&M requirements and guidelines. It also includes references to plans and procedures that aid in maintaining compliance with DOE, federal, and Commonwealth of Kentucky policies and statutes. Supporting plans and procedures referenced in this O&M Plan can be found in the procedures folder on the Public Documents website (https://pubdocs.pad.pppo.gov/). The appendix contains a list of plans and procedures developed for the NEPCS and general pump-and-treat operations. It should be emphasized that the O&M Plan is a dynamic document. Modifications and improvements to NEPCS operational procedures and this O&M Plan will continue as methods are identified that improve the overall performance and efficiency of system operations.

8.3.2 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 NEPCS. DOE submits progress reports to the Kentucky Department for Environmental Protection and EPA. For this project, effluent discharge and other information will be summarized in semiannual reports. Such information may include, but not be limited to, TCE concentrations, maintenance performed, down time, TCE removed, effluent discharges that do not meet the criteria in Table 1, etc.

8.4 EMERGENCY PROCEDURES AND NOTIFICATIONS

The HASP provides guidance on emergency response and notification. The HASP is reviewed annually and made available for inspection by employees, their supervisors, health and safety personnel, and other government agencies having relevant responsibilities. The plan addresses all of the following:

- Personnel roles, lines of authority, and communication;
- Emergency recognition and prevention;
- Evacuation routes and procedures;
- Emergency medical treatment and first aid;
- Emergency alarm and response procedures;
- Hazardous material release; and
- Personal protective equipment and emergency equipment.

8.4.1 Existing Programs

The PGDP has a comprehensive program for emergency response. The Pump-and-Treat Operations Manager will ensure that personnel are trained to implement the site program. In the area of emergency response procedures, the NEPCS is considered a part of PGDP. NEPCS personnel will cooperate with emergency response personnel and may be asked to provide assistance in accounting for personnel, gathering at the safe refuge point, and reporting the status of the incident.

8.4.2 Accident/Incident Reporting

NEPCS personnel are required to immediately report any injury, regardless of severity, to the Pump-and-Treat Operations Manager. Once informed, the Pump-and-Treat Operations Manager will report the incident to management, who will make necessary notifications. In the event of a serious injury, personnel may seek immediate emergency medical assistance before notifying the Pump-and-Treat Operations Manager.

Major incidents occurring at the NEPCS must be reported to DOE. Examples of reportable incidents include, but are not limited to, medical emergencies, spills, and major operational disruptions.

8.4.3 Emergencies

Personnel are trained during the PGDP site training to report emergencies. Emergencies are to be immediately reported to the Plant Shift Superintendent's Office, located at C-300, using the fastest route possible. This could be a telephone call (270 441-6333) or a radio network call to Alpha One (if possible, person will remain in the area to direct the responders).

9. OPERATIONS AND MAINTENANCE COST ESTIMATE

The costs associated with the O&M of the NEPCS and the Northwest Plume Groundwater System no longer are tracked separately. O&M of the two systems have been combined under the current contract. The average annual cost for O&M of both systems is approximately $800,000.00. This cost is a total project cost that includes, but is not limited to, the following:

- Labor/personnel,
- O&M of the systems, including corrective maintenance,
- Waste disposal,
- Sampling and analysis,
- Health and safety,
- Data management,
- Technical reporting, and
- Financial tracking.

NEPCS operating costs are expected to remain relatively stable; however, events that may impact costs include, but are not limited to, unscheduled maintenance events, document review cycles, and project scope changes generated during baseline planning.

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10. REFERENCES

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APPENDIX

PLANS AND PROCEDURES LIST

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This appendix provides a list of currently existing plans and procedures developed specifically for the Northeast Plume Containment System (NEPCS) or general pump-and-treat operations; sitewide plans and procedures germane to pump-and-treat operation are not included in this list. The list is accurate as of the date of this Operations and Maintenance (O&M) Plan and is included here as a point-in-time reference. The number of plans and procedures specific to the NEPCS and general pump-and-treat operations may increase or decrease over time; such changes will not change the intent or validity of this O&M Plan. Likewise, titles and document numbers associated with these plans and procedures may change but will not change the intent or validity of this O&M Plan.

PLANS

CP2-ER-0012 *Waste Management Plan for the Pump-and-Treat Operations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

CP2-ER-0046 *Paducah Plume Operations Maintenance, Sampling and Analysis, and Calibration and Testing Plan*

CP2-ER-0067 *Health and Safety Plan for the Paducah Plumes Operations and C-613 Sediment Basin Paducah, Kentucky*

CP2-ER-1000 *Data Management Implementation Plan for the Paducah Plumes Operations Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

PROCEDURES

CP4-ER-0005 *Startup and Normal Operation of the Northeast Plume Containment System*

CP4-ER-0017 *Northwest/Northeast Plume Daily Operational Data Collection and Maintenance*

CP4-ER-0018 *Shutdown for the Northeast Plume Containment System*

CP4-ER-0020 *Control and Use of Pressure-Related Measuring and Test Equipment for the Northwest and Northeast Plume Operations*

CP4-ER-0028 *NWNE Pump & Treat Systems Federal Facility Agreement Semi-Annual Report Calculations*

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