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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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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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Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
LATA ENVIRONMENTAL SERVICES OF KENTUCKY, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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ACRONYMS

ARAR	applicable or relevant and appropriate requirements
ATU	alternate treatment unit
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
HASP	health and safety plan
HDPE	high-density polyethylene
IRA	interim remedial action
ISMS	Integrated Safety Management System
KPDES	Kentucky Pollutant Discharge Elimination System
NEPCS	Northeast Plume Containment System
NWPGS	Northwest Plume Groundwater System
O&M	operation and maintenance
PGDP	Paducah Gaseous Diffusion Plant
PLC	programmable logic controller
QC	quality control
ROD	record of decision
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* (ROD), which was signed in June 1995.

The objective of this IRA is to retard the migration of the highest concentration volume of trichloroethene (TCE) in the Northeast Plume and to meet the objectives stated in the ROD.

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 TCE-contaminated groundwater within the Regional Gravel Aquifer northeast of the plant. This plume is referred to as the Northeast Plume. To conduct an investigation leading to a remedial action for the contaminated groundwater, DOE submitted, as required for a hazardous waste permit, an interim corrective measures work plan to EPA and the Commonwealth of Kentucky. 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. This O&M Plan revision provides the NEPCS operators with background information; program organization; reporting requirements; O&M requirements and guidelines; training requirements; and PGDP emergency response guidelines.

This O&M plan revision also addresses system modifications, primarily that of replacing the C-637 Cooling Towers with a shallow tray air stripper for TCE treatment known as the alternate treatment unit (ATU). The C-637 Cooling Towers were shut down June 2013 as part of the United States Enrichment Corporation's effort to cease uranium enrichment operations. Installation of the ATU will result in a new discharge point, which is planned to be a Comprehensive Environmental Response, Compensation, and Liability Act outfall or a Kentucky Pollutant Discharge Elimination System outfall. The NEPCS still consists of the original extraction well field components including two extraction wells (EW331 and EW332), an equalization tank, and a transfer pump, but will extend the transfer line (past the existing cooling tower tie-in location) to the new ATU.

The intent of this O&M plan revision is to provide an updated plan that can be used to guide operation, under the current configuration, from shutdown of the cooling towers (and incorporation of the ATU) until installation and startup of the optimized NEPCS. An explanation of significant differences has been prepared that documents the changes recently made to the NEPCS and the planned optimization of the NEPCS with a new extraction well field, additional treatment capacity, and other system changes. A new O&M Plan will be developed in the future to address NEPCS optimization.

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1. EQUIPMENT STARTUP AND OPERATOR TRAINING

1.1 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 a treatment system for air stripping. The NEPCS consists of the original two extraction wells (EW331 and EW332), each of which is equipped with a submersible pump, drop pipe, and electrical service. After extraction, water is pumped through a transfer line to an underground equalization (EQ) tank. The EQ tank, ancillary piping, control panel, and power panel all are located at an equipment pad designated as C-614. A transfer pump moves the groundwater from the EQ tank through approximately 5,800 linear ft of underground transfer piping to a new alternate treatment unit (ATU), which consists of bag filters and an air stripper. 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 pumped to a planned Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) outfall, or a Kentucky Pollutant Discharge Elimination System (KPDES)-permitted outfall.

The new ATU will replace the C-637 Cooling Towers that currently are being used for air stripping. The layout of the new 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. A process flow diagram and more detailed system information are contained in Section 7.

1.2 INITIAL NEPCS STARTUP GUIDELINES

The initial startup phases for the NEPCS were completed in February 1997 by implementing an Integrated Test Plan and conducting Shakedown Operations. Normal operations began on February 28, 1997.

Additional startup activities will be performed to test the new treatment system and ancillary components. This will include, but not be limited to, system interlocks, instrumentation, alarms, air stripper performance, and overall treatment system operation. A batch run(s) will be performed to ensure that the air stripper is reducing the TCE concentration to meet applicable or relevant and appropriate requirements (ARARs) at the outfall. Treated water will be captured in a temporary storage tank(s) and sampled to verify compliance. Once the performance of the air stripper has been verified, the treatment system will be fully integrated into the NEPCS for routine system operation. Outfall discharge criteria are presented in Table 1.

1.3 OPERATOR TRAINING

Personnel training activities regarding operational work instructions will be completed and documented during the system start-up period. New personnel are required to complete system training before performing work at NEPCS. Additional training is performed when significant changes are made to operating procedures and system modifications are implemented. General training requirements regarding health and safety and Paducah Gaseous Diffusion Plant (PGDP) requirements for work on-site are documented in the training position descriptions and *Health and Safety Plan for the Paducah Plumes Operations, Paducah, Kentucky*, PAD-PROJ-0067 (HASP). Training position descriptions and personnel training records are maintained by the U.S. Department of Energy (DOE) Prime Contractor training department.

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 (^{o}F)	N/A	Record	89
Trichloroethene (µg/L)	N/A	30	Record
Chronic toxicity (TU_c)	N/A	N/A	1.00
Technetium-99 (µCi/mL)[a]	6E-5	Record	N/A
pH	N/A	6 (min)	9
1,1-Dichloroethene (µg/L)	N/A	7,100	Record

[a] Based upon 10 *CFR* Part 20, Appendix B.

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 developed for the NEPCS. These documents are located at the Northwest Plume Groundwater System (NWPGS), C-612-T02. This location is the field office for both the NWPGS and NEPCS.

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

2.2.1 Operational Strategy

The objective of the NEPCS is to retard the migration of the highest concentration volume of TCE in the Northeast Plume. Based on system, extraction well, and monitoring well data, NEPCS flow rates are adjusted to optimize system performance in meeting the interim remedial action (IRA) objectives. The NEPCS can be operated with a minimum flow of 45 gallons per minute (gpm) from one extraction well. During system operation with a flow rate less than 100 gpm, the transfer pump cycles on and off as needed to control the water level in the EQ tank. The maximum system flow is 200 gpm, as limited by the throughput of the air stripper.

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 and/or a remote access computer located at C-612-T-02.

2.2.3 Conduct of Operations

Conduct of operations for the NEPCS is governed by *Integrated Safety Management System Description and Environmental Management System Description for the Paducah Environmental Remediation Project Paducah, Kentucky*, PAD-PLA-SAF-001. 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 5480.19, *Conduct of Operations Requirements for DOE Facilities*.

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.

2.4 OPERATING PROCEDURES

The NEPCS is operated in accordance with approved procedures, equipment manuals, and sound engineering practices. Additional work control documents are developed, as necessary, for NEPCS operations. Operating procedures are located at C-612-T-02.

2.5 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 or remotely by a computer located at C-612-T-02. 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 procedure, PAD-SO-0017, *Northwest/Northeast Plume Operations Daily Operational Data Collection and Maintenance*. This procedure can be found at C-612-T-02.

2.6 SYSTEM MAINTENANCE AND CALIBRATION

NEPCS maintenance (corrective and preventive) and calibration are performed in accordance with equipment manufacturer's recommendations and sound engineering practices. Every five years of operation, a precision test is conducted on the underground EQ tank and a hydrostatic test is conducted on the system pipeline(s) to verify their integrity. If unacceptable conditions are found during testing, an evaluation of potential corrective measures will be conducted with involvement of the appropriate regulatory agencies. Detailed information on maintenance activities is included in PAD-SO-0046, *Paducah Plume Operations Maintenance, Calibration, and Testing Plan.* This plan can be found at C-612-T-02.

2.7 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. The autodialer operates over standard telephone equipment.

Emergency telephone numbers for police, fire, medical emergencies, and key NEPCS personnel, as well as PGDP interplant emergency lines, are provided in the HASP.

2.8 WASTE MANAGEMENT

Other than the treatment system effluent, the NEPCS system generates minimal waste, primarily protective clothing associated with sampling. Waste is handled and disposed of in accordance with PAD-ENM-0012, *Paducah Plume Operations Waste Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*. This waste management plan addresses the management of waste 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 plan was developed in accordance with site procedures and is located at C-612-T-02.

The major waste stream will be the treated groundwater, which will be discharged to a CERCLA or KPDES outfall in accordance with ARARs. This discharge will be monitored at the outfall as indicated in Table 1 to ensure compliance.

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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 automatically as a result of system alarms or when initiated by an operator.

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)
1. PLC off-line	Fault(s) in the PLC, Input/Output module, or scanner module.
2. Low flow to/from EQ tank	Transfer pump may have shut off on high pressure or fault condition. Extraction well pump(s) may have shut off on low or high pressure.
3. Low pressure at the treatment system	System has shut down due to low pressure in the transfer line.
4. EQ tank level high	Transfer pump may have shut down or the flow rate may be inadequate to maintain preset level in EQ tank. Extraction well pumps will shut off automatically.

Note: Only the low pressure switch at the treatment system and emergency shutoff buttons at the PLC and treatment system will shut down the entire system. Shutdown of individual components may lead to system shutdown.

Operator-initiated shutdowns may be performed during situations such as routine maintenance, severe weather, personnel injury, and fire. The system will shut down automatically due to adverse conditions such as electrical failure.

3.2 RESPONSE AND NOTIFICATION PROCEDURE FOR NEPCS SHUTDOWN

To troubleshoot and correct system problems, personnel follow appropriate procedures, plans, manufacturer's equipment manuals, and seek any necessary outside technical assistance. NEPCS operators record events, actions taken, and other pertinent information. The NEPCS operations manager reports required information to the appropriate personnel and/or government agencies.

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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 *Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2 (ROD) (DOE 1995). 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 NEPCS pumps TCE-contaminated groundwater to the treatment system air stripper where the TCE is stripped from the groundwater. Effluent water is discharged into a CERCLA or KPDES outfall. The Northeast Plume groundwater does not contain levels of technetium-99 (Tc-99) above 900 pCi/L. Monitoring well data are collected to ensure that Tc-99 does not migrate from PGDP to the NEPCS that will exceed the CERCLA or KPDES outfall discharge requirements. The objective of the NEPCS is to retard the migration of the highest concentration volume of TCE in the Northeast Plume and to meet the objectives stated in the ROD.

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.

4.3 EVALUATION OF EXTRACTION FIELD EFFECTIVENESS

As part of the initial system startup, water levels were measured in associated monitoring wells, piezometers, and extraction wells to determine the local potentiometric surface. Monitoring wells used for modeling and/or early prediction of Tc-99 migration from PGDP to the NEPCS are listed below. In addition, water levels are measured concurrently in adjacent monitoring wells not associated with the system. The water level data are used to tie the Northeast Plume local information into the potentiometric information for the regional area. For the original NEPCS startup, colloidal borescope measurements were taken in each of the wells in the extraction field to document the local baseline groundwater flow directions and velocities. Groundwater samples are collected from each of the monitoring wells and analyzed for TCE to confirm initial contaminant distributions in the extraction field. Groundwater data collected before NEPCS continuous operations began (water levels, colloidal borescope measurements, and contaminant levels from the wells listed below) were used as a baseline. Colloidal borescope measurements were taken only as part of the original NEPCS startup, and future measurements using this technology are not anticipated.

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

	Question/Goal	Decision Rule	Data Needs
1	Are we retarding the migration of the highest concentration volume of the plume?	If field data[a] collected from the monitoring well network at the extraction field indicate that the extraction wells are not effectively retarding the migration of the highest concentration volume of the plume, then operation of the extraction field will be reevaluated and adjustments made as necessary. Otherwise, operation of the extraction field will continue at existing levels.	TCE and Tc-99 samples will be collected from monitoring wells. Water level data and pumping rates will be recorded for the extraction wells. Water level data will be collected for the monitoring wells.
2	Are we effectively stripping the TCE?	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. Otherwise, operation of the system will continue as outlined.	TCE samples will be collected from the air stripper effluent.
3	Are we affecting environmental performance at the CERCLA or KPDES outfall?	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. Otherwise, operation of the system will continue as outlined.	Data from the CERCLA or KPDES outfall will be evaluated.
4	What levels of TCE are being discharged into the atmosphere?	If air emissions of TCE from the NEPCS, as a single source or as a contributor to site emissions, exceed the regulatory guidelines, then the operating status will be reviewed and revised as necessary. Otherwise, operation of the system will continue as outlined.	Emissions will be calculated based on TCE samples taken from the EQ tank and air stripper effluent and evaluating associated pump rates.
5	Are we meeting the requirements stated in the Facility and Nuclear Safety evaluation?[b]	If TCE or Tc-99 levels exceed the levels used in assumptions serving as the basis for safety, environmental, or operating limiting conditions, then system operation will be suspended until the impacts can be evaluated and appropriate operating conditions can be reestablished. Otherwise, operation of the system will continue as outlined.	TCE and Tc-99 samples will be taken from monitoring wells and EQ tank.
6	Is the system running efficiently in terms of O&M?	If system components are not operating within the manufacturer's specified performance criteria, then system operation will be evaluated. Otherwise, operation of the NEPCS will continue as outlined.	Operational data will be recorded to include flow rates from pumps; pressure readings; EQ tank level; maintenance data; and pipeline and system integrity.

[a] Monitoring well groundwater sampling will be performed under the Environmental Monitoring Plan. Frequencies and analytes are as follows:

- Every sampling event—depth to water, dissolved oxygen, pH, specific conductance, temperature, redox, and turbidity.
- Quarterly parameters—Tc-99
- Semiannual parameters—volatile scan, Tc-99, and gross alpha and beta

[b] The current safety basis for the NEPCS is contained in the sitewide industrial preliminary hazard screening PHS-PH-INDSTRL-0067/R1, June 2013.

Monitoring Wells:	MW124, MW126, MW145, MW255, MW256, MW258, MW283, MW284, MW288, MW291, MW292, MW293, and MW294
Extraction Wells:	EW331 and EW332
Piezometers:	PZ287, PZ289, and PZ290

4.4 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 4.

4.4.1 Quality Assurance and Quality Control

The Paducah Site maintains a quality sample and data management program to verify the integrity of data generated within the Environmental Monitoring Program. Each aspect of the monitoring program, from sample collection to data reporting, must comply with quality requirements and assessment standards. The Environmental Monitoring Program Quality Assurance Project Plan will be consistent with DOE/LX/07-1269&D2/R1, *Paducah Gaseous Diffusion Plant Programmatic Quality Assurance Project Plan.* Requirements and guidelines for the quality program at the Paducah site are established by the following:

- DOE Order 414.1D, *Quality Assurance*
- *Quality Assured Data*, PAD-ENM-5003
- Commonwealth of Kentucky and federal regulations; and guidance from EPA
- American National Standards Institute
- American Society of Mechanical Engineers
- American Society of Testing and Materials
- American Society for Quality Control

4.4.2 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 rule No. 5 (see Table 3). These analyses are performed using approved 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.

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.

4.4.3 Data Review

The data review process consists of the verification, validation (if applicable), and assessment of the field measurements and analytical results received from the laboratory and is performed in accordance with procedure PAD-ENM-5003, *Quality Assured Data*. Data verification is performed on all analytical data to determine if the number of samples, analytical and field methods, parameters, and other requirements are met. The data validation process determines whether proper QC methods are used and whether the results meet established QC criteria. Validation is performed in accordance with procedures at a target frequency of a minimum of 5% (1 out of every 20 data packages). Data verification, validation (if applicable), and

Table 4. Summary of Sampling, Analysis, and Data Collection

Sample point (s)	Parameters	Frequency[a]	Decision rule
EW331, EW332	Pump rates	Daily	#1, #4
	Water levels	Weekly	#1
	TCE, Tc-99	Quarterly	N/A
EQ Tank	TCE, Tc-99	Monthly	#5
Monitoring Wells[b]	Routine groundwater monitoring parameters[c]	Quarterly	#1, #5
Air Stripper Liquid Effluent	TCE	Weekly	#2
CERCLA or KPDES Outfall	Flow, Total Suspended Solids, Oil and Grease, Total Residual Chlorine, Temperature, TCE	Weekly	#3
	Chronic Toxicity, Technetium-99	Quarterly	#3
	pH	Weekly	#3
	1,1-Dichloroethylene	Weekly	#3

Note: Sampling temporarily may be increased to support operational troubleshooting. Sampling will be temporarily suspended when the facility is shut down or if other operational conditions exist that would make sampling impractical.

[a] Daily samples—Daily refers to normally manned operations excluding weekends, holidays, or days when the facility is shutdown.
Monthly—One sample per calendar month.
Quarterly—One sample every three months not to exceed four months/sample.

[b] The samples are collected and analyzed by the Environmental Monitoring Plan.

[c] See footnote "a" in Table 3 for a list of analytes.

assessment will be performed on analytical data. Environmental Monitoring personnel perform verification on 100% of laboratory data. NEPCS/Environmental Monitoring personnel perform data assessment on 100% of laboratory data. Data assessment consists of a review of DQOs and the sampling and analysis plan. Any problems found during the review process will be documented and resolved.

4.4.4 Corrective Action Procedures

Project personnel are responsible for identifying conditions adverse to quality and informing the NEPCS Operations Manager. Corrective action procedures require that conditions adverse to quality be identified and documented, and corrective action be taken and verified in accordance with procedure PAD-QA-1610, *Noncompliance Determination and Reporting*.

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5. DESCRIPTION OF ALTERNATE OPERATIONS AND MAINTENANCE

The simplicity of the NEPCS does not lend itself to an alternate O&M Plan. 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 is possible when only one of the two extraction wells is functional.

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6. HEALTH AND SAFETY PLAN

A HASP (PAD-PROJ-0067) 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. The HASP can be found at C-612-T-02.

An Integrated Safety Management System (ISMS) is implemented into all work performed at the 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 the NEPCS is presented in Figure 1. Detailed information on system configurations and equipment specifications can be found in the system's "as-built" drawings and manufacturer's equipment manuals located at C-612-T-02.

7.1.2 Groundwater Extraction Wells and Associated Equipment

The location of the two extraction wells and associated NEPCS equipment relative to PGDP is presented in Figure 2. The system consists of two extraction wells: EW331, with a minimum flow rate of 74 gpm and a maximum flow rate of 150 gpm, and EW332, with a minimum flow rate of 45 gpm and a maximum flow rate of 110 gpm. The extraction wells will be throttled to a flow rate of 200 gpm or less to match the flow capacity of the air stripper. The groundwater extraction wells supply influent groundwater for NEPCS operations. The extraction wells are constructed of 8-inch diameter polyvinyl chloride well casing above the standing water level and stainless steel casing and screen at and below the standing water level. Each well is housed inside a concrete vault.

The discharge piping from the concrete extraction well vaults to the equipment vaults and the below-grade piping from the equipment vault to the EQ tank is constructed of high-density polyethylene (HDPE). Piping inside the equipment vault is constructed of stainless steel. Each extraction well contains an electric-driven centrifugal submersible well pump that pumps groundwater through the discharge piping to an underground EQ tank. The wellhead piping; sample tap; pressure gauge; high and low pressure switches; manual flow control valve; and flowmeter are located below grade in a secured equipment vault at each well location.

Each groundwater extraction well pump operates continuously in either an ON or AUTO mode. When a well pump is ON, it supplies water continually to the NEPCS until the pump is manually shut down by switching it to OFF. When a well pump is in AUTO, it operates automatically on signals generated by the system PLC.

7.1.3 Control/Instrumentation Description

Main power to the extraction well pumps is supplied from a local overhead line that supplies power to power distribution panel boards. Each well pump has a local control panel. The local control panel has no-load and overload protection, a selector switch, an overload reset push-button, and indicator lights.

Each well has a flowmeter/totalizer, pressure gauge, and high and low pressure switches. The pressure switches cause the PLC to shut down the well pump at preset pressures. Once all alarm conditions have been cleared, the well pumps can be manually restarted by the operator 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.

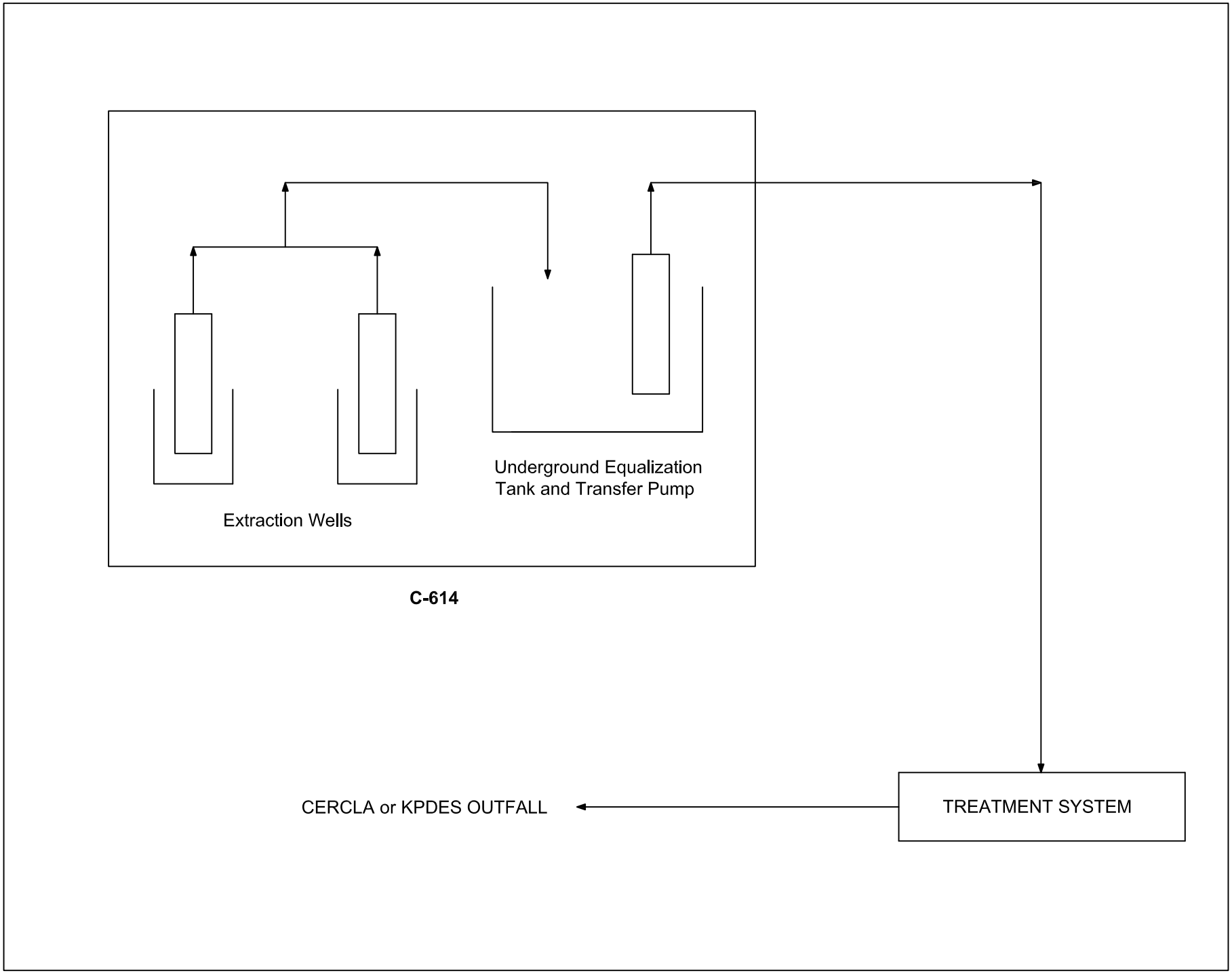

Figure 1. System Process Flow Diagram for NEPCS

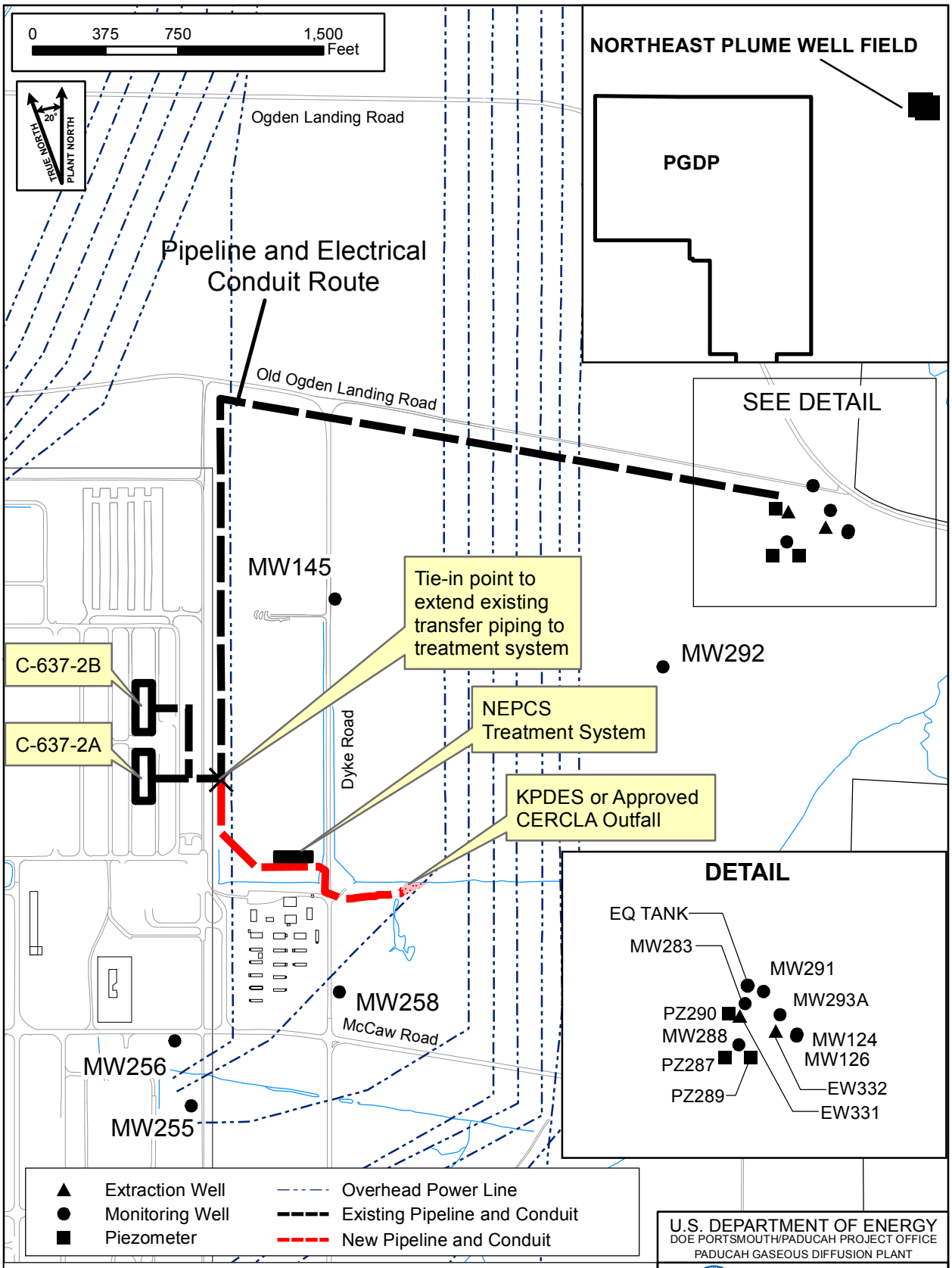

Figure 2. Location of Monitoring Wells, Extraction Wells, and the NEPCS Relative to PGDP

The system control panels at C-614 and at the treatment system utilize graphical control panels, PLCs, and a modem used with an autodialer for notifying NEPCS personnel of system shutdown. The control panels display the status of system components and alarm conditions. System status also can be monitored through a remote access computer located at C-612-T-02 (refer to Section 2.5).

7.1.4 Process Control

Groundwater extraction well flow rates are determined by the system's effects on the site hydrogeology. Groundwater monitoring wells near the extraction wells are monitored for water level and routinely sampled for contaminant parameters. The proposed frequency of well monitoring (includes sampling and other modeling parameters) is addressed in Section 4. As the results of this monitoring are assessed, the pumping rates from the groundwater extraction wells may be modified to reflect changes in the site hydrogeology.

The flow from each groundwater extraction well is adjusted by manually throttling the pump discharge valve and referring to the local flowmeter for confirmation of flow. The flow rate is adjusted to operate within the minimum and maximum design flow for each extraction well pump, while staying within the design flow rate of the air stripper. Changes to extraction well flow rates must be made slowly so that the high pressure switches in the pump discharge lines are not inadvertently activated.

7.1.5 Underground EQ Tank, Transfer Pump, and Transfer Piping

The 20,000-gal EQ tank is constructed of fiberglass-reinforced plastic. The tank is located underground and backfilled with crushed rock in accordance with the tank manufacturer's instructions.

The transfer pump is a submersible pump mounted inside the EQ tank through a 24-inch manway and transfers the combined groundwater from the extraction wells to the treatment system air stripper.

The underground transfer piping (from the EQ tank to the treatment system) is approximately 5,800 linear ft and is constructed primarily of 6-inch diameter HDPE. A new tie-in point was made to extend the transfer piping to the new air stripper/treatment system. Refer to Figure 2 for the tie-in location. The existing HDPE piping leading to the C-637 Cooling Tower will remain in place, but isolated using a below grade valve box where the discharge piping branches west to the cooling towers. System controls will be located inside the new treatment system enclosure in conjunction with those existing at C-614.

7.1.6 Treatment System

The treatment system is contained within an approximate 8.5-ft by 53-ft weathertight enclosure, which includes bag filters, air stripper, and control panel. 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 if suspended solids concentrations are low enough to meet the CERCLA or KPDES outfall criteria without their use. Additionally, the treatment system enclosure was designed with capacity for future treatment system components if required by changing groundwater conditions. This may include ion exchange resin for treating Tc-99 and/or vapor phase carbon for treating the air stripper vapor discharge.

System component status, information, and associated alarms may be monitored via the treatment system control panel. Treated groundwater is discharged into a CERCLA or KPDES outfall.

7.2 MONITORING COMPONENTS

A mechanical flow rate/totalizer is installed in each equipment vault at EW331 and EW332 for recording flow rates and total gal pumped. Also, two magnetic flow meters are installed on the influent piping and effluent piping at the EQ tank for measuring the influent flow rate to the EQ tank and the effluent flow rate to the treatment system.

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 the PAD-SO-0046, *Paducah Plume Operations Maintenance, Calibration and Testing Plan*, located at C-612-T-02 (LATA Kentucky 2013a).

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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, sampling events, visitors on-site, 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 development of sampling through the archiving of information in accordance with DOE/OR/07-1595&D2, *Data and Documents Management and Quality Assurance Plan for Paducah Environmental Management and Enrichment Facilities*, and PAD-ENM-0063, *Environmental Monitoring Data Management Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (LATA Kentucky 2013b). This necessitates that each step or variation of the sampling and analytical process is documented. Quality assured data are obtained through appropriate planning, adequate sampling and laboratory quality controls, and documented data review as outlined in procedure PAD-ENM-5003, *Quality Assured Data*.

8.3 PROGRAM REPORTING REQUIREMENTS

Routine O&M of the NEPCS and the monitoring wells includes preparation of various operations and progress reports for submittal to EPA Region 4 and the Kentucky Division of Waste Management. 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 was developed in accordance with the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707, EPA Region 4, DOE, and Kentucky Energy and Environment Cabinet. It 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. Training requirements and PGDP emergency response and operating procedures are also referenced. 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 this report, which may include, but not be limited to, TCE concentrations, maintenance performed, down time, TCE removed, effluent discharges in excess of those 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 NEPCS 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. A memorandum of understanding between the DOE Prime Contractor and United States Enrichment Corporation dictates that PGDP emergency response personnel handle requests for assistance from the NEPCS. 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 their supervisor. Once informed, the supervisor 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 their supervisor.

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 (441-6333), a radio network call to Alpha One, or an emergency call box activation (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 NWPGS 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 $1 million. This cost is a total project cost that includes, but is not limited to, the following:

- O&M of the systems, including corrective maintenance,
- 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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