

CERTIFICATION

Document Identification: *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*

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

Fluor Federal Services, Inc.



Mark Duff, Director of Environmental Management

11-10-15

Date Signed

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

U.S. Department of Energy (DOE)

William E. Murphie, Manager
Portsmouth/Paducah Project Office

Date Signed

CERTIFICATION

Document Identification: *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*

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

Fluor Federal Services, Inc.



Mark Duff, Director of Environmental Management

11-10-15
Date Signed

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

U.S. Department of Energy (DOE)

William E. Murphie, Manager
Portsmouth/Paducah Project Office

Date Signed

Mr. Brian Begley
Federal Facility Agreement Manager
Division of Waste Management
Kentucky Department for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, Kentucky 40601

PPPO-XX-XXXXXXXX-16

Ms. Julie Corkran
Federal Facility Agreement Manager
U.S. Environmental Protection Agency, Region 4
Federal Facilities Branch
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Begley and Ms. Corkran:

TRANSMITTAL 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/R2

Please find enclosed for your approval the certified *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). The ESD has been revised to incorporate requirements that resulted from the signing of the *Memorandum of Agreement for Resolution of the 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, conditions issued by U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) on September 30, 2015. Also incorporated are additional comments/clarifications received during comment resolution meetings held among the parties on October 23, 2015, and November 6, 2015. A redlined version of the document and condition response summaries for each agency are included to assist in identifying the modifications made to the document.

If additional information is required, please contact David Dollins at 270-441-6819.

Sincerely,

Jennifer Woodard
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosures:

1. Northeast Plume ESD (Redline and Clean)
2. Certification Page
3. Condition Response Summary—EPA
4. Condition Response Summary—KDEP

e-copy w/enclosure:

april.webb@ky.gov, KDEP/Frankfort
brian.begley@ky.gov, KDEP/Frankfort
corkran.julie@epa.gov, EPA/Atlanta
craig.jones@ffspaducah.com, FFS/Kevil
dave.dollins@lex.doe.gov, PPPO/PAD
ffscorrespondence@FFSPaducah.com, FFS/Kevil
gaye.brewer@ky.gov, KDEP/PAD
jana.White@ffspaducah.com, FFS/Kevil
jennifer.woodard@lex.doe.gov, PPPO/PAD
karen.walker@ffspaducah.com, FFS/Kevil
kim.knerr@lex.doe.gov, PPPO/PAD
leo.williamson@ky.gov, KDEP/Frankfort
mark.duff@ffspaducah.com, FFS/Kevil
mike.guffey@ky.gov, KDEP/Frankfort
myrna.redfield@ffspaducah.com, FFS/Kevil
reinhard.knerr@lex.doe.gov, PPPO/PAD
richards.jon@epamail.epa.gov, EPA/Atlanta
stephaniec.brock@ky.gov, KYRHB/Frankfort
todd.powers@ffspaducah.com, FFS/Kevil
tracey.duncan@lex.doe.gov, PPPO/PAD

DOE/LX/07-1291&D2/R2
Primary Document

**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**



CLEARED FOR PUBLIC RELEASE

**DOE/LX/07-1291&D2/R2
Primary Document**

**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**

Date Issued—November 2015

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FLUOR FEDERAL SERVICES, INC.,
Paducah Deactivation Project
managing the
Deactivation Project at the
Paducah Gaseous Diffusion Plant
under Task Order DE-DT0007774

CLEARED FOR PUBLIC RELEASE

THIS PAGE INTENTIONALLY LEFT BLANK

PREFACE

The regulations to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require that changes to remedial actions that are proposed after the adoption of a signed Record of Decision (ROD) be documented using one of the following three processes: (1) ROD Amendment if the change “fundamentally alters” basic features of the remedy; (2) Explanation of Significant Differences (ESD) if the change is significant, but not fundamentally different from the selected remedy in the ROD; or (3) Memorandum to File if the proposed changes to the remedy are minor. The proposed changes to the Northeast Plume interim remedial action (IRA) are not considered to “fundamentally alter” the basic features of the remedy, as presented in the ROD, but certain components of the proposed changes are considered “significant” changes that require development of an ESD. This *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/R1, was prepared in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 117(c); 40 *CFR* § 300.435(c)(2)(i) of the NCP; and a *Guide to Preparing Superfund Proposed Plans, Records of Decision, and other Remedy Selection Decision Documents*, EPA 540-R-98-031, July 1999. It provides the public the opportunity to understand the proposed modifications to the IRA for the Northeast Plume and the changes that significantly differ from the approach delineated in the *Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2 (DOE 1995).

The major components of the interim action remedy in the 1995 ROD include these:

- The contaminated groundwater was to be extracted at a location in the northern portion of the high trichloroethene (TCE) concentration area of the plume (greater than 1,000 µg/L of TCE). The contaminated groundwater was to be pumped at a rate of approximately 100 gal per minute (gpm) to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may have been modified to optimize the hydraulic containment by adjusting flow from the extraction wells (EWs) and to support subsequent actions.
- The extracted groundwater was to be collected and piped to a treatment system prior to release to a Kentucky Pollutant Discharge Elimination System-permitted outfall. The treatment facility was to consist of a sand filter for removal of suspended solid materials and utilization of the Paducah Gaseous Diffusion Plant’s (PGDP’s) cooling towers for volatilization of contaminated groundwater. The chemicals of concern are TCE and 1,1-dichloroethene (1,1-DCE).
- Two treatability studies were to be conducted to include (1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater.

The U.S. Environmental Protection Agency (EPA) and Kentucky Department for Environmental Protection, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA since the EWs were designed with an artificial sand pack that serves as a sand filter for sediments. Thus, the quality of water being discharged from the EWs would be similar to that of a drinking water well, with the exception of the TCE contamination.

A minor modification to the ROD was written on May 2, 1996, to postpone the treatability studies [(1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater].

The proposed changes described by this ESD will be implemented in a phased approach and will consist of the following anticipated modifications to the IRA:

- Replace the two existing EWs (EW331 and EW332) with two new groundwater EWs (EW234 and EW235) to be in the upgradient high concentration portion of the Northeast Plume and near the eastern edge of the PGDP industrial facility. The combined pumping capacity of the two new EWs will be approximately 300 gal per minute.
- Install new treatment units as an alternative to the cooling towers to remove volatile organic compounds (VOCs), namely TCE and DCE, from extracted groundwater. These units will include pretreatment filtration and removal of VOCs via air stripping technology. The two treatment units will strip VOCs and discharge treated groundwater at levels that are compliant with identified applicable or relevant and appropriate requirements. One treatment unit was installed in 2013 to replace the loss of the cooling tower air stripping capacity and currently is utilized for pump-and-treat operations.
- Create a maximum of two new CERCLA outfalls for discharge of treated groundwater from the treatment units into Little Bayou Creek.
- 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) signed by the Federal Facility Agreement (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 upgradient 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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

The extraction of Northeast Plume mass from new EWs (EW234 and EW235) located upgradient of the current EWs (EW331 and EW332) and in the vicinity of the eastern boundary of the plant site will both remove VOC mass in the contaminated groundwater from the higher concentration portion of the Northeast Plume and control the amount of plume mass migrating off-site.

None of the above anticipated changes are considered to be fundamentally different from the original selected remedy in the 1995 ROD; however, the creation of up to two new CERCLA outfalls for discharge of the treated groundwater will require identification and inclusion of new applicable or relevant and appropriate requirements. Under EPA guidance (EPA 1999), these new discharges would be considered to be a significant change that should be documented in an ESD. EPA guidance (EPA 1999) states that while the ESD is being prepared and made available to the public, the lead agency may proceed with the pre-design, design, construction, or operation activities associated with the remedy.

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENTS

PREFACE.....	iii
FIGURES.....	ix
TABLES.....	ix
ACRONYMS.....	xi
EXECUTIVE SUMMARY.....	xiii
1. INTRODUCTION AND PURPOSE.....	1
1.1 SITE NAME AND LOCATION.....	1
1.2 REGULATORY BACKGROUND.....	3
1.3 CIRCUMSTANCES CREATING THE NEED FOR AN ESD.....	3
2. SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY.....	7
2.1 SITE HISTORY AND CONTAMINATION ASSOCIATED WITH THE NORTHEAST PLUME.....	7
2.2 INTERIM REMEDIAL ACTION REMEDY APPROVED IN THE ROD.....	7
3. BASIS FOR THE ESD.....	11
3.1 INFORMATION SUPPORTING OPTIMIZED REMEDY.....	11
3.1.1 Five-Year Reviews for Remedial Actions at the Paducah Gaseous Diffusion Plant.....	11
3.2 REMEDIAL ACTION WORK PLAN FOR THE NORTHEAST PLUME INTERIM REMEDIAL ACTION OPTIMIZATION.....	12
3.3 ADMINISTRATIVE RECORD INFORMATION SUPPORTING THE NEEDED CHANGE.....	12
4. DESCRIPTION OF SIGNIFICANT DIFFERENCES.....	13
4.1 SIGNIFICANT DIFFERENCES BETWEEN THE REMEDY AND ESD MODIFICATIONS.....	13
4.2 EXPECTED OUTCOMES OF THE ESD.....	15
4.2.1 Key Design Changes.....	15
4.2.2 Key Design Assumptions.....	16
4.2.3 Well Field Design.....	16
4.2.4 Baseline Monitoring.....	16
4.2.5 Construction.....	17
4.2.6 Start-up and Testing.....	17
4.2.7 Operation and Maintenance.....	17
4.2.8 Remedial Action Work Plan.....	18
5. SUPPORT AGENCY CONCURRENCE.....	19
6. STATUTORY DETERMINATIONS.....	21
7. PUBLIC PARTICIPATION REQUIREMENTS.....	31

8. APPROVALS..... 33

9. REFERENCES..... 35

APPENDIX: AIR DISPERSION ANALYSIS A-1

FIGURES

1.	PGDP Location	2
2.	TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2010)	4
3.	Extent of PGDP TCE Plumes (1994).....	8
4.	TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2014)	9
5.	Locations of New and Preexisting EWs Associated with the Northeast Plume IRA at PGDP	14

TABLES

1.	Summary of Modifications to the Selected Remedy	13
2.	Additional Applicable or Relevant and Appropriate Requirements.....	22
3.	Outfall Discharge Criteria	29

THIS PAGE INTENTIONALLY LEFT BLANK

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
ATU	alternate treatment unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
<i>CFR</i>	<i>Code of Federal Regulation</i>
CWA	Clean Water Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant differences
EW	extraction well
Fed. Reg.	Federal Register
FFA	Federal Facility Agreement
IRA	interim remedial action
<i>KAR</i>	<i>Kentucky Administrative Regulation</i>
KDAQ	Kentucky Division for Air Quality
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollution Discharge Elimination System
MOA	Memorandum of Agreement
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PGDP	Paducah Gaseous Diffusion Plant
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
ROD	record of decision
USEC	United States Enrichment Corporation
VOC	volatile organic compound
VOHAP	volatile organic hazardous air pollutant

THIS PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) has prepared this Explanation of Significant Differences (ESD) to document the changes to the Record of Decision (ROD) for Interim Remedial Action (IRA) of the Northeast Plume at the Paducah Gaseous Diffusion Plant (PGDP) that are necessary to optimize the existing Northeast Plume Groundwater System.

The ROD was signed by DOE, the U.S. Environmental Protection Agency (EPA), and the Kentucky Department for Environmental Protection in June 1995. The primary objective of this IRA 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 selected remedy was designed to reduce the concentrations of trichloroethene (TCE) in the most contaminated portions of the Northeast Plume. The extraction well (EW) location was defined in the ROD as the northern portion of the high TCE concentration of the plume (greater than 1,000 µg/L of TCE). The planned changes presented in the ESD are protective of human health and the environment and will not impact the protectiveness of the IRA. As recognized in the ROD, successful control of the plume, in combination with existing controls (alternate water supply, monitoring, etc.), ensures protection during the period of the interim response.

The modification to the IRA for the Northeast Plume documented in this ESD is as follows:

- Replace the two existing EWs (EW331 and EW332) with two new groundwater EWs (EW234 and EW235) to be in the upgradient high concentration portion of the Northeast Plume and near the eastern edge of the PGDP industrial facility (approximately 300 gal per minute combined extraction rate).
- Install new treatment units as an alternative to the cooling towers to remove volatile organic compounds (VOCs), namely TCE and dichloroethene, from extracted groundwater. These treatment units will include pretreatment filtration and removal of VOCs via air stripping technology. The two treatment units will strip VOCs and discharge treated groundwater at levels that are compliant with identified applicable or relevant and appropriate requirements.
- Create a maximum of two Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) outfalls for discharge of treated groundwater from the treatment units into Little Bayou Creek.
- 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) 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

Techneium-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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

Design, construction, and operation will be performed in addition to start-up testing and will include installation of piping, process control equipment, electrical equipment, and placement of additional monitoring wells to evaluate performance and effectiveness of the new optimization system. This Northeast Plume IRA optimization project is intended to increase volatile organic compound mass removal and enhance capture of contaminants migrating in the Northeast Groundwater Plume at the eastern edge of the PGDP industrial facility (see Figure 1). This optimization action was initiated in response to recommendations that are documented in the 2003 CERCLA Five-Year Review (DOE 2003) and approval letters (EPA 2003; KDEP 2003); Sitewide Remedy Review (DOE 2006); *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007); 2008 CERCLA Five-Year Review (DOE 2009) and approval letters (EPA 2009; KEEC 2009); 2013 CERCLA Five-Year Review (DOE 2014); Site Management Plan (DOE 2012); negotiations among the Federal Facility Agreement parties, including the Memorandum of Agreement for Resolution (DOE 2015a); and in response to the deactivation of PGDP.

In conclusion, the planned changes presented in the ESD are protective of human health and the environment and will not impact the protectiveness of the IRA. The optimized interim action will continue to rely on other actions to achieve protectiveness while the IRA continues.

1. INTRODUCTION AND PURPOSE

The U.S. Department of Energy (DOE) is conducting cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP) under its Environmental Management Program. Cleanup efforts are necessary to address contamination resulting from past waste-handling and disposal practices at the plant. The cleanup activities comply with the requirements of the U.S. Environmental Protection Agency (EPA), the Kentucky Energy and Environment Cabinet, and DOE.

Pursuant to the Record of Decision (ROD) for Interim Remedial Action (IRA) of the Northeast Plume at PGDP signed by DOE, EPA, and Kentucky Department for Environmental Protection (KDEP) in June 1995, DOE currently is operating groundwater extraction wells (EWs) (EW331 and EW332) and a treatment system at PGDP to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence. The treatment system is designed to remove trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE) from extracted groundwater.

Reviews and assessments, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-mandated periodic five-year review documents for years 2003 (DOE 2003) and approval letters (EPA 2003; KDEP 2003); 2008 (DOE 2009) and approval letters (EPA 2009; KEEC 2009); 2013 (DOE 2014); Sitewide Remedy Review (DOE 2006); *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007); and Site Management Plan (DOE 2012), have resulted in recommended changes to the IRA to enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility and to reduce further migration off-site. 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*, (DOE 2015) (MOA for Resolution) also documents the Federal Facility Agreement (FFA) parties' agreement that an optimization of the existing Northeast Plume IRA is warranted. Accordingly, DOE has prepared this Explanation of Significant Differences (ESD) to document the changes made to the Northeast Plume IRA that were necessary in optimizing the IRA.

This ESD has been prepared in accordance with CERCLA Section 117(c) and 40 *CFR* § 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). An ESD is required when a significant change is made to the remedy defined in the decision document (e.g., ROD). A significant change generally involves a change to a component of a remedy that does not fundamentally alter the overall cleanup approach. This ESD describes the nature of the significant change, summarizes the information that led to making the change(s), and affirms that the revised remedy complies with the NCP and the statutory requirements of CERCLA. As required by 40 *CFR* § 300.435(c)(2)(i)(B), DOE will publish a notice of availability and a brief description of the ESD in a major local newspaper of general circulation. The ESD also is made available to the public by placing it in the Administrative Record file and information repository at the following link <http://www.paducaheic.com>, as well as at the Special Collections counter at the local public library [40 *CFR* § 300.435(c)(2)(i)(A) and § 300.825(a)(2)].

1.1 SITE NAME AND LOCATION

PGDP is located in the northwestern corner of Kentucky in western McCracken County, about 10 miles west of Paducah, Kentucky, and 3.5 miles south of the Ohio River (Figure 1). Past operations and

disposal of waste material resulted in the contamination of the groundwater migrating to the northeast from PGDP (Figure 2). Areas of contaminated groundwater within the Regional Gravel Aquifer (RGA) extend beyond the DOE property boundary on the north and northeast. These areas are referred to as the Northwest and Northeast Plumes, respectively. A portion of the Northwest Plume discharges to Little Bayou Creek, a perennial surface water body located northeast of the DOE property.

1.2 REGULATORY BACKGROUND

PGDP was placed on the National Priorities List in 1994. Pursuant to Section 120 of CERCLA, the PGDP FFA (EPA 1998) was negotiated and implemented to coordinate the CERCLA remedial action and Resource Conservation and Recovery Act (RCRA) corrective action processes into a set of comprehensive requirements for site remediation. Since 1998, DOE, EPA, and KDEP have been operating under the FFA, with DOE as the lead agency and EPA and KDEP as support agencies providing oversight.

In 1995, a decision was made among DOE, EPA, and KDEP to proceed with an IRA for the high TCE concentration Northeast Groundwater Plume. The ROD for this IRA of the Northeast Plume was signed by DOE, EPA, and KDEP in June 1995. The remedy has been effective in achieving hydraulic control and reducing off-site TCE levels in the Northeast Plume and, in combination with existing controls (alternate water supply, monitoring, etc.), remains protective of human health and the environment and continues to comply with federal and state applicable or relevant and appropriate requirements (ARARs) that were identified in the ROD.

1.3 CIRCUMSTANCES CREATING THE NEED FOR AN ESD

The Northeast Plume IRA optimization project is to continue to serve as an interim measure to remove TCE and 1,1-DCE mass and enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility to reduce further migration off-site. This optimization action was initiated in response to recommendations documented in the following documents:

- 2003 CERCLA Five-Year Review (DOE 2003) and approval letters (EPA 2003; KDEP 2003)
- Sitewide Remedy Review (DOE 2006)
- *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007)
- 2008 CERCLA Five-Year Review (DOE 2009) and approval letters (EPA 2009; KEEC 2009)
- Site Management Plan (DOE 2012)
- 2013 CERCLA Five-Year Review (DOE 2014)
- *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 2015a)

G:\GIS\PROJECTS\INE Plume\2014_TCE_plume_map_ESD.mxd 7/31/2015

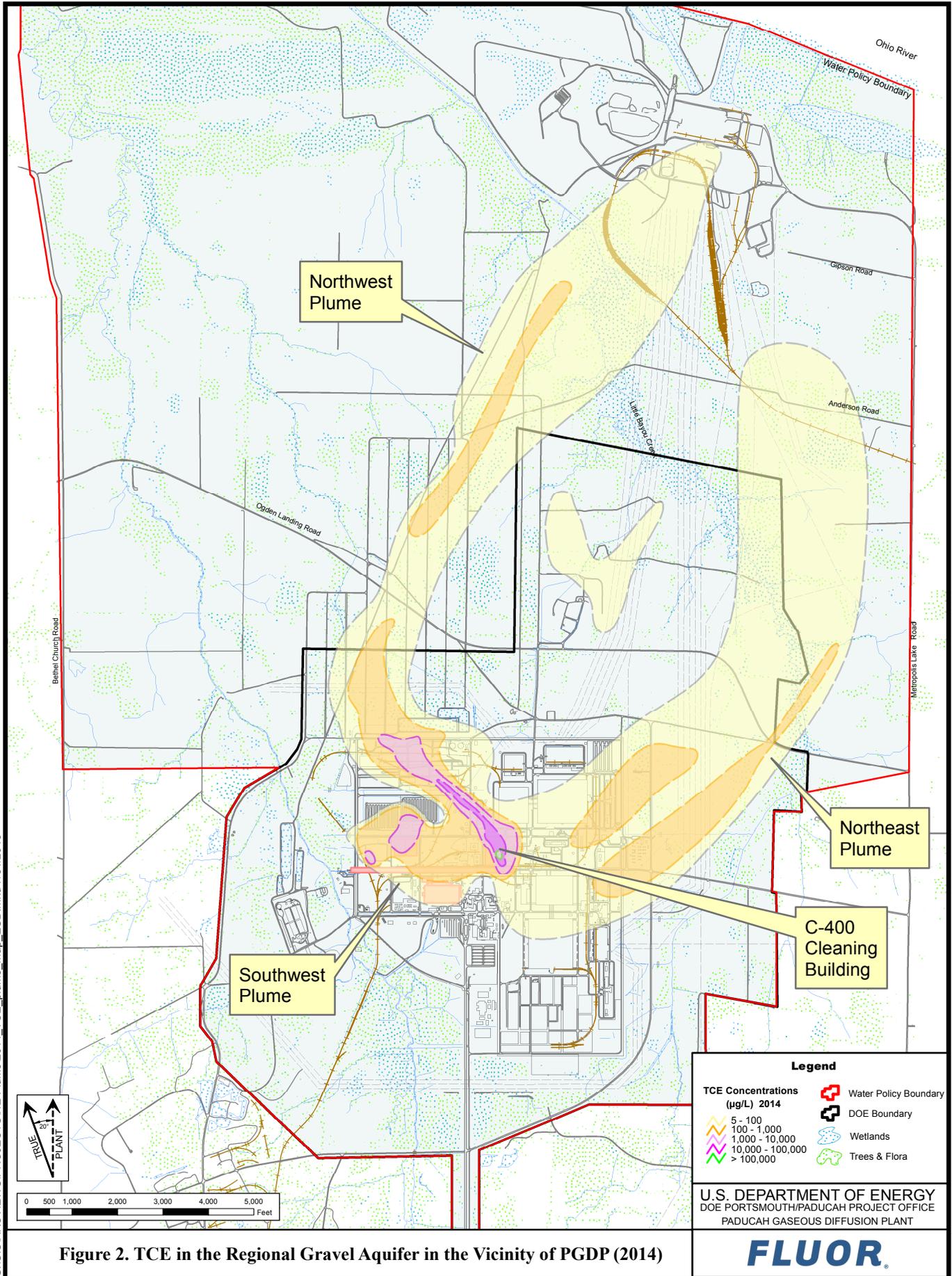


Figure 2. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2014)

The cessation of enrichment operations at PGDP by the United States Enrichment Corporation (USEC) in June 2013, resulted in loss of the cooling tower that acted as the air stripper and provided further need to optimize the system with the use of a treatment unit that could air strip the contamination.

The scope of the Northeast Plume optimized project, as documented in this 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 2013), (a revision to this document currently is under development) is consistent with the general findings and recommendations in the documents referenced above and with the identified modifications by the FFA parties as contained in the 2015 MOA for Resolution of formal dispute. Additional specific supporting information from these evaluations is contained in Section 3, Basis for the ESD.

THIS PAGE INTENTIONALLY LEFT BLANK

2. SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

This section provides a brief summary of the site contamination and history along with presenting the selected remedy as originally described in the ROD.

2.1 SITE HISTORY AND CONTAMINATION ASSOCIATED WITH THE NORTHEAST PLUME

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in private wells north of PGDP. The site investigation demonstrated that the principal contaminants of concern in the off-site groundwater are Tc-99, a radionuclide, and TCE, an organic solvent. TCE is a nonflammable, highly volatile, colorless liquid used extensively for removing grease. The PGDP's use of TCE as a degreaser ceased July 1, 1993. Tc-99 is a radionuclide that was introduced at the PGDP through the reprocessing of uranium.

Past handling practices and disposal of waste material resulted in the contamination of the groundwater migrating to the northwest and northeast from PGDP. Over time, dissolved-phase TCE in groundwater in the RGA has spread generally northeastward toward the Ohio River in multiple plumes. In the 1993 time frame, the outer boundary of the Northeast Plume was approximately 1 mile from the northeastern border of the PGDP facility. Concentrations of TCE within the Northeast Plume exceeded 1,000 µg/L in some locations.

Figure 2 illustrates the extent of the Northeast Plume. Figures 3 and 4 compare the TCE plumes between 1994 and 2014 (the latest available plume map). The downgradient limit of the Northeast Plume is in the vicinity of the Ohio River, Tennessee Valley Authority Shawnee Fossil Plant, and Little Bayou Creek.

2.2 INTERIM REMEDIAL ACTION REMEDY APPROVED IN THE ROD

The major components of the selected remedy defined in the ROD (DOE 1995) included the following:

- The contaminated groundwater was to be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 µg/L of TCE). The contaminated groundwater was to be pumped at a rate of approximately 100 gal per minute (gpm) to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may have been modified to optimize the hydraulic containment, by adjusting flow from the EWs (EW331 and EW332), and to support subsequent actions.
- The extracted groundwater was to be collected and piped to a treatment system prior to release to a KPDES-permitted outfall. The treatment facility was to consist of a sand filter for removal of suspended solid materials, and utilization of the PGDP's existing cooling towers for volatilization of contaminated groundwater. The chemicals of concern were TCE and 1,1-DCE.
- Two treatability studies were to be conducted to include (1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater.

EPA and KDEP, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA because the EWs (EW331 and EW332) were designed with an artificial sand pack that serves as a sand

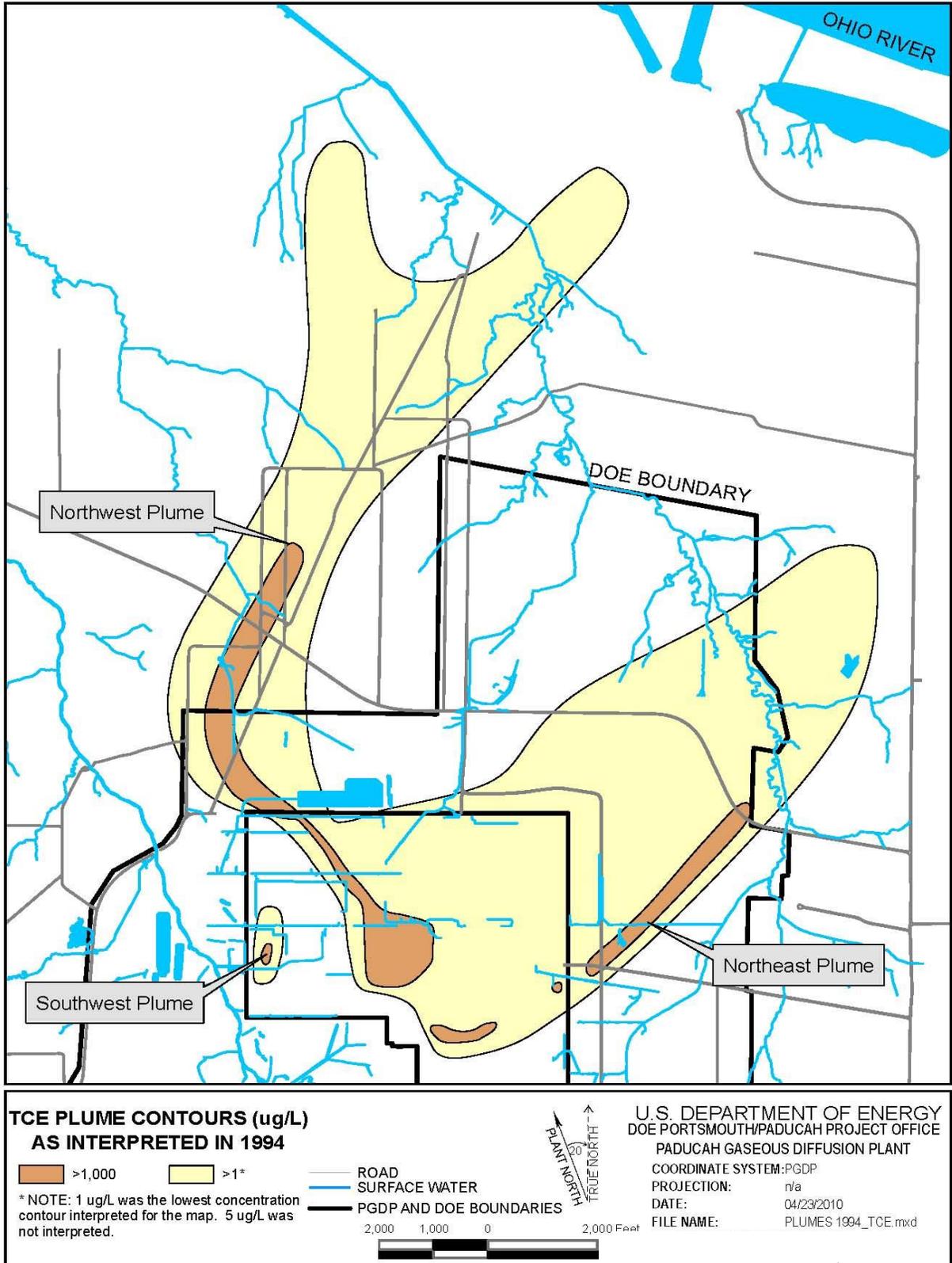


Figure 3. Extent of PGDP TCE Plumes (1994)

G:\GIS\PROJECTS\INE Plume\2014_TCE_plume_map_ESD.mxd 7/31/2015

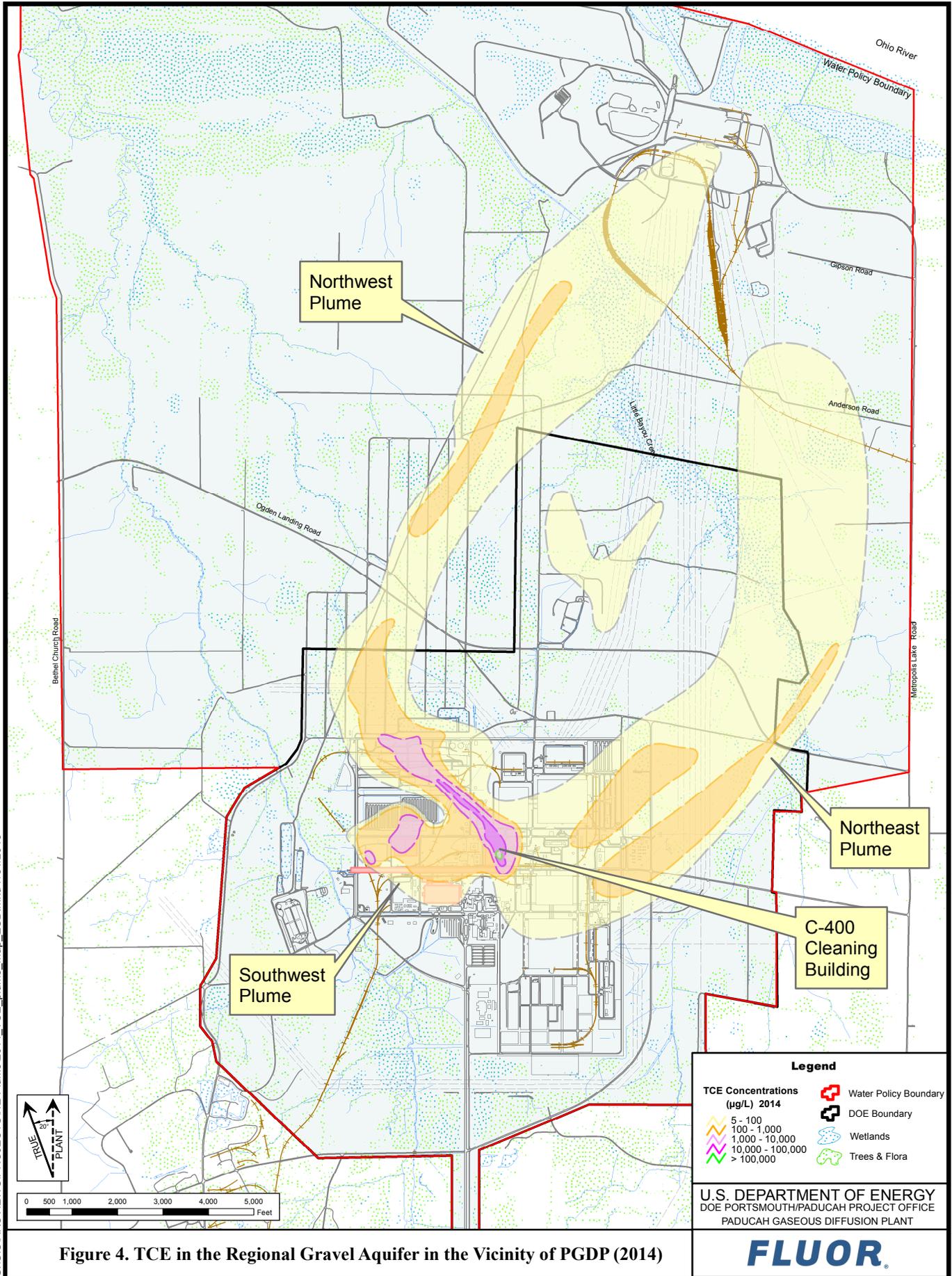


Figure 4. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2014)

filter for sediments; thus, the quality of water being discharged from the EWs (EW331 and EW332) would be similar to that of a drinking water well, with the exception of the TCE contamination.

A minor modification to the ROD was written on May 2, 1996, to postpone the treatability studies [(1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater].

3. BASIS FOR THE ESD

This section presents information that formed the basis for changes to the remedy. In general, installation of the new optimization wells will reduce off-site groundwater migration of VOCs, in particular TCE, and continue treatment of high concentrations of VOCs in groundwater. Installation of the ATU and creation of the new CERCLA outfall(s) are necessary to provide an alternate treatment/discharge option to the cooling towers that have been shut down.

3.1 INFORMATION SUPPORTING OPTIMIZED REMEDY

Five evaluations have been conducted that support the proposed changes to the Northeast Plume Groundwater System. Summary of the evaluation and relevant findings for these five evaluations are detailed in this section.

3.1.1 Five-Year Reviews for Remedial Actions at the Paducah Gaseous Diffusion Plant

The Northeast Plume IRA optimization project is to serve as an interim measure to remove TCE and 1,1-DCE mass and enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility and to reduce further migration off-site. This action was initiated in response to recommendations documented in past system evaluations and assessments as follows:

- 2003 CERCLA Five-Year Review (DOE 2003) and approval letters (EPA 2003; KDEP 2003)
- 2008 CERCLA Five-Year Review (DOE 2009) and approval letters (EPA 2009; KEEC 2009)
- 2013 CERCLA Five-Year Review (DOE 2014)

Sitewide Remedy Review (March 2006)

In February and March 2006, DOE Headquarters conducted a Sitewide Remedy Review at PGDP. A report following the assessment was generated and finalized in April, 2006 and was titled, Paducah 2006 Sitewide Remedy Review. The Sitewide Remedy Review report recommended an optimization of the Northeast Plume IRA.

Site Management Plan (February 2012)

Implementation of an optimized IRA was evaluated along with other Groundwater Operable Unit projects relative to site priorities in the approved Site Management Plan (DOE 2012). The prioritization was performed by the FFA managers, with consideration given to the sitewide strategy that includes a series of sequenced activities consisting of source actions and control of off-site groundwater migration followed by a final action for the overall dissolved-phased plume. This evaluation resulted in the optimization of the Northeast Plume IRA being prioritized to further enhance controls to prevent off-site migration prior to implementing final actions for the off-site dissolved-phase plume.

Additionally, cessation of enrichment operations at PGDP resulted in the loss of the use of the cooling tower used in the original operational approach, thus requiring an alternate treatment approach, as of June 2013.

Memorandum of Agreement for Resolution of Formal Dispute (July 2015)

The MOA documents the FFA parties' agreement that an optimization of the existing Northeast Plume Interim Remedial Action (namely relocation of the two EWs upgradient and operation of two treatment units) is warranted to increase TCE mass removal and to enhance control of Northeast Plume migration at the eastern edge of the PGDP industrial facility. The FFA parties reached consensus that the optimized EWs installed under this ESD should not cause or contribute to the undesired migration of Tc-99 contamination from the source area(s) (e.g., C-400 Building and Northwest Plume) and that actions (as further described herein) may be undertaken to prevent any undesirable expansion of Tc-99 and TCE within the Northeast Plume.

3.2 REMEDIAL ACTION WORK PLAN FOR THE NORTHEAST PLUME INTERIM REMEDIAL ACTION OPTIMIZATION

The Remedial Action Work Plan (RAWP) for Optimization of the Northeast Plume IRA (DOE 2013) (a revision to this document currently is under development) will document the design and construction process associated with the optimization process. Detailed information is included concerning the use of the PGDP groundwater model to optimize the locations of the EWs for increased contaminant capture, treatment equipment capabilities, and EW construction, including screen size and locations.

3.3 ADMINISTRATIVE RECORD INFORMATION SUPPORTING THE NEEDED CHANGE

Information contained in the administrative record that supports the modified remedy is discussed in Section 3.1. As required by 40 *CFR* § 300.825(a)(2), this ESD will be made available to the public by placing it in the Administrative Record file. Contact information for the Administrative Record is as follows:

DOE Environmental Information Center
115 Memorial Drive, Barkley Centre
Paducah, KY 42001
(270) 554-3004
<http://www.paducaheic.com>

Hours of Operation: Monday through Friday
8 A.M.–12:00 P.M.

4. DESCRIPTION OF SIGNIFICANT DIFFERENCES

This section describes the key differences between the remedy in the ROD and the ESD modifications, highlighting scope, cost, and performance along with any changes in expected outcomes when the modifications are implemented.

4.1 SIGNIFICANT DIFFERENCES BETWEEN THE REMEDY AND ESD MODIFICATIONS

Table 1 summarizes the main components of the selected remedy and identifies how the remedy modification impacts these components.

Table 1. Summary of Modifications to the Selected Remedy

Selected Remedy (IRA) in the ROD	Remedy Modification
The contaminated groundwater will be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 µg/L of TCE).	The optimized remedy modifies the location of the EWs to be in the upgradient portion of the high concentration portions of the Northeast Plume as documented in the 2014 Plume Map (see Figure 5) and near the eastern edge of the PGDP industrial facility.
The contaminated groundwater will be pumped at a rate of approximately 100 gpm to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may be modified to optimize the hydraulic containment, by adjusting flow from the EWs, and to support subsequent actions.	The existing IRA allows the pumping rate to be modified. The estimated combined pumping rate is expected to be approximately 300 gpm. Consistent with the MOA for Resolution, "...the modified NE Plume IRA will include installation (at a minimum) of five new RGA monitoring wells in a north-south transect located approximately 600 ft east of the C-400 Building. These transect monitoring wells 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." Refer to Section 4.2.4 and 4.2.7 of the ESD for additional direction provided from the MOA for Resolution. Additionally, the MOA for Resolution is located at the following link: http://paducaheic.com/Search.aspx?accession=ENV1.A-00934
The extracted groundwater will be collected and piped to a treatment system prior to release to a KPDES-permitted outfall.	Treated groundwater will be discharged through a maximum of two created CERCLA outfall(s).
The treatment facility will consist of a sand filter* for removal of suspended solid materials, and utilization of the PGDP's existing cooling towers for volatilization of contaminated groundwater. The chemicals of concern are TCE and 1,1-DCE.	The modified remedy will provide an engineered treatment unit, using air stripping, capable of treating TCE and 1,1-DCE in water in the range of expected contaminant concentrations.

*The EPA and KDEP, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA because the EWs were designed with an artificial sand pack that serves as a sand filter for sediments. Thus, the quality of water being discharged from the EWs would be similar to that of a drinking water well, with the exception of the TCE contamination.

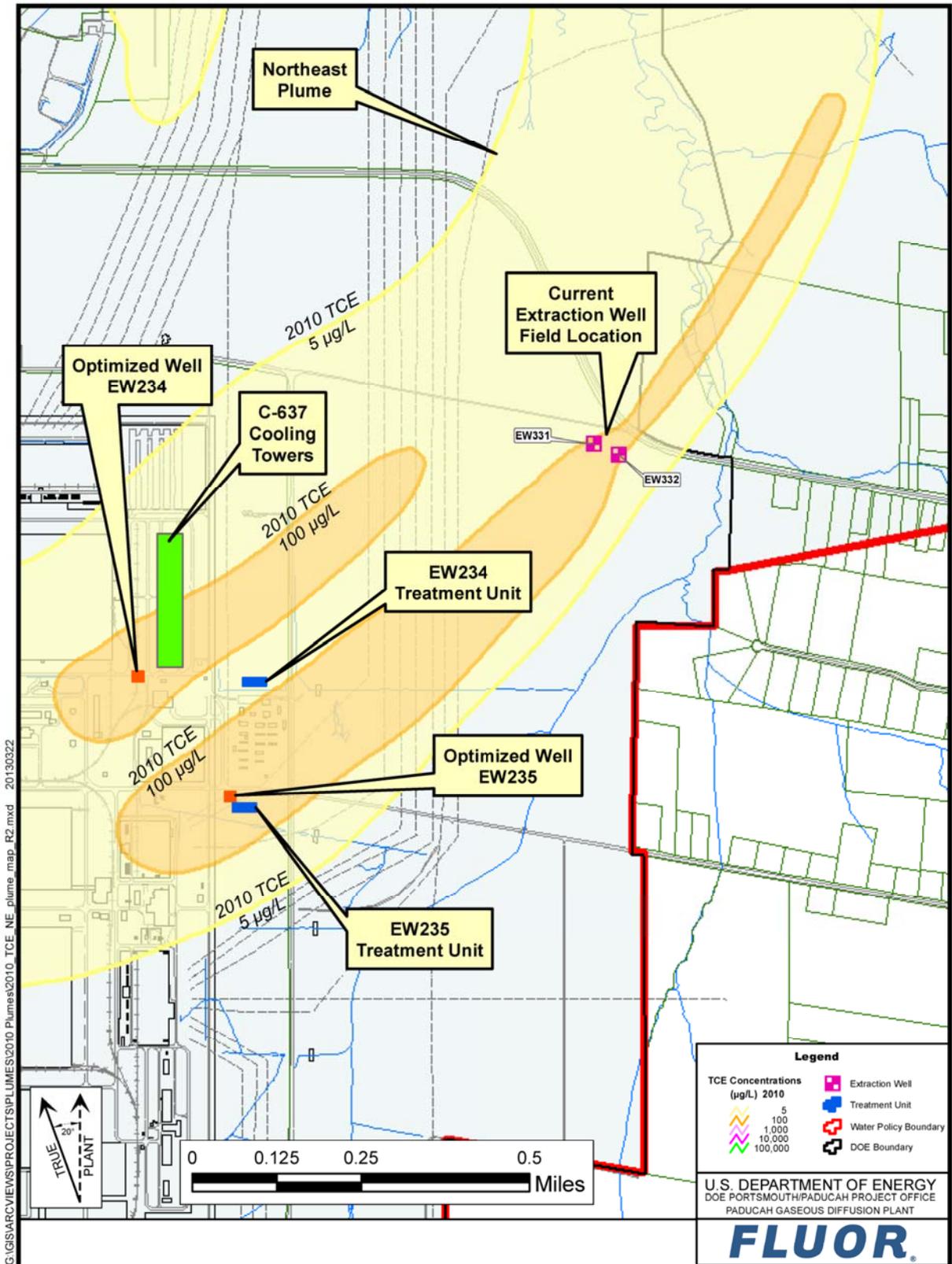


Figure 5. Locations of New and Preexisting EWs Associated with the Northeast Plume IRA at PGDP

None of the above anticipated changes in Table 1 are considered to be “fundamentally” different from the original selected remedy in the 1995 ROD; however, the creation of up to two CERCLA outfall(s) for discharge of treated groundwater will require identification and inclusion of new ARARs. Under EPA guidance (EPA 1999), these new discharges would be considered to be a “significant” change that should be documented in an ESD. EPA guidance (EPA 1999) states that while the ESD is being prepared and made available to the public, the lead agency may proceed with the predesign, design, construction, or operation activities associated with the remedy.

4.2 EXPECTED OUTCOMES OF THE ESD

The optimization of the Northeast Plume IRA is intended to increase TCE and 1,1-DCE mass removal and enhance control of the Northeast Plume migration at the eastern edge of the PGDP facility. The key components of the optimization are discontinuing the use of the two existing EWs (EW331 and EW332) and replacing those wells with two new EWs (EW234 and EW235) located, as shown in Figure 5, near the eastern edge of the PGDP facility. Groundwater modeling was performed to guide the placement of EWs (EW234 and EW235). The FFA parties will continue to work together to establish completion criteria for operation of the EWs in a manner consistent with requirements set forth in the MOA for Resolution. Additional key components of the optimization include increasing the treatment capacity through installation of two new engineered water treatment units and discharging the treated groundwater through up to two CERCLA outfall(s). The changes being made to the remedial action do not alter the type of treatment technology being deployed (i.e., air stripping), or the reliability or protectiveness of the overall remedy.

4.2.1 Key Design Changes

The Northeast Plume IRA optimization was designed based on the following key changes and assumptions that are different from that documented in the ROD (DOE 1995):

- Northeast Plume EWs (EW234 and EW235) will be located near the eastern edge of PGDP and the existing EWs (EW331 and EW332) will be kept in good working condition until the FFA parties agree the maintenance no longer is necessary.
- Consistent with the MOA for Resolution, “...the modified NE Plume IRA will include installation (at a minimum) of five new RGA monitoring wells in a north-south transect located approximately 600 ft east of C-400 Building. These transect monitoring wells 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.” Refer to Section 4.2.4 and 4.2.7 of the ESD for additional direction provided from the MOA for Resolution. Additionally, the MOA for Resolution is located at the following link: <http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>
- Use of the PGDP cooling towers for stripping TCE and 1,1-DCE has been discontinued and was replaced with engineered water treatment unit(s) that utilize air stripping (shallow tray air stripper) for TCE and 1,1-DCE contamination.
- Treated VOC-contaminated groundwater discharge will be through a maximum of two CERCLA designated outfalls. The receiving water body is the Little Bayou Creek, which carries a Kentucky use classification of Recreational.
- A new electrical power connection will be installed for the treatment units and EWs (EW234 and EW235).

4.2.2 Key Design Assumptions

The Northeast Plume IRA optimization was designed based on keeping the existing EWs (EW331 and EW332), to the extent required by Section 4 of the MOA for Resolution, in good working condition until the FFA parties agree the maintenance no longer is necessary. The optimized Northeast Plume EW field volumetric flow rate is limited not by the engineered treatment plant capacity (approximately 200 gpm per unit) but by EW yield.

4.2.3 Well Field Design

Well field optimization modeling indicates that a two-well configuration is optimal. The two new wells, EW234 and EW235 are to be located near the eastern edge of the PGDP facility. Refer to Figure 5 for well locations. The EWs (EW234 and EW235) are expected to have an operational flow rate of approximately 150 gpm each. Detailed lithologic logs and grain size analysis to the extent available will be used in well screen and filter pack design of the new EWs (EW234 and EW235). Once the two optimized EWs are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well's quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples' showing an increase, then potential changes in groundwater flow or source impacts (e.g., rising contaminant concentrations in the Northeast Plume, source migration, etc.) will be examined further. The FFA parties will consider adjustments (e.g., adjusting EW pumping rates) for the optimized Northeast Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

4.2.4 Baseline Monitoring

The MOA states the following:

The transect monitoring wells will be monitored for 4 consecutive quarters to establish baseline contaminant concentrations before the two newly relocated extraction wells begin operation. The anticipated contaminant concentrations of Tc-99 and TCE in the transect monitoring wells are expected to be no higher than 200 pCi/L and 600 ug/L, respectively. If baseline contaminant concentrations in any of the transect monitoring wells during the initial quarterly sampling are detected at twice the anticipated contaminant concentrations, then the FFA parties agree to temporarily suspend start-up of the extraction wells until the parties meet to evaluate the identified discrepancy, its potential impact on the NW Plume source actions and the planned NE Plume optimization project. The FFA parties will conduct an evaluation of the planned action and develop recommendations and a schedule for modifications of the optimized action to address the unanticipated contaminant concentrations. In the event the FFA parties decide that significant changes to the scope of the action under the ESD are necessary to continue with the optimization, then DOE shall continue implementing the current NE Plume Interim Remedial Action (Interim ROD 1995) and shall propose modification to the Interim Remedial Action through another ESD and RAWP Addendum. The PGDP Site Management Plan will be updated to reflect establishment of any enforceable milestones under the FFA such as due dates for the aforementioned Primary documents (DOE 2015).

4.2.5 Construction

Construction of the optimization project will be performed consistent with the RAWP and certified for construction remedial design drawings and specifications.

4.2.6 Start-up and Testing

The Northeast Plume optimized IRA system will undergo start-up and integrated testing consistent with quality requirements contained in the approved RAWP and certified for construction remedial design drawings and specifications. Additionally, start-up and testing of the optimized IRA system will be contingent upon baseline monitoring results and requirements as documented in Section 2 of the MOA for Resolution.

4.2.7 Operation and Maintenance

A revised operation and maintenance plan to include optimized IRA operations will be submitted and approved before the two newly relocated EWs begin operation. Following successful completion of construction and start-up and integrated testing of facilities of the Northeast Plume, optimized IRA operations will be initiated consistent with a revised and approved operation and maintenance plan. The MOA for Resolution states the following:

Once the two optimized extraction wells are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well's quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples showing an increase, then potential changes in groundwater flow or source impacts (e.g. rising contaminant concentrations in the NE Plume, source migration, etc.) will be further examined and the FFA parties will consider adjustments (e.g. adjusting extraction well pumping rates) for the optimized NE Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

If the measures taken by the FFA parties (e.g. adjusting extraction well pumping rates) do not result in decreased or stabilized concentrations at the transect monitoring wells, or if such adjustments reduce the effectiveness of the optimized extraction wells or if Tc-99 concentrations continue to increase and are detected at twice their baseline concentration in any one (or more) of the transect wells for two consecutive quarters, then DOE must notify EPA and KDEP within 30 days of receiving sampling results or one of the other aforementioned conditions occurring. After EPA and KDEP have been notified, the FFA parties will discuss and evaluate options to address continued increase of groundwater concentrations and plume expansion. Within 1 year from the notification, DOE shall submit an ESD and RAWP Addendum as the Primary documents to undertake modification to the existing CERCLA Interim Remedial Action pursuant to the FFA to address the contaminated groundwater plume expansion and to prevent Tc-99 at levels above the MCL from further being pulled within the NE Plume.

The FFA parties will discuss whether to temporarily suspend operation of one or both of the extraction wells while determining the modifications to the CERCLA Interim Remedial Action to prevent further plume expansion. If FFA parties decide to implement a modification to the Interim Remedial Action to address the NE Plume contamination (including the expansion), then depending on the scope of the modification it is possible

that the FFA parties will decide to shut down the optimized pump and treat system in part or in its entirety. If a determination is made to shut down the optimized pump and treat system either before a modification to the Interim Remedial Action or as part of a modification to the Interim Action, then DOE shall reinstate implementation of the NE Plume Interim Remedial Action (Interim ROD 1995). DOE shall keep the extraction wells associated with the NE Plume Interim Remedial Action in good working condition until the FFA parties agree the maintenance is no longer necessary (DOE 2015).

The optimized Northeast Plume system will continue operating until one the following occurs:

- The FFA parties mutually agree to cease operations,
- The FFA parties decide to implement a modification to the IRA to address the Northeast Plume contamination (including contaminated groundwater plume expansion) and to prevent Tc-99 at levels above the MCL from being pulled further within the Northeast Plume,
- A CERCLA Five-Year Review determination supports ceasing operations, or
- The ROD associated with the Dissolved-Phase Plume supports ceasing operations.

4.2.8 Remedial Action Work Plan

A revised RAWP currently is under development for the implementation of the remedy modifications based on the above assumptions and expected outcomes. The RAWP includes an overview of the optimization modeling, system design and construction, start-up and testing, operations and maintenance requirements, and plans for environmental compliance, waste management, worker health and safety, quality assurance, and data management.

5. SUPPORT AGENCY CONCURRENCE

KDEP and EPA have evaluated the information contained in the Administrative Record for this IRA. EPA approves and the Commonwealth of Kentucky concurs that the information supports the need for the modification to the remedy, and both agencies concur with the revised remedy selected in this ESD.

THIS PAGE INTENTIONALLY LEFT BLANK

6. STATUTORY DETERMINATIONS

The modified interim remedy will increase TCE and 1,1-DCE mass removal and enhance control of Northeast Plume migration at the eastern edge of the PGDP industrial facility. As such, the modified interim remedy, meets the threshold criteria of CERCLA Section 121 and the NCP. The planned changes presented in the ESD will not impact the protectiveness of the IRA. As recognized in the ROD, successful control of the plume, in combination with existing controls (alternate water supply, monitoring, etc.), ensures protection during the period of the interim response. The modified interim remedy continues to be protective of human health and the environment and complies with ARARs presented in the ROD, as supplemented and modified by the ARARs provided in Table 2. As part of this modification, however, ARARs included in the ROD pertaining to discharge through a KPDES-permitted outfall are being supplemented with ARARs to allow the utilization of up to two CERCLA outfall(s) for treated water discharge, as defined by Table 2 of this ESD. The ARARs address requirements necessary to ensure the protection of the waters of the Commonwealth for the discharge of effluent through up to two CERCLA outfall(s). Based on the ARARs contained in Table 2, the outfall discharge criteria contained in Table 3 will serve as the criteria and effluent limits for discharge to the new CERCLA outfalls.

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

Most of the contaminated groundwater extracted for treatment exceeds this site-specific health-based level; thus, it must be managed as RCRA listed hazardous waste. Consequently, certain solid wastes generated from treatment units that treat groundwater containing TCE above 30 ppb are considered RCRA hazardous waste due to the derived-from rule at 40 CFR § 261.3(c) and (d) (401 KAR 31:010 § 3). The treated groundwater that is discharged into the receiving surface water body (e.g., Little Bayou

Table 2. Additional Applicable or Relevant and Appropriate Requirements

Action	Requirements	Prerequisite	Citation
General duty to mitigate for discharge of wastewater from groundwater treatment system	Take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of effluent standards which has a reasonable likelihood of adversely affecting human health or the environment.	Discharge of pollutants to surface waters— applicable .	401 KAR 5:065 § 2(1) and 40 CFR § 122.41(d)
Operation and maintenance of treatment system	Properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve compliance with the effluent standards. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures.	Discharge of pollutants to surface waters— applicable .	401 KAR 5:065 § 2(1) and 40 CFR § 122.41(e)
Technology-based treatment requirements for wastewater discharge	To the extent that EPA promulgated effluent limitations are inapplicable, shall develop on a case-by-case Best Professional Judgment basis under § 402(a)(1)(B) of the Clean Water Act (CWA), technology based effluent limitations by applying the factors listed in 40 CFR § 125.3(d) and shall consider: <ul style="list-style-type: none"> • The appropriate technology for this category or class of point sources, based upon all available information; and • Any unique factors relating to the discharger. 	Discharge of pollutants to surface waters from other than a publicly owned treatment works— applicable .	40 CFR § 125.3(c)(2)
Water quality-based effluent limits for wastewater discharge	Must develop water quality based effluent limits that ensure that: <ul style="list-style-type: none"> • The level of water quality to be achieved by limits on point source(s) established under this paragraph is derived from, and complies with all applicable water quality standards; and • Effluent limits developed to protect narrative or numeric water quality criteria are consistent with the assumptions and any available waste load allocation for the discharge prepared by the State and approved by EPA pursuant to 40 CFR § 130.7. 	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a State water quality standard established under § 303 of the CWA— applicable .	40 CFR § 122.44(d)(1)(vii)

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Water quality-based effluent limits for wastewater discharge (continued)	Must attain or maintain a specified water quality through water quality related effluent limits established under § 302 of the CWA.	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a state water quality standard— applicable .	40 <i>CFR</i> § 122.44(d)(2)
Monitoring requirements for groundwater treatment system discharges	<p>The numeric water quality criteria for fish consumption specified in Table 1 of 401 <i>KAR</i> 10:031 Section 6(1) provides allowable instream concentrations of pollutants that may be found in surface waters or discharged into surface waters.</p> <p>In addition to 40 <i>CFR</i> § 122.48(a) and (b) and to assure compliance with effluent limitations, one must monitor, as provided in subsections (i) thru (iv) of 122.44(i)(1).</p> <p><i>NOTE: Monitoring parameters, including frequency of sampling, will be developed as part of the CERCLA process and included in a Remedial Design, RAWP, or other appropriate FFA CERCLA document.</i></p> <p>All effluent limitations, standards and prohibitions shall be established for each outfall or discharge point, except as provided under § 122.44(k).</p>	Discharge of pollutants to surface waters— applicable .	40 <i>CFR</i> § 122.44(i)(1) 401 <i>KAR</i> § 5:065 2(4)
Mixing zone for discharge of pollutants	<p>All effluent limitations, standards and prohibitions, including those necessary to achieve water quality standards, shall unless impracticable be stated as:</p> <p>Maximum daily and average monthly discharge limitations for all discharges.</p> <p>The relevant requirements provided in 401 <i>KAR</i> 10:029 § 4 shall apply to a mixing zone for a discharge of pollutants.</p> <p><i>NOTE: Determination of the appropriate mixing zone will, if necessary, be documented in the CERCLA remedial design or other appropriate CERCLA document.</i></p>	Continuous discharge of pollutants to surface waters— applicable .	40 <i>CFR</i> § 122.45(a) 401 <i>KAR</i> § 5:065 2(5) 40 <i>CFR</i> § 122.45(d)(1) 401 <i>KAR</i> § 5:065 2(5)
		Discharge of pollutants to surface waters— applicable .	401 <i>KAR</i> 10:029 § 4

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
<p>Minimum criteria applicable to all surface waters</p>	<p>Surface waters shall not be aesthetically or otherwise degraded by substances that:</p> <ul style="list-style-type: none"> • Settle to form objectionable deposits; • Float as debris, scum, oil, or other matter to form a nuisance; • Produce objectionable color, odor, taste, or turbidity; • Injure, are chronically or acutely toxic to or produce adverse physiological or behavioral responses in humans, animals, fish, and other aquatic life; • Produce undesirable aquatic life or result in the dominance of nuisance species; <ol style="list-style-type: none"> 1. Cause fish flesh tainting. 2. The concentration of phenol shall not exceed 300 mg/L as an instream value. 	<p>Discharge of pollutants to surface waters—applicable.</p>	<p>401 KAR 10:031 § 2(1)(a-f)</p>
	<p>The water quality criteria for the protection of human health related to fish consumption in Table 1 of 401 KAR 10:031 § 6 are applicable to all surface water at the edge of assigned mixing zone except for those points where water is withdrawn for domestic water supply use.</p> <p>(a) The criteria are established to protect human health from the consumption of fish tissue and shall not be exceeded.</p> <p>(b) For those substances associated with a cancer risk, an acceptable risk level of not more than one (1) additional cancer case in a population of 1,000,000 people, (or 1×10^{-6}) shall be utilized to establish the allowable concentration.</p>		<p>401 KAR 10:031 § 2(2)(a) and (b)</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
<p>Criteria for surface water designated as warm water aquatic life habitat</p>	<p>The following parameters and associated criteria shall apply for the protection of productive warm water aquatic communities, fowl, animal wildlife, arborous growth, agricultural, and industrial uses:</p> <ul style="list-style-type: none"> • Natural alkalinity as CaCO₃ shall not be reduced by more than 25 percent; • pH shall not be less than 6.0 nor more than 9.0 and shall not fluctuate more than 1.0 pH units over a period of 24 hours; • Flow shall not be altered to a degree that will adversely affect the aquatic community; • Temperature shall not exceed 31.7°C (89°F); • Dissolved oxygen shall be maintained at a minimum concentration of 5.0 mg/L as a 24 hour average; instantaneous minimum shall not be less than 4.0 mg/L; • Total dissolved solids or specific conductance shall not be changed to the extent that the indigenous aquatic community is adversely affected; • Total suspended solids shall not be changed to the extent that the indigenous aquatic community is adversely affected; • Addition of settleable solids that may alter the stream bottom so as to adversely affect productive aquatic communities shall be prohibited; • Concentration of the un-ionized ammonia shall not be greater than 0.05 mg/L at any time instream after mixing; <p>Instream concentrations for total residual chlorine shall not exceed an acute criteria value of 19 µg/L or a chronic criteria value of 11 µg/L.</p>	<p>Discharge of pollutants to surface waters designated as warm water aquatic life habitat—applicable.</p>	<p>401 KAR 10:031 § 4(1)(a)-(i) and (k)</p>
<p>Criteria for surface water designated as warm water aquatic life habitat</p>	<p>The allowable instream concentration of toxic substances, or whole effluents containing toxic substances, which are noncumulative or nonpersistent with a half-life of less than 96 hours, shall not exceed:</p> <ol style="list-style-type: none"> a. 0.1 of the 96 hour median LC₅₀ of representative indigenous or indicator aquatic organisms; or b. A chronic toxicity unit of 1.00 utilizing the 25 percent inhibition concentration, or LC₂₅. 	<p>Discharge of toxic pollutants to surface waters designated as warm water aquatic life habitat—applicable.</p>	<p>401 KAR 10:031 § 4(1)(j)(1)</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Criteria for surface water designated as warm water aquatic life habitat (continued)	<p>The allowable instream concentration of toxic substances, or whole effluents containing toxic substances, which are bioaccumulative or persistent, including pesticides, if not otherwise regulated, shall not exceed:</p> <ul style="list-style-type: none"> a. 0.01 of the 96 hour median LC₅₀ of representative indigenous or indicator aquatic organisms; or b. A chronic toxicity unit of 1.00 utilizing the LC₂₅. <p>In the absence of acute criteria for pollutants listed in Table 1 of 401 KAR 10:031 § 6, for other substances known to be toxic but not listed in this regulation, or for whole effluents that are acutely toxic, the allowable instream concentration shall not exceed the LC₁ or 1/3 LC₅₀ concentration derived from toxicity tests on representative indigenous or indicator aquatic organisms or exceed 0.3 acute toxicity units.</p> <p>If specific factors have been determined for a toxic substance or whole effluent such as an acute to chronic ratio or water effect ratio, they may be used instead of the 0.1 and 0.01 factors upon demonstration that such factors are scientifically defensible.</p> <p><i>NOTE: Demonstration that such factors are scientifically defensible will be reflected in the appropriate CERCLA document.</i></p> <p>If a discharge causes, has the reasonable potential to cause, or contribute to an in-stream excursion above the numeric criterion for whole effluent toxicity using the procedures in paragraph (d)(1)(ii), develop effluent limits for whole effluent toxicity.</p>		401 KAR 10:031 § 4(1)(j)(2)
			401 KAR 10:031 § 4(1)(j)(3)
			401 KAR 10:031 § 4(1)(j)(4)
		Discharge of wastewater causes, has the reasonable potential to cause, or contributes to an in-stream excursion above the numeric criterion for whole effluent toxicity— applicable.	40 CFR § 122.44(d)(1)(iv)

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
<p>Characterization of industrial wastewater</p>	<p>Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act, as amended, are not solid wastes for the purpose of hazardous waste management.</p> <p>[Comment: This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected, stored or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.]</p> <p><i>NOTE: For purpose of this exclusion, the CERCLA on-site treatment system will be considered equivalent to a wastewater treatment unit and the point source discharges subject to regulation under CWA Section 402, provided the effluent meets all identified CWA ARARs.</i></p>	<p>Generation of industrial wastewater for treatment and discharge into surface water—applicable.</p>	<p>40 <i>CFR</i> § 261.4(a)(2) 401 <i>KAR</i> 31:010 § 4</p>
<p>Transport or conveyance of collected RCRA wastewater to a wastewater treatment unit located on the facility</p>	<p>All tank systems, conveyance systems, and ancillary equipment used to treat, store, or convey wastewater to an on-site wastewater treatment facility are exempt from the requirements of RCRA Subtitle C standards.</p> <p><i>NOTE: For purposes of this exclusion, any dedicated tank systems, conveyance systems, and ancillary equipment used to treat, store or convey CERCLA remediation wastewater to a CERCLA on-site wastewater treatment unit that meets all of the identified CWA ARARs for point source discharges from such a facility, are exempt from the requirements of RCRA Subtitle C standards.</i></p>	<p>On-site wastewater treatment units (as defined in 40 <i>CFR</i> § 260.10) subject to regulation under § 402 or § 307(b) of the CWA (i.e., KPDES-permitted) that manages hazardous wastewaters—applicable.</p>	<p>40 <i>CFR</i> § 264.1(g)(6) 401 <i>KAR</i> 34:010 § 1</p>
<p>Activities causing toxic substances or potentially hazardous matter emissions</p>	<p>Persons responsible for a source from which hazardous matter or toxic substances may be emitted shall provide the utmost care and consideration in the handling of these materials to the potentially harmful effects of the emissions resulting from such activities. No owner or operator shall allow any affected facility to emit potentially hazardous matter or toxic substances in such quantities or duration as to be harmful to the health and welfare of humans, animals and plants.</p>	<p>Emissions of potentially hazardous matter or toxic substances as defined in 401 <i>KAR</i> 63:020 § 2 (2)—applicable.</p>	<p>401 <i>KAR</i> 63:020 § 2</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Activities causing radionuclide emissions	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrems/yr.	Radionuclide emissions from point sources at a DOE facility— applicable .	40 <i>CFR</i> § 61.92 401 <i>KAR</i> 57:002
General standards for process vents used in treatment of VOC contaminated groundwater	<p>For each affected process vent, except as exempted under 40 <i>CFR</i> § 63.7885(c), must meet one of the options in paragraphs (b)(1) through (b)(3) of this section.</p> <ul style="list-style-type: none"> • Control HAP emissions from the affected process vents according to the applicable standards specified in § 63.7890 through 63.7893. • You determine for the remediation material treated or managed by the process vent through the affected process vents that the average total VOHAP [volatile organic hazardous air pollutant] concentration, as defined in Section 63.7957, of this material is less than 10 ppmw. <p>Determination of the VOHAP concentration is made using the process specified in Section 63.7943.</p> <ul style="list-style-type: none"> • If the process vent is also subject to another subpart under 40 <i>CFR</i> part 61 or part 63, you control emissions of the HAP listed in Table 1 of this subpart from the affected process vent in compliance with the standards specified in the applicable subpart. This means you are complying with all applicable emissions limitations and work practice standards under the other subpart (e.g., you install and operate the required air pollution controls or have implemented the required work practice to reduce HAP emissions to levels specified by the applicable subpart). This provision does not apply to any exemption of the affected source from the emission practice standards allowed by the other applicable SUBPART. <p><i>NOTE: Any determination of the VOHAP concentration of the remediation material can be based on knowledge of the material. Based on existing data it is expected that the VOHAP concentration of the NE Plume groundwater is less than 10 ppmw. Historical data from the locations near the proposed new well locations shows the highest anticipated concentration of TCE in the groundwater is less than 1 ppmw.</i></p>	<p>Process vents as defined in 40 <i>CFR</i> § 63.7957 used in site remediation of media (e.g., soil and groundwater) that could emit hazardous air pollutants (HAP) listed in Table 1 of Subpart GGGGG of Part 63—relevant and appropriate.</p>	<p>40 <i>CFR</i> § 63:7885(b)(1)–(3)</p> <p>401 <i>KAR</i> 63:002 § 1 and 2, except for 40 <i>CFR</i> § 63.72 as incorporated in § 2(3)</p>

Table 3. Outfall Discharge Criteria

Effluent Parameter/Characteristic	Discharge Limitations			Initial Monitoring Frequency*
	Yearly Average	Monthly Average	Daily Maximum	
Flow (mgd)	N/A	Monitor Only	Monitor Only	Weekly
Total suspended solids (mg/L)	N/A	30	60	Weekly
Oil and grease (mg/L)	N/A	10	15	Weekly
Total residual chlorine (mg/L)	N/A	0.011	0.019	Weekly
Temperature (°F)	N/A	N/A	89	Weekly
Trichloroethene (µg/L)	N/A	30	N/A	Weekly
Chronic toxicity (TU _c)	N/A	N/A	1.00	Quarterly
Technetium-99 (µCi/ml)	N/A	N/A	N/A	Quarterly
pH	N/A	6 (min)	9	Weekly
1,1-Dichloroethene (µg/l)	N/A	7,100	N/A	Weekly

*Initial Monitoring Frequency based upon KPDES Permit KY0004049 at the time of the ESD; these monitoring frequencies may be adjusted in the operation and maintenance plan.

Creek) through the CERCLA outfalls will comply with identified Clean Water Act and Kentucky water quality standards identified as ARARs and will be below the 30 ppb TCE. Pursuant to 40 *CFR* § 261.4(a)(2) (401 *KAR* 31:010 § 4), point source discharges are excluded from regulation as a hazardous wastes. The exclusion applies only to the actual point source discharge and does not exclude industrial wastewaters while they are collected, stored, treated before the discharge, nor does it exclude sludge that is generated by industrial wastewater treatment.

The modified interim remedy also changes the air emission point location and characteristics that affect the air distribution of TCE. As a result, the project consulted with the Kentucky Division for Air Quality (KDAQ). KDAQ requested the project comply with the substantive requirements of 401 *KAR* 63:020; consequently, 401 *KAR* 63:022 is being replaced with 401 *KAR* 63:020 § 3. Air dispersion analysis demonstrates that the anticipated TCE airborne emissions would not be harmful to the health and welfare of humans, animals, and plants. The analysis is included as an appendix to this ESD.

The revised remedy is cost-effective and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

THIS PAGE INTENTIONALLY LEFT BLANK

7. PUBLIC PARTICIPATION REQUIREMENTS

Community involvement is a critical aspect of the cleanup process at PGDP. The DOE encourages the public to review this ESD. As required by 40 *CFR* § 300.435(c)(2)(i), a Notice Availability and brief description of this ESD will be published in the local newspaper announcing the availability of the ESD for review in the Administrative Record file and information repository, as required by the NCP [40 *CFR* § 300.435(c)(2)(i)(A) and 300.825(a)(2)]. The Administrative Record file that contains the ROD and the CERCLA Five-Year Reviews and other associated documentation is available for review at the following:

DOE Environmental Information Center
115 Memorial Drive, Barkley Centre
Paducah, KY 42001
(270) 554-3004
<http://www.paducaheic.com>

Hours of Operation: Monday through Friday
8 A.M.–12:00 P.M.

THIS PAGE INTENTIONALLY LEFT BLANK

8. APPROVALS

*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

November 2015

APPROVAL

William E. Murphie, Manager
Portsmouth/Paducah Project Office
U.S. Department of Energy

Date

Franklin E. Hill, Director
Superfund Division
U.S. Environmental Protection Agency—Region 4

Date

CONCURRENCE

Tony Hatton, Director
Division of Waste Management
Kentucky Department for Environmental Protection

Date

THIS PAGE INTENTIONALLY LEFT BLANK

9. REFERENCES

- DOE (U.S. Department of Energy) 1995. *Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2, U.S. Department of Energy, Paducah, KY, June.
- DOE 2003. *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2067&D2, U.S. Department of Energy, Paducah, KY, October.
- DOE 2006. *Paducah 2006 Sitewide Remedy Review*, Office of Environmental Management, Office of Engineering Technical Expertise Project 610, U.S. Department of Energy, April 13.
- DOE 2007. *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky*, prepared for Office of Groundwater and Soil Remediation and Office of Engineering and Technology, U.S. Department of Energy, May 24.
- DOE 2009. *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0117&D2, U.S. Department of Energy, Paducah, KY, May.
- DOE 2012. *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, Annual Revision—FY 2012, DOE/LX/07-1264&D2, U.S. Department of Energy, Paducah, KY, February.
- DOE 2013. *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, U.S. Department of Energy, Paducah, KY, August.
- DOE 2014. *Five-Year Review for Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1, Secondary Document, U.S. Department of Energy, Paducah, KY, May.
- DOE 2015. *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*, U.S. Department of Energy, Paducah, KY, July.
- EPA (U.S. Environmental Protection Agency) 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707, U.S. Environmental Protection Agency, Atlanta, GA, February.
- EPA 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents*, EPA 540-R-98-031, Office of Solid Waste and Emergency Response, Washington, DC, July.

- EPA 2003. Winston A. Smith, Director, Waste Management Division, U.S. Environmental Protection Agency, Atlanta, GA, letter to William E. Murphie, Manager, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, and Glenn E. VanSickle, Paducah Manager of Projects, Bechtel Jacobs Company LLC, Kevil, KY, approval of the “Five-Year Review for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-2067&D2), December 30.
- EPA 2009. Franklin E. Hill, Director, Superfund Division, Sam Nunn Federal Center, Atlanta, GA, letter to William Murphie, Director Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah Site Office, Paducah, KY, “Approval of the 2008 CERCLA Five-Year Review for the Paducah Gaseous Diffusion Plant (DOE/LX/07-0117&D2),” June 4.
- KDEP 2003. Michael V. Welch, P.E., Manager Hazardous Waste Branch, Kentucky Natural Resources and Environmental Protection Cabinet, Kentucky Department for Environmental Protection, Frankfort, KY, to William E. Murphie, Manager, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, and Gordon L. Dover, Plant Manager, Bechtel Jacobs Company LLC, Kevil, KY, approval of the “Five-Year Review for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-2067&D2). McCracken County, Kentucky, KY8-890-008-982,” November 14.
- KEEC (Kentucky Energy and Environment Cabinet) 2009. April J. Webb, P.E., Manager, Hazardous Waste Branch, Kentucky Energy and Environment Cabinet, Frankfort, KY, letter to Reinhard Knerr, Paducah Site Lead, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, approval of the “Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant (DOE/LX/07-0117&D2),” March 30.

APPENDIX

AIR DISPERSION ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX
AIR DISPERSION ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

A.1. INTRODUCTION

As a result of cessation of uranium enrichment operations at Paducah Gaseous Diffusion Plant (PGDP), the use of the C-637 Cooling Towers as an air stripper facility for trichloroethene (TCE)-contaminated groundwater was discontinued for this interim remedial action (IRA). Since PGDP ceased operations and until completion of the Northeast Plume IRA optimization project, one Northeast Plume treatment unit (TU), located near the planned location for EW234, will be used temporarily to continue treatment of groundwater from the two existing Northeast Plume extraction wells (EW331 and EW332) until EW234 and EW235 begin operation. The TU systems include a skid-mounted treatment system consisting of a high efficiency air stripper, air blower, effluent pump, influent bag filters, and process control system all enclosed in a heated weatherproof enclosure. In addition, the EW234 TU includes a tie-in point to the existing Northeast Plume IRA EWs. Two separate TUs will be used to treat extracted water from each new EW; one TU for EW234 and one TU for EW235, and will be located in the same general area as the new extraction wells.

This appendix describes the air dispersion analysis of potential hazardous air pollutant (HAP) and/or toxic air pollutant (TAP) emissions after implementation of the Northeast Plume IRA Optimization project is complete, and EW234 and EW235 have begun operation. The property boundary concentrations for potential HAP/TAP emissions were estimated using BREEZE AERMOD version 7.7.1. The results of the dispersion analysis are summarized herein.

A.1.1 AIR DISPERSION MODEL SELECTION

The BREEZE AERMOD version 7.7.1 program was used to conduct air dispersion modeling using the latest version (12345) of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) to estimate maximum ground-level concentrations. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

A.1.2 MODELING RECEPTOR GRIDS

Ground-level concentrations were calculated within one Cartesian receptor grid and at receptors placed along the property line (property line). The property line grid receptors were spaced at a maximum of approximately 50 m apart. The Cartesian receptor grid extending out a minimum of 600 meters beyond the property line was spaced at 200-m intervals in all directions. The Cartesian receptor grid was generated to ensure concentrations were decreasing away from the property line. All resultant maximum concentrations occur well within this distance.

A.1.3 TERRAIN

AERMOD uses advanced terrain characterization to account for the effects of terrain features on plume dispersion and travel. AERMOD's terrain pre-processor, AERMAP (latest version 11103), imports digital terrain data and computes a height scale for each receptor from National Elevation Dataset (NED) data files. A height scale is assigned to each individual receptor and is used by AERMOD to determine whether the plume will go over or around a hill.

The modeled receptor terrain elevations input into AERMAP are the highest elevations extracted from United States Geological Survey (USGS) 1:24,000 scale (7.5-minute series) NED data for the area surrounding PGDP. For each modeled receptor, the maximum possible elevation within a box centered on the receptor of concern and extending halfway to each adjacent modeled receptor was chosen. This is a conservative technique for estimating terrain elevations by ensuring that the highest terrain elevations are accounted for in the analysis. HAP/TAP emission concentrations were calculated at all receptors.

A.1.4 BUILDING DOWNWASH ANALYSIS

The emission units were evaluated in terms of their proximity to nearby structures.¹ The purpose of this evaluation was to determine if stack discharge might become caught in the turbulent wakes of these structures leading to downwash of the plume. Wind blowing around a building creates zones of turbulence that are greater than if the building were absent. The current version of the AERMOD dispersion model treats building wake effects following the algorithms developed by Schulman and Scire.² This approach requires the use of wind direction-specific building dimensions for structures located within 5L of a stack, where L is the lesser of the height or projected width of a nearby structure. Stacks taller than the structure height plus 1.5L are not subject to the effects of downwash in the AERMOD model.

The current version of the AERMOD dispersion model considers the trajectory of the plume near a building and uses the position of the plume relative to the building to calculate interaction with the building wake. The direction-specific building dimensions used as inputs to the AERMOD model were calculated using the Building Profile Input Program Plume Rise Model Enhancement (BPIP PRIME), version 04274.³ BPIP PRIME calculates fields of turbulence intensity, wind speed, and the slopes of the mean streamlines as a function of the projected building dimensions. BPIP PRIME is authorized by the U.S. Environmental Protection Agency (EPA) and is designed to incorporate the concepts and procedures expressed in the good engineering practice (GEP) technical support document,⁴ the building downwash guidance document, and other related documents.

BPIP PRIME results indicate the stack height of each emission unit is greater than the GEP stack height; therefore, building downwash is not a concern. Each building processed using BPIP PRIME was assigned a unique numerical identification, which correspond to BPIP PRIME files, and are illustrated in Figure A.1.

¹ Buildings located farther than 800 m or 2,625 ft of a stack were not considered in the building downwash analysis. <http://www.epa.state.oh.us/portals/27/aqmp/eiu/attach2.pdf>

² Earth Tech, Inc., *Addendum to the ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model*, Concord, MA, November 1997.

³ EPA, User's Guide to the Building Profile Input Program (Research Triangle Park, NC), EPA-454/R-93-038, April 2004.

⁴ EPA, Office of Air Quality Planning and Standards, *Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)* (Research Triangle Park, NC), EPA 450/4-80-023R, June 1985.

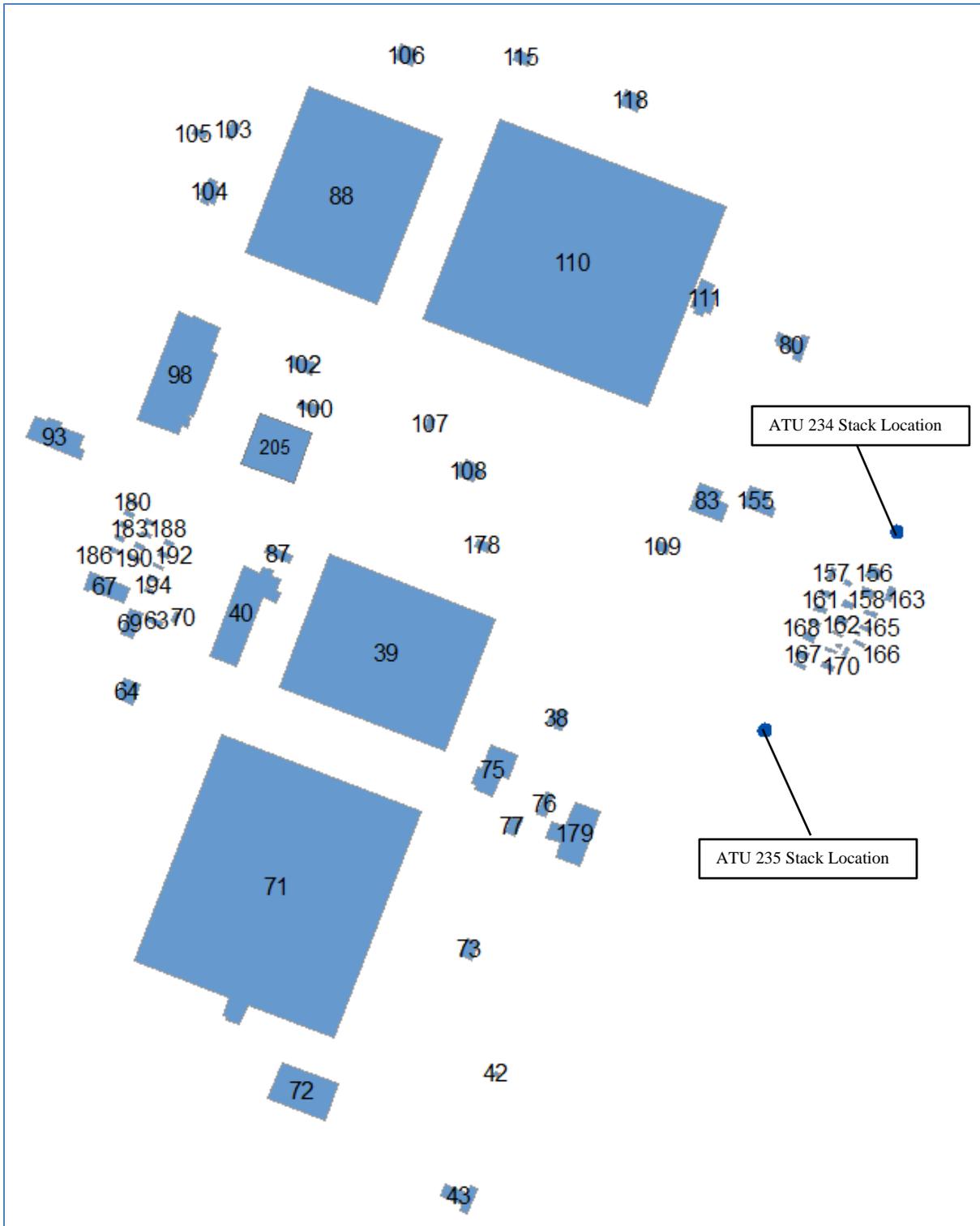


Figure A.1. Buildings Processed Using BPIP PRIME

A.2. IDENTIFICATION OF AIR POLLUTANTS

The potential HAPs/TAPs that could be emitted by the Northeast Plume IRA optimization project have been identified based on groundwater characterization. The potential HAPs/TAPs that could be emitted are trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE).

A.3. ALLOWABLE OFF-SITE CONCENTRATIONS CALCULATIONS

The treated vapor/gases must comply with the contaminant concentration requirements of 401 KAR 63:020. This states that no owner or operator shall allow any affected facility to emit potentially hazardous matter or toxic substances in such quantities or duration as to be harmful to the health and welfare of humans, animals, and plants.

A.3.1 TCE ALLOWABLE OFF-SITE CONCENTRATIONS

The maximum allowable air concentration for TCE was estimated using the EPA Region 9 Regional Screening Levels (RSLs), formerly referred to as Preliminary Remediation Goals, which are available from the EPA's Web site at: <http://www.epa.gov/region9/superfund//prg/index.html>. The TCE value is based on the carcinogenic risk posed by lifetime⁵ exposure to TCE. The health effects of exposure to TCE are measured by a target risk of one in one million (1×10^{-6}). The residential RSL was used to develop an allowable off-site concentration limit.

The ambient air allowable off-site concentration for TCE is $0.43 \mu\text{g}/\text{m}^3$. The allowable off-site concentration for TCE was selected from the EPA publication of RSLs. (Note: The air dispersion analysis was performed in 2013.)

A.3.2 1,1-DCE ALLOWABLE OFF-SITE CONCENTRATIONS

The maximum allowable air concentration for 1,1-DCE also was estimated using the EPA RSL. The 1,1-DCE value is based on the noncancer risks posed by long-term exposure to 1,1-DCE. The health effects of exposure to 1,1-DCE are measured by a hazardous index, with a hazard index of 1 being an indication of the nearest off-site receptor having detrimental health effects from exposure to 1,1-DCE. The residential RSL was used to develop an allowable off-site concentration limit.

The ambient air allowable off-site concentration for 1,1-DCE is $210 \mu\text{g}/\text{m}^3$. The allowable off-site concentration for 1,1-DCE was selected from the EPA publication of RSLs. (Note: The air dispersion analysis was performed in 2013.)

⁵ Lifetime exposure is assumed to be 70 years by convention for this air toxics risk assessment. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm. In such assessments, if exposure duration is less than 70 years, inhalation exposure estimates and/or allowable off-site concentrations limits may be adjusted accordingly. http://epa.gov/ttn/fera/risk_atra_vol2.html. For simplicity in this report, allowable off-site concentration limits were not adjusted although exposure duration is expected to be less than 70 years for this project.

The allowable off-site concentrations for TCE and 1,1-DCE are shown in Table A.1.

Table A.1. Allowable Off-site Concentration Limits

Pollutant	Allowable Off-site Concentration ($\mu\text{g}/\text{m}^3$)	Reference Source
TCE	0.43	Regional Screening Levels, May 2013
1,1-DCE	210	

A.4. ESTIMATED EMISSION RATES

A.4.1 EMISSIONS

During operation of the project, hazardous constituents in extracted groundwater will be volatilized using two identical TUs including, but limited to, a skid-mounted treatment system consisting of a high efficiency four-tray air stripper (QED EZ-Tray P/N EZ-24.4SS),⁶ air blower, effluent pump, influent bag filters, and process control system all enclosed in a heated weatherproof enclosure. The current design criteria for the TUs are for each air stripper to have a removal efficiency of up to 99% for volatile organic compounds.⁷ No vapor phase controls to capture or destroy contaminants prior to release to the atmosphere following stripping are included in the TUs at this time.

The following preliminary design parameters⁸ for the stack were used in the model to estimate the dispersion of the hazardous constituents:

- 8-inch diameter;
- 19.5-ft high (approximate);
- 1,300 scfm flow rate (approximate);
- 55°F exhaust gas temperature; and
- The stack will not be equipped with a rain cap.

In order to assess the potential impacts on ambient TCE and 1,1-DCE concentrations from the project, modeling was performed using estimated maximum potential emissions based on the system's maximum TCE input of 1,000 ppb; information was provided from the manufacturer.

The average expected TCE concentrations in groundwater prior to treatment are 517 ppb and 450 ppb for ATU 234 and ATU 235, respectively. Based on average expected TCE concentration in untreated groundwater, the TCE emissions to air are estimated as 5.167×10^{-2} pound per hour (lb/hr) and 4.498×10^{-2} lb/hr for ATU 234 and ATU 235, respectively. The maximum observed TCE mass concentration based on sampling data from existing extraction wells was 870 ppb.⁹ As such, 9.994×10^{-2} lb/hr based on 1,000 ppb provides a conservative basis for modeling potential emissions.

⁶ Air stripper model information based on as-built equipment.

⁷ http://www.qedenv.com/products/air_s.html

⁸ Design parameters received in e-mail to Geosyntec on January 24, 2013, and January 28, 2013.

⁹ Sampling data received in e-mail to Geosyntec on January 24, 2013. See May 8, 2013, e-mail to Todd Mullins, Kentucky Department for Environmental Protection, from Stan Knaus, LATA Environmental Services of Kentucky, LLC.

The maximum emission rates during operation for each model scenario are listed in Table A.2 in both lb/hr and g/s.

Table A.2. Estimated Emission Rates

Model ID	Scenario Description	TU 234 Mass Emissions (lb/hr)	TU 234 Mass Emissions (g/s)	Untreated Water Concentration (ppb)	TU 235 Mass Emissions (lb/hr)	TU 235 Mass Emissions (g/s)	Untreated Water Concentration (ppb)
Max_TCE	Maximum TCE	9.994×10^{-2}	1.259×10^{-2}	1,000	9.994×10^{-2}	1.259×10^{-2}	1,000
Max_11DCE	Maximum 1,1-DCE ¹⁰	9.994×10^{-2}	1.259×10^{-2}	1,000	9.994×10^{-2}	1.259×10^{-2}	1,000

A.4.2 MAXIMUM OFF-SITE CONCENTRATIONS

The property boundary ambient concentration for each HAP/TAP was estimated using the air dispersion model BREEZE AERMOD version 7.7.1.

Surface meteorology data from station number 3816 (Paducah, KY) and the nearest available upper air meteorology data from station 00013897 (Nashville, TN) were used. Dispersion analysis was performed using meteorological data from these stations for calendar years 2008, 2009, 2010, 2011, and 2012 (January 1, 2008, through December 31, 2012). The AERMOD-ready meteorological files were purchased from Trinity Consultants, Inc.

The air dispersion modeling analysis was performed using the pollutant-specific controlled emission rates discussed in Section A.4.1 to estimate the off-site concentration for each pollutant.

The results of the air dispersion modeling analysis suggest that the maximum annual concentration occurs at a receptor (341114.10, 4109112.90) along the property boundary northeast of the proposed stack locations, illustrated in Figure A.2.

¹⁰ 1,1-DCE is a volatile similar to TCE; therefore, mass emission rates of 1,1-DCE were conservatively assumed to equal TCE.

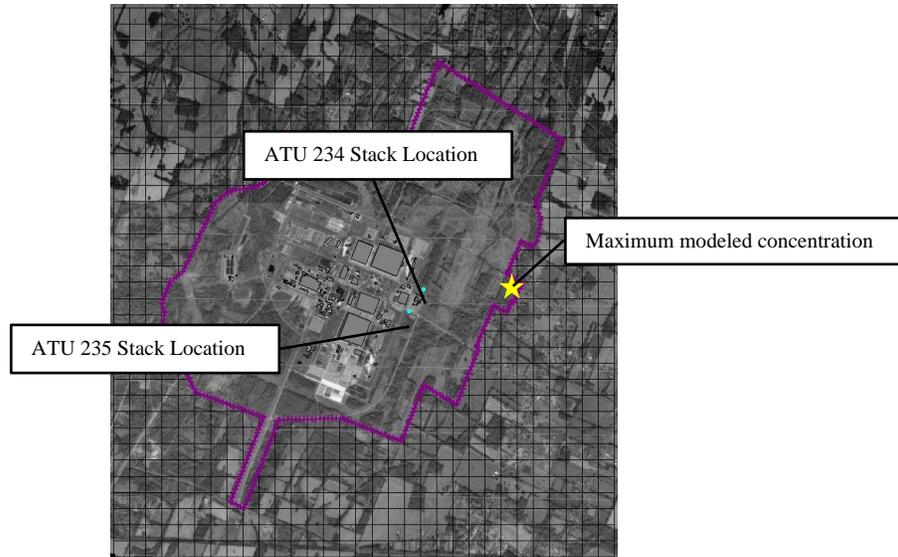


Figure A.2. Modeling Results

The estimated off-site pollutant concentrations for each modeling scenario are shown in Table A.3.

Table A.3. Estimated Off-site Concentrations

Model ID	Off-Site Concentration Limit ($\mu\text{g}/\text{m}^3$)	Annual Off-site Concentration ($\mu\text{g}/\text{m}^3$)	Below Limit? (Yes/No)
Max_TCE	0.43	0.084	Yes
Max_11DCE	210	0.084	Yes

The results of these air dispersion modeling analyses show the estimated maximum annual average concentration for both modeling scenarios will be below the corresponding maximum allowable off-site concentrations of respective pollutants. Additionally, the allowable off-site concentration limit for TCE was developed using a lifetime (i.e., 70-year exposure period) per EPA’s RSL User’s Guide.¹¹ The duration of potential exposure associated with the operation of the TUs will be less than 70 years. Therefore, emissions associated with this project are not expected to be harmful to the health and welfare of humans, animals, or plants.

¹¹ http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

THIS PAGE INTENTIONALLY LEFT BLANK

DOE/LX/07-1291&D2/R2
Primary Document

Deleted: 1

**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**



CLEARED FOR PUBLIC RELEASE

Deleted: DRAFT

DOE/LX/07-1291&D2/R2
Primary Document

Deleted: 1

**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**

Date Issued—~~November~~ 2015

Deleted: August

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FLUOR FEDERAL SERVICES, INC.,
Paducah Deactivation Project
managing the
Deactivation Project at the
Paducah Gaseous Diffusion Plant
under Task Order DE-DT0007774

CLEARED FOR PUBLIC RELEASE

THIS PAGE INTENTIONALLY LEFT BLANK

PREFACE

The regulations to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) require that changes to remedial actions that are proposed after the adoption of a signed Record of Decision (ROD) be documented using one of the following three processes: (1) ROD Amendment if the change “fundamentally alters” basic features of the remedy; (2) Explanation of Significant Differences (ESD) if the change is significant, but not fundamentally different from the selected remedy in the ROD; or (3) Memorandum to File if the proposed changes to the remedy are minor. The proposed changes to the Northeast Plume interim remedial action (IRA) are not considered to “fundamentally alter” the basic features of the remedy, as presented in the ROD, but certain components of the proposed changes are considered “significant” changes that require development of an ESD. This *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/R1, was prepared in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 117(c); 40 *CFR* § 300.435(c)(2)(i) of the NCP; and a *Guide to Preparing Superfund Proposed Plans, Records of Decision, and other Remedy Selection Decision Documents*, EPA 540-R-98-031, July 1999. It provides the public the opportunity to understand the proposed modifications to the IRA for the Northeast Plume and the changes that significantly differ from the approach delineated in the *Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2 (DOE 1995).

The major components of the interim action remedy in the 1995 ROD include these:

- The contaminated groundwater was to be extracted at a location in the northern portion of the high trichloroethene (TCE) concentration area of the plume (greater than 1,000 µg/L of TCE). The contaminated groundwater was to be pumped at a rate of approximately 100 gal per minute (gpm) to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may have been modified to optimize the hydraulic containment by adjusting flow from the extraction wells (EWs) and to support subsequent actions.
- The extracted groundwater was to be collected and piped to a treatment system prior to release to a Kentucky Pollutant Discharge Elimination System-permitted outfall. The treatment facility was to consist of a sand filter for removal of suspended solid materials and utilization of the Paducah Gaseous Diffusion Plant’s (PGDP’s) cooling towers for volatilization of contaminated groundwater. The chemicals of concern are TCE and 1,1-dichloroethene (1,1-DCE).
- Two treatability studies were to be conducted to include (1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater.

The U.S. Environmental Protection Agency (EPA) and Kentucky Department for Environmental Protection, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA since the EWs were designed with an artificial sand pack that serves as a sand filter for sediments. Thus, the quality of water being discharged from the EWs would be similar to that of a drinking water well, with the exception of the TCE contamination.

A minor modification to the ROD was written on May 2, 1996, to postpone the treatability studies [(1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater].

The proposed changes described by this ESD will be implemented in a phased approach and will consist of the following anticipated modifications to the IRA:

- Replace the two existing EWs (EW331 and EW332) with two new groundwater EWs (EW234 and EW235) to be in the upgradient high concentration portion of the Northeast Plume and near the eastern edge of the PGDP industrial facility. The combined pumping capacity of the two new EWs will be approximately 300 gal per minute.
- Install new treatment units as an alternative to the cooling towers to remove volatile organic compounds (VOCs), namely TCE and DCE, from extracted groundwater. These units will include pretreatment filtration and removal of VOCs via air stripping technology. The two treatment units will strip VOCs and discharge treated groundwater at levels that are compliant with identified applicable or relevant and appropriate requirements. One treatment unit was installed in 2013 to replace the loss of the cooling tower air stripping capacity and currently is utilized for pump-and-treat operations.
- Create a maximum of two new CERCLA outfalls for discharge of treated groundwater from the treatment units into Little Bayou Creek.

Deleted: (

Deleted: combined)

- 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) signed by the Federal Facility Agreement (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 upgradient 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. 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 (DOE 2015).

The MOA for Resolution is located at the following link: <http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

The extraction of Northeast Plume mass from new EWs (EW234 and EW235) located upgradient of the current EWs (EW331 and EW332) and in the vicinity of the eastern boundary of the plant site will both remove VOC mass in the contaminated groundwater from the higher concentration portion of the Northeast Plume and control the amount of plume mass migrating off-site.

Deleted: both

None of the above anticipated changes are considered to be fundamentally different from the original selected remedy in the 1995 ROD; however, the creation of up to two new CERCLA outfalls for discharge of the treated groundwater will require identification and inclusion of new applicable or relevant and appropriate requirements. Under EPA guidance (EPA 1999), these new discharges would be considered to be a significant change that should be documented in an ESD. EPA guidance (EPA 1999) states that while the ESD is being prepared and made available to the public, the lead agency may proceed with the pre-design, design, construction, or operation activities associated with the remedy.

| **THIS PAGE INTENTIONALLY LEFT BLANK**

CONTENTS

PREFACE.....	iii
FIGURES.....	ix
TABLES.....	ix
ACRONYMS.....	xi
EXECUTIVE SUMMARY.....	xiii
1. INTRODUCTION AND PURPOSE.....	1
1.1 SITE NAME AND LOCATION.....	1
1.2 REGULATORY BACKGROUND.....	3
1.3 CIRCUMSTANCES CREATING THE NEED FOR AN ESD.....	3
2. SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY.....	7
2.1 SITE HISTORY AND CONTAMINATION ASSOCIATED WITH THE NORTHEAST PLUME.....	7
2.2 INTERIM REMEDIAL ACTION REMEDY APPROVED IN THE ROD.....	7
3. BASIS FOR THE ESD.....	11
3.1 INFORMATION SUPPORTING OPTIMIZED REMEDY.....	11
3.1.1 Five-Year Reviews for Remedial Actions at the Paducah Gaseous Diffusion Plant.....	11
3.2 REMEDIAL ACTION WORK PLAN FOR THE NORTHEAST PLUME INTERIM REMEDIAL ACTION OPTIMIZATION.....	12
3.3 ADMINISTRATIVE RECORD INFORMATION SUPPORTING THE NEEDED CHANGE.....	12
4. DESCRIPTION OF SIGNIFICANT DIFFERENCES.....	13
4.1 SIGNIFICANT DIFFERENCES BETWEEN THE REMEDY AND ESD MODIFICATIONS.....	13
4.2 EXPECTED OUTCOMES OF THE ESD.....	15
4.2.1 Key Design Changes.....	15
4.2.2 Key Design Assumptions.....	16
4.2.3 Well Field Design.....	16
4.2.4 Baseline Monitoring.....	16
4.2.5 Construction.....	17
4.2.6 Start-up and Testing.....	17
4.2.7 Operation and Maintenance.....	17
4.2.8 Remedial Action Work Plan.....	18
5. SUPPORT AGENCY CONCURRENCE.....	19
6. STATUTORY DETERMINATIONS.....	21
7. PUBLIC PARTICIPATION REQUIREMENTS.....	31

8. APPROVALS..... 33

9. REFERENCES..... 35

APPENDIX: AIR DISPERSION ANALYSISA-1

FIGURES

1. PGDP Location	2
2. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2010)	4
3. Extent of PGDP TCE Plumes (1994).....	8
4. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2014)	9
5. Locations of New and Preexisting EWs Associated with the Northeast Plume IRA at PGDP	14

TABLES

1. Summary of Modifications to the Selected Remedy	13
2. Additional Applicable or Relevant and Appropriate Requirements.....	22
3. Outfall Discharge Criteria	29

THIS PAGE INTENTIONALLY LEFT BLANK

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
ATU	alternate treatment unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
<i>CFR</i>	<i>Code of Federal Regulation</i>
CWA	Clean Water Act
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant differences
EW	extraction well
Fed. Reg.	Federal Register
FFA	Federal Facility Agreement
IRA	interim remedial action
<i>KAR</i>	<i>Kentucky Administrative Regulation</i>
KDAQ	Kentucky Division for Air Quality
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollution Discharge Elimination System
MOA	Memorandum of Agreement
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PGDP	Paducah Gaseous Diffusion Plant
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
ROD	record of decision
USEC	United States Enrichment Corporation
VOC	volatile organic compound
VOHAP	volatile organic hazardous air pollutant

THIS PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) has prepared this Explanation of Significant Differences (ESD) to document the changes to the Record of Decision (ROD) for Interim Remedial Action (IRA) of the Northeast Plume at the Paducah Gaseous Diffusion Plant (PGDP) that are necessary to optimize the existing Northeast Plume Groundwater System.

The ROD was signed by DOE, the U.S. Environmental Protection Agency (EPA), and the Kentucky Department for Environmental Protection in June 1995. The primary objective of this IRA 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 selected remedy was designed to reduce the concentrations of trichloroethene (TCE) in the most contaminated portions of the Northeast Plume. The extraction well (EW) location was defined in the ROD as the northern portion of the high TCE concentration of the plume (greater than 1,000 µg/L of TCE). The planned changes presented in the ESD are protective of human health and the environment and will not impact the protectiveness of the IRA. As recognized in the ROD, successful control of the plume, in combination with existing controls (alternate water supply, monitoring, etc.), ensures protection during the period of the interim response.

The modification to the IRA for the Northeast Plume documented in this ESD is as follows:

- Replace the two existing EWs (EW331 and EW332) with two new groundwater EWs (EW234 and EW235) to be in the upgradient high concentration portion of the Northeast Plume and near the eastern edge of the PGDP industrial facility (approximately 300 gal per minute combined extraction rate).
- Install new treatment units as an alternative to the cooling towers to remove volatile organic compounds (VOCs), namely TCE and dichloroethene, from extracted groundwater. These treatment units will include pretreatment filtration and removal of VOCs via air stripping technology. The two treatment units will strip VOCs and discharge treated groundwater at levels that are compliant with identified applicable or relevant and appropriate requirements.
- Create a maximum of two Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) outfalls for discharge of treated groundwater from the treatment units into Little Bayou Creek.

Deleted: The EW extraction rates may be adjusted if monitoring results identify potential changes in groundwater flow or contaminant source impacts (e.g., rising contaminant concentrations in the Northeast Plume, source migration, etc.) in order to minimize these potential impacts.

- *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) 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. 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 (DOE 2015).

The MOA for Resolution is located at the following link: <http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

Deleted: Install 18 monitoring wells to evaluate performance and effectiveness of the optimized EWs. Consistent with the MOA for Resolution, five of these monitoring wells, at a minimum, will be located in a north-south transect located approximately 600 ft east of the C-400 Building. These transect monitoring wells 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.

Design, construction, and operation will be performed in addition to start-up testing and will include installation of piping, process control equipment, electrical equipment, and placement of additional monitoring wells to evaluate performance and effectiveness of the new optimization system. This Northeast Plume IRA optimization project is intended to increase volatile organic compound mass removal and enhance capture of contaminants migrating in the Northeast Groundwater Plume at the eastern edge of the PGDP industrial facility (see Figure 1). This optimization action was initiated in response to recommendations that are documented in the 2003 CERCLA Five-Year Review (DOE 2003) and approval letters (EPA 2003; KDEP 2003); Sitewide Remedy Review (DOE 2006); *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007); 2008 CERCLA Five-Year Review (DOE 2009) and approval letters (EPA 2009; KEEC 2009); 2013 CERCLA Five-Year Review (DOE 2014); Site Management Plan (DOE 2012); negotiations among the Federal Facility Agreement parties, including the Memorandum of Agreement for Resolution (DOE 2015a); and in response to the deactivation of PGDP.

Deleted: DOE 2009;

In conclusion, the planned changes presented in the ESD are protective of human health and the environment and will not impact the protectiveness of the IRA. The optimized interim action will continue to rely on other actions to achieve protectiveness while the IRA continues.

1. INTRODUCTION AND PURPOSE

The U.S. Department of Energy (DOE) is conducting cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP) under its Environmental Management Program. Cleanup efforts are necessary to address contamination resulting from past waste-handling and disposal practices at the plant. The cleanup activities comply with the requirements of the U.S. Environmental Protection Agency (EPA), the Kentucky Energy and Environment Cabinet, and DOE.

Pursuant to the Record of Decision (ROD) for Interim Remedial Action (IRA) of the Northeast Plume at PGDP signed by DOE, EPA, and Kentucky Department for Environmental Protection (KDEP) in June 1995, DOE currently is operating groundwater extraction wells (EWs) (EW331 and EW332) and a treatment system at PGDP to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence. The treatment system is designed to remove trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE) from extracted groundwater.

Reviews and assessments, including the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-mandated periodic five-year review documents for years 2003 (~~DOE 2003~~) and approval letters (~~EPA 2003; KDEP 2003~~); 2008 (~~DOE 2009~~) and approval letters (~~EPA 2009; KEEC 2009~~); 2013 (~~DOE 2014~~); Sitewide Remedy Review (DOE 2006); Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky (DOE 2007); and Site Management Plan (DOE 2012), have resulted in recommended changes to the IRA to enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility and to reduce further migration off-site. 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*, (DOE 2015) (MOA for Resolution) also documents the Federal Facility Agreement (FFA) parties' agreement that an optimization of the existing Northeast Plume IRA is warranted. Accordingly, DOE has prepared this Explanation of Significant Differences (ESD) to document the changes made to the Northeast Plume IRA that were necessary in optimizing the IRA.

Deleted: and

Deleted: DOE 2003; DOE 2009;

Deleted: ,

Deleted: and

Deleted: a

This ESD has been prepared in accordance with CERCLA Section 117(c) and 40 *CFR* § 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). An ESD is required when a significant change is made to the remedy defined in the decision document (e.g., ROD). A significant change generally involves a change to a component of a remedy that does not fundamentally alter the overall cleanup approach. This ESD describes the nature of the significant change, summarizes the information that led to making the change(s), and affirms that the revised remedy complies with the NCP and the statutory requirements of CERCLA. As required by 40 *CFR* § 300.435(c)(2)(i)(B), DOE will publish a notice of availability and a brief description of the ESD in a major local newspaper of general circulation. The ESD also is made available to the public by placing it in the Administrative Record file and information repository at the following link <http://www.paducaeic.com>, as well as at the Special Collections counter at the local public library [40 *CFR* § 300.435(c)(2)(i)(A) and § 300.825(a)(2)].

1.1 SITE NAME AND LOCATION

PGDP is located in the northwestern corner of Kentucky in western McCracken County, about 10 miles west of Paducah, Kentucky, and 3.5 miles south of the Ohio River (Figure 1). Past operations and

Figure 1. PGDP Location

disposal of waste material resulted in the contamination of the groundwater migrating to the northeast from PGDP (Figure 2). Areas of contaminated groundwater within the Regional Gravel Aquifer (RGA) extend beyond the DOE property boundary on the north and northeast. These areas are referred to as the Northwest and Northeast Plumes, respectively. A portion of the Northwest Plume discharges to Little Bayou Creek, a perennial surface water body located northeast of the DOE property.

1.2 REGULATORY BACKGROUND

PGDP was placed on the National Priorities List in 1994. Pursuant to Section 120 of CERCLA, the PGDP FFA (EPA 1998) was negotiated and implemented to coordinate the CERCLA remedial action and Resource Conservation and Recovery Act (RCRA) corrective action processes into a set of comprehensive requirements for site remediation. Since 1998, DOE, EPA, and KDEP have been operating under the FFA, with DOE as the lead agency and EPA and KDEP as support agencies providing oversight.

In 1995, a decision was made among DOE, EPA, and KDEP to proceed with an IRA for the high TCE concentration Northeast Groundwater Plume. The ROD for this IRA of the Northeast Plume was signed by DOE, EPA, and KDEP in June 1995. The remedy has been effective in achieving hydraulic control and reducing off-site TCE levels in the Northeast Plume and, in combination with existing controls (alternate water supply, monitoring, etc.), remains protective of human health and the environment and continues to comply with federal and state applicable or relevant and appropriate requirements (ARARs) that were identified in the ROD.

1.3 CIRCUMSTANCES CREATING THE NEED FOR AN ESD

The Northeast Plume IRA optimization project is to continue to serve as an interim measure to remove TCE and 1,1-DCE mass and enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility to reduce further migration off-site. This optimization action was initiated in response to recommendations documented in the following documents:

- [2003 CERCLA Five-Year Review \(DOE 2003\) and approval letters \(EPA 2003; KDEP 2003\)](#)
- Sitewide Remedy Review (DOE 2006)
- *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky* (DOE 2007)
- 2008 CERCLA Five-Year Review ([DOE 2009](#)) and approval letters ([EPA 2009](#); [KEEC 2009](#))
- Site Management Plan (DOE 2012)
- 2013 CERCLA Five-Year Review (DOE 2014)
- *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 2015a)

Deleted: h

Deleted: DOE 2009;

Figure 2. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2010)

The cessation of enrichment operations at PGDP by the United States Enrichment Corporation (USEC) in June 2013, resulted in loss of the cooling tower that acted as the air stripper and provided further need to optimize the system with the use of a treatment unit that could air strip the contamination.

The scope of the Northeast Plume optimized project, as documented in this 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 2013), (a revision to this document currently is under development) is consistent with the general findings and recommendations in the documents referenced above and with the identified modifications by the FFA parties as contained in the 2015 MOA for Resolution of formal dispute. Additional specific supporting information from these evaluations is contained in Section 3, Basis for the ESD.

Deleted: a revised version of the

Deleted: 2015b

Deleted: which

Deleted: is

THIS PAGE INTENTIONALLY LEFT BLANK

2. SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

This section provides a brief summary of the site contamination and history along with presenting the selected remedy as originally described in the ROD.

2.1 SITE HISTORY AND CONTAMINATION ASSOCIATED WITH THE NORTHEAST PLUME

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in private wells north of PGDP. The site investigation demonstrated that the principal contaminants of concern in the off-site groundwater are Tc-99, a radionuclide, and TCE, an organic solvent. TCE is a nonflammable, highly volatile, colorless liquid used extensively for removing grease. The PGDP's use of TCE as a degreaser ceased July 1, 1993. Tc-99 is a radionuclide that was introduced at the PGDP through the reprocessing of uranium.

Past handling practices and disposal of waste material resulted in the contamination of the groundwater migrating to the northwest and northeast from PGDP. Over time, dissolved-phase TCE in groundwater in the RGA has spread generally northeastward toward the Ohio River in multiple plumes. In the 1993 time frame, the outer boundary of the Northeast Plume was approximately 1 mile from the northeastern border of the PGDP facility. Concentrations of TCE within the Northeast Plume exceeded 1,000 µg/L in some locations.

Figure 2 illustrates the extent of the Northeast Plume. Figures 3 and 4 compare the TCE plumes between 1994 and 2014 (the latest available plume map). The downgradient limit of the Northeast Plume is in the vicinity of the Ohio River, Tennessee Valley Authority Shawnee Fossil Plant, and Little Bayou Creek.

2.2 INTERIM REMEDIAL ACTION REMEDY APPROVED IN THE ROD

The major components of the selected remedy defined in the ROD (DOE 1995) included the following:

- The contaminated groundwater was to be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 µg/L of TCE). The contaminated groundwater was to be pumped at a rate of approximately 100 gal per minute (gpm) to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may have been modified to optimize the hydraulic containment, by adjusting flow from the EWs (EW331 and EW332), and to support subsequent actions.
- The extracted groundwater was to be collected and piped to a treatment system prior to release to a KPDES-permitted outfall. The treatment facility was to consist of a sand filter for removal of suspended solid materials, and utilization of the PGDP's existing cooling towers for volatilization of contaminated groundwater. The chemicals of concern were TCE and 1,1-DCE.
- Two treatability studies were to be conducted to include (1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater.

EPA and KDEP, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA because the EWs (EW331 and EW332) were designed with an artificial sand pack that serves as a sand

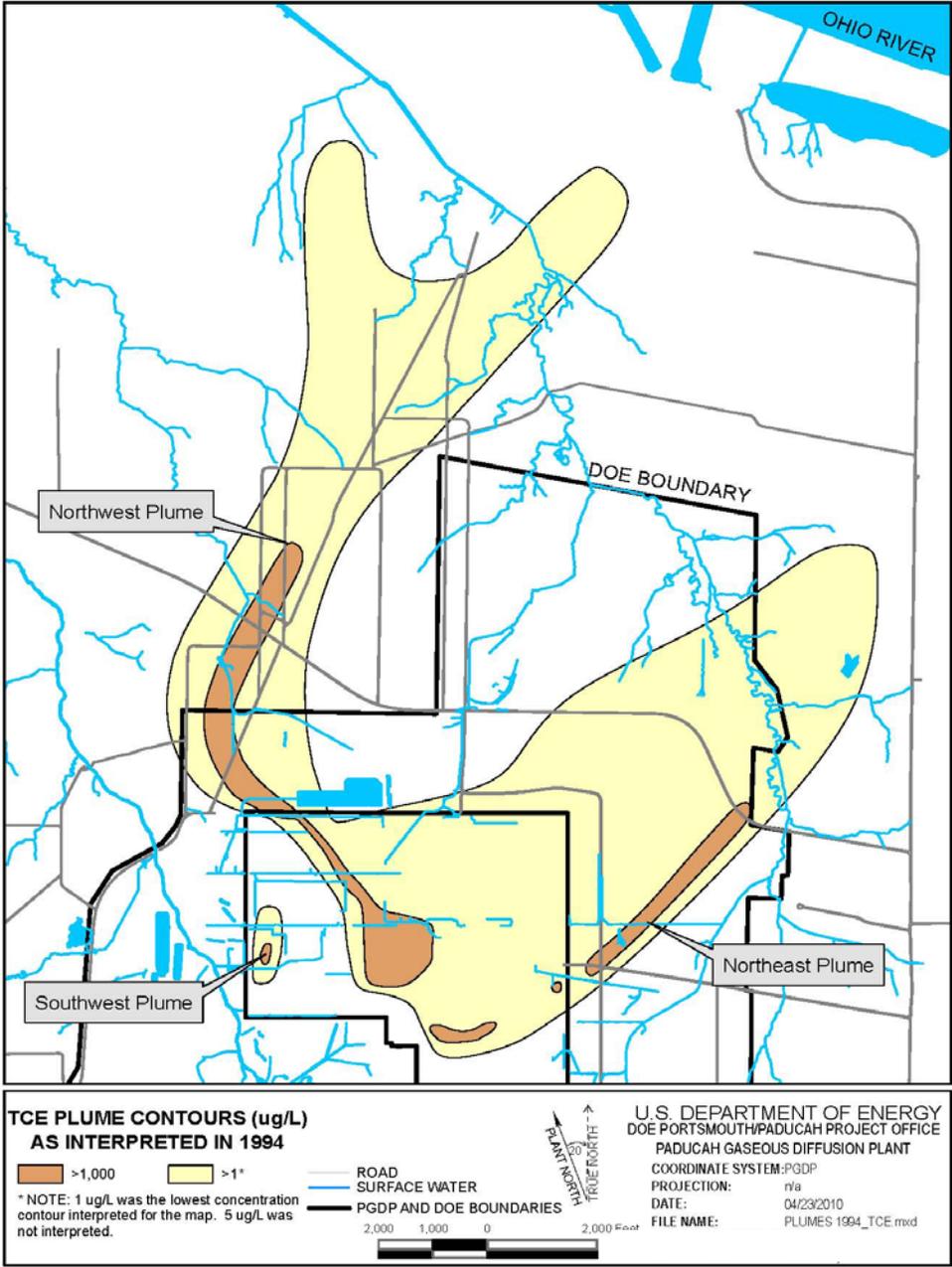


Figure 3. Extent of PGDP TCE Plumes (1994)

Use update and revised figure.

Figure 4. TCE in the Regional Gravel Aquifer in the Vicinity of PGDP (2014)

filter for sediments; thus, the quality of water being discharged from the EWs (EW331 and EW332) would be similar to that of a drinking water well, with the exception of the TCE contamination.

A minor modification to the ROD was written on May 2, 1996, to postpone the treatability studies [(1) photocatalytic oxidation of TCE-contaminated off-gas and (2) *in situ* treatment of TCE-contaminated groundwater].

3. BASIS FOR THE ESD

This section presents information that formed the basis for changes to the remedy. In general, installation of the new optimization wells will reduce off-site groundwater migration of VOCs, in particular TCE, and continue treatment of high concentrations of VOCs in groundwater. Installation of the ATU and creation of the new CERCLA outfall(s) are necessary to provide an alternate treatment/discharge option to the cooling towers that have been shut down.

3.1 INFORMATION SUPPORTING OPTIMIZED REMEDY

Five evaluations have been conducted that support the proposed changes to the Northeast Plume Groundwater System. Summary of the evaluation and relevant findings for these five evaluations are detailed in this section.

3.1.1 Five-Year Reviews for Remedial Actions at the Paducah Gaseous Diffusion Plant

The Northeast Plume IRA optimization project is to serve as an interim measure to remove TCE and 1,1-DCE mass and enhance capture of the Northeast Plume contamination in the vicinity of the eastern edge of PGDP industrial facility and to reduce further migration off-site. This action was initiated in response to recommendations documented in past system evaluations and assessments as follows:

- [2003 CERCLA Five-Year Review \(DOE 2003\) and approval letters \(EPA 2003; KDEP 2003\)](#)
- 2008 CERCLA Five-Year Review ([DOE 2009](#)) and approval letters ([EPA 2009; KEEC 2009](#))
- 2013 CERCLA Five-Year Review (DOE 2014)

Deleted: DOE 2009;

Sitewide Remedy Review (March 2006)

In February and March 2006, DOE Headquarters conducted a Sitewide Remedy Review at PGDP. A report following the assessment was generated and finalized in April, 2006 and was titled, Paducah 2006 Sitewide Remedy Review. The Sitewide Remedy Review report recommended an optimization of the Northeast Plume IRA.

Site Management Plan (February 2012)

Implementation of an optimized IRA was evaluated along with other Groundwater Operable Unit projects relative to site priorities in the approved Site Management Plan (DOE 2012). The prioritization was performed by the FFA managers, with consideration given to the sitewide strategy that includes a series of sequenced activities consisting of source actions and control of off-site groundwater migration followed by a final action for the overall dissolved-phased plume. This evaluation resulted in the optimization of the Northeast Plume IRA being prioritized to further enhance controls to prevent off-site migration prior to implementing final actions for the off-site dissolved-phase plume.

Additionally, cessation of enrichment operations at PGDP resulted in the loss of the use of the cooling tower used in the original operational approach, thus requiring an alternate treatment approach, as of June 2013.

Memorandum of Agreement for Resolution of Formal Dispute (July 2015)

The MOA documents the FFA parties' agreement that an optimization of the existing Northeast Plume Interim Remedial Action (namely relocation of the two EWs upgradient and operation of two treatment units) is warranted to increase TCE mass removal and to enhance control of Northeast Plume migration at the eastern edge of the PGDP industrial facility. The FFA parties reached consensus that the optimized EWs installed under this ESD should not cause or contribute to the undesired migration of Tc-99 contamination from the source area(s) (e.g., C-400 Building and Northwest Plume) and that actions (as further described herein) may be undertaken to prevent any undesirable expansion of Tc-99 and TCE within the Northeast Plume.

3.2 REMEDIAL ACTION WORK PLAN FOR THE NORTHEAST PLUME INTERIM REMEDIAL ACTION OPTIMIZATION

The Remedial Action Work Plan (RAWP) for Optimization of the Northeast Plume IRA (DOE 2013) (a revision to this document currently is under development) will document the design and construction process associated with the optimization process. Detailed information is included concerning the use of the PGDP groundwater model to optimize the locations of the EWs for increased contaminant capture, treatment equipment capabilities, and EW construction, including screen size and locations.

Deleted: (DOE 2015b)
Deleted: s
Deleted: (DOE 2015b)

3.3 ADMINISTRATIVE RECORD INFORMATION SUPPORTING THE NEEDED CHANGE

Information contained in the administrative record that supports the modified remedy is discussed in Section 3.1. As required by 40 *CFR* § 300.825(a)(2), this ESD will be made available to the public by placing it in the Administrative Record file. Contact information for the Administrative Record is as follows:

DOE Environmental Information Center
115 Memorial Drive, Barkley Centre
Paducah, KY 42001
(270) 554-3004
<http://www.paducaheic.com>

Hours of Operation: Monday through Friday
8 A.M.–12:00 P.M.

4. DESCRIPTION OF SIGNIFICANT DIFFERENCES

This section describes the key differences between the remedy in the ROD and the ESD modifications, highlighting scope, cost, and performance along with any changes in expected outcomes when the modifications are implemented.

4.1 SIGNIFICANT DIFFERENCES BETWEEN THE REMEDY AND ESD MODIFICATIONS

Table 1 summarizes the main components of the selected remedy and identifies how the remedy modification impacts these components.

Table 1. Summary of Modifications to the Selected Remedy

Selected Remedy (IRA) in the ROD	Remedy Modification
The contaminated groundwater will be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 µg/L of TCE).	The optimized remedy modifies the location of the EWs to be in the upgradient portion of the high concentration portions of the Northeast Plume as documented in the 2014 Plume Map (see Figure 5) and near the eastern edge of the PGDP industrial facility.
The contaminated groundwater will be pumped at a rate of approximately 100 gpm to initiate hydraulic control without changing groundwater gradients enough to cause adverse effects. During operation, this pumping rate may be modified to optimize the hydraulic containment, by adjusting flow from the EWs, and to support subsequent actions.	The existing IRA allows the pumping rate to be modified. The estimated combined pumping rate is expected to be approximately 300 gpm. Consistent with the MOA for Resolution, “...the modified NE Plume IRA will include installation (at a minimum) of five new RGA monitoring wells in a north-south transect located approximately 600 ft east of the C-400 Building. These transect monitoring wells 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.” Refer to Section 4.2.4 and 4.2.7 of the ESD for additional direction provided from the MOA for Resolution. Additionally, the MOA for Resolution is located at the following link: http://paducaheic.com/Search.aspx?accession=ENV1.A-00934
The extracted groundwater will be collected and piped to a treatment system prior to release to a KPDES-permitted outfall.	Treated groundwater will be discharged through a maximum of two created CERCLA outfall(s).
The treatment facility will consist of a sand filter* for removal of suspended solid materials, and utilization of the PGDP’s existing cooling towers for volatilization of contaminated groundwater. The chemicals of concern are TCE and 1,1-DCE.	The modified remedy will provide an engineered treatment unit, using air stripping, capable of treating TCE and 1,1-DCE in water in the range of expected contaminant concentrations.

Deleted: Install 18 monitoring wells to evaluate performance and effectiveness of the optimized EWs.

Deleted: of

Deleted:

Deleted: , at a minimum, will be located

Deleted: If TCE and/or Tc-99 concentrations in any of the newly constructed transect monitoring wells increase, as described in Section 3 of the MOA for Resolution, then potential changes in groundwater flow or source impacts will be examined further, and the FFA parties will consider adjustments for the optimized Northeast Plume interim action to minimize these potential impacts.

Deleted: or a KPDES outfall

*The EPA and KDEP, in a letter received on April 23, 1996, agreed to remove the sand filter from the IRA because the EWs were designed with an artificial sand pack that serves as a sand filter for sediments. Thus, the quality of water being discharged from the EWs would be similar to that of a drinking water well, with the exception of the TCE contamination.

Figure 5. Locations of New and Preexisting EWs Associated with the Northeast Plume IRA at PGDP

None of the above anticipated changes in Table 1 are considered to be “fundamentally” different from the original selected remedy in the 1995 ROD; however, the creation of up to two CERCLA outfall(s) for discharge of treated groundwater will require identification and inclusion of new ARARs. Under EPA guidance (EPA 1999), these new discharges would be considered to be a “significant” change that should be documented in an ESD. EPA guidance (EPA 1999) states that while the ESD is being prepared and made available to the public, the lead agency may proceed with the predesign, design, construction, or operation activities associated with the remedy.

4.2 EXPECTED OUTCOMES OF THE ESD

The optimization of the Northeast Plume IRA is intended to increase TCE and 1,1-DCE mass removal and enhance control of the Northeast Plume migration at the eastern edge of the PGDP facility. The key components of the optimization are discontinuing the use of the two existing EWs (EW331 and EW332) and replacing those wells with two new EWs (EW234 and EW235) located, as shown in Figure 5, near the eastern edge of the PGDP facility. Groundwater modeling was performed to guide the placement of EWs (EW234 and EW235). The FFA parties will continue to work together to establish completion criteria for operation of the EWs in a manner consistent with requirements set forth in the MOA for Resolution. Additional key components of the optimization include increasing the treatment capacity through installation of two new engineered water treatment units and discharging the treated groundwater through up to two CERCLA outfall(s). The changes being made to the remedial action do not alter the type of treatment technology being deployed (i.e., air stripping), or the reliability or protectiveness of the overall remedy.

Deleted: currently

Deleted: and will continue to be utilized to determine the need for further optimization

Deleted: or a KPDES outfall

4.2.1 Key Design Changes

The Northeast Plume IRA optimization was designed based on the following key changes and assumptions that are different from that documented in the ROD (DOE 1995):

- Northeast Plume EWs (EW234 and EW235) will be located near the eastern edge of PGDP and the existing EWs (EW331 and EW332) will be kept in good working condition until the FFA parties agree the maintenance no longer is necessary.
- Consistent with the MOA for Resolution, “...the modified NE Plume IRA will include installation (at a minimum) of five new RGA monitoring wells in a north-south transect located approximately 600 ft east of C-400 Building. These transect monitoring wells 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.” Refer to Section 4.2.4 and 4.2.7 of the ESD for additional direction provided from the MOA for Resolution. Additionally, the MOA for Resolution is located at the following link: <http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.
- Use of the PGDP cooling towers for stripping TCE and 1,1-DCE has been discontinued and was replaced with engineered water treatment unit(s) that utilize air stripping (shallow tray air stripper) for TCE and 1,1-DCE contamination.
- Treated VOC-contaminated groundwater discharge will be through a maximum of two CERCLA designated outfalls. The receiving water body is the Little Bayou Creek, which carries a Kentucky use classification of Recreational.
- A new electrical power connection will be installed for the treatment units and EWs (EW234 and EW235).

Deleted: Install 18 monitoring wells to evaluate performance and effectiveness of the optimized EWs. Consistent with the MOA for Resolution,

Deleted: the

Deleted: five of these monitoring wells, at a minimum, will be located in a north-south transect located approximately 600 ft east of the C-400 Building. These transect monitoring wells 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 requires quarterly sampling of the transect monitoring wells and describes actions that may be taken by the FFA parties based upon transect monitoring well sampling results.

Deleted: or a KPDES outfall

4.2.2 Key Design Assumptions

The Northeast Plume IRA optimization was designed based on keeping the existing EWs (EW331 and EW332), to the extent required by Section 4 of the MOA for Resolution, in good working condition until the FFA parties agree the maintenance no longer is necessary. The optimized Northeast Plume EW field volumetric flow rate is limited not by the engineered treatment plant capacity (approximately 200 gpm per unit) but by EW yield.

4.2.3 Well Field Design

Well field optimization modeling indicates that a two-well configuration is optimal. The two new wells, EW234 and EW235 are to be located near the eastern edge of the PGDP facility. Refer to Figure 5 for well locations. The EWs (EW234 and EW235) are expected to have an operational flow rate of approximately 150 gpm each. Detailed lithologic logs and grain size analysis to the extent available will be used in well screen and filter pack design of the new EWs (EW234 and EW235). Once the two optimized EWs are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well's quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples' showing an increase, then potential changes in groundwater flow or source impacts (e.g., rising contaminant concentrations in the Northeast Plume, source migration, etc.) will be examined further. The FFA parties will consider adjustments (e.g., adjusting EW pumping rates) for the optimized Northeast Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

Deleted: based in part on groundwater modeling.

4.2.4 Baseline Monitoring

The MOA states the following:

The transect monitoring wells will be monitored for 4 consecutive quarters to establish baseline contaminant concentrations before the two newly relocated extraction wells begin operation. The anticipated contaminant concentrations of Tc-99 and TCE in the transect monitoring wells are expected to be no higher than 200 pCi/L and 600 ug/L, respectively. If baseline contaminant concentrations in any of the transect monitoring wells during the initial quarterly sampling are detected at twice the anticipated contaminant concentrations, then the FFA parties agree to temporarily suspend start-up of the extraction wells until the parties meet to evaluate the identified discrepancy, its potential impact on the NW Plume source actions and the planned NE Plume optimization project. The FFA parties will conduct an evaluation of the planned action and develop recommendations and a schedule for modifications of the optimized action to address the unanticipated contaminant concentrations. In the event the FFA parties decide that significant changes to the scope of the action under the ESD are necessary to continue with the optimization, then DOE shall continue implementing the current NE Plume Interim Remedial Action (Interim ROD 1995) and shall propose modification to the Interim Remedial Action through another ESD and RAWP Addendum. The PGDP Site Management Plan will be updated to reflect establishment of any enforceable milestones under the FFA such as due dates for the aforementioned Primary documents (DOE 2015).

4.2.5 Construction

Construction of the optimization project will be performed consistent with the RAWP and certified for construction remedial design drawings and specifications.

Deleted: The transect monitoring wells will be monitored for four consecutive quarters to establish baseline contaminant concentrations before the two newly relocated EWs begin operation.¶

4.2.6 Start-up and Testing

The Northeast Plume optimized IRA system will undergo start-up and integrated testing consistent with quality requirements contained in the approved RAWP and certified for construction remedial design drawings and specifications. Additionally, start-up and testing of the optimized IRA system will be contingent upon baseline monitoring results and requirements as documented in Section 2 of the MOA for Resolution.

4.2.7 Operation and Maintenance

A revised operation and maintenance plan to include optimized IRA operations will be submitted and approved before the two newly relocated EWs begin operation. Following successful completion of construction and start-up and integrated testing of facilities of the Northeast Plume, optimized IRA operations will be initiated consistent with a revised and approved operation and maintenance plan. The MOA for Resolution states the following:

Deleted: extraction wells

Deleted: and contingent upon the results of baseline and ongoing monitoring activities described in Sections 2 through 4 of the MOA for Resolution,

Deleted: the

Deleted: “

Once the two optimized extraction wells are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well's quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples showing an increase, then potential changes in groundwater flow or source impacts (e.g. rising contaminant concentrations in the NE Plume, source migration, etc.) will be further examined and the FFA parties will consider adjustments (e.g. adjusting extraction well pumping rates) for the optimized NE Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

If the measures taken by the FFA parties (e.g. adjusting extraction well pumping rates) do not result in decreased or stabilized concentrations at the transect monitoring wells, or if such adjustments reduce the effectiveness of the optimized extraction wells or if Tc-99 concentrations continue to increase and are detected at twice their baseline concentration in any one (or more) of the transect wells for two consecutive quarters, then DOE must notify EPA and KDEP within 30 days of receiving sampling results or one of the other aforementioned conditions occurring. After EPA and KDEP have been notified, the FFA parties will discuss and evaluate options to address continued increase of groundwater concentrations and plume expansion. Within 1 year from the notification, DOE shall submit an ESD and RAWP Addendum as the Primary documents to undertake modification to the existing CERCLA Interim Remedial Action pursuant to the FFA to address the contaminated groundwater plume expansion and to prevent Tc-99 at levels above the MCL from further being pulled within the NE Plume.

The FFA parties will discuss whether to temporarily suspend operation of one or both of the extraction wells while determining the modifications to the CERCLA Interim Remedial Action to prevent further plume expansion. If FFA parties decide to implement a modification to the Interim Remedial Action to address the NE Plume contamination (including the expansion), then depending on the scope of the modification it is possible

that the FFA parties will decide to shut down the optimized pump and treat system in part or in its entirety. If a determination is made to shut down the optimized pump and treat system either before a modification to the Interim Remedial Action or as part of a modification to the Interim Action, then DOE shall reinstate implementation of the NE Plume Interim Remedial Action (Interim ROD 1995). DOE shall keep the extraction wells associated with the NE Plume Interim Remedial Action in good working condition until the FFA parties agree the maintenance is no longer necessary (DOE 2015).

Deleted: "

The optimized Northeast Plume system will continue operating until one the following occurs:

- The FFA parties mutually agree to cease operations,
- The FFA parties decide to implement a modification to the IRA to address the Northeast Plume contamination (including contaminated groundwater plume expansion) and to prevent Tc-99 at levels above the MCL from being pulled further within the Northeast Plume,
- A CERCLA Five-Year Review determination supports ceasing operations, or
- The ROD associated with the Dissolved-Phase Plume supports ceasing operations.

4.2.8 Remedial Action Work Plan

A revised, RAWP currently is under development for the implementation of the remedy modifications based on the above assumptions and expected outcomes. The RAWP includes an overview of the optimization modeling, system design and construction, start-up and testing, operations and maintenance requirements, and plans for environmental compliance, waste management, worker health and safety, quality assurance, and data management.

Deleted: n

Deleted: was

Deleted: ed

5. SUPPORT AGENCY CONCURRENCE

KDEP and EPA have evaluated the information contained in the Administrative Record for this IRA. ~~EPA approves, and the Commonwealth of Kentucky concurs~~ that the information supports the need for the modification to the remedy, and both agencies concur with the revised remedy selected in this ESD.

Deleted: and concur

Deleted: via

Deleted: al

Deleted: ,

Deleted: rence,

Deleted:

THIS PAGE INTENTIONALLY LEFT BLANK

6. STATUTORY DETERMINATIONS

The modified interim remedy will increase TCE and 1,1-DCE mass removal and enhance control of Northeast Plume migration at the eastern edge of the PGDP industrial facility. As such, the modified interim remedy, meets the threshold criteria of CERCLA Section 121 and the NCP. The planned changes presented in the ESD will not impact the protectiveness of the IRA. As recognized in the ROD, successful control of the plume, in combination with existing controls (alternate water supply, monitoring, etc.), ensures protection during the period of the interim response. The modified interim remedy continues to be protective of human health and the environment and complies with ARARs presented in the ROD, as supplemented and modified by the ARARs provided in Table 2. As part of this modification, however, ARARs included in the ROD pertaining to discharge through a KPDES-permitted outfall are being supplemented with ARARs to allow the utilization of up to two CERCLA outfall(s) for treated water discharge, as defined by Table 2 of this ESD. The ARARs address requirements necessary to ensure the protection of the waters of the Commonwealth for the discharge of effluent through up to two CERCLA outfall(s). ~~Based on the ARARs contained in Table 2, the outfall discharge criteria contained in Table 3 will serve as the criteria and effluent limits for discharge to the new CERCLA outfalls.~~

Deleted: or KPDES outfall

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

Most of the contaminated groundwater extracted for treatment exceeds this site-specific health-based level; thus, it must be managed as RCRA listed hazardous waste. Consequently, certain solid wastes generated from treatment units that treat groundwater containing TCE above 30 ppb are considered RCRA hazardous waste due to the derived-from rule at 40 *CFR* § 261.3(c) and (d) (401 *KAR* 31:010 § 3). The treated groundwater that is discharged into the receiving surface water body (e.g., Little Bayou

Moved down [1]: Kentucky water quality standards identified as ARARs and will be below the 30 ppb TCE. Pursuant to 40 *CFR* § 261.4(a)(2) (401 KAR 31:010 § 4), point source discharges are excluded from regulation as a hazardous wastes. The exclusion applies only to the actual point source discharge and does not exclude

Section Break (Next Page)

Table 2. Additional Applicable or Relevant and Appropriate Requirements

Action	Requirements	Prerequisite	Citation
General duty to mitigate for discharge of wastewater from ground water treatment system	Take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of effluent standards which has a reasonable likelihood of adversely affecting human health or the environment.	Discharge of pollutants to surface waters— applicable .	401 KAR 5:065 § 2(1) and 40 <i>CFR</i> § 122.41(d)
Operation and maintenance of treatment system	Properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used to achieve compliance with the effluent standards. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures.	Discharge of pollutants to surface waters— applicable .	401 KAR 5:065 § 2(1) and 40 <i>CFR</i> § 122.41(e)
Technology-based requirements for wastewater discharge	To the extent that EPA promulgated effluent limitations are inapplicable, shall develop on a case-by-case Best Professional Judgment basis under § 402(a)(1)(B) of the Clean Water Act (CWA), technology based effluent limitations by applying the factors listed in 40 <i>CFR</i> § 125.3(d) and shall consider: <ul style="list-style-type: none"> • The appropriate technology for this category or class of point sources, based upon all available information; and • Any unique factors relating to the discharger. 	Discharge of pollutants to surface waters from other than a publicly owned treatment works— applicable .	40 <i>CFR</i> § 125.3(c)(2)
Water quality-based effluent limits for wastewater discharge	Must develop water quality based effluent limits that ensure that: <ul style="list-style-type: none"> • The level of water quality to be achieved by limits on point source(s) established under this paragraph is derived from, and complies with all applicable water quality standards; and • Effluent limits developed to protect narrative or numeric water quality criteria are consistent with the assumptions and any available waste load allocation for the discharge prepared by the State and approved by EPA pursuant to 40 <i>CFR</i> § 130.7. 	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a State water quality standard established under § 303 of the CWA— applicable .	40 <i>CFR</i> § 122.44(d)(1)(vii)

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Water quality-based effluent limits for wastewater discharge (continued)	Must attain or maintain a specified water quality through water quality related effluent limits established under § 302 of the CWA.	Discharge of pollutants to surface waters that causes, or has reasonable potential to cause, or contributes to an instream excursion above a narrative or numeric criteria within a state water quality standard— applicable .	40 <i>CFR</i> § 122.44(d)(2)
Monitoring requirements for groundwater treatment system discharges	<p>The numeric water quality criteria for fish consumption specified in Table 1 of 401 KAR 10:031 Section 6(1) provides allowable instream concentrations of pollutants that may be found in surface waters or discharged into surface waters.</p> <p>In addition to 40 <i>CFR</i> §122.48(a) and (b) and to assure compliance with effluent limitations, one must monitor, as provided in subsections (i) thru (iv) of 122.44(i)(1).</p> <p><i>NOTE: Monitoring parameters, including frequency of sampling, will be developed as part of the CERCLA process and included in a Remedial Design, RAWP, or other appropriate FFA CERCLA document.</i></p> <p>All effluent limitations, standards and prohibitions shall be established for each outfall or discharge point, except as provided under § 122.44(k).</p> <p>All effluent limitations, standards and prohibitions, including those necessary to achieve water quality standards, shall unless impracticable be stated as: Maximum daily and average monthly discharge limitations for all discharges.</p> <p>The relevant requirements provided in 401 KAR 10:029 § 4 shall apply to a mixing zone for a discharge of pollutants. <i>NOTE: Determination of the appropriate mixing zone will, if necessary, be documented in the CERCLA remedial design or other appropriate CERCLA document.</i></p>	Discharge of pollutants to surface waters— applicable .	401 KAR 10:031 § 6(1) 40 <i>CFR</i> § 122.44(i)(1) 401 KAR § 5:065 2(4)
			40 <i>CFR</i> § 122.45(a) 401 KAR § 5:065 2(5)
Mixing zone for discharge of pollutants		Continuous discharge of pollutants to surface waters— applicable .	40 <i>CFR</i> § 122.45(d)(1) 401 KAR § 5:065 2(5)
		Discharge of pollutants to surface waters— applicable .	401 KAR 10:029 § 4

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
<p>Minimum criteria applicable to all surface waters</p>	<p>Surface waters shall not be aesthetically or otherwise degraded by substances that:</p> <ul style="list-style-type: none"> • Settle to form objectionable deposits; • Float as debris, scum, oil, or other matter to form a nuisance; • Produce objectionable color, odor, taste, or turbidity; • Injure, are chronically or acutely toxic to or produce adverse physiological or behavioral responses in humans, animals, fish, and other aquatic life; • Produce undesirable aquatic life or result in the dominance of nuisance species; <ol style="list-style-type: none"> 1. Cause fish flesh tainting. 2. The concentration of phenol shall not exceed 300 mg/L as an instream value. 	<p>Discharge of pollutants to surface waters—applicable.</p>	<p>401 KAR 10:031 § 2(1)(a-f)</p>
	<p>The water quality criteria for the protection of human health related to fish consumption in Table 1 of 401 KAR 10:031 § 6 are applicable to all surface water at the edge of assigned mixing zone except for those points where water is withdrawn for domestic water supply use.</p> <p>(a) The criteria are established to protect human health from the consumption of fish tissue and shall not be exceeded.</p> <p>(b) For those substances associated with a cancer risk, an acceptable risk level of not more than one (1) additional cancer case in a population of 1,000,000 people, (or 1×10^{-6}) shall be utilized to establish the allowable concentration.</p>		<p>401 KAR 10:031 § 2(2)(a) and (b)</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
<p>Criteria for surface water designated as warm water aquatic life habitat</p>	<p>The following parameters and associated criteria shall apply for the protection of productive warm water aquatic communities, fowl, animal wildlife, arborous growth, agricultural, and industrial uses:</p> <ul style="list-style-type: none"> • Natural alkalinity as CaCO₃ shall not be reduced by more than 25 percent; • pH shall not be less than 6.0 nor more than 9.0 and shall not fluctuate more than 1.0 pH units over a period of 24 hours; • Flow shall not be altered to a degree that will adversely affect the aquatic community; • Temperature shall not exceed 31.7°C (89°F); • Dissolved oxygen shall be maintained at a minimum concentration of 5.0 mg/L as a 24 hour average; instantaneous minimum shall not be less than 4.0 mg/L; • Total dissolved solids or specific conductance shall not be changed to the extent that the indigenous aquatic community is adversely affected; • Total suspended solids shall not be changed to the extent that the indigenous aquatic community is adversely affected; • Addition of settleable solids that may alter the stream bottom so as to adversely affect productive aquatic communities shall be prohibited; • Concentration of the un-ionized ammonia shall not be greater than 0.05 mg/L at any time instream after mixing; <p>Instream concentrations for total residual chlorine shall not exceed an acute criteria value of 19 µg/L or a chronic criteria value of 11 µg/L.</p>	<p>Discharge of pollutants to surface waters designated as warm water aquatic life habitat—applicable.</p>	<p>401 KAR 10:031 § 4(1)(a)-(i) and (k)</p>
	<p>The allowable instream concentration of toxic substances, or whole effluents containing toxic substances, which are noncumulative or nonpersistent with a half-life of less than 96 hours, shall not exceed:</p> <ol style="list-style-type: none"> a. 0.1 of the 96 hour median LC₅₀ of representative indigenous or indicator aquatic organisms; or b. A chronic toxicity unit of 1.00 utilizing the 25 percent inhibition concentration, or LC₂₅. 	<p>Discharge of toxic pollutants to surface waters designated as warm water aquatic life habitat—applicable.</p>	<p>401 KAR 10:031 § 4(1)(j)(1)</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Criteria for surface water designated as warm water aquatic life habitat (continued)	<p>The allowable instream concentration of toxic substances, or whole effluents containing toxic substances, which are bioaccumulative or persistent, including pesticides, if not otherwise regulated, shall not exceed:</p> <ul style="list-style-type: none"> a. 0.01 of the 96 hour median LC₅₀ of representative indigenous or indicator aquatic organisms; or b. A chronic toxicity unit of 1.00 utilizing the LC₃⁵. <p>In the absence of acute criteria for pollutants listed in Table 1 of 401 KAR 10:031 § 6, for other substances known to be toxic but not listed in this regulation, or for whole effluents that are acutely toxic, the allowable instream concentration shall not exceed the LC₁ or 1/3 LC₅₀ concentration derived from toxicity tests on representative indigenous or indicator aquatic organisms or exceed 0.3 acute toxicity units.</p> <p>If specific factors have been determined for a toxic substance or whole effluent such as an acute to chronic ratio or water effect ratio, they may be used instead of the 0.1 and 0.01 factors upon demonstration that such factors are scientifically defensible. <i>NOTE: Demonstration that such factors are scientifically defensible will be reflected in the appropriate CERCLA document.</i></p> <p>If a discharge causes, has the reasonable potential to cause, or contribute to an in-stream excursion above the numeric criterion for whole effluent toxicity using the procedures in paragraph (d)(1)(ii), develop effluent limits for whole effluent toxicity.</p>		401 KAR 10:031 § 4(1)(j)(2)
			401 KAR 10:031 § 4(1)(j)(3)
			401 KAR 10:031 § 4(1)(j)(4)
		Discharge of wastewater causes, has the reasonable potential to cause, or contributes to an in-stream excursion above the numeric criterion for whole effluent toxicity— applicable .	40 CFR § 122.44(d)(1)(iv)

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Characterization of industrial wastewater	<p>Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act, as amended, are not solid wastes for the purpose of hazardous waste management.</p> <p>[Comment: This exclusion applies only to the actual point source discharge. It does not exclude industrial wastewaters while they are being collected, stored or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.]</p> <p><i>NOTE: For purpose of this exclusion, the CERCLA on-site treatment system will be considered equivalent to a wastewater treatment unit and the point source discharges subject to regulation under CWA Section 402, provided the effluent meets all identified CWA ARARs.</i></p>	<p>Generation of industrial wastewater for treatment and discharge into surface water—applicable.</p>	<p>40 <i>CFR</i> § 261.4(a)(2) 401 <i>KAR</i> 31:010 § 4</p>
Transport or conveyance of collected RCRA wastewater to a treatment unit located on the facility	<p>All tank systems, conveyance systems, and ancillary equipment used to treat, store, or convey wastewater to an on-site wastewater treatment facility are exempt from the requirements of RCRA Subtitle C standards.</p> <p><i>NOTE: For purposes of this exclusion, any dedicated tank systems, conveyance systems, and ancillary equipment used to treat, store or convey CERCLA remediation wastewater to a CERCLA on-site wastewater treatment unit that meets all of the identified CWA ARARs for point source discharges from such a facility, are exempt from the requirements of RCRA Subtitle C standards.</i></p>	<p>On-site wastewater treatment units (as defined in 40 <i>CFR</i> § 260.10) subject to regulation under § 402 or § 307(b) of the CWA (i.e., KPDES-permitted) that manages hazardous wastewaters—applicable.</p>	<p>40 <i>CFR</i> § 264.1(g)(6) 401 <i>KAR</i> 34:010 § 1</p>
Activities causing toxic substances or potentially hazardous matter emissions	<p>Persons responsible for a source from which hazardous matter or toxic substances may be emitted shall provide the utmost care and consideration in the handling of these materials to the potentially harmful effects of the emissions resulting from such activities. No owner or operator shall allow any affected facility to emit potentially hazardous matter or toxic substances in such quantities or duration as to be harmful to the health and welfare of humans, animals and plants.</p>	<p>Emissions of potentially hazardous matter or toxic substances as defined in 401 <i>KAR</i> 63:020 § 2 (2)—applicable.</p>	<p>401 <i>KAR</i> 63:020 § 2</p>

Table 2. Additional Applicable or Relevant and Appropriate Requirements (Continued)

Action	Requirements	Prerequisite	Citation
Activities causing radionuclide emissions	Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	Radionuclide emissions from point sources at a DOE facility— applicable .	40 <i>CFR</i> § 61.92 401 <i>KAR</i> 57-002
General standards for process vents used in treatment of VOC contaminated groundwater	<p>For each affected process vent, except as exempted under 40 <i>CFR</i> § 63.7885(c), must meet one of the options in paragraphs (b)(1) through (b)(3) of this section.</p> <ul style="list-style-type: none"> • Control HAP emissions from the affected process vents according to the applicable standards specified in § 63.7890 through 63.7893. • You determine for the remediation material treated or managed by the process vent through the affected process vents that the average total VOHAP [volatile organic hazardous air pollutant] concentration, as defined in Section 63.7957, of this material is less than 10 ppmw. Determination of the VOHAP concentration is made using the process specified in Section 63.7943. • If the process vent is also subject to another subpart under 40 <i>CFR</i> part 61 or part 63, you control emissions of the HAP listed in Table 1 of this subpart from the affected process vent in compliance with the standards specified in the applicable subpart. This means you are complying with all applicable emissions limitations and work practice standards under the other subpart (e.g., you install and operate the required air pollution controls or have implemented the required work practice to reduce HAP emissions to levels specified by the applicable subpart). This provision does not apply to any exemption of the affected source from the emission practice standards allowed by the other applicable SUBPART. <p><i>NOTE: Any determination of the VOHAP concentration of the remediation material can be based on knowledge of the material. Based on existing data it is expected that the VOHAP concentration of the NE Plume groundwater is less than 10 ppmw. Historical data from the locations near the proposed new well locations shows the highest anticipated concentration of TCE in the groundwater is less than 1 ppmw</i></p>	<p>Process vents as defined in 40 <i>CFR</i> § 63.7957 used in site remediation of media (e.g., soil and groundwater) that could emit hazardous air pollutants (HAP) listed in Table 1 of Subpart GGGGG of Part 63—relevant and appropriate.</p>	<p>40 <i>CFR</i> § 63.7885(b)(1)–(3)</p> <p>401 <i>KAR</i> 63-002 § 1 and 2, except for 40 <i>CFR</i> § 63.72 as incorporated in § 2(3)</p>

Table 3. Outfall Discharge Criteria

Effluent Parameter/Characteristic	Discharge Limitations			Initial Monitoring Frequency*
	Yearly Average	Monthly Average	Daily Maximum	
Flow (mgd)	N/A	Monitor Only	Monitor Only	Weekly
Total suspended solids (mg/L)	N/A	30	60	Weekly
Oil and grease (mg/L)	N/A	10	15	Weekly
Total residual chlorine (mg/L)	N/A	0.011	0.019	Weekly
Temperature (°F)	N/A	N/A	89	Weekly
Trichloroethene (µg/L)	N/A	30	N/A	Weekly
Chronic toxicity (TU _c)	N/A	N/A	1.00	Quarterly
Technetium-99 (µCi/ml)	N/A	N/A	N/A	Quarterly
pH	N/A	6 (min)	9	Weekly
1,1-Dichloroethene (µg/l)	N/A	7,100	N/A	Weekly

*Initial Monitoring Frequency based upon KPDES Permit KY0004049 at the time of the ESD; these monitoring frequencies may be adjusted in the operation and maintenance plan.

Creek) through the CERCLA outfalls will comply with identified Clean Water Act and Kentucky water quality standards identified as ARARs and will be below the 30 ppb TCE. Pursuant to 40 CFR § 261.4(a)(2) (401 KAR 31:010 § 4), point source discharges are excluded from regulation as a hazardous wastes. The exclusion applies only to the actual point source discharge and does not exclude industrial wastewaters while they are collected, stored, treated before the discharge, nor does it exclude sludge that is generated by industrial wastewater treatment.

Deleted: or KPDES outfall

Moved (insertion) [1]

The modified interim remedy also changes the air emission point location and characteristics that affect the air distribution of TCE. As a result, the project consulted with the Kentucky Division for Air Quality (KDAQ). KDAQ requested the project comply with the substantive requirements of 401 KAR 63:020; consequently, 401 KAR 63:022 is being replaced with 401 KAR 63:020 § 3. Air dispersion analysis demonstrates that the anticipated TCE airborne emissions would not be harmful to the health and welfare of humans, animals, and plants. The analysis is included as an appendix to this ESD.

The revised remedy is cost-effective and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

THIS PAGE INTENTIONALLY LEFT BLANK

7. PUBLIC PARTICIPATION REQUIREMENTS

Community involvement is a critical aspect of the cleanup process at PGDP. The DOE encourages the public to review this ESD. As required by 40 *CFR* § 300.435(c)(2)(i), a Notice Availability and brief description of this ESD will be published in the local newspaper announcing the availability of the ESD for review in the Administrative Record file and information repository, as required by the NCP [40 *CFR* § 300.435(c)(2)(i)(A) and 300.825(a)(2)]. The Administrative Record file that contains the ROD and the CERCLA Five-Year Reviews and other associated documentation is available for review at the following:

Deleted: (

Deleted:)

DOE Environmental Information Center
115 Memorial Drive, Barkley Centre
Paducah, KY 42001
(270) 554-3004
<http://www.paducaheic.com>

Hours of Operation: Monday through Friday
8 A.M.–12:00 P.M.

THIS PAGE INTENTIONALLY LEFT BLANK

8. APPROVALS

*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

Deleted: R1

November 2015

Deleted: August

APPROVAL

William E. Murphie, Manager
Portsmouth/Paducah Project Office
U.S. Department of Energy

Date

Franklin E. Hill, Director
Superfund Division
U.S. Environmental Protection Agency—Region 4

Date

CONCURRENCE

Tony Hatton, Director
Division of Waste Management
Kentucky Department for Environmental Protection

Date

Deleted: With Concurrence by

THIS PAGE INTENTIONALLY LEFT BLANK

9. REFERENCES

- DOE (U.S. Department of Energy) 1995. *Record of Decision for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1356&D2, U.S. Department of Energy, Paducah, KY, June.
- DOE 2003. *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2067&D2, U.S. Department of Energy, Paducah, KY, October.
- DOE 2006. *Paducah 2006 Sitewide Remedy Review*, Office of Environmental Management, Office of Engineering Technical Expertise Project 610, U.S. Department of Energy, April 13.
- DOE 2007. *Review Report: Groundwater Remedial System Performance Optimization at PGDP, Paducah, Kentucky*, prepared for Office of Groundwater and Soil Remediation and Office of Engineering and Technology, U.S. Department of Energy, May 24.
- DOE 2009. *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0117&D2, U.S. Department of Energy, Paducah, KY, May.
- DOE 2012. *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, Annual Revision—FY 2012, DOE/LX/07-1264&D2, U.S. Department of Energy, Paducah, KY, February.
- DOE 2013. 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, U.S. Department of Energy, Paducah, KY, August.
- DOE 2014. *Five-Year Review for Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1, Secondary Document, U.S. Department of Energy, Paducah, KY, May.
- DOE 2015. *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*, U.S. Department of Energy, Paducah, KY, July.
- EPA (U.S. Environmental Protection Agency) 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707, U.S. Environmental Protection Agency, Atlanta, GA, February.
- EPA 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents*, EPA 540-R-98-031, Office of Solid Waste and Emergency Response, Washington, DC, July.

Deleted: DOE 2013b. *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/R3, U.S. Department of Energy, Paducah, KY, May.

Deleted: a

Deleted: DOE 2015b. *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, U.S. Department of Energy, Paducah, KY, August.

EPA 2003. Winston A. Smith, Director, Waste Management Division, U.S. Environmental Protection Agency, Atlanta, GA, letter to William E. Murphie, Manager, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, and Glenn E. VanSickle, Paducah Manager of Projects, Bechtel Jacobs Company LLC, Kevil, KY, approval of the "Five-Year Review for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-2067&D2), December 30.

EPA 2009. Franklin E. Hill, Director, Superfund Division, Sam Nunn Federal Center, Atlanta, GA, letter to William Murphie, Director Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah Site Office, Paducah, KY, "Approval of the 2008 CERCLA Five-Year Review for the Paducah Gaseous Diffusion Plant (DOE/LX/07-0117&D2)," June 4.

KDEP 2003. Michael V. Welch, P.E., Manager Hazardous Waste Branch, Kentucky Natural Resources and Environmental Protection Cabinet, Kentucky Department for Environmental Protection, Frankfort, KY, to William E. Murphie, Manager, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, and Gordon L. Dover, Plant Manager, Bechtel Jacobs Company LLC, Kevil, KY, approval of the "Five-Year Review for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/07-2067&D2). McCracken County, Kentucky, KY8-890-008-982." November 14.

KEEC (Kentucky Energy and Environment Cabinet) 2009. April J. Webb, P.E., Manager, Hazardous Waste Branch, Kentucky Energy and Environment Cabinet, Frankfort, KY, letter to Reinhard Knerr, Paducah Site Lead, Portsmouth/Paducah Project Office, U.S. Department of Energy, Paducah, KY, approval of the "Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant (DOE/LX/07-0117&D2)," March 30.

APPENDIX
AIR DISPERSION ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX
AIR DISPERSION ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

A.1. INTRODUCTION

As a result of cessation of uranium enrichment operations at Paducah Gaseous Diffusion Plant (PGDP), the use of the C-637 Cooling Towers as an air stripper facility for trichloroethene (TCE)-contaminated groundwater ~~was discontinued~~ for this interim remedial action (IRA). ~~Since PGDP ceased operations and until completion of the Northeast Plume IRA optimization project, one Northeast Plume treatment unit (TU), located near the planned location for EW234, will be used temporarily to continue treatment of groundwater from the two existing Northeast Plume extraction wells (EW331 and EW332) until EW234 and EW235 begin operation. The TU systems include a skid-mounted treatment system consisting of a high efficiency air stripper, air blower, effluent pump, influent bag filters, and process control system all enclosed in a heated weatherproof enclosure. In addition, the EW234 TU includes a tie-in point to the existing Northeast Plume IRA EWs. Two separate TUs will be used to treat extracted water from each new EW; one TU for EW234 and one TU for EW235, and will be located in the same general area as the new extraction wells.~~

Deleted: the

Deleted: expected

Deleted: will be

Deleted: After

Deleted: s

Deleted: prior to

Deleted: will

Deleted: , at minimum,

Deleted: will

This appendix describes the air dispersion analysis of potential hazardous air pollutant (HAP) and/or toxic air pollutant (TAP) emissions after implementation of the Northeast Plume IRA Optimization project is complete, and EW234 and EW235 have begun operation. The property boundary concentrations for potential HAP/TAP emissions were estimated using BREEZE AERMOD version 7.7.1. The results of the dispersion analysis are summarized herein.

A.1.1 AIR DISPERSION MODEL SELECTION

The BREEZE AERMOD version 7.7.1 program was used to conduct air dispersion modeling using the latest version (12345) of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) to estimate maximum ground-level concentrations. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

A.1.2 MODELING RECEPTOR GRIDS

Ground-level concentrations were calculated within one Cartesian receptor grid and at receptors placed along the property line (property line). The property line grid receptors were spaced at a maximum of approximately 50 m apart. The Cartesian receptor grid extending out a minimum of 600 meters beyond the property line was spaced at 200-m intervals in all directions. The Cartesian receptor grid was generated to ensure concentrations were decreasing away from the property line. All resultant maximum concentrations occur well within this distance.

A.1.3 TERRAIN

AERMOD uses advanced terrain characterization to account for the effects of terrain features on plume dispersion and travel. AERMOD's terrain pre-processor, AERMAP (latest version 11103), imports digital terrain data and computes a height scale for each receptor from National Elevation Dataset (NED) data files. A height scale is assigned to each individual receptor and is used by AERMOD to determine whether the plume will go over or around a hill.

The modeled receptor terrain elevations input into AERMAP are the highest elevations extracted from United States Geological Survey (USGS) 1:24,000 scale (7.5-minute series) NED data for the area surrounding PGDP. For each modeled receptor, the maximum possible elevation within a box centered on the receptor of concern and extending halfway to each adjacent modeled receptor was chosen. This is a conservative technique for estimating terrain elevations by ensuring that the highest terrain elevations are accounted for in the analysis. HAP/TAP emission concentrations were calculated at all receptors.

A.1.4 BUILDING DOWNWASH ANALYSIS

The emission units were evaluated in terms of their proximity to nearby structures.¹ The purpose of this evaluation was to determine if stack discharge might become caught in the turbulent wakes of these structures leading to downwash of the plume. Wind blowing around a building creates zones of turbulence that are greater than if the building were absent. The current version of the AERMOD dispersion model treats building wake effects following the algorithms developed by Schulman and Scire.² This approach requires the use of wind direction-specific building dimensions for structures located within 5L of a stack, where L is the lesser of the height or projected width of a nearby structure. Stacks taller than the structure height plus 1.5L are not subject to the effects of downwash in the AERMOD model.

The current version of the AERMOD dispersion model considers the trajectory of the plume near a building and uses the position of the plume relative to the building to calculate interaction with the building wake. The direction-specific building dimensions used as inputs to the AERMOD model were calculated using the Building Profile Input Program Plume Rise Model Enhancement (BPIP PRIME), version 04274.³ BPIP PRIME calculates fields of turbulence intensity, wind speed, and the slopes of the mean streamlines as a function of the projected building dimensions. BPIP PRIME is authorized by the U.S. Environmental Protection Agency (EPA) and is designed to incorporate the concepts and procedures expressed in the good engineering practice (GEP) technical support document,⁴ the building downwash guidance document, and other related documents.

BPIP PRIME results indicate the stack height of each emission unit is greater than the GEP stack height; therefore, building downwash is not a concern. Each building processed using BPIP PRIME was assigned a unique numerical identification, which correspond to BPIP PRIME files, and are illustrated in Figure A.1.

¹ Buildings located farther than 800 m or 2,625 ft of a stack were not considered in the building downwash analysis. <http://www.epa.state.oh.us/portals/27/aqmp/eiu/attach2.pdf>

² Earth Tech, Inc., *Addendum to the ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model*, Concord, MA, November 1997.

³ EPA, User's Guide to the Building Profile Input Program (Research Triangle Park, NC), EPA-454/R-93-038, April 2004.

⁴ EPA, Office of Air Quality Planning and Standards, *Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)* (Research Triangle Park, NC), EPA 450/4-80-023R, June 1985.



Figure A.1. Buildings Processed Using BPIP PRIME

Deleted: u

A.2. IDENTIFICATION OF AIR POLLUTANTS

The potential HAPs/TAPs that could be emitted by the Northeast Plume IRA optimization project have been identified based on groundwater characterization. The potential HAPs/TAPs that could be emitted are trichloroethene (TCE) and 1,1-dichloroethene (1,1-DCE).

A.3. ALLOWABLE OFF-SITE CONCENTRATIONS CALCULATIONS

The treated vapor/gases must comply with the contaminant concentration requirements of 401 KAR 63:020. This states that no owner or operator shall allow any affected facility to emit potentially hazardous matter or toxic substances in such quantities or duration as to be harmful to the health and welfare of humans, animals, and plants.

A.3.1 TCE ALLOWABLE OFF-SITE CONCENTRATIONS

The maximum allowable air concentration for TCE was estimated using the EPA Region 9 Regional Screening Levels (RSLs), formerly referred to as Preliminary Remediation Goals, which are available from the EPA's Web site at: <http://www.epa.gov/region9/superfund/prg/index.html>. The TCE value is based on the carcinogenic risk posed by lifetime⁵ exposure to TCE. The health effects of exposure to TCE are measured by a target risk of one in one million (1×10^{-6}). The residential RSL was used to develop an allowable off-site concentration limit.

The ambient air allowable off-site concentration for TCE is $0.43 \mu\text{g}/\text{m}^3$. The allowable off-site concentration for TCE was selected from the EPA publication of RSLs. ~~(Note: The air dispersion analysis was performed in 2013.)~~

Deleted: most recent

Deleted: , which occurred in May 2013

A.3.2 1,1-DCE ALLOWABLE OFF-SITE CONCENTRATIONS

The maximum allowable air concentration for 1,1-DCE also was estimated using the EPA RSL. The 1,1-DCE value is based on the noncancer risks posed by long-term exposure to 1,1-DCE. The health effects of exposure to 1,1-DCE are measured by a hazardous index, with a hazard index of 1 being an indication of the nearest off-site receptor having detrimental health effects from exposure to 1,1-DCE. The residential RSL was used to develop an allowable off-site concentration limit.

The ambient air allowable off-site concentration for 1,1-DCE is $210 \mu\text{g}/\text{m}^3$. The allowable off-site concentration for 1,1-DCE was selected from the EPA publication of RSLs. ~~(Note: The air dispersion analysis was performed in 2013.)~~

Deleted: most recent

Deleted: , which occurred in May 2013

⁵ Lifetime exposure is assumed to be 70 years by convention for this air toxics risk assessment. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm. In such assessments, if exposure duration is less than 70 years, inhalation exposure estimates and/or allowable off-site concentrations limits may be adjusted accordingly. http://epa.gov/ttn/fera/risk_atra_vol2.html. For simplicity in this report, allowable off-site concentration limits were not adjusted although exposure duration is expected to be less than 70 years for this project.

The allowable off-site concentrations for TCE and 1,1-DCE are shown in Table A.1.

Table A.1. Allowable Off-site Concentration Limits

Pollutant	Allowable Off-site Concentration ($\mu\text{g}/\text{m}^3$)	Reference Source
TCE	0.43	Regional Screening Levels, May 2013
1,1-DCE	210	

Deleted: last updated

A.4. ESTIMATED EMISSION RATES

A.4.1 EMISSIONS

During operation of the project, hazardous constituents in extracted groundwater will be volatilized using two identical TUs including, but limited to, a skid-mounted treatment system consisting of a high efficiency four-tray air stripper (QED EZ-Tray P/N EZ-24.4SS),⁶ air blower, effluent pump, influent bag filters, and process control system all enclosed in a heated weatherproof enclosure. The current design criteria for the TUs are for each air stripper to have a removal efficiency of up to 99% for volatile organic compounds.⁷ No vapor phase controls to capture or destroy contaminants prior to release to the atmosphere following stripping are included in the TUs at this time.

The following preliminary design parameters⁸ for the stack were used in the model to estimate the dispersion of the hazardous constituents:

- 8-inch diameter;
- 19.5-ft high (approximate);
- 1,300 scfm flow rate (approximate);
- 55°F exhaust gas temperature; and
- The stack will not be equipped with a rain cap.

Deleted: .

In order to assess the potential impacts on ambient TCE and 1,1-DCE concentrations from the project, modeling was performed using estimated maximum potential emissions based on the system's maximum TCE input of 1,000 ppb; information was provided from the manufacturer.

The average expected TCE concentrations in groundwater prior to treatment are 517 ppb and 450 ppb for ATU 234 and ATU 235, respectively. Based on average expected TCE concentration in untreated groundwater, the TCE emissions to air are estimated as 5.167×10^{-2} pound per hour (lb/hr) and 4.498×10^{-2} lb/hr for ATU 234 and ATU 235, respectively. The maximum observed TCE mass concentration based on sampling data from existing extraction wells was 870 ppb.⁹ As such, 9.994×10^{-2} lb/hr based on 1,000 ppb provides a conservative basis for modeling potential emissions.

⁶ Air stripper model information based on as-built equipment.

⁷ http://www.qedenv.com/products/air_s.html

⁸ Design parameters received in e-mail to Geosyntec on January 24, 2013, and January 28, 2013.

⁹ Sampling data received in e-mail to Geosyntec on January 24, 2013. See May 8, 2013, e-mail to Todd Mullins, Kentucky Department for Environmental Protection, from Stan Knaus, LATA Environmental Services of Kentucky, LLC.

The maximum emission rates during operation for each model scenario are listed in Table A.2 in both lb/hr and g/s.

Table A.2. Estimated Emission Rates

Model ID	Scenario Description	TU 234 Mass Emissions (lb/hr)	TU 234 Mass Emissions (g/s)	Untreated Water Concentration (ppb)	TU 235 Mass Emissions (lb/hr)	TU 235 Mass Emissions (g/s)	Untreated Water Concentration (ppb)
Max_TCE	Maximum TCE	9.994×10^{-2}	1.259×10^{-2}	1,000	9.994×10^{-2}	1.259×10^{-2}	1,000
Max_11DCE	Maximum 1,1-DCE ¹⁰	9.994×10^{-2}	1.259×10^{-2}	1,000	9.994×10^{-2}	1.259×10^{-2}	1,000

A.4.2 MAXIMUM OFF-SITE CONCENTRATIONS

The property boundary ambient concentration for each HAP/TAP was estimated using the air dispersion model BREEZE AERMOD version 7.7.1.

Surface meteorology data from station number 3816 (Paducah, KY) and the nearest available upper air meteorology data from station 00013897 (Nashville, TN) were used. Dispersion analysis was performed using meteorological data from these stations for calendar years 2008, 2009, 2010, 2011, and 2012 (January 1, 2008, through December 31, 2012). The AERMOD-ready meteorological files were purchased from Trinity Consultants, Inc.

The air dispersion modeling analysis was performed using the pollutant-specific controlled emission rates discussed in Section A.4.1 to estimate the off-site concentration for each pollutant.

The results of the air dispersion modeling analysis suggest that the maximum annual concentration occurs at a receptor (341114.10, 4109112.90) along the property boundary northeast of the proposed stack locations, illustrated in Figure A.2.

¹⁰ 1,1-DCE is a volatile similar to TCE; therefore, mass emission rates of 1,1-DCE were conservatively assumed to equal TCE.

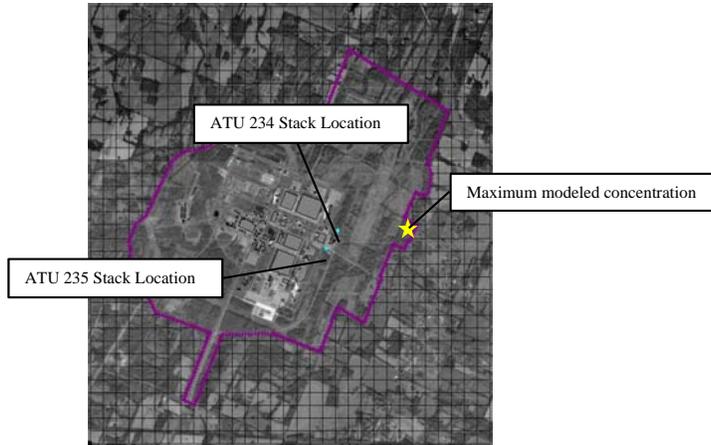


Figure A.2. Modeling Results

The estimated off-site pollutant concentrations for each modeling scenario are shown in Table A.3.

Table A.3. Estimated Off-site Concentrations

Model ID	Off-Site Concentration Limit (µg/m³)	Annual Off-site Concentration (µg/m³)	Below Limit? (Yes/No)
Max_TCE	0.43	0.084	Yes
Max_11DCE	210	0.084	Yes

The results of these air dispersion modeling analyses show the estimated maximum annual average concentration for both modeling scenarios will be below the corresponding maximum allowable off-site concentrations of respective pollutants. Additionally, the allowable off-site concentration limit for TCE was developed using a lifetime (i.e., 70-year exposure period) per EPA’s RSL User’s Guide.¹¹ The duration of potential exposure associated with the operation of the TUs will be less than 70 years. Therefore, emissions associated with this project are not expected to be harmful to the health and welfare of humans, animals, or plants.

¹¹ http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

THIS PAGE INTENTIONALLY LEFT BLANK

**Response to U.S. Environmental Protection Agency
Conditions Submitted September 30, 2015,
*Explanation of Significant Differences to the Record of Decision for the Interim
Remedial Action of the Northeast Plume Paducah Gaseous Diffusion Plant,*
DOE/LX/07-1291&D2/R1, Dated August 30, 2015**

General Conditions:

EPA's review determined that the *Explanation of Significant Difference to the Record of Decision for the Interim Remedial Action of the Northeast Plume (D2/R1)*, the "revised ESD", is not fully consistent with the *Memorandum of Agreement for Resolution of the Formal Dispute of the ESD to the ROD for the Interim Remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant*, hereafter the "2015 MOA", signed by the Federal Facility Agreement Parties on July 31, 2015. A summary of the content of the 2015 MOA, and identification of a few of the inconsistencies between the MOA and the revised ESD, are provided in the bullets that follow. In addition, Specific Comments are offered to expedite DOE revision of the decision document.

Condition 1a:

a. In the 2015 MOA, the FFA Parties agreed to the following remedial action objective (RAO) to manage migration of Technetium-99 due to operation of the optimized extractions wells. The ESD (including the *Preface* and the *Executive Summary*), will require revision to include this RAO.

The optimized extraction wells installed under the NE Plume Explanation of significant Differences 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).

Response 1a:

The proposed language is not appropriate as an RAO for the following reasons:

1. Identifying an RAO at this time is inconsistent with the NCP and EPA Guidance. First, an RAO is a central component of the CERCLA process and, if EPA believed the creation of an RAO was a component of the MOA, that belief should have been raised and resolved during the MOA negotiation process. Second, the NCP requires RAOs to be identified at the Feasibility Study stage of the CERCLA process, with final determination of remediation goals included in a ROD. Third, the NCP requires RAOs (and ultimately remediation goals) to include consideration of exposure routes and acceptable contaminant levels for each route. The proposed RAO includes neither.
2. The proposed RAO undercuts the specific details set forth in the MOA. Sections 3 and 4 of the MOA specifically define the changes in Tc-99 concentrations that would trigger corrective actions by the FFA parties. The proposed RAO raises the possibility that mere "undesired migration" could cause the remedial action to fail without first following the express, detailed requirements described in Sections 3 and 4 of the MOA. This was clearly not the intent of DOE's negotiation of specific trigger levels for corrective actions. Implicitly excluding such corrective actions from the RAO effectively rewrites at least paragraphs 3 and 4 of the MOA.

Per the October 23, 2015, meeting with the FFA parties, EPA stated this condition would be satisfied if the requested text from the MOA for Resolution was included in the Preface and the Executive Summary. The requested text from the MOA for Resolution is included in the revised ESD in the Preface and Executive Summary. For example, refer to the response to Specific Condition #4 (Preface) and Specific Condition #7 (Executive Summary).

Condition 1b:

b. The 2015 MOA requires the installation of a minimum of five (5) transect wells between the source area(s) and the planned location of the optimized extraction wells. *However, the MOA does not specify the installation of 18 monitoring wells, nor does the MOA specify that the five (or more) transect wells are a subset of 18 monitoring wells. Text of this nature requires removal from the ESD. The FFA Parties should work to resolve this DOE proposal in the context of tri-party review and comment on the revised Remedial Action Work Plan (RAWP).*

Response 1b:

References to 18 monitoring wells have been removed from the ESD.

Condition 1c:

c. In order to manage uncertainty regarding undesired mobilization of TC-99 from the source areas, the 2015 MOA requires monitoring of the transect wells prior to, and during, operation of the optimized extraction wells. Based on the assumption that the expected baseline contaminant concentrations of Tc-99 and TCE in the transect monitoring wells prior to bring the new EWs on-line are expected to be no higher than 200 pCi/L and 600 ug/L, respectively, the 2015 MOA presents a series of decision rules that will drive tri-party discussion and specific actions regarding operation of the optimized NE Plume interim action. Two (2) sets of decision rules were identified for use by the Parties prior to starting pumping of the optimized wells, and three (3) sets decision rules were identified for use by the Parties once the new extraction wells are online.

Response 1c:

DOE cannot identify any conditions set forth in Condition 1c; however, a hyperlink to the MOA for Resolution has been included in the Preface.

Condition 1d:

d. The 2015 MOA requires that the two wells from the 1995 NE Plume IROD, EW331 and EW332, will be maintained in good working condition until the FFA parties agree that maintenance of the wells is no longer necessary. *DOE's revisions to the ESD have addressed this requirement of the 2015 MOA (Section 4.2.J, Key Design Changes).*

Response 1d:

This condition did not result in a change to the document.

Condition 1e:

e. Finally, the 2105 MOA eliminates from the revised MOA the NRC regulation specifying a facility-wide annual effluent limit of 60,000 pCi/L for discharges of Tc-99 into surface water. *DOE's*

revisions to the ESD have addressed this requirement of the 2015 MOA (Section 6, Statutory Determinations).

Response 1e:

This condition did not result in a change to the document.

Condition 2:

The revised ESD includes an unsolicited change, not addressed by the 2015 MOA, in which DOE identifies discharge of treated groundwater from the optimized wells to “a KPDPES outfall” as an alternative to creation of up to two (2) CERCLA outfalls to Little Bayou Creek. Revise the ESD to remove references to a KPDES outfall. Alternatively, DOE's written response to this question should address the rationale for, and implications of, the proposed text in support of three party discussion and comment resolution. Example:

- On Page 4 of the revised ESD, the following related text has been removed: *New CERCLA outfalls are being identified because there are no DOE Kentucky Pollutant Discharge Elimination System-(KPDES) permitted outfalls in the vicinity of the new alternate treatment unit (ATU) location.*
- Subsequently, in Section 4.2/page 15 (Expected Outcomes of the ESD), DOE introduces “*or a KPDES outfall*” as an option to creation and utilization of the CERCLA outfalls previously mentioned.

Response 2:

References to the option of KPDES Outfalls for discharge have been removed from the ESD.

Condition 3:

The revised ESD includes an unsolicited change (see, for example *Preface*), not addressed in the 2015 MOA, to state that the NE Plume Optimization interim response will be a “phased” activity EPA recommends that, in order to craft an approvable ESD, the DOE eliminate the unsolicited text from the ESD and the FFA Parties agree to discuss any DOE proposal for project phasing in the context of tri-party review and comment on the revised NE Plume Optimization Remedial Action Work Plan that is currently under review.

Response 3:

The use of the term “phased” was in the D2 version of the ESD and is therefore not an unsolicited change and remains a factual statement. For example, one treatment unit was installed and one CERCLA outfall was created in 2013 to replace the loss of the cooling tower air stripping capacity and currently is utilized for pump-and-treat operations. Additionally, the MOA for Resolution states the following:

“The transect monitoring wells will be monitored for 4 consecutive quarters to establish baseline contaminant concentrations before the two newly relocated extraction wells begin operation.”

This condition did not result in a change to the document.

Condition 4:

In a set of unsolicited changes to the text in Section 4.2, *Expected Outcomes of the ESD*, DOE has created in this decision document a new requirement for additional groundwater modeling to support the location of the optimized EWs and (presumably, although the proposed revisions are not clear) the locations of the performance monitoring well network. EPA recommends that, in order to craft an approvable ESD, the DOE eliminate the unsolicited text from Section 4.2 of the ESD and the FFA Parties agree to resolve this concern in the context of tri-party review and comment on the revised RAWP that is currently under review.

Response 4:

In the first paragraph of Section 4.2 of the ESD, the referenced change “and will continue to be utilized to determine the need for future optimization” was removed. Additionally, the reference to modeling in Section 4.2.3, “based in part on groundwater modeling” has been removed to address the concern raised in this condition.

Condition 5:

The revised ESD includes text changes, not addressed by the 2015 MOA, in which DOE identifies various documents, as well as the cessation of enrichment activities at the PGDP, as the basis for optimization of the NE Plume interim action. These changes are found in the Executive Summary (page xii), Section 1.0 (3rd paragraph), Section 1.3 (page 4, bullet list), and Section 3 (page 11), for example. Updating document references is reasonable; however, the text changes made by DOE are not internally consistent in the ESD. Please evaluate each of the lists presented in these sections and revise to be complete and correct.

In addition, each occurrence in the ESD of the revision “2008 CERLCA Five-Year Review and approval letters (DOE 2009; EPA 2009, KEEC 2009)” should be revised for clarity to read as follows: “2008 CERCLA five year Review (DOE 2009) and approval letters (EPA 2009; KEEC 2009)”.

Response 5:

The lists and the (DOE 2009) reference were corrected.

Specific Conditions:**Condition 1: Preface, page iv**

At the top of the page, delete the phrase “will be implemented in a phased approach” from the first sentence.

Response 1:

The use of the term “will be implemented in a phased approach” was in the D2 version of the ESD and is therefore not an unsolicited change and remains a factual statement. For example, one treatment unit was installed and one CERCLA outfall was created in 2013 to replace the loss of the cooling tower air stripping capacity and is currently utilized for pump-and-treat operations. Additionally, the MOA for Resolution states the following:

“The transect monitoring wells will be monitored for 4 consecutive quarters to establish baseline contaminant concentrations before the two newly relocated extraction wells begin operation.”

This condition did not result in a change to the document.

Condition 2: Preface, page iv

First bullet: The parenthetical phrase “(approximately 300 gal per minute combined)” does not logically follow the preceding information in the bullet. Delete the phrase and add a second sentence to this bullet for clarity, e.g.: The combined pumping capacity of the two new extraction wells will be approximately 300 gallons per minute.

Response 2:

The use of the term “(approximately 300 gal per minute combined)” was in the D2 version of the ESD. However, the phrase was deleted and a second sentence was added to the bullet for clarity stating, “The combined pumping capacity of the two new EWs will be approximately 300 gal per minute.”

Condition 3: Preface, page iv

Second bullet: The ESD (including the *Preface*) should be clear to the reader that the remedy changes described in the second bullet have already been completed by DOE. Add language to the *Preface* telling the reader when this work was initiated and completed, preferably after the last sentence on this page that reads “*EPA guidance (EPA 1999) states that while the ESD is being prepared and made available to the public, the lead agency may proceed with the pre-design, design, construction, or operation activities associated with the remedy.*”

Response 3:

A sentence was added at the end of the second bullet to state “One treatment unit was installed in 2013 to replace the loss of the cooling tower air stripping capacity and currently is utilized for pump-and-treat operations.”

Condition 4: Preface, page iv

As written, the *Preface* does not address the remedy change (2015 MOA) to include installation and monitoring of transect wells to manage the uncertainty related to the undesired migration of Technitium-99 (Tc-99) from the source areas (C-400 Building and the Northwest Plume). Add a bullet to page iv to address this omission.

Response 4:

To address multiple conditions, a fourth bullet was added to the Preface to include verbiage from the MOA for Resolution verbatim that states the following:

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) signed by the Federal Facility Agreement (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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

Condition 5: Preface, page iv

In the paragraph “The extraction of...” change the phrase “remove both...” to “both remove...” for correctness. As written, the paragraph unintentionally states that the remedy implementation will remove control of the amount of plume mass migrating off-site.

Response 5:

The sentence was revised as requested.

Condition 6: Executive Summary

First bullet: DOE's rationale for including in the *Executive Summary* a paraphrase of just one half (1/2) of one (1) of the five (5) sets of decision rules agreed upon in the 2015 MOA is not clear to the reviewer. Delete the sentence that begins “The EW extraction rates...” from the first bullet. If DOE desires to present the pre-EW on-line and post-EW on-line decision rules in the *Executive Summary*, create a new paragraph and provide a comprehensive presentation.

Response 6:

The sentence that begins with “The EW extraction rates...” has been deleted.

Condition 7: Executive Summary

As written, the *Executive Summary* does not address the remedy change (2015 MOA) to include installation and monitoring of transect wells to manage the uncertainty related to the undesired migration of Tc-99 from the source areas. Add a bullet between the current bullets 3 and 4 on page xi to address this concern.

Response 7:

To address multiple conditions, the fourth bullet of the Executive Summary was revised to include verbiage directly from the MOA for Resolution as follows:

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) 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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

Condition 8: Executive Summary

Fourth bullet:

a. The 2015 MOA does not include tri-party agreement regarding the number of monitoring wells to be included in well network. Further, “placement of additional monitoring wells to evaluate performance and effectiveness ...” is already captured in the original language of the ESD immediately below the bullet list on page ix. Therefore, strike the first sentence of the fourth bullet stating that “18 monitoring wells” will be installed. Revise the second sentence of this bullet to read as follows: “Consistent with the MOA for Resolution, a minimum of five (5) transect wells will be located....”

Response 8a:

The first sentence of the fourth bullet (18 monitoring wells) has been deleted.

To address multiple conditions, the fourth bullet of the Executive Summary was revised to include verbiage directly from the MOA for Resolution as follows:

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) 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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV.1.A-00934>.

Condition 8b:

b. The last sentence of the fourth bullet is incomplete: the transect monitoring wells will also be used to better understand the baseline level of Tc-99 contamination east of the source areas where there is currently little or no well control. Either revise this sentence for completeness, or strike the existing detailed text and simply add language from the MOA regarding the source migration RAO.

Response 8b:

The last sentence of the fourth bullet is taken directly from the MOA and does not need to be supplemented for completeness. Moreover, in response to Condition 8a above, DOE is simply referencing the introduction and first section of the MOA. Second, DOE will not “simply add language from the MOA regarding the source migration RAO,” because the FFA parties negotiated no RAO in the MOA and, as described in DOE’s response to EPA Condition 1, the identification of selected MOA language as an RAO is inappropriate.

Condition 9: Section 1.3 Circumstances Creating the Need for an ESD

Evaluate the bulleted list of documents for accuracy and revise as appropriate. For example, the 2013 CERCLA Five Year Review (DOE 2014) is listed as a basis here, but not in previous lists of the basis for the need for NE Plume optimization.

Response 9:

The lists were revised as requested.

Condition 10: Section 3.3 Administrative Record Information Supporting the Needed Change

Section 3.3 directs the reader to the DOE Environmental Information Center for access to the documents and information that support the need for this ESD to the NE Plume IROD (1995). Previously, in Section 1 (page 1), the reader was advised that the ESD itself would be placed “in the Administrative Record file and information repository”, suggesting to the reader that there is a separate Information Repository where an individual can go and review the ESD: this is not the case. It is EPA's understanding that DOE provides access to the PGDP Administrative Record via the internet at <http://www.paducaheic.com>. Minimally, the language in Section 1 should be revised to refer the reader to the internet address listed in Section 3.3. Ideally, DOE would provide a hard copy of the ESD for some reasonable period of time at both the local public library Special Collections counter and the DOE EIC counter and revise the ESD language to direct the reader to those locations in the near term.

Response 10:

The text in Section #1 was revised to include “<http://www.paducaheic.com>” and also “Special Collections counter at the local public library.”

Condition 11: Section 4.1 Significant Differences between the Remedy and ESD Modifications: Table 1

The 2015 MOA does not establish requirements for the number of wells to be included in the performance monitoring well network. Also, it is not clear to the reader why DOE includes reference to only one (1) of five (5) sets of decision rules in the MOA in Table 1. Starting with the second sentence

that states “Install 18 monitoring wells...”, revise Row 2/Column 2 entry generally as follows for consistency with the 2015 MOA.

“Install a monitoring well network to evaluate performance and effectiveness of the optimized EWs. Consistent with the MOA for Resolution, install a minimum of five transect wells in a north-south transect located approximately 600 ft. east of the 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 determine current contaminant concentrations east of C-400 prior before the new EWs begin operation. The transect wells will also be used to assess the impact of groundwater EWs on contaminant migration from sources areas, including impacts to the groundwater divide east of C-400 Building. Sections 2 and 3 of the Memorandum for Resolution provide decision rules to be followed if baseline contaminant concentrations are not consistent with expected conditions or if quarterly sampling of the transect wells demonstrates an unacceptable increase above the established baseline. The specific decision rules are summarized in Table 2.”

Response 11:

As requested, DOE has eliminated references to the number of monitoring wells to be included in the performance monitoring well network. In addition, DOE’s position is that Sections 2 and 3 of the MOA, which are fully incorporated into the revised ESD, should stand on their own without the need for paraphrasing. Instead of inserting paraphrased language, DOE has revised the referenced table by including language directly from the MOA and referenced a hyperlink to the entire MOA.

Condition 12: Section 4.2 Expected Outcomes of the ESD

In a pair of unsolicited changes to the text, DOE has attempted to create in this decision document a new requirement for additional groundwater modeling to support the location of the optimized EWs and (presumably, although the revisions are not clear) optimization of the performance monitoring well network. Revise the ESD to remove the language bulleted below. The parties may or may not identify a need to conduct groundwater modeling for this action or any other action at the PGDP, but such groundwater modeling is not a component of this ESD and will be determined as part of the RAWP and future iterations of the *Operations and Maintenance Plan*. Delete:

- “currently”
- “and will continue to be utilized to determine the need for further optimization.”

Response 12:

The text “currently” and “and will continue to be utilized to determine the need for further optimization” has been deleted. Additionally, the reference to modeling in Section 4.2.3, “based in part on groundwater modeling” has been removed to address the concern raised in this condition.

Condition 13: Section 4.2 Expected Outcomes of the ESD

Revise the second bullet in Section 4.2.1, *Key Design Changes*, as follows for consistency with the 2015 MOA and to remove the reference to 18 monitoring wells. Note: the first sentence of the revised text presented below is paraphrased from page xi of the *Executive Summary*.

“Design, construction and operation of the NE Plume optimization will include placement of additional monitoring wells to evaluate performance and effectiveness of the new optimization system. Consistent with the MOA for Resolution, a minimum of five transect wells will be installed and located in a north-south transect approximately 600 ft. east of the C-400 Building (exact locations to be determined

by the FFA parties as part of the finalization of the RAWP). These transect wells will be monitored to establish baseline concentrations of contaminants before the optimized EWs begin operation. These transect wells will also be used to assess the impact of the optimized EWs on contaminant migration from source areas, including impacts to the groundwater divide east of C-400 Building. Sections 2 and 3 of the Memorandum for Resolution provide decision rules to be followed if baseline contaminant concentrations are not consistent with expected conditions or if quarterly sampling of the transect wells demonstrates an unacceptable increase above the established baseline. The specific decision rules are summarized in Table 2.”

Response 13:

As requested, DOE has eliminated references to the number of monitoring wells to be included in the performance monitoring well network. In addition, DOE’s position is that Sections 2 and 3 of the MOA, which are fully incorporated into the revised ESD, should stand on their own without the need for paraphrasing. DOE has revised the referenced bullet by including language directly from the MOA and referenced a hyperlink to the entire MOA.

Condition 14: Section 4.2 Expected Outcomes of the ESD

Revise Section 4.2.4, *Baseline Monitoring*, to include the following text: *“The anticipated contaminant concentrations of Tc-99 and TCE in the transect monitoring wells are expected to be no higher than 200 pCi/L and 600 ug/L, respectively. However, since tri-party signature on the 2015 Memorandum of Resolution, DOE has provided data to the regulators indicating that current baseline activities of Tc-99 in groundwater east of the C-400 building, and very near the proposed location of the transect wells, were far in excess of the anticipated concentrations cited by DOE in the 2015 MOA. Section 2 of the Memorandum for Resolution provides decision rules for the FFA Parties to follow in the event transect well monitoring is not consistent with the expected conditions stated in the MOA.”*

Response 14:

DOE disagrees it is appropriate to include EPA’s italicized language for the following reasons. First, EPA has been in possession of the data in question since they were collected; EPA cannot reasonably claim that it has just become aware of the data. Secondly, it is not appropriate to use a single historic sample point from 1997 that was collected from a temporary open boring to conclude that anticipated baseline levels will be exceeded when DOE has accumulated and transmitted to EPA over fifteen years of Tc-99 data from 21 permanent monitoring wells, which support the anticipated maximum baseline concentrations that are set forth in the MOA. Thirdly, the data point that EPA is relying on is screening-level data that only reflects beta activity which was never analyzed for Tc-99, and as such, is not appropriate for decision making purposes. Lastly, DOE stands behind anticipated baseline numbers and that the process established by the MOA will provide information needed to manage uncertainties in the action's conceptual site model that might impact the pump-and-treat optimization.

To address multiple conditions, Section 4.2.4 of the ESD, *Baseline Monitoring*, has been revised to include Section 2 of the MOA for Resolution verbatim as follows:

The transect monitoring wells will be monitored for 4 consecutive quarters to establish baseline contaminant concentrations before the two newly relocated extraction wells begin operation. The anticipated contaminant concentrations of Tc-99 and TCE in the transect monitoring wells are expected to be no higher than 200 pCi/L and 600 ug/L, respectively. If baseline contaminant concentrations in any of the transect monitoring wells during the initial quarterly sampling are detected at twice the anticipated

contaminant concentrations, then the FFA parties agree to temporarily suspend start-up of the extraction wells until the parties meet to evaluate the identified discrepancy, its potential impact on the NW Plume source actions and the planned NE Plume optimization project. The FFA parties will conduct an evaluation of the planned action and develop recommendations and a schedule for modifications of the optimized action to address the unanticipated contaminant concentrations. In the event the FFA parties decide that significant changes to the scope of the action under the ESD are necessary to continue with the optimization, then DOE shall continue implementing the current NE Plume Interim Remedial Action (Interim ROD 1995) and shall propose modification to the Interim Remedial Action through another ESD and RAWP Addendum. The PGDP Site Management Plan will be updated to reflect establishment of any enforceable milestones under the FFA such as due dates for the aforementioned Primary documents (DOE 2015).

Condition 15: Section 4.2 Expected Outcomes of the ESD

The introductory sentence in Section 4.2.7, *Operation and Maintenance*, describes conditions for initiating optimized IRA operations. Therefore, revise the sentence to amend the phrase “in Sections 2 through 4 of the MOA ...” to read “in Section 2 of the MOA...”. Add a statement that “The results of ongoing monitoring activities will be evaluated consistent with Sections 3 through 4 of the MOA for Resolution.” After the last bullet on page 17, add a new paragraph incorporating language from the MOA that “If a determination is made to shut down the optimized pump and treat system, either before a modification to the Interim Remedial Action or as part of a modification of the Interim Action, then DOE shall reinstate implementation of the NE Plume Interim Remedial Action (IROD, 1995).”

Response 15:

Rather than incorporate the proposed changes as requested and to address multiple conditions, Section 4.2.7 of the ESD has been revised to include sections 3 and 4 of the MOA for Resolution verbatim as follows:

A revised operation and maintenance plan to include optimized IRA operations will be submitted and approved before the two newly relocated EWs begin operation. Following successful completion of the construction and start-up and integrated testing of the facilities of the Northeast Plume, optimized IRA operations will be initiated consistent with a revised and approved operations and maintenance plan. The MOA for Resolution states the following:

Once the two optimized extraction wells are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well’s quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples showing an increase, then potential changes in groundwater flow or source impacts (e.g. rising contaminant concentrations in the NE Plume, source migration, etc.) will be further examined and the FFA parties will consider adjustments (e.g. adjusting extraction well pumping rates) for the optimized NE Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

If the measures taken by the FFA parties (e.g. adjusting extraction well pumping rates) do not result in decreased or stabilized concentrations at the transect monitoring wells, or if such adjustments reduce the effectiveness of the optimized extraction wells or if Tc-99 concentrations continue to increase and are detected at twice their baseline concentration in any one (or more) of the transect wells for two consecutive quarters, then DOE must notify EPA and KDEP within 30 days of receiving sampling results or one of the other aforementioned conditions occurring. After EPA and KDEP have been notified, the FFA parties will discuss and evaluate options to address continued increase of groundwater concentrations and plume expansion. Within 1 year from the notification, DOE shall submit an ESD and RAWP Addendum as the Primary documents to undertake modification to the existing CERCLA Interim Remedial Action pursuant to the FFA to address the contaminated groundwater plume expansion and to prevent Tc-99 at levels above the MCL from further being pulled within the NE Plume.

The FFA parties will discuss whether to temporarily suspend operation of one or both of the extraction wells while determining the modifications to the CERCLA Interim Remedial Action to prevent further plume expansion. If FFA parties decide to implement a modification to the Interim Remedial Action to address the NE Plume contamination (including the expansion), then depending on the scope of the modification it is possible that the FFA parties will decide to shut down the optimized pump and treat system in part or in its entirety. If a determination is made to shut down the optimized pump and treat system either before a modification to the Interim Remedial Action or as part of a modification to the Interim Action, then DOE shall reinstate implementation of the NE Plume Interim Remedial Action (Interim ROD 1995). DOE shall keep the extraction wells associated with the NE Plume Interim Remedial Action in good working condition until the FFA parties agree the maintenance is no longer necessary (DOE 2015).

Condition 16: Section 6. Support Agency Concurrence

Under CERCLA and the NCP, the EPA jointly selects remedies, including amendments and ESDs, with the DOE. Revise Section 5 text to reflect EPA approval, and Commonwealth of KY concurrence, with the ESD.

Response 16:

The text has been revised as described above.

Condition 17: Section 7. Public Participation Requirements

The statement “...in the Administrative Record file as required by the NCP...” should be revised for completeness to state “...in the Administrative Record file and information repository as required by the NCP...”.

Response 17:

The text has been revised as described above.

Condition 18: Section 8. Approvals

EPA recommends addition of the phrase “With Concurrence by...” since, per the NCP, a State (e.g., KDEP) can only concur on the selected remedy as opposed to selecting the remedy.

Response 18:

The text has been revised to show concurrence by the commonwealth.

**Response to Commonwealth of Kentucky Division of Waste Management
Conditions Submitted September 30, 2015,
*Explanation of Significant Differences to the Record of Decision for the Interim
Remedial Action of the Northeast Plume Paducah Gaseous Diffusion Plant,
DOE/LX/07-1291&D2/R1, Dated August 30, 2015***

General Conditions:

Condition 1:

MOA linkage to ESD:

The overall connection between the requirements set forth in the Memorandum of Agreement for Resolution and the ESD is not well established in the document. Kentucky was unable to locate a statement in the ESD that made the complete connection to the MOA for Resolution. Instead, the ESD appears to emphasize certain sections of the MOA and not mention other sections at all. Please add a sentence, preferably towards the beginning of the ESD, that establishes a better relation with the MOA for Resolution and the ESD. Also consider providing a hyperlink within the document to the MOA for Resolution, especially if DOE does not intend to incorporate it (completely) into the ESD.

Response 1:

To address multiple conditions, a fourth bullet was added to the Preface that states the following:

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) signed by the Federal Facility Agreement (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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV.1.A-00934>.

Condition 2:

Reference to installation of 18 MWs:

This report contains multiple references implying that 18 MWs will be installed “to evaluate performance and effectiveness of the optimized EWs.” The references are confusing and misleading. Kentucky acknowledges that referencing 18 MWs may be applicable for budgeting and planning scenarios, but does not recognize 18 MWs as an agreed upon value that would constrain future technical discussions regarding the placement and number of monitoring wells necessary to evaluate performance and effectiveness of the optimized wells. Furthermore, modifications to the ESD were to be reflective of the MOA for Resolution. Kentucky cannot find reference to the 18 MWs in the D1 or D2 ESD, nor can it locate 18 MWs within the agreed upon language of the MOA for Resolution. Remove all references to the number (18) regarding MWs. Removing the number of MWs is consistent with conversations and meetings held after the issuance of the MOA for Resolution, where DOE conveyed that the actual number of MWs is yet to be determined.

Response 2:

References to 18 monitoring wells have been removed from the ESD.

Specific Conditions:

Condition 1:

Executive Summary, 1st bullet, Page xi:

The new language in this bullet is directly linked to section three of the MOA for Resolution; however, a key provision is missing. Please add language to reflect that the FFA parties will consider adjustments once criteria (specified in the MOA) are met.

Response 1:

The sentence that begins with “The EW extraction rates...” has been deleted. Additionally, Section 4.2.7 of the ESD was revised to include sections 3 and 4 of the MOA for Resolution verbatim as follows:

A revised operation and maintenance plan to include optimized IRA operations will be submitted and approved before the two newly relocated EWs begin operation. Following successful completion of the construction and start-up and integrated testing of the

facilities of the Northeast Plume, optimized IRA operations will be initiated consistent with a revised and approved operations and maintenance plan. The MOA for Resolution states the following:

Once the two optimized extraction wells are online, contaminant concentrations in samples from the transect wells will be collected on a quarterly basis and reported to EPA and KDEP. If contaminant concentrations in any transect well's quarterly samples are determined to be increasing and may double above the established baseline within a year of the quarterly samples showing an increase, then potential changes in groundwater flow or source impacts (e.g. rising contaminant concentrations in the NE Plume, source migration, etc.) will be further examined and the FFA parties will consider adjustments (e.g. adjusting extraction well pumping rates) for the optimized NE Plume interim action to minimize these potential impacts. These adjustments are considered within the scope of the optimization under the ESD.

If the measures taken by the FFA parties (e.g. adjusting extraction well pumping rates) do not result in decreased or stabilized concentrations at the transect monitoring wells, or if such adjustments reduce the effectiveness of the optimized extraction wells or if Tc-99 concentrations continue to increase and are detected at twice their baseline concentration in any one (or more) of the transect wells for two consecutive quarters, then DOE must notify EPA and KDEP within 30 days of receiving sampling results or one of the other aforementioned conditions occurring. After EPA and KDEP have been notified, the FFA parties will discuss and evaluate options to address continued increase of groundwater concentrations and plume expansion. Within 1 year from the notification, DOE shall submit an ESD and RAWP Addendum as the Primary documents to undertake modification to the existing CERCLA Interim Remedial Action pursuant to the FFA to address the contaminated groundwater plume expansion and to prevent Tc-99 at levels above the MCL from further being pulled within the NE Plume.

The FFA parties will discuss whether to temporarily suspend operation of one or both of the extraction wells while determining the modifications to the CERCLA Interim Remedial Action to prevent further plume expansion. If FFA parties decide to implement a modification to the Interim Remedial Action to address the NE Plume contamination (including the expansion), then depending on the scope of the modification it is possible that the FFA parties will decide to shut down the optimized pump and treat system in part or in its entirety. If a determination is made to shut down the optimized pump and treat system either before a modification to the Interim Remedial Action or as part of a modification to the Interim Action, then DOE shall reinstate implementation of the NE Plume Interim Remedial Action (Interim ROD 1995). DOE shall keep the extraction wells associated with the NE Plume Interim Remedial Action in good working condition until the FFA parties agree the maintenance is no longer necessary (DOE 2015).

Condition 2:

Executive Summary, 1st bullet, Page xi:

The MOA for Resolution is mentioned for the first time in the Executive Summary Section in the 4th bullet. Clarify the details of the MOA to include the entire name and date of finalization, along with a citation reference. For additional occurrences in the ESD it will be acceptable to use the abbreviated designation 'MOA for Resolution,' once it has been properly introduced.

Response 2:

To address multiple conditions, a fourth bullet was added to the Preface that states the following:

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) signed by the Federal Facility Agreement (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. 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 (DOE 2015).

The MOA for Resolution is located at the following link:
<http://paducaheic.com/Search.aspx?accession=ENV 1.A-00934>.

Condition 3:

Section 1.3, Page 4, last paragraph:

This paragraph tries to link the D2/R1 ESD (referred to in the text as “this ESD”) with the 2013 D2 RAWP, which is confusing. Both documents are currently being reviewed as D2/R1 versions. Please clarify and fix the wording and/or the cited reference; which currently specifies the D2 version of the RAWP as being a 2015 document. Perhaps the references need to be updated to reflect the D2/R1 version, otherwise Kentucky does not understand DOE’s intent for the reference to a D2 document that has already been revised and is currently under regulatory review.

Response 3:

The (DOE 2015b) reference has been revised to be (DOE 2013) and text has been revised to state the following, “The scope of the Northeast Plume optimized project, as documented in this 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 2013), (a revision to this document currently is under development) is consistent with the general findings and recommendations in the documents referenced above and with the identified modifications by the FFA parties as contained in the 2015 MOA for Resolution of formal dispute. Additional specific supporting information from these evaluations is contained in Section 3, Basis for the ESD.” Other references to the RAWP in Section 3.2 and Section 4.2.8 were revised similarly to address this condition.

Condition 4:

Section 4.2.7, Page 16:

“... optimized IRA operations will be initiated consistent with the approved operation and maintenance plan.” The most recent Operation and Maintenance (O&M) version D3/R4 (approved) does not cover optimized IRA operations. The only mention of optimization occurs in the following paragraph in the D3/R4 O&M Plan “*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.*” When is DOE planning to submit an updated O&M plan that will address optimized IRA operations? The current project schedule presented in the D2/R1 RAWP does not provide a date for an O&M Plan revision. Revise the ESD language so that it does not reference an O&M Plan that does not even address optimized IRA operations.

Response 4:

A revised O&M Plan will be developed that addresses the optimized IRA operations and associated treatment units. FFA parties’ approval of this O&M Plan is planned to occur before the newly relocated extraction wells begin operation.

The first paragraph of Section 4.2.7 was revised as follows:

“A revised operation and maintenance plan to include optimized IRA operations will be submitted and approved before the two newly relocated EWs begin operation. Following successful completion of the

construction and start-up and integrated testing of the facilities of the Northeast Plume, optimized IRA operations will be initiated consistent with a revised and approved operations and maintenance plan.”

CERTIFICATION

Document Identification: *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*

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

Fluor Federal Services, Inc.

Mark Duff, Director of Environmental Management

Date Signed

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

U.S. Department of Energy (DOE)

William E. Murphie, Manager
Portsmouth/Paducah Project Office

Date Signed