City: PADUCAH
PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 07/22/1993
Operable Unit: 02
ROD ID: EPA/ROD/R04-93/165

Media: GW

Contaminant: DNAPLS, VOCs, Radioactive Materials

Abstract: The USDOE Paducah Gas Diffusion Plant is an active Uranium Enrichment facility in McCracken County, Kentucky, three miles south of the Ohio River. Land use in the area is predominantly industrial. From 1952 to present, the USDOE Paducah Gaseous Diffusion Plant (PGDP) has operated a uranium enrichment facility, which supplies fuel for commercial reactors. The PGDP uses a gaseous diffusion process to provide a physical separation process, which allows for enrichment of the uranium. TCE has been used continuously at the site to degrease fabricated metal parts. Technetium (Tc[99]) was introduced to PGDP as a by-product of the reprocessing of uranium. An evaluation of the quantities, concentrations, and records related to Tc[99] indicated that this radionuclide probably was introduced to ground water from past handling or disposal of TCE contaminated with Tc[99] and scrap metal contaminated with Tc[99]. In 1988, VOCs and radionuclides were detected in private wells north of the PGDP. Later in 1988, EPA required DOE to conduct an investigation to determine the nature and extent of contamination. The site investigation demonstrated that improper past handling practices and disposal of waste material led to the contamination of ground water, including DNAPLs, migrating to the northwest from PGDP. The contamination is spreading toward the Ohio River in multiple plumes. Following the discovery of ground water contamination, DOE began providing

an alternative water supply to those residences with contaminated ground water. This ROD addresses interim remediation of the ground water in the northwest plume and will control the ongoing migration of contaminants in the northwest plume. Future RODs will provide a final remedy for the ground water contamination and for other onsite media. The primary contaminants of concern affecting the ground water are DNAPLs; VOCs, including TCE; and radioactive materials. SELECTED REMEDIAL ACTION: The selected remedial action for this site includes extracting and containing DNAPL-contaminated ground water; treating the ground water onsite using ion exchange, followed by air stripping, with onsite discharge of the treated water to a State permitted outfall; filtering off-gas emissions; and implementing a treatability study to evaluate the use of iron filings as an innovative technology and an alternative to pumping and treatment in the final remedial action. The estimated present worth cost for this remedial action is $15,188,190, which includes an estimated annual O&M cost of $1,719,236. PERFORMANCE STANDARDS OR GOALS: Chemical-specific ground water interim cleanup goals are based on SDWA MCLs, and include TCE 5 ug/l. INSTITUTIONAL CONTROLS: Not provided.

Remedy: The primary objective of this interim remedial action is to initiate a first phase remedial action, as an interim action to initiate control of the source and mitigate the spread of contamination in the Northwest plume. This operable unit addresses a portion of the contaminated ground water. Additional interim actions associated with this integrator operable unit are being considered, as well as for other areas of contaminated ground water. Other investigations are underway to address other environmental media (e.g., surface water) and contaminated source areas.

The major components of the interim action remedy include:
. The contaminated ground water will be extracted at two locations. The first location, immediately north of the plant on the U.S. Department of Energy (DOE) property, is intended to control the source. The second ground water extraction location is offsite of the DOE reservation at the northern tip of the most contaminated portion of the plume [greater than 1000 g/l of trichloroethylene) TCE]. The contaminated ground water will be pumped at a rate to reduce further contribution to contamination northwest of the plant without changing hydraulic gradients enough to mobilize Dense Non-aqueous Phase Liquids (DNAPL) or significantly affect other plumes. This pumping rate may be modified during operation to optimize hydraulic containment by adjusting flow from the extraction wells and to support subsequent actions.
. The extracted ground water will be collected in a manifold and

piped to the treatment system, which will consist of two ion exchange units in parallel followed by an air stripperwith treatment for off gas emissions. This technology will provide treatment to the contaminants of concern (TCE and technetium-99). The target level for treatment of TCE is 5 ppb and 900 pCi/l for [99]Tc.
. The amount of treated water discharged will be limited by the flow capacity of the skid mounted treatment units. The treated water will be discharged through Kentucky Pollution Discharge Elimination System (KPDES) permitted outfall 001.
. This interim action also includes implementation of a treatability study to evaluate an innovative technology. The innovative technology to be studied involves the potential utilization of iron filings as a viable alternative to pump and treat technology for ground water treatment.
. The remedy does not address source remediation, however; the remedy will address continuing release from a DNAPL principal threat source area.

Text: Full-text ROD document follows on next page.

Text:
Record of Decision for Interim Remedial Action of the Northwest Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

July 1993

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NOTATIONS

The following list of acronyms, and abbreviations (including units of measure) are provided to assist in the review of this document. Acronyms used in tables only are defined in those respective tables.

ACRONYMS AND ABBREVIATIONS

ACO	Administrative Order by Consent
AEA	Atomic Energy Act
ALARA	as low as reasonably allowable
ARARs	applicable or relevant and appropriate requirements
BAT	best available technology
BETX	benzene, ethlybenzene, toulene and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
CWA	Clean Water Act
DCGs	drivied concentration guides
DNAPL	dense non-aqueous phase liquids
DOE	U.S. Department of Energy
DOI	Department of Interior
DOT	Department of Transportation
DQO	Data Quality Objective
EDE	effective dose equivalent
Energy Systems	Martin Marietta Energy Systems Inc.
EPA	U.S. Environmental Protection Agency
Fe	iron
FS	feasibility study
HSWA	Hazardous and Solid Waste Amendments
HSP	Health and Safety Plan
ICM	Interim Corrective Measure
IM	interim measures
IROD	interim record of decision
KAR	Kentucky Administrative Record
KDEP	Kentucky Department for Environmental Protection
KDFW	Kentucky Division of Fish and Wildlife
KPDES	Kentucky Pollutant Discharge Elimination System
LDR	land disposal restrictions
LLRWPA	Low-Level Radioactive Waste Policy Act of 1985
MCL	Maximum Contaminant Level
MSL	Mean Sea Level

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbon
PGDP	Paducah Gaseous Diffusion Plant
PHEA	Results of the Public Health and Ecological Assessment, Phase II
PP	proposed plan
RBC	Kentucky Radiation Control Branch
RCRA	Resource Conservation and Recovery Act, as amended
RGA	regional gravel aquifer
RME	reasonable maximum exposure
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
Si	silicon
SMP	Site Management Plan
TBC	to be considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TcO[4]	pertechtenate ion
[99]Tc	technetium-99
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TVA	Tennessee Valley Authority
UCRS	upper continental recharge system
UF[6]	uranium hexafluoride
USGS	United States Geological Survey
UV	ultraviolet
[235]U	uranium-235
[238]U	uranium-238
VOC	volatile organic compound
WAGs	waste area groups
WQC	water quality criteria
WKWMA	West Kentucky Wildlife Management Area

Record of Decision for Interim Remedial Action
of the Northwest Plume at the
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

July 1993

Prepared by
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Prepared for
U.S. Department of Energy

Enrichment Restoration Division

DECLARATION FOR THE RECORD OF DECISION

INTERIM REMEDIAL ACTION OF THE NORTHWEST PLUME

SITE NAME AND LOCATION

Northwest Plume
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Northwest Plume at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substance Contingency Plan. This decision is based on the administrative record file for this site.

This action was initiated pursuant to the Interim Measure provisions of the EPA and Commonwealth of Kentucky Resource Conservation and Recovery Act (RCRA) permits. The Commonwealth of Kentucky concurs with the Federal Agencies on the selected interim action, in accordance with the requirements of the Kentucky Hazardous Waste permit.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this record of decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this interim remedial action is to initiate a first phase remedial action, as an interim action to initiate control of the source and mitigate the spread of contamination in the Northwest plume. This operable unit addresses a portion of the contaminated ground water. Additional interim actions associated with this integrator operable unit are beingconsidered, as well as for other areas of contaminated ground water. Other investigations are underway to address other environmental media (e.g., surface water) and contaminated source areas.

The major components of the interim action remedy include:

- The contaminated ground water will be extracted at two locations. The first location, immediately north of the plant on the U.S. Department of Energy (DOE) property, is intended to control the source. The second ground water extraction location is offsite of the DOE reservation at the northern tip of the most contaminated portion of the plume [greater than l000 ug/l of trichloroethylene) TCE]. The contaminated ground water will be pumped at a rate to reduce further

contribution to contamination northwest of the plant without changing hydraulic gradients enough to mobilize Dense Non-aqueous Phase Liquids (DNAPL) or significantly affect other plumes. This pumping rate may be modified during operation to optimize hydraulic containment by adjusting flow from the extraction wells and to support subsequent actions.

- The extracted ground water will be collected in a manifold and piped to the treatment system, which will consist of two ion exchange units in parallel followed by an air stripper with treatment for off gas emissions. This technology will provide treatment to the contaminants of concern (TCE and technetium-99). The target level for treatment of TCE is 5 ppb and 900 pCi/l for [99]Tc.

- The amount of treated water discharged will be limited by the flow capacity of the skid mounted treatment units. The treated water will be discharged through Kentucky Pollution Discharge Elimination System (KPDES) permitted outfall 001.

- ù This interim action also includes implementation of a treatability study to evaluate an innovative technology. The innovative technology to be studied involves the potential utilization of iron filings as a viable alternative to pump and treat technology for ground water treatment.

- The remedy does not address source remediation, however; the remedy will address continuing release from a DNAPL principal threat source area.

DECLARATION

This interim action is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements for this limited-scope action, and is cost-effective. Although this interim action is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is in furtherance of that statutory mandate. Although partially addressed in this remedy, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be addressed by both this and the final response action. Subsequent actions are planned to address fully the principal threats posed by the conditions at this site. This pilot plant will be examined during the next two years to determine the effectiveness of the remedial action. Remedial activities associated with this remedy which continue beyond the pilot plant phase will require a review be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action. This review is necessary because this remedy will result in hazardous substances remaining on site above health-based levels. Because this remedy is an interim action ROD, review of this site and of this remedy will be ongoing as DOE continues to develop final remedial alternatives for the integrator operable unit.

PART 2

DECISION SUMMARY

2.1 Site Name, Location, and Description

The Paducah Gaseous Diffusion Plant (PGDP) is an active Uranium Enrichment facility owned and operated by the United States Department of Energy (DOE) and cooperated by Martin Marietta Energy Systems, Inc. (Energy Systems). PGDP is located in the northwestern corner of Kentucky in western McCracken County, about 10 miles west of Paducah, Kentucky, and 3 miles south of the Ohio River (Figures 1 and 2).

The DOE in the role of "Lead Agency," as defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is conducting cleanup activities at PGDP under its Environmental Restoration and Waste Management Program. Pursuant to Executive Order No. 12,580, 3 C.F.R. 193 (1987), 53 Fed. Reg. 2923 (January 29, 1987), the Lead Agency is required to assume the responsibility of ensuring that sufficient action is taken to cleanup its sites so as to provide protection for human health and the environment. These remedial activities are being conducted in compliance with the requirements of the Commonwealth of Kentucky, the Environmental Protection Agency (EPA) and DOE, as further described in the following section.

The PGDP is an active uranium enrichment facility which supplies fuel for commercial reactors. Construction of the plant began in 1951 with operations initiated by 1952. The PGDP uses gaseous diffusion to provide a physical separation process which allows for enrichment of the uranium. Commercially produced uranium hexafluoride (UF[6]) is composed of mostly uranium-238 ([238]U), with a small percent of uranium-235 ([235]U). The gaseous diffusion process is premised on the fact that UF[6] with fissionable [235]U is slightly lighter than UF[6] with [238]U. Therefore, as the UF[6] passes through the gaseous diffusion plant's cascade system, separation of the [235]U from the [238]U takes place. This separation results in enriched uranium (slightly higher percentage of [235]U). The enriched uranium can then be transported to other DOE facilities for further enrichment.

2.2 Site History and Enforcement Activities

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in private wells north of the PGDP. The site investigation demonstrated that the principle contaminants of concern in the offsite ground water are technetium-99 (^{99}Tc), a radionuclide, and trichloroethylene (TCE), an organic solvent. The

contamination is spreading generally northward towards the Ohio River in multiple plumes. Past handling practices and disposal of waste material has lead to the contamination of the ground water migrating to the northwest from PGDP. The interpretation of the location of these plumes is presented in Figure 3. This figure is for illustrative purposes only and should not be interpreted as a precise description of the locations of the plumes. The outer boundary of the plume is approximately three miles from the northern border of the facility security fence.

The contaminated area spans approximately 1.6 square miles. The contamination of approximately three billion gallons of ground water may have occurred in the Northwest Plume. Concentrations of the contaminants within the Northwest Plume vary, with the higher concentrations within the centroid of the mass. The concentrations also increase with proximity to the source areas (northwest corner of PGDP).

Trichloroethylene is a nonflammable, highly volatile, colorless liquid used extensively for degreasing fabricated metal parts. Trichloroethylene (TCE) has been produced commercially in the United States since 1925, and used at PGDP continuously since 1952. The use of this product has been steadily reduced by DOE during the last several years by instituting waste minimization activities and using alternative compounds.

Technetium was introduced to PGDP as a by-product of the reprocessing of uranium. An evaluation of the quantities, concentrations, and all records related to ^{99}Tc indicates that this radionuclide was probably introduced to ground water from past handling or disposal of TCE contaminated with ^{99}Tc and scrap metal contaminated with [99]Tc.

In the fall of 1988, the EPA and DOE entered into an "Administrative Order by Consent" (ACO) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA) to address the offsite contamination. Pursuant to the ACO, PGDP conducted an investigation to determine the nature and extent of contamination. Results of this effort were published in a document entitled Results of the Site Investigation, Phase I (Document #KY/ER-4, March 1991). A subsequent investigation sought to further characterize the extent of contamination. Results of this investigation were published in Draft Results of the Site Investigation, Phase II (Document #KY/SUB/13B-97777CP-03/1991/1, October 1991). A revised version of this document was submitted to EPA and the Commonwealth of Kentucky in April 1992. Alternatives for remediation were identified and evaluated and published in the

document Draft Summary of Alternatives for Remediation of Offsite Contamination at the Paducah Gaseous Diffusion Plant (Document #DOE/OR-1013, December 1991).

On July 16, 1991, EPA and the Commonwealth of Kentucky jointly issued permits under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendment of 1984 (HSWA). The EPA permit contains only provisions of HSWA, while the Commonwealth of Kentucky permit contains provisions to address hazardous waste management as well as provisions of HSWA. The HSWA provisions require evaluation of hazardous constituents releases and implementation of interim and final corrective measures to address such releases. In May, 1992 the Draft Interim Corrective Measure Work Plan For Hydraulic Containment and Ground Water Treatability Test (ICM) (Document #DOE-OR-1031) was submitted to EPA and the Commonwealth, in accordance with the HSWA provisions of the Commonwealth of Kentucky and EPA permits, describing an option for initiating containment of the Northwest ground water plume. However, information derived from ongoing ground water investigations indicated the need to modify this work plan. The rationale for this modification included: collection of additional information concerning the characteristics of the Northwest Plume, better

definition of the plume's boundaries, and to ensure consistency with the final action which may include a passive treatment system.

A series of meetings between DOE, EPA and the Commonwealth of Kentucky, lead to the agreement whereby DOE utilized the Interim Corrective Measure (ICM) Work Plan to develop a Technical Memorandum for Hydraulic Containment of the Northwest Plume, (SAIC 1993). The Technical Memorandum, in combination with the Draft Summary of Alternatives for Remediation of Offsite Contamination constitute DOE's equivalent of a Focused Feasibility Study for the Northwest Plume interim remedial action. The interim alternatives were summarized and transmitted for Public and Regulatory comment in the Proposed Plan for Interim Remedial Action of the Northwest Plume, (SAIC 1993). The Technical Memorandum will also serve as the ICM Work Plan, subject to review and approval in accordance with the provisions of HSWA.

2.3 Highlights of Community Participation

On March 14, 1993, a notice of availability was published in The Paducah Sun, a regional newspaper, regarding the Proposed Plan. This notice appeared in The Paducah Sun from March 14th until the 21st of 1993. The Proposed Plan for Interim Remedial Action of the Northwest Plume was released to the public on March 18, 1993. This document was made available at both the onsite and off-site administrative records and at the Paducah Public Library. A public comment period was held from March 18, 1993 through April 16, 1993.

Specific groups which received individual copies of the Proposed Plan included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. Informal meetings were held with each group on March 18th and 22nd, respectively. At these meetings, DOE personnel briefed the groups on the proposed action and solicited both written and verbal comments.

On March 29, 1993, an announcement of a public meeting scheduled for April 6th appeared in The Paducah Sun. A display ad was placed in the newspaper on April 4, 1993 which also announced the public meeting and the availability of the document. Information bulletins were mailed to 1,933 residents, 1,850 PGDP employees, and 133 local officials on March 31, 1993. Phone calls and/or visits were made to various stakeholders, including neighbors and representatives of environmental groups, to alert them of the public comment period and briefly explain the Proposed Plan. Proposed Plans and/or Technical Memorandums were mailed to those contacted. At the April 6th public meeting, representatives of DOE, EPA and the Commonwealth of Kentucky answered questions and addressed community concerns. Pursuant to a request from the Tennessee Valley Authority (TVA) the comment period was extended until April 23, 1993. This extension of time for public comment appeared in The Paducah Sun on April 18, 1993. A response to the comments received during the public participation period is included in the Responsiveness Summary, which is part of this Record of Decision.

This decision document presents the selected interim remedial action for the Northwest Plume at PGDP, chosen in accordance with CERCLA, as amended by SARA, the EPA and Commonwealth of Kentucky permits issued under the RCRA, as amended by HSWA, and to the extent practicable, the National Oil and

Hazardous Substances Pollution Contingency Plan (NCP). The decision for this interim action at this site is based on the administrative record.

2.4 Scope and Role of Operable Unit or Response Action

Previous Response Action Associated with this Response Action

Following the initial discovery in 1988 of ground water contamination, DOE began providing an alternative water supply to those residences with contaminated ground water. Provision of an alternate water supply was initiated to ensure immediate protection of human health from potential adverse effects due to the consumption and use of the contaminated ground water.

This Response Action and the Site Management Strategy

Pursuant to EPA Office of Solid Waste and Emergency Waste Response (OSWER) Directive 9355.3-02, possible reasons for implementing an interim action include: protection of human health and the environment from an imminent threat, or institution of temporary measures to stabilize the site to prevent further migration of the contaminant plume. The primary objective of this response action is to stabilize the site by controlling the ongoing migration of contaminants in the Northwest Plume.

A Site Management Plan (SMP) has been drafted which specifies the strategy for investigating and remediating hazardous substance releases. The draft SMP was submitted to the EPA and the Commonwealth of Kentucky for review. The proposed strategy in the draft SMP is to divide the site into source areas and environmental media which may be impacted by commingled hazardous substance releases from source areas. Discrete response actions (i.e., operable units) will be selected and implemented to address the source areas (i.e., source operable units) and the environmental media (i.e., integrator operable units) impacted by commingled releases from source operable units. Prioritization in the draft SMP for investigation and possible interim remedial actions have been assigned to each of the integrator operable units and source operable units depending on their potential for contributing to off-site contamination. Because integrator units serve as migration pathways that transport contamination from source operable units to off-site receptors, they receive the highest priority for undergoing initial evaluation and interim actions.

Consistent with the site management strategy in the draft SMP, this action has been prioritized to address the Northwest Plume of the ground water integrator operable unit which includes offsite contamination that may continue to migrate and contaminate clean aquifers and potentially expose additional offsite receptors. This interim action (operable unit) comprises an incremental step towards comprehensively addressing site problems. The primary objective of the interim action is to stabilize the site by initiating control of the northwest contamination plume. This interim remedial action addresses a portion of the ground water integrator operable unit by mitigating the spread of the high concentration portion of the Northwest Plume, decreasing the migration of contaminants from the Northwest Plume source area, and providing mass removal of the contaminants in the Northwest Plume. By implementation of interim actions, the ground water

integrator unit can be addressed in the most expedient manner consistent with the program management principles of the NCP.

The limited scale extraction and treatment systems in this ROD constitute the first phase in remediation of the ground water contamination. This action can be implemented rapidly while feasibility studies can be conducted for the remainder of the integrator operable unit. This phased approach is consistent with EPA OSWER Directive 9283.1-06 which sets EPA's policy for remediation of DNAPL contaminated ground water. The directive advises that the plume should be contained early, that initiation of early actions should take place as soon as possible after a problem is identified for which an early action is appropriate, and early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action. The directive further advises that remedial actions for DNAPL contaminated ground water should be implemented in a phased approach so that information gathered from implementation of the early phase(s) can support selection of an appropriate final action.

This interim action also includes implementation of a treatability study to evaluate an innovative technology that may serve to further reduce the long-term operating costs associated with this remedial action. The innovative technology to be studied is the utilization of iron filings as a viable alternative to pump and treat technology for ground water treatment. Section 2.7 of this ROD provides greater detail regarding the innovative technology and its treatability evaluation.

Future Response Actions Associated with this Response Action

The remedial action described by this ROD is not the final action for ground water or for the Northwest Plume. Following issuance of the ROD for this extraction and treatment system interim action, a feasibility study will be initiated to evaluate additional remedial alternatives to improvethe effectiveness of this limited scope interim remedial action. The use of low permeability walls around the source and pump areas of the dissolved phase plume will be included in the feasibility study. This study may lead to a Proposed Plan for a second interim action for the Northwest Plume.

Although a site investigation, public health and ecological assessment, and an alternative evaluation was performed for the PGDP site, a final action cannot be recommended until further characterization activities have been completed. Before a final action can be recommended for the ground water integrator operable unit, a baseline risk assessment must be completed for the ground water integrator operable unit, including ecological risk, and the following data gaps need to be addressed, at a minimum: more complete characterization of the Northeast Plume; the interaction between the Regional Gravel Aquifer (RGA) and the deep aquifer; the interaction between the RGA and Ohio River; and the interaction of all source operable units with the ground water integrator operable unit. Although additional data will be needed before the selection of a final action, sufficient information is available to support the interim remedial action presented in this document. This interim action should not be inconsistent with nor preclude implementation of any currently anticipated final remedy. Furthermore, data which is collected during this interim action will be utilized to assist in evaluation of design and implementation of the final

action.

2.5 Integrator Operable Unit Characteristics

Hydrogeologic Characteristics

The subsurface underlying the PGDP consists of four primary, correlational hydrogeologic units, the Upper Continental Recharge System (UCRS), the RGA, the Porters Creek Clay, and the McNairy Formation. These correlations are based primarily on the physical properties of the specific units. (SeeFigure 4).

The UCRS consists of clayey silt, with thin zones of sand and gravel appearing at various elevations throughout the plant site. The sand and gravel are relatively discontinuous laterally throughout the predominantly clayey silt of the upper continental deposits. The flow direction is primarily vertical in this unit owing to the large conductivity contrasts between it and the underlying RGA.

The RGA consists of sand and gravel facies of the lower continental deposits. This is the dominant flow system for this region due to its relatively high hydraulic conductivity and is the primary aquifer of interest in this interim remedial action. The unit ranges in thickness from 10 to 40 feet with its main source of recharge as infiltration from the upper continental deposits. The RGA is truncated by the Porters Creek Clay. This "terrace" results in the restriction of flow and high hydraulic gradient in this region of the plant. Toward the north end of the plant, near the Ohio River, the gradient increases indicating discharge conditions. Existing regional maps show that the RGA is thin or absent beneath the river implying that flow beneath the river is unlikely. The normal pool elevation of the Ohio River as reported by the United States Geological Survey (USGS) is 290 feet Mean Sea Level (MSL). This level depicts discharge conditions at the boundary of the RGA with the Ohio River. Consequently, the Ohio River is assumed to act as a sink, or hydraulic boundary to the flow system and is designated a constant head boundary with an elevation of 290 feet (MSL) for both the UCRS and the RGA.

The Porters Creek Clay is a predominantly clay layer that appears as a confining layer to the McNairy Formation only at the southern portions of the PGDP site, and is absent beneath most of the site. The exact northerly extent of this layer is not certain, but it appears to extend only slightly north of the terrace.

The McNairy Formation consists of interbedded and interlensing sand, silt, and clay. This unit is approximately 225 feet thick and lies at depths ranging from 70 to 100 feet below the ground surface. Regionally, the McNairy grades from predominantly sand near the Mississippi River Valley to both sand and clay near the PGDP. Water within this unit moves probably in a northerly direction with discharge areas along the Ohio River.

Various testing methods were used to characterize these units with respect to conductivity, transmissivity, storativity, and hydraulic gradient. Investigative methods include collection of monthly water level data from monitoring wells onsite and offsite of the plant, aquifer pump tests, slug

tests and numerical modeling and optimization of the site. The most complete set of conductivity data for the area comes from slug tests performed on the various hydrogeologic units.

In 1990, DOE commissioned the Phase I Ground Water Study which prepared a three dimensional ground water flow model of the PGDP. This model has been updated into a regional three dimensional ground water flow model for the PGDP and an optimization plan for well placement by means of a three phase study incorporating the results of new data obtained at the plant since 1990. The Phase I Ground Water Study which was completed in March, 1992 served to outline the strategy proposed to meet the objectives for the updated three phase study. Specifically, Phase 1 outlined the current conceptual model and new hydrogeologic data to be incorporated into the new model.

The Phase II Ground Water Study incorporated the new data and conceptual model revisions into an updated three dimensional flow model. Calibration and sensitivity analyses also were conducted. This phase was completed in August of 1992. The Phase III Ground Water Study is the latest optimization plan for well placement utilizing the results from the updated Phase II Ground Water Study flow model. This phase was completed in December of 1992.

The model is based on a USGS finite difference block centered numerical code called MODFLOW. This code allows variable grid dimensions, layer thickness and a mixed distribution of aquifer parameters. In addition, MODFLOW is modular, which means that additional programs may be used in conjunction with the main code. Additional enhancement codes have been utilized for purposes of modeling the PGDP to mathematically determine the best well locations and optimal pumping rates necessary to contain the plume.

The model was calibrated by matching computer generated water levels to observed water levels. Calibration helped to determine layer elevations and hydraulic aquifer parameters. Following calibration, the pathway and rates of ground water movement were modeled using particle tracking.

Contaminant Characteristics

The contaminants of concern within the Northwest plume are TCE and [99]Tc. TCE was commonly used onsite as an industrial solvent for several years. This halogenated compound is designated as a dense non-aqueous phase liquid (DNAPL) due to the characteristic insolubility at high concentrations and a higher specific gravity than water. Once released into the environment TCE tends to travel by gravity in a downward path. Lateral movement results predominantly by contact with low permeable areas and capillary action. Due to the insolubility, TCE will tend to travel along bedding planes regardless of the direction of ground water flow. DNAPLs tend to persist for long periods, while slowly releasing a dissolve phase into the ground water.

[99]Tc is the most widespread radionuclide present at PGDP. This radionuclide resulted as a by-product of the reprocessing of uranium. The introduction of TCE and ^{99}Tc into the ground water was probably due to the past handling or disposal practices. [99]Tc is very soluble in water and will tend to readily migrate in the direction of normal ground water flow.

2.6 Summary of Site Risks

The findings of an assessment of potential risks to public health and the environment as a result of the contamination migrating offsite was reported in the Draft Results of the Public Health and Ecological Assessment, Phase II (Document #KY/SUB/13B-97777CP-03/1991/1, 1991). Contaminated residential wells are currently not being utilized for domestic use of ground water. However, the domestic use of off-site ground water is a potential future exposure pathway.

The results of the Draft Results of the Public Health and Ecological Assessment, Phase II (PHEA) suggested potential adverse effects from domestic use of ground water based on the estimated excess lifetime cancer risk and hazard indices. Trichloroethylene from off-site monitoring wells created a potential increased lifetime cancer risk for the sum of ingestion and inhalation pathways. The concentration of TCE within the area of the planned interim action is above 1,000 ug/l, while the Maximum Contaminant Level (MCL) cited in the Safe Drinking Water Act (SDWA) is 5 ug/l.

The PHEA found that the critical exposure pathway is related to the offsite migration of on-site contaminant sources. The PHEA also recommended action to eliminate the off-site migration of these contaminants. Based on the preliminary results of the PHEA and the ground water studies, DOE, EPA, and the Kentucky Division of Waste Management have decided that there is sufficient potential risk to the public and environment to warrant an interim action. The principle goals of this interim action are to decrease the risk by mitigating the spread of the high concentration portion of the Northwest Plume, retarding the migration of the contaminants emanating from the source area, and to provide mass removal of the contaminants in the Northwest Plume. Prior tothe implementation of the final remedial action a baseline risk assessment will be conducted on the ground water integrator operable unit.

2.7 Description of Alternatives

Two alternatives were considered for addressing the ground water contamination in the Northwest Plume. The first alternative would be to take no action at this time and simply allow the ground water to continue to migrate toward the Ohio River. The second alternative would provide for an interim action which will alter the hydraulic gradients through ground water extraction. This second alternative will initiate containment of both the source and high concentration areas of the ground water plume. These two alternatives are described in greater detail in the subsequent paragraphs.

Alternative 1 - No Action

Pursuant to Section 300.430(e)(6) of the NCP, DOE is required to consider a no action alternative. This alternative is useful as a baseline for comparison between potential alternatives. Under this alternative no further action would be taken with regard to the contaminated ground water.

Alternative 2 - Extraction and Treatment, and Innovative Technology Treatability Study

This alternative involves the operation of a pilot extraction and treatment system to initiate hydraulic containment of the source area and the centroid of the plume. The selected remedy will include the following activities:

i) The contaminated ground water will be extracted at two locations. The first location, immediately north of the plant on DOE property, is to initiate control of the source. While the second ground water extraction location is offsite of the DOE reservation at the northern tip of the most contaminated portion (greater than 1000 ug/l of TCE) of the plume. The contaminated ground water will be pumped at a rate to reduce further contribution to contamination northwest of the plant without changing hydraulic gradients enough to mobilize Dense Non-aqueous Phase Liquids (DNAPL) or significantly affect other plumes. This pumping rate may be modified during operation to optimize hydraulic containment by adjusting flow from the extraction wells and to support subsequent actions.

ii) The extracted ground water will be collected in a manifold and piped to the treatment system, which will consist of two ion exchange units in parallel followed by an air stripper with filtration for off gas emissions.

iii) The amount of treated water discharged will be limited by the flow capacity of the skid mounted treatment units. The treated water will be discharged through Kentucky Pollution Discharge Elimination System (KPDES) permitted outfall 001.

iv) This interim action also includes implementation of a treatability study to evaluate an innovative technology. The innovative technology to be studied involves the potential utilization of iron filings as a viable alternative to pump and treat technology for ground water treatment.

v) The remedy does not address source remediation, however; the remedy will address continuing release from a DNAPL principal threat source area.

Approximately fourteen (14) months will be required to design and construct the selected remedy prior to initiation of operation and maintenance activities. This pilot system will be evaluated for a period of 2 years to determine the treatment efficiency of the extracted ground water, the effect of extraction on the RGA, and to evaluate the potential benefit of an innovative technology (treatment with iron filings) Alternative 2 as developed in the Focused Feasibility Study and presented in the Proposed Plan, satisfies all identified ARARs for the interim action cited within this document.

2.8 Summary of the Comparative Analysis of the Interim Alternative

This section provides the basis for determining which alternative (i) meets the threshold criteria of overall protection of human health and the environment, State approval, and compliance with ARARs, and (ii) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost, and (iii) satisfies community acceptance. Because of the limited scope of this interim action, the comparative analysis focuses on the selected remedy, while considering the no action alternative under the appropriate criteria.

Federal law requires nine criteria be used for evaluating the expected performance of remedial actions. The nine criteria are introduced below and the present proposal is evaluated on the basis of these criteria. Because this action is intended to integrate both RCRA and CERCLA requirements, State acceptance has been substituted for State approval and listed as one of the threshold criteria. This change is necessary to reflect the fact that this interim action was initiated under the provisions of the Kentucky Hazardous Waste Permit and must fulfill those RCRA requirements.

1. Overall protection of human health and the environment. Requires that the alternative adequately protect human health and the environment, in both the short and long-term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

2. Compliance with applicable or relevant and appropriate requirements (ARARs). The alternatives must be assessed to determine if they attain compliance with applicable or relevant and appropriate requirements of both state and federal law.

3. Long-term effectiveness and permanence. Focuses on the magnitude and nature of the risks associated with untreated waste and/or treatment residuals. This criterion includes consideration of the adequacy and reliability of any associated engineering controls, such as monitoring and maintenance requirements.

4. Reduction of contaminant toxicity, mobility, or volume through treatment. The degree to which the alternative employs treatment to reduce the toxicity, mobility, or volume of the contamination.

5. Short-term effectiveness. The effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers and the time required until protection is achieved.

6. Implementability. Potential difficulties associated with implementing the alternative. This may include: the technical feasibility, administrative feasibility, and the availability of services and materials.

7. Cost. The costs associated with the alternatives. These include the capital cost, annual operation and maintenance and the combined net present value.

8. State approval. The incorporation of any formal comments by the Kentucky Division of Waste Management to the Interim Measure for the Northwest Plume.

9. Community acceptance. The consideration of any formal comments by the community to the Proposed Plan for interim remedial action.

The criteria listed above are categorized into three groups. The first, second, and eighth categories are threshold criteria. The chosen final alternative must meet the threshold criteria to be eligible for selection. The five primary balancing criteria include criterion three through seven. The last criterion is termed the modifying criterion. The modifying

criterion was evaluated following issuance of the Proposed Plan for public review and comment.

Overall Protection of Human Health and the Environment

Alternative 1 doesn't provide protection of human health or the environment. However, the risk cannot be quantified until a baseline risk assessment has been conducted at this site. Alternative 2 is intended to serve as an interim action which will provide protection to both the public and the environment by limiting the migration of the contaminated plume. Additionally, Alternative 2 will provide treatment of the ground water to decrease the concentration of the specific contaminants which are causing the threat.

Currently, the threat of direct exposure to the contaminated ground water has been mitigated by the supply of a clean alternative water source to the affected residences. However, due to the persistence of this form of contamination in ground water the potential exists for risk to future water well users.

Compliance with ARARs

Table 1 lists the ARARs for this interim remedial action. This table only lists those ARARs pertinent to the limited scope of this interim remedial action. Therefore the ARARs listed in Table 1 pertain to the extraction and treatment system operations and not to any ARARs associated with aquifer remediation goals. Such ARARs will be addressed in subsequent remedial actions. In some instances, rules cited contain both substantive and procedural or administrative requirements. In accordance with the NCP, only the substantive requirements are ARARs.

Alternative 2 as developed in the Focused Feasibility Study and presented in the Proposed Plan, satisfies all identified ARARs for the interim action cited within this document. No ARAR waivers were necessary.

Long-term Effectiveness and Permanence

The no action alternative could cause potential health and environmental impacts to occur through a future exposure scenario. The extraction and treatment system is intended as an interim action until sufficient information can be accumulated to formulate the final solution for this integratoroperable unit. This action is intended to be consistent and appropriate with the final remedial action. The effectiveness and efficiency of this system will be evaluated for potential final actions. Additionally, the treatability test for the in situ reactor concept will be evaluated to determine its feasibility as a future remedial solution. This potential future action uses an innovative passive system which utilizes iron filings to efficiently remove contaminants while also providing cost effectiveness.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The extraction and treatment system would serve to reduce the mobility of the contamination by initiating control of the source area and preventing

further spread of the high concentration areas of the ground water plume. Further, the extracted ground water will be treated by ion exchange and air stripping to lower the concentration of the contaminants to reduce the toxicity and volume of the contaminants. The potential exists for the ^{99}Tc to become concentrated within the

ion exchange media. The DOE is prepared to provide for the handling and storage of contaminated ion exchange material at PGDP.

Short-term Effectiveness

The remediation of ground water contaminated with organic solvents and radionuclides is a long-term process. The treatment systems may require extensive periods of time before the remedial objective can be defined and attained. This interim action will provide effective short-termstabilization of the contaminated plume.

The extraction and treatment will be conducted in compliance with all of the ARARs cited in Table 1. This alternative will not pose a threat to nearby communities or the workers associated with the operation and maintenance of the treatment system. Workers associated with the construction and operation of the extraction and treatment system will abide by the requirements of a site-specific Health and Safety Plan (HSP). This HSP will be prepared as part of the bid package and submitted to the selected contractor prior to the award of the project. Prior to implementation of this interim action the EPA and KDEP will be provided the opportunity to review the HSP. The draft HSP will be modified by the contractor to reflect pertinent comments by the Regulatory Agencies.

Implementability

The ground water extraction, and air stripping, cited in Alternative 2 are readily available technologies and no difficulty should be encountered in finding vendors to supply the treatment equipment. Experience with large scale treatment for ^{99}Tc, however, is limited and data on the capacity of the ion exchange resins selected for this action is incomplete.

Cost

The estimated capital cost of the extraction and treatment system is between $11-12 million with an annual operating cost of between $1.5-2 million. A complete breakdown estimate for the costs associated with Alternative 2 is included in Table 2 of this document. DOE considers the expenditures associated with extraction and treatment to be reasonable and appropriate for this interim remedial action.

State Approval

The Technical Memorandum, Proposed Plan and Draft ROD were issued for review and comments by both the Commonwealth of Kentucky and the EPA. This documentation was developed consistent with the RCRA Interim Corrective Measures Work Plan. The Kentucky Division of Waste Management concurs with this action, consistent with the requirements of the Commonwealth of Kentucky's RCRA permit.

Community Acceptance

Judging from the comments received during the public comment period, the selected interim remedy specified in the Record of Decision is supported by the residents of McCracken County, Kentucky; including the local PGDP Neighborhood Council, and the PGDP Environmental Advisory Committee. The United States Environmental Protection Agency, Kentucky Division of Waste Management, the Tennessee Valley Authority, and the United States Department of the Interior also concur with the selected remedy.

Groups and organizations which oppose this interim action include the Association of Concerned Environmentalists, the Coalition for Health Concern, and the Kentucky Radiation Control Branch (RCB). Those opposing the interim remedial action generally expressed a concern that insufficient information is available to select a remedial action and that this remedy is not cost effective.

Community response to the alternatives is presented in the responsiveness summary which addresses comments received during the public meeting and the public comment period.

2.9 Selected Remedy

The selected remedy for the interim action at

the Northwest Plume is Alternative 2. The principle objectives of this action are to initiate a first phase remedial action, which in combination with possible future remedial actions for ground water, will ultimately result in achieving the final remedial goals for the site. The ground water will be extracted at two locations and pumped to mobile treatment units. The first well location is just north of the plant on DOE property. The second well location is at the northern tip of the most contaminated portion (TCE greater than 1000 ug/l) of the plume (Figure 3). The contaminated ground water will be pumped at a rate based on the predictions provided by ground water modeling. The rate at which the ground water will be extracted will be adjusted to reduce further contribution to contamination northwest of the plant without changing hydraulic gradients enough to mobilize DNAPL or significantly affect other plumes. Data gathered during the operation will be used to modify the model in order to optimize hydraulic containment by adjusting flow from the extraction wells.

The extracted ground water will be collected and piped to the treatment system consisting of two ion exchange units followed by an air stripper unit. The amount of water discharged will be limited by the flow capacity of the skid mounted treatment units. The treated water will be discharged through Kentucky Pollution Discharge Elimination System (KPDES) permitted outfall 001. This outfall is located on DOE property and discharges into Big Bayou Creek.

Ion exchange is a process by which an ion is captured from a solution and replaced with a different ion. The capture takes place by chemisorption onto an electrochemically charged resin surface. Anion exchange resin beads are composed of chemicals which carry positive charges. The resin contains

anions adsorbed into the surface of the resin beads. Pertechnetate (TcO[4-]) ions have a greater affinity for the resins under consideration than other ions in the ground water so that pertechnetate ions tend to preferentially adsorb onto the surface of the resin. Lab and bench scale studies using ion exchange to remove ^{99}Tc have shown this method to be effective. Air stripping is a process by which water containing VOCs is brought into contact with air. The stripper will be designed to reduce the concentrations of TCE in the water. Other VOC contaminants such as TCE degradation products are present in much smaller concentrations so that an air stripper that removes the TCE will also remove other volatiles that might be present. The effectiveness of this technology is enhanced by exposing an increased surface area of contaminated water with the airstream. This is accomplished by performing the operation in packed towers. Conventional air strippers spray water into the top of the column and allow the water to trickle over the packing. Air is blown into the bottom of the tower and contacts the water in a countercurrent flow. In the event that air stripping is selected, it will be necessary to install a filter system to eliminate mobilization of contamination into the air. The decision to install these filters is based upon EPA OSWER Policy Directive 9355.0-28, and Sections 300.430(e)(7)(i) and 300.430(e)(9)(iii)(D) of the NCP, which sets forth the statutory preference for implementing actions which employs effective treatment.

It may be necessary to obtain a permit for discharging TCE into the airstream. A Kentucky water withdrawal permit may also be required by the State for withdrawal, diversion, or public transfer of more than 10,000 gallons per day public water from its source. The State also may require construction and operating permits for the construction of the wastewater treatment facility. Estimated cost of the hydraulic containment remedy is presented in Table 3.

The DOE will begin to prepare a detailed design of the treatment system when EPA and the Kentucky Division of Waste Management concur with the ROD for this interim action, in accordance with the approved ICM Work Plan. The conceptual proposal presented in the Technical Memorandum for Interim Action of the Northwest Plume suggests the following system. Ground water wouldbe pumped into a manifold where it will be routed to the water into the treatment system. A sample valve would be installed just before the treatment system for inlet water sampling. The water then passes through an inlet filter which removes suspended solids from the water. A side stream is pulled off after the inlet filter to supply the treatability study for the iron filings reactor on the south treatment system. The other treatment system will not have an iron filing reactor. The next split in the line allows the air stripping process to occur prior to ^{99}Tc removal if desired. The influent is split into two streams to supply each of the ion exchange columns. Both streams pass through flow rate meters and cumulative flow meters in route to the ion exchangers. From the ion exchange columns, the water passes another sample point and through a second anion exchange column to monitor the discharge for radiation. The treated water from the bottom of the air stripper is pumped to either discharge or to the ^{99}Tc treatment loop. A sample valve is provided after the pump discharge line.

The primary parameters to be monitored are the influent and effluent concentrations of contaminants. The data quality objectives (DQO) for these

parameters will include level I (field data), II (field scintillation), and III (laboratory data). Influent and effluent concentrations will be monitored on a daily basis throughout the testing program. Each treatment system will be sampled on alternate days. Analytes initially will included ^{99}Tc, TCE, and pH, although this list may be expanded or reduced as the program evolves upon concurrence by EPA and KDEP.

Piezometric measurements of the water table will be made throughout the program to gather data necessary for ground water modeling and to demonstrate gradients toward the collection wells. These measurements will meet the criteria for DQO level I. Cumulative flows will be monitored in order to establish resin capacity in the ion exchange treatment system. The DQO level for these measurements will be level I. DQO level I & II analyses will be performed by personnel on-site. Each treatment

Table 3. Estimated Cost of Hydraulic Containment Remedy

Surface water discharge, Air Stripper with carbon filtration, double-walled piping

Capital Investment of Hydraulic Containment Option
with Air Stripping and Ion Exchange Systems:

1. Ion Exchange System:
$202,223

2. Air Stripping System:
$529,370

3. Well Installation, laboratory construction, piping and miscellaneous:
$8,713,171

Subtotal
$9,444,764

Contingencies @25%:
$2,361,191

Total Capital Investment:
$11,805,955

Estimated Operation and Maintenance (annually):
$1,719,236

TOTAL COSTS:

Net Present Value assuming an inflation rate of 3.5%,
a discount rate of 7% and two years of operation:
$15,188,190

facility will be sampled every other day. Monthly samples will be taken from both treatment facilities on the first working day of each month. The frequencies may be changed when sufficient data has been accumulated to make

more informed judgments about data adequacy. Changes in frequencies or in operating parameters will occur only after concurrences by EPA andthe Commonwealth of Kentucky. Monthly replicate samples taken by onsite personnel will be analyzed by laboratory personnel. The cost of the analysis of the replicates is estimated to be $100/sample for TCE, $40/sample for ^{99}Tc, and $200/sample for metals. Other compounds that will be analyzed on a monthly basis include TCE degradation products and other organic compounds.

Observation wells will be installed in the area proximal to the extraction wells. Approximately 20 observation wells will be installed near the pumping wells. Data loggers will be installed in the well field to constantly monitor ground water level. All observation wells will be use in the effectiveness monitoring program. The purpose of the well effectiveness monitoring is to create and maintain an adequate database on the hydrogeologic situation in the Northwest Plume and to enable changes to be made in extraction/injection that will optimize remediation and containment. This data base will be created using newly constructed and existing wells.

Concurrent with the interim remedial action proposed in Alternative 2, was a provision for a treatability study to examine a promising innovative technology. In this treatability test, ground water will be extracted from wells just north of the plant and diverted from the treatment facility to a cylinder packed with iron filings in order to ascertain the effectiveness of iron filings in destroying TCE and precipitating [99]Tc. Studies examining sorption of organic contaminants on well casing materials demonstrated that several chlorinated organic compounds disappeared from solution over time when in contact with galvanized metal and aluminum. Further investigation verified the disappearance of chlorinated organic compounds from solutions when in contact with various metals. The same effect was later demonstrated using iron filings. The reaction mechanism associated with this innovative treatment technology has not yet been fully explained. Pilot demonstrations have been conductedusing an in situ reactor which consisted of a wall composed of 22% by weight iron and 78% by weight sand constructed below the ground perpendicular to the direction of flow of the ground water. A source of mixed chlorinated organic compounds, including TCE, was emplaced upstream of the wall and it was demonstrated that the TCE concentration was reduced by 95% as a result of passing through the reactive wall. Since iron will also reduce pertechnetate ion to insoluble technetium dioxide, the reactive wall concept can also be used for removal of ^{99}Tc from the ground water.

If the innovative technology is shown to be an effective treatment technology, a feasibility study will evaluate use of this technology as a reactive material placed as a vertical wall in the contaminated aquifer. The wall would be designed to allow ground water to naturally flow through the reactive medium and be passively treated without extraction and treatment at the surface. The reactive wall concept shows great promise as a viable alternative to pump and treat technology for ground water treatment. However, at this time, it is an emerging innovative technology which needs further development before it can be utilized as a final remedy.

An additional aspect of the treatability study of this action is to evaluate, on a pilot plant scale, the effectiveness of ion exchange technology in remediation of ground water contaminated with technetium.

2.10 Statutory Determinations

The DOE, EPA and Kentucky Division of Waste Management concur that the extraction and treatment system will satisfy the CERCLA 121(b) statutory requirements of: providing protection of human health and the environment, attaining applicable or relevant and appropriate requirements directly associated with this action, being cost-effective, utilization of permanent solutions and alternative treatment technologies to the maximumextent practicable, and a preference for treatment as a principle element.

Protection of Human Health and the Environment

Although the ground water within the contaminated plume is not currently used as a source of drinking water for the local residents, under future use scenarios it presents a potential threat to human health and the environment. The interim action remedy initiates protection of human health for the future users through mitigation of the spread of the plume until a final action is determined. The remedy also provides protection to the environment by providing treatment of the extracted ground water prior to discharge, and effective management of all residual wastes generated during implementation of the action.

Compliance with ARARs

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 was passed by Congress and signed into law on December 11, 1980 (Public Law 96-510). This act was intended to provide for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive waste disposal sites." The Superfund Amendments and Reauthorization Act (SARA), adopted on October 17, 1986 (Public Law 99-499), did not substantially alter the original structure of CERCLA but provided extensive amendments to it. In particular, 121 of CERCLA specifies that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws which are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site. Inherent in the interpretation of applicable or relevant and appropriate requirements (ARARs) is the assumption that protection of human health and the environment is ensured.

CERCLA on-site remedial response actions must only comply with the substantive requirements of a regulation and not the administrative requirements to obtain federal, state, or local permits [CERCLA 121(e). For the purposes of this ARAR summary, remediation of off-site ground water at PGDP is considered an "on-site" CERCLA response pursuant to the National Contingency Plan, 40 C.F.R. 300.5.]

The final cleanup levels for the ground water are not addressed in this ROD because such goals are beyond the limited scope of this action. The final cleanup levels will be addressed by the final remedial action ROD for the ground water integrator operable unit.

The treatment system for the extracted ground water will meet all Federal

and State surface water quality standards. Additionally, the air stripper will be designed to meet the Federal and State air quality standards. The treated ground water will meet the substantive requirements of the Kentucky Pollutant Discharge Elimination System (KPDES) program for discharge to surface water.

A listing of ARARs (chemical-specific, location-specific, and action-specific) are provided in Table 1 of this document. Pursuant to 300.430(f)(1)(ii)(C) of the NCP an alternative which doesn't meet federal or state ARARs can be selected if the action is an interim measure that would become part of a final action which will attain ARARs.

Chemical-Specific ARARs

The principal contaminants of concern in the off-site ground water are ^{99}Tc and TCE. Therefore, available chemical-specific criteria that have been promulgated under federal and Kentucky state law that are applicable to this response action are listed in Table 1. TCE degradation products, metals, and gross alpha and beta activity will be included in the list of analytes and analyzed on a routine basis.

The Kentucky Water Quality Standards nondegradation policy [Title 401 Kentucky Administrative Record (KAR), Chapter 5:029(2)] is to safeguard the surface waters of the state for their designated uses, to prevent the creation of any new pollution, and to abate existing pollution. The Kentucky regulations list six use-designation categories for Kentucky's surface waters (KAR 5:026). Specific water quality standards are promulgated for each use category. Big Bayou Creek is not specifically listed and given a use classification in the Kentucky water regulations (401 KAR 5:026); however, it is classified by reference for warm water aquatic habitat, and primary and secondary contact recreation [401 KAR 5:026; KAR 5:200(2)]. The Kentucky WQC for warm water habitat are found in Title 401 KAR 5:031.

Also listed on Table 1 are the effluent limitations established for Outfall 001 on Big Bayou Creek (KPDES Permit No. KY0004049). This permit was revised and reissued, effective November 1, 1992.

The chemical-specific federal and state regulations for protection of the surface water are presented below in Table 4.

Radiation Protection Standards

Very few applicable standards are available for the cleanup of radioactively contaminated CERCLA sites. The Atomic Energy Act (AEA) of 1954 and its amendments delegated authority for control of nuclear energy to DOE, the U.S. Nuclear Regulatory Commission (NRC), and EPA. In addition, certain states have regulatory authority and programs for radioactive waste. EPA's regulations are derived from several other statutes as well and cover many types of activities and all types of radioactive materials. The NRC licenses the possession and use of various types of radioactive materials at certain types of facilities. Kentucky is an NRC-agreement state and, as such, has its own authority and licensing regulations. DOE is authorized to control all types of nuclear materials at sites under its jurisdiction and is exempt from the NRC licensing and regulatory requirements.

DOE regulations for handling and cleanup of radioactive materials are outlined in a series of internal DOE Orders that are contractually binding to DOE contractors but are not considered by EPA to be ARARs. However, DOE Orders are "generally" consistent with, and "typically" incorporate NRC technical requirements that are appropriate for DOE operations and waste management. Therefore, for the purposes of development of ARARs, DOE Orders will be treated as TBC guidance.

If any wastes generated during drilling of wells or as treatment residuals contain radionuclides and are identified as RCRA-characteristic waste, the waste would then be termed "mixed waste." In effect, mixed wastes are those containing a RCRA hazardous waste as defined in 40 C.F.R. 261 and a radioactive waste subject to the AEA. RCRA regulations apply to the hazardous component of the waste, and AEA regulations apply to the radioactive component. When the application of both standards is conflicting or inconsistent, RCRA yields to the AEA. Kentucky received final authorization to regulate radioactive mixed waste on December 19, 1988 (53 Fed. Reg. 41164, October 20, 1988); however, the state has not implemented any regulations governing the radioactive component of mixed waste.

EPA has promulgated MCLs for radionuclides in community water systems. These MCLs appear in two forms-concentration limits for certain alphaemitting radionuclides (40 C.F.R. 141.15) and an annual dose limit for the ingestion of certain beta- and gamma-emitting radionuclides (40 C.F.R. 141.16). Kentucky lists MCLs in the Kentucky Public and Semipublic Drinking Water Regulations, Title 401 KAR Chapter 8:550, Section 4 which are identical to the federal MCLs. The use of MCLs as ARARs are not appropriate for this action due to the fact that the extracted water will not be reinjected back into the aquifer and the scope of this interim action is not intended to provide ground water restoration. However, the treatment system described in Alternative 2 will be designed to provide treatment to levels comparable with MCLs. Therefore, the MCL levels will be utilized as remedial goals. The treatment system will remain within compliance parameters as long as the applicable substantive KPDES requirements for discharge are maintained.

Subpart H of 40 C.F.R. 61 addresses atmospheric radionuclide emissions from DOE facilities and may be applicable to airborne emissions during cleanup of contaminated ground water. EPA has issued a final NESHAP rule (54 Fed. Reg. 51654, December 15, 1989) that limits emissions of radionuclides to the ambient air from DOE facilities to amounts that would not cause any member of the public to receive an effective dose equivalent of 10 mrem/year (40 C.F.R. 61.92).

DOE Orders. The radiation exposure limits for the general public defined in DOE Order 5400.5 (Radiation Protection of the Public and the Environment, February 8, 1990) are: an effective dose equivalent (EDE) of 100 mrem/year from all exposure pathways and all DOE sources of radiation and a dose of less than 500 rem/year as a temporary maximum exemption under specially-permitted and DOE-approved circumstances. The overriding principle of the DOE Order is that all releases of radioactive material shall be ALARA.

DOE Order 5400.5 lists Derived Concentration Guides (DCGs) for radionuclide

isotopes which are based on a committed effective dose equivalent of 100 mrem/year for ingestion of air or water. For liquid wastes containing radionuclides which are discharged to surface waters, the best available technology (BAT) must be used if the receiving water, at the point of discharge, would receive radioactive material at a concentration greater than the DCG. Guidelines for selecting the BAT are given. Implementation of theBAT process is not required if annual releases to surface water are below the DCG. In the case of releases of multiple radionuclides, the sum of the fractional DCGs must not exceed unity. The ingested water DCG for ^{99}Tc is 1.0E-4 Ci/ml. In addition, effluent releases to surface water must not result in exposures to aquatic organisms which exceed an absorbed dose of 1 rad/d.

Location-Specific ARARs

Location-specific requirements "set restrictions upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 Fed. Reg. 51394). Table 1 lists locationspecific ARARs that might be pertinent to this remedial action.

Aquatic resources. There are no federal wilderness areas, wildlife refuges, or scenic rivers near PGDP. However, the land between the plant boundary and the Ohio River was deeded or leased to the Kentucky Department of Natural Resources and Environmental Protection as part of the West Kentucky Wildlife Management Area (WKWMA). There are no federal or state regulations specifically applicable to wildlife management areas. However, the Kentucky Department of Fish and Wildlife (KDFW) manages the area. In the event that any remedial activities would impact the WKWMA, DOE will consult with KDFW.

Action-Specific ARARs

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (52 Fed. Reg. 32496). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals. Federal and state regulations appear in Table 1 and are summarized below.

Construction Activities

Site preparation. Certain on-site construction activities may be necessary to prepare the site for remediation; these action might include the development of additional roads for vehicular traffic or site cleaning activities. Airborne pollutants may result from these construction activities. The primary concern is elevation of particulate concentrations resulting from earthmoving and site-grading activities. The Kentucky Air Quality regulations contain General Standards of Performance governing fugitive dust emissions (401 KAR 63:010).

Storm water discharges from activities at industrial sites involving construction operations that result in the disturbance of five acres total land have been included in the final rule for NPDES permits for storm water discharges (40 C.F.R. 122). Kentucky is developing storm water discharge regulations; however, until they are promulgated, they are operating under

40 C.F.R. 122. This Rule specifies that Best Management Practices and sediment and erosion controls be implemented at a site to control storm water runoff (57 Fed. Reg. 41176, September 9, 1992). Kentucky does have a general permit in place for storm water runoff from construction sites (KYP100000).

Well construction. Although the construction of water withdrawal wells is regulated under 401 KAR 6:310, this action will be exempted from this requirement. The regulation is not applicable for monitoring wells. However, wells must be constructed by a certified driller [401 KAR 6:310(3)] according to specified design factors [401 KAR 6:310(4)] and construction materials [401 KAR 6:310(9)], as well as other requirements. Requirements are also given for monitoring well construction [401 KAR 6:310(13)].

Pumping. Water withdrawal permits are required under authority of KRS 151 and 401 KAR 4:010 for wells or systems that pump greater than 10,000 gallon per day. Although a permit is not required for a CERCLA action, the substantive requirements of these regulations are applicable. Treatment. As mentioned previously, no federal or state permits are required for on-site CERCLA response. However, compliance with the substantive requirements of any applicable permitting processes are required. An air stripper with an air filter will be used to remove TCE and other degradation products from the water column, and an ion exchange column will remove radionuclides; mobile wastewater treatment units will be utilized.

Air emission control. Kentucky regulates air emissions via their Air Toxics Regulation (401 KAR 63:022); the state has issued a "Guidance for Compliance with the Air Toxics Rule." Since this is a CERCLA action, no air permit would be required if emissions exceed the standards, but the threshold of TCE will not be exceeded in the air stripper. However, compliance with the substantive requirements will be fulfilled.

Disposal of treatment residuals. During operation, spent ion exchange elements or other treatment residuals may be generated by the treatment unit. Accumulation or on-site storage of this waste may be required prior to disposal. If the residuals are RCRA-characteristic waste and are accumulated for greater than 90 days, the 40 C.F.R. 264 regulations apply ("Container storage," Table 1). This wastewater treatment unit selected for this action will be exempt from RCRA Subtitle C standards for tank systems, conveyance systems, and other ancillary equipment. Under 40 C.F.R. 270.1(c)(2)(v), the action would be considered an action under 402 or 307(b) of the Clean Water Act, therefore fulfilling RCRA requirements for exemption.

Placement of treatment residuals containing RCRA-characteristic waste to another unit that has not been designated as a Corrective Action Management Unit, will trigger the 40 C.F.R. 268 LDR. However, DOE applied for a one-year case-by-case extension under 40 C.F.R. 268.5 of the May 8, 1992, effective date of the LDRs applicable to Third/Third mixed wastes generated and stored at PGDP, as well as 30 other sites (57 Fed. Reg. 22024, May 26, 1992). Whether the waste is characterized as RCRA characteristic, LLW, or mixed waste, it will be stored at an appropriate facility at PGDP which meets the substantive requirements of RCRA.

Transportation of treatment residuals. RCRA hazardous waste must be

packaged in accordance with Department of Transportation (DOT) regulations codified in 49 C.F.R. 175, 178, and 179 if transporting occurs along public roads. In addition to the manifest and pre-transport requirements of 40 C.F.R. 262, standards for labeling, marking, and placarding are stated in 49 C.F.R. 172. These requirements are considered ARARs for hazardous or radioactive waste if the action meets the prerequisites as a generator of a hazardous waste and the transportation of wastes from the site to PGDP is considered an off-site action.

Disposal of Treated Media

Direct discharge to surface water body. Direct discharge to a surface water body (see "direct discharge of treatment system effluent," Table 1) will be implemented if the treated water meets CWA State Water Quality Criteria for the designated use of the water body and the substantive requirements of the Kentucky Pollutant Discharge Elimination System (KPDES) effluent standards for point source discharge to Outfall 001 (KPDES Permit KY0004049). Table 1 lists these standards.

The extraction and treatment system would meet all of the regulatory requirements cited as ARARs for this action. The final ground water effluent will meet all Federal and State water quality standards for discharge to surface water. In the event that air stripping is selected, it will be designed to meet the Federal and State air quality standards. This may include receipt or modification of the necessary permits, compliance with all maintenance and reporting requirements, and adherence to treatment performancecriteria.

It is premature to establish chemical-specific ARARs for ground water at this time. Once the ground water is pumped to the surface, chemicalspecific ARARs will apply in the form of discharge limits. Location-specific ARARs such as wetlands protection and action-specific ARARs such as monitoring wells will also apply.

Cost Effectiveness

The interim action remedy employs a proven technology which affords overall effectiveness proportional to its costs such that the remedy represents reasonable value. This action will utilize a relatively inexpensive technology to initiate control of the source and mitigate the spread of the contaminated ground water. This limited scale containment operation should reduce the cost of the overall remediation of the integrator operable unit by retarding the migration of the high concentration portion of the plume. By extracting the ground water at the locations proposed in this document, DOE will be able to mitigate the area of highest contamination through the use of four wells and portable skid mounted treatment units.

Utilization of Permanent Solutions and Alternative Treatment Technologies

The objectives for this interim action are to stabilize the site by mitigating the spread of the most contaminated portion of the plume. This action should provide protection for human health and the environment. However, it does not fully address the principle threats to human health and the environment posed by the Northwest Plume operable unit. Extraction and

treatment of contaminants in the aquifer will achieve some reduction in the contamination at the site. This is not the final action planned for the ground water contamination. Subsequent actions will address fully the principle threats posed by the conditions at the PGDP. Utilization of a permanent solution will be addressed in thefinal decision document for the site.

Preference for Treatment as a Principle Element

This interim action satisfies the statutory preference for treatment of the discharged effluent as a principle element of the containment system.

2.11 Documentation of Significant Changes

The Proposed Plan for Interim Remedial Action of the Northwest Plume, was released for public comment on March 18, 1993. The Proposed Plan identified Alternative 2, extraction and treatment, as the preferred alternative. DOE has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 03/28/1994
Operable Unit: 06
ROD ID: EPA/ROD/R04-94/169

Media: soil, sediment

Contaminant: Radionuclides, polychlorinated biphenyls (PCBs)

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The 740-acre Paducah Gaseous Diffusion Plant (PGDP) is located in Paducah, Kentucky. The PGDP is located on a 1,350- acre reservation approximately 4 miles south of the Ohio River. PGDP is a uranium enrichment facility that supplies fuel for commercial reactors. It is currently operated by Martin Marrietta and is under contract for the Department of Energy (DOE). The plant has been in operation since 1952. DOE is conducting cleanup activities at the PGDP under its Environmental Restoration and Waste Management Program.

The North-South Diversion Ditch (NSDD) originates within the plant boundaries and joins with Little Bayou Creek to the north of the plant. Little Bayou Creek flows north and converges with Big Bayou Creek before discharging to the Ohio River. Both creeks flow through the Kentucky Wildlife Management Area (WKWMA) which is a 6,000-acre wildlife preserve used for recreational purposes. The groundwater in the area of the plant consists of the Regional Gravel Aquifer located within the Lower Continental Deposits and the

McNairy Flow System.

The portion of the NSDD within the security area is approximately 2,600 feet long and varies in width from 15 to 36 feet. The depth ranges from one-half to 5 feet. The ditch receives stormwater runoff from the steam plant (C-600), process buildings (C-335 and C-337), cooling tower (C-635), and the switchyards (C-535 and C-537). The NSDD also receives wastewater containing radio nuclides from the cleaning building (C-400) and residual fly ash with associated metals from the steam plant (C-600). The soil and sediment in the ditch has been contaminated by radio nuclides and polychlorinated biphenyls (PCBs).

EPA and DOE entered into an Administrative Order by Consent (AOC) in 1988 to address offsite contamination at PGDP. The PGDP was proposed for the NPL May 10, 1993. January 28, 1993, DOE was directed by KDEP and EPA to implement an interim measure at the NSDD. A Phase I and Phase II Site Investigation was conducted to characterize the extent of contamination. In May 1993, PGDP was proposed for inclusion on the National Priorities List (NPL).

This Record of Decision addresses interim remedial actions to control the source of continued contamination into the North-South Drainage Ditch (NSDD) and mitigate the spread of contamination from the NSDD. The surface water at PGDP will be addressed comprehensively in a subsequent OU.

The remedy status for the media addressed in this ROD are as follows: Liquid Waste 1 is Interim Action. The media volume associated with the Radioactive Manufacturing/Handling/Disposal site is not documented.

Liquid Waste 2 is Interim Action. The media volume associated with the Radioactive Manufacturing/Handling/Disposal site is not documented.

The state concurs with the selected remedy.

Remedy: The selected remedial action for this site includes treating the effluent discharged from the C-400 Building by ion exchange to reduce the concentration of radio nuclides to the MCLs established under the Safe Drinking Water Act; treating effluent discharged from the C-600 Steam Plant to remove fly ash prior to discharge to the NSDD using settling lagoons, installing lift stations near or in NSDD and a pipeline to transport permitted effluent and storm water runoff to the southern end of the NSDD; installing a sediment trap of rock and nonwoven geotextile material; and posting warning signs. The overall Present Worth costs are $1,419,525. The annual O&M costs are $17,000 (Year 1 to 5).

Text: Full-text ROD document follows on next page.

Text:

PB94-964003
EPA/ROD/R04-94/169
July 1994

EPA Superfund
Record of Decision:

Paducah Gaseous Diffusion Plant,
Paducah, KY

Record of Decision
for Interim Action Source Control
at the North-South Diversion Ditch,
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

March 1994

Prepared by
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DE-AC05-91OR21950
P.O. Box 9 Kevil, Kentucky 4205

Prepared for
U.S. Department of Energy
Environmental Restoration and Waste Management

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NOTATIONS

The following list of acronyms, and abbreviations are provided to assist in the review of this document. Acronyms used in Tables only are defined in those respective tables.

ACRONYMS AND ABBREVIATIONS

ACO	Administrative Order by Consent
AEA	Atomic Energy Act of 1954, as amended
ANSI	American National Standards Institute
AR	administrative recor
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended
C.F.R.	Code of Federal Regulations
DCG	derived concentration guides
DOE	U.S. Department of Energy
EQs	ecological quotients
EPA	U.S. Environmental Protection Agency
GM	Geiger Muller
HSP	Health and Safety Plan
HSWA	Hazardous and Solid Waste Amendments
K.A.R	Kentucky Administrative Record
K.R.S.	Kentucky Regulatory Statutes
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
MCL	maximum contaminant level
MMUS	Martin Marietta Utility Services, Inc.
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
237Np	neptunium 237
NRC	Nuclear Regulatory Commission

NSDD	North-South Diversion Ditch
PCBs	polychlorinated biphenyls
pCi/g	picocuries per gram
pCi/l	picocuries per liter
PGDP	Paducah Gaseous Diffusion Plant
239Pu	plutonium 239
RCRA	Resource Conservation and Recovery Act, as amended
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SMP	Site Management Plan
TBC	to be considered
99Tc	technetium 99
230Th	thorium 230
TSCA	Toxic Substances Control Act
TSS	total suspended solids
235U	uranium 235

DECLARATION FOR THE RECORD OF DECISION FOR INTERIM ACTION SOURCE CONTROL AT THE NORTH-SOUTH DIVERSION DITCH

SITE NAME AND LOCATION

North-South Diversion Ditch
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim action for the North-South Diversion Ditch (NSDD) at the Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky, chosen in accordance with the Resource Conservation and Recovery Act of 1976 (RCRA), Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by th Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the administrative record documentation file for this site.

The PGDP was proposed for inclusion on the National Priorities List (NPL) on May 10, 1993, and was issued a Kentucky Hazardous Waste Permit and Environmental Protection Agency Hazardous and Solid Waste Permit on July 16, 1991. On January 28, 1993, the U.S. Department of Energy (DOE) was directed by the Kentucky Department for Environmental Protection (KDEP) and the U.S. Environmental Protection Agency (EPA) to submit a work plan to implement an interim measure at the NSDD. This interim action will be initiated pursuant to the Interim Measure provisions of PGDP's Kentucky Hazardous Waste Permit issued by the Kentucky Division of Waste Management, the Hazardous and Solid Waste Permit issued by the Environmental Protection Agency and this Record of Decision. The Division of Waste Management concurs with the DOE and the EPA on the selected interim action, in accordance with the requirements of the Kentucky Hazardous Waste Permit. This action will serve as an

incremental step toward comprehensively addressing site problems.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the North-South Diversion Ditch, if not addressed by implementing the response action selected in this Record of Decision (ROD) for Interim Action, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this interim remedial action is to initiate control of the source of continued contaminant releases into the NSDD and mitigate the spread of contamination from the NSDD. The surface water system at PGDP will be addressed comprehensively in a subsequent operable unit (hereinafter defined as the "Surface Water Integrator Operable Unit"). The NSDD is one part of the Surface Water Integrator Operable Unit. This interim action at the NSDD constitutes an incremental step towards comprehensively addressing site-wide problems. This action will mitigate the introduction of contaminants into the

NSDD, decrease the migration of contaminants already present in the NSDD, and decrease the potential for direct contact with the contaminated material. Final remedial decisions for the NSDD and the surface water integrator operable unit will be made through the remedial investigation and remedy selection process after the nature and extent of contamination in the surface water system and the contribution of contaminants into the surface water system from source operable units are more fully understood.

The principal threats associated with the NSDD are the potential for transport of contaminants to offsite areas, continued contaminant releases into the NSDD, and the potential for worker exposure to contaminants within the NSDD. The major components of the interim action remedy include:

- The effluent discharged from the C-400 Cleaning Building shall be treated to reduce radionuclide concentrations. PGDP shall install an ion exchange filtration unit in the C-400 Cleaning Building t reduce radionuclides concentrations in the effluent before it is discharged into the ditch. The proposed ion exchange unit will require a calibration period of six months or more after installation in order to optimize the removal of the radionuclides. The target treatment level for radionuclides will be the Safe Drinking Water Act and Kentucky Public and Semi-Public Drinking Water Regulations Maximum Contaminant Levels (MCL). The treatment level will be re-evaluated through the baseline risk assessment and remedy selection process to be conducted to determine the final remedial action for the NSDD and Surface Water Integrator Operable Unit.

- The effluent from the C-600 Steam Plant shall be treated to remove

fly ash from the effluent prior to discharge to the NSDD. Fly ash which accumulates in the NSDD may potentially become cross contaminated due to other materials in the ditch and would subsequently increase the volume of contaminated material which may need to be addressed in a future final action. Settling lagoons will be used for source control treatment of the C-600 steam plant fly ash effluent. However, final design of the fly ash source control may be modified as the detailed design process proceeds.

- Lift station(s) shall be installed in the NSDD near the C-400 Building and C-600 Steam Plant. The lift station(s) shall discharge into a pipeline to transport permitted effluent discharges and storm water runoff from the southern end of the NSDD to the Ditch 001 Lift Station. The installed pipeline will discharge into the NSDD by the Outfall 001 Lift Station. This will bypass approximately 50% of the existing NSDD, thereby reducing the potential for mobilizing contaminated sediments in the vicinity of the NSDD. Elimination of a constant flow of effluent and storm water through the bypassed portion of the NSDD will also reduce the amount of contaminated surface water available for infiltration into the ground water. This reduced infiltration will also mitigate leaching from the existing contaminated sediments and soil into the ground water.

- A gabion type rock structure with nonwoven geotextile material secured to the upstream side shall be installed near the Ditch 001 Lift Station. This sediment trap will mitigate the potential for contaminant transport from the bypassed portion of the NSDD to offsite areas.

- Warning signs shall be installed at intervals not to exceed 100 feet, on both sides of the ditch, from Virginia Avenue to the C-616 Lift Station. These signs shall give notice that elevated levels of radionuclides, metals, and PCBs are present in the area.

The KDEP and EPA have participated in the development of the ROD, including review and comment on the content of the document. All KDEP and EPA comments issued to DOE have been incorporated into the ROD.

DECLARATION

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed for this unit; complies with federal and state applicable or relevant and appropriate requirements for the scope of this limited action, and is cost effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is in furtherance of that statutory mandate. Although partially addressed in this remedy, the statutory preference for remedies that employ

treatment that reduces toxicity, mobility, or volume as a principle element will be addressed by both this and the final response action. Subsequent actions are planned to address fully the principal threats posed by the conditions at this site. Because this remedy will result in hazardous substances remaining onsite above health based levels, a review will be conducted within five years after commencement of the remedial action and every five years thereafter until a final remedial alternative is selected and implemented for this unit. These reviews will be conducted to ensure that the selected remedy continues to provide adequate protection of human health and the environment. Because this is an Interim Action ROD, review of this unit and of this remedy will be ongoing, as DOE continues to develop final remedial alternatives for the North-South Diversion Ditch and the Surface Water Integrator Operable Unit.

Date 3-5-94

William D. Adams
Assistant Manager, Environmental Restoration and Waste Management
U.S. Department of Energy

Date 3-28-94

John H. Hankinson, Jr.
Regional Administrator
U.S. Environmental Protection Agency, Region IV

PART 2

DECISION SUMMARY

DECISION SUMMARY

2.1 Site Name, Location, And Description

The United States Department of Energy (DOE) is conducting cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP) under its Environmental Restoration and Waste Management Program. These cleanup efforts are necessary to address contamination that has resulted from historic operation of the plant. Remedial activities are being conducted in consultation with the Commonwealth of Kentucky's Division of Waste Management and the United States Environmental Protection Agency (EPA).

The Paducah Gaseous Diffusion Plant (PGDP), located in Western Kentucky (Figure 1), is an active Uranium Enrichment facility which is owned by DOE Effective July 1, 1993, DOE leased the plant production operation facilities to the United States Enrichment Corporation (USEC) which in turn contracted with Martin Marietta Utility Services, Inc. (MMUS) to provide operations and maintenance services. Martin Marietta Energy Systems, Inc. manages the environmental restoration and waste management activities for DOE at PGDP.

The PGDP is an active uranium enrichment facility which supplies fuel for commercial reactors. Construction of the plant began in 1951, and started operating in 1952. The PGDP uses gaseous diffusion to provide a physical separation process which allows for enrichment of the uranium. Commercially produced uranium hexafluoride (UF6) is composed primarily of uranium-238 ([238]U), and a small percentage of uranium-235 ([235]U). The gaseous diffusion process is premised on the fact that UF6 with fissionable [235]U is slightly lighter than UF6 with [238]U. Therefore, as the UF6 passes through the gaseous diffusion plant's cascade system, separation of [235]U from [238]U takes place. This separation results in enriched uranium (slightly higher percentage of [235]U). This enriched uranium is then transported to other DOE facilities for further enrichment.

The PGDP is situated on a 1,350 acre reservation (Figure 2) approximately four miles south of the Ohio River and about ten miles west of Paducah, Kentucky. Approximately 740 acres of the reservation are within a security area and buffer zone which has restricted access to the general public. Beyond the DOE-owned buffer zone is an extensive wildlife management area of approximately 6,000 acres.

The PGDP is located within the drainage basins of Big Bayou and Little Bayou Creeks, which meet about three miles north of the site and discharge into the Ohio River. Big Bayou Creek, which flows along the western boundary of the plant, is a perennial stream with drainage extending from approximately two and one-half miles south of the plant to the Ohio River. Little Bayou Creek, which originates in the West Kentucky Wildlife Management Area (WKWMA), flows north toward the Ohio River along a course that includes sections of the eastern boundary of the plant. During dry weather, much of the flow in both creeks is due to controlled effluent releases from PGDP. The North-South Diversion Ditch (NSDD) originates within

<Figure>

Figure 1. PGDP Vicinity Map

<Figure>

Figure 2. Area Map, Paducah Gaseous Diffusion Plant

the plant boundaries and joins with Little Bayou Creek to the north of the plant. Both creeks flow through the wildlife management area and may potentially be used for recreational purposes. However, neither creek is currently used as a drinking water source

The PGDP is located within the Jackson Purchase region of Western Kentucky. The ground water in the area of the plant consists of the Regional Gravel Aquifer located within the Lower Continental Deposits and the McNairy Flow System.

2.2 Site History and Enforcement Activities

The NSDD is located in the north central portion of the security area (Figure 3). The portion of the ditch within the security area is approximately 2600 feet long and varies in width from 15 to 36 feet. The depth ranges from one-half to 5 feet. The portion of the NSDD located within the security fence, flows from Virginia Avenue to the C-616-C Lift Station. The ditch receives stormwater runoff from the steam plant (C-600), process buildings (C-335 and C-337), cooling tower (C-635), and the switchyards (C-535 and C-537). The NSDD also receives wastewater from the cleaning building (C-400) and residual fly ash with associated metals from the steam plant (C-600). Weekly flow measurements for the NSDD for the period of January 1991 through October 1993 are presented in Table 1 and Figure 4.

The NSDD receives wastewater containing radionuclides from the cleaning building (C-400). The soil and sediment in the ditch has been contaminated by radionuclides and polychlorinated biphenyls (PCBs). Potential sources of PCB contamination include dust palliative areas surrounding the nearby cascade buildings (C-335 and C-337), a pipeline and vault area southwest of the ditch (C-616-L) and the switchyards (C-535 and C-537).

The DOE in the role of "Lead Agency," as defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), is conducting cleanup activities at PGDP under its Environmental Restoration and Waste Management Program. Pursuant to Executive Order No. 12580, 3 C F R 193 (1987), 53 Fed. Reg. 2923 (January 29, 1987), the Lead Agency is required to assume responsibility for ensuring that sufficient action is taken to cleanup its sites in order to provide protection for human health and the environment. Remedial activities are being conducted in consultation with the Commonwealth of Kentucky and the EPA.

In the fall of 1988, EPA and DOE entered into an "Administrative Order by Consent" (ACO) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, to address offsite contamination from PGDP. Pursuant to the ACO, PGDP conducted an investigation to determine the nature and extent of contamination. Results of this effort were published in a document entitled Results of the Site Investigation, Phase I (KY/ER-4, March 1991). A subsequent investigation sought to further characterize the extent of contamination. Results of this investigation were published in Draft Results of the Site Investigation, Phase II (KY/SUB/13B-97777CP-03/1991/1, October 1991). A revised version of this document was submitted to EPA and the Commonwealth of Kentucky in April 1992. Alternatives for remediation were identified, evaluated, and

<Figure>

Figure 3. Selected Interim Action for the North-South Diversion Ditc

<Figure>

Figure 4. Weekly Flow Measurements in the North-South Diversion Ditch

<Figure>

published in the document Draft Summary of Alternatives for Remediation of Offsite Contamination at the Paducah Gaseous Diffusion Plant (DOE/OR-1013, December 1991). Additional specific information on the NSDD is available in the Interim Corrective Measures Work Plan for the North-South Diversion Ditch Virginia Avenue to C-616-C Lift Station (September 1993).

On July 16, 1991, EPA and the Commonwealth of Kentucky jointly issued permits under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendment of 1984 (HSWA). The EPA permit contains only provisions of HSWA, while the Commonwealth of Kentucky permit contains provisions to address hazardous waste management as well as provisions similar to HSWA. The HSWA provisions require evaluation of hazardous constituent releases and implementation of interim and final corrective measures to address such releases.

On May 10, 1993, the PGDP was proposed for inclusion on the National Priorities List (NPL). The identification of a site on the NPL indicates that a site warrants further investigation to assess the nature and extent of the public health and environmental risks associated with the site and to determine what CERCLA remedial actions may be appropriate. Federal facilities, such as the PGDP, may be placed on the NPL even if they are also subject to the corrective action mandates of RCRA Subtitle C. Therefore, environmental restoration activities must satisfy both CERCLA and RCRA corrective action requirements.

2.3 Highlights of Community Participation

On November 7, 1993, a notice of availability was published in The Paducah Sun, a regional newspaper, regarding the Proposed Plan. This notice appeared in The Paducah Sun from November 7 until November 14, 1993. The Proposed Remedial Action Plan for Source Control at the North-South Diversion Ditch was released to the public on November 8, 1993. The plan was made available for public review at the Paducah Public Library and the offsite Administrative Record Center located in Kevil, Kentucky at the West Kentucky Technology Park. A public comment period was held November 8, 1993

through December 8, 1993.

Specific groups that received individual copies of the Proposed Plan included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. Informal meetings were held with the PGDP Neighborhood Council and PGDP Environmental Advisory Committee on December 9, 1993 and December 13, 1993, respectively. At these meetings DOE personnel briefed the groups on the proposed action and solicited both written and verbal comments.

Phone calls and/or visits were made to various stakeholders, including neighbors and representatives of environmental groups, to advise them of the public comment period and briefly explain the Proposed Plan. Proposed Plans were mailed to those contacted. A response to the comments received during the public participation period is included in the Responsiveness Summary, which is part of this Record of Decision.

The Proposed Plan contained a notice of the availability of a public meeting to discuss the NSDD and proposed actions. However, no requests for a public meeting were received.

This decision document presents the selected interim remedial action for the NSDD at PGDP, chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Acts of 1986 (SARA), EPA and Commonwealth of Kentucky permits issued under RCRA, as amended by HSWA, and the NCP. The decision for this interim action at this site is based on administrative record (AR) documentation.

2.4 Scope and Role of Operable Unit or Response Action

This Response Action and the Site Management Strategy

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. Therefore, a Site Management Plan (SMP) has been drafted to specify the strategy for investigating and remediating hazardous substance releases at the site. The draft SMP is currently being revised following review by EPA and the Commonwealth of Kentucky. The proposed strategy in the draft SMP is to divide the site into operable units grouped by source areas and environmental media. Discrete response actions will be selected and implemented for each operable unit to address the source areas (i.e., source operable units) and the environmental media (i.e., integrator operable units) impacted by commingled releases from source operable units. Prioritization in the draft SMP for investigation and possible interim remedial actions have been assigned to each of the integrator operable units and source operable units depending on their potential for contributing to offsite contamination. Because integrator units serve as migration pathways that transport contamination from source operable units to offsite receptors, they receive the highest priority for undergoing initial evaluation and interim actions.

Consistent with the site management strategy described in the draft SMP,

this action is intended as an incremental step toward addressing the surface water system integrator operable unit. The NSDD contributes to offsite surface water contamination that may continue to migrate and contaminate clean resources and potentially expose additional offsite receptors. The primary objective of this interim action is to stabilize the NSDD through decreasing the levels of contamination entering the NSDD and decreasing the migration of contaminants from the NSDD. By implementation of this interim action, increased stabilization of the site will be achieved, while a final remedy for the Surface Water Integrator Operable Unit is being developed.

The source control measures in this record of decision (ROD) constitute th first phase in remediation of the NSDD and also a step toward comprehensive remediation of the surface water integrator operable unit. This action can be rapidly implemented while remedial investigations can be conducted for the remainder of the NSDD and Surface Water Integrator Operable Unit. This phased approach is consistent with the NCP, which advises initiation of early actions as soon as possible

after a problem is identified for which an early action is appropriate, and early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action.

Future Response Actions Associated with this Response Action

The remedial action described by this ROD is not the final action for NSDD. Following issuance of the ROD for this source control measure, a remedial investigation will be initiated to evaluate additional remedial alternatives to implement a final remedy which will provide definitive protection of human health and the environment. This remedial investigation will be consistent with the requirements of both the draft SMP and the draft Federal Facility Agreement being developed by the DOE, EPA, and KDEP. This study may lead to a Proposed Plan for a second interim action and/or a final action for the NSDD or the entire Surface Water Integrator Operable Unit.

Although a site investigation, public health and ecological assessment, and an alternative evaluation was performed for the PGDP site as a whole, a final action cannot be recommended until further characterization activities have been completed. Before a final action can be recommended for the NSDD portion of the surface water integrator operable unit, a baseline risk assessment must be completed for the surface water integrator operable unit, including ecological risk. Additionally, a more complete characterization of the NSDD needs to be performed and the interaction of all source operable units with the surface water integrator operable unit must be better defined. Although additional data will be needed before the selection of a final action, sufficient information is available to support the interim remedial action presented in this document. This interim action should not be inconsistent with nor preclude implementation of any currently anticipated final remedy.

2.5 Operable Unit Characteristics

Contaminant Characteristics

Environmental samples obtained from the NSDD have identified contaminant levels that indicate a need for interim action. These sampling events include the collection of: six sediment/soil samples and two surface water samples that were collected as part of the Phase I and Phase II Site Investigations, and a radiological walkover survey to assess gross radionuclide contamination and to identify radiological hot spots. As part of the PGDP monitoring operations, weekly water samples are taken from the NSDD near the C-616-C Lift Station and samples from the uranium recovery unit filtrate solution in the C-400 Building are characterized prior to release into the NSDD.

Radioactive Contaminants

The data collected indicate that the NSDD may contribute to offsite ^{99}Tc and uranium (U) contamination of the surface water and sediment. The data also suggests that the NSDD is potentially contributing to offsite ground water

contamination. Technetium-99 has been detected in onsite and offsite ground water at concentrations above 1,000 g/l. Technetium-99 in the NSDD has been recorded at levels as high as 45,315 picocuries per gram (pCi/g) in the soil and 139 picocuries per liter (pCi/l) in the surface water. Samples from the uranium recovery unit filtrate solution in the C-400 Building have recorded levels of ^{99}Tc from 81,000 pCi/l to 170,000 pCi/l. Although the levels of ^{99}Tc are below DOE Order 5400.5 Radiation Protection to the Public and the Environment derived concentration guidelines of 100,000 pCi/l at the permitted Kentucky Pollutant Discharge Elimination System (KPDES) outfalls, the levels may be contributing to the offsite ground water ^{99}Tc contamination. However, the derived concentration guideline for ^{99}Tc was developed to protect aquatic organisms, not human beings. The current federal and state maximum contaminant level (MCL) for beta emitters in drinking water, including ^{99}Tc, is 4 mrem/yr. The effluent from the uranium recovery unit typically exceeds these limits. The derived concentration guideline of 100,000 pCi/l is equivalent to a dose of 1 rad per day.

Monitoring of the surface water in the NSDD has also detected elevated levels of total uranium, beta radiation and alpha radiation. Concentration of alpha radiation, measured as total alpha emitters in pCi/l, have exceeded the MCL of 15 pCi/l. Measured total uranium levels have exceeded the proposed MCL of 20 micrograms per liter (g/l). While the NSDD is not a source of drinking water, comparison with criteria such as drinking water MCLs provides an indicator of the potential site risks and potential impacts on the local shallow ground water system. Radionuclides concentrations in the surface water fluctuated only slightly along the length of the NSDD.

A radiological survey of the NSDD was conducted as part of the Phase I Site Investigation in March, 1990. The radiological survey consisted of the three following activities: a walkover survey of each bank of the NSDD

using high efficiency gamma scintillation detectors; ground-contact, open-window, and closed-window measurements at 500-foot intervals along each bank of the NSDD using thin-end window Geiger-Muller (GM) detectors; and soil sampling at two background stations and five stations where the surveys indicated elevated radioactivity on the banks of the creeks and ditches. An additional sediment sample was collected during the Phase II Site Investigation. During the walkover survey, readings which were often more than 3 times background were found.

Sediment and soil samples were taken from the NSDD by PGDP personnel in November, 1988. The seven samples were analyzed for total U, [235]U, ^{99}Tc, [239]Pu, [237]Np, and [230]Th. Levels of the analyzed radionuclides were found to be as high as: U - 118 pCi/g, [239]Pu - 4.3 pCi/g, [235]U - 0.71 wt. percent, [237]Np - 42.2 pCi/g, [99]Tc - 45,315 pCi/g, [230]Th - 106 pCi/g.

The level of radionuclides, especially ^{99}Tc, decreased significantly from a high reading around the C-400 Building (45,315 pCi/g) to a low reading near the NSDD 001 Lift Station (no detect). Elevated beta and gamma level were observed at most locations during the ground-contact open-window and closed window GM detectors.

The highest levels of radionuclides were detected at a isolated hot spot about 4 feet from the storm drain located between Virginia Avenue and the NSDD (across from the C-400 Building). The location adjacent to the C-400 Building discharge pipe suggests the discharge from the C-400 is the source of the hot spot. The boundary of this area is approximately 227 feet long and 3- to 15-feet wide. The gamma walkover readings at this hot spot measured 30,000 to 120,000 cpm (counts per minute) which is approximately 3 to 12 times the average background reading. The GM measurements were approximately 1,800 gross cpm (unshielded) which is up to 45 times greater than the average background reading.

Filtrate samples are taken from the Uranium Recovery Unit located inside the C-400 Building prior to the release of the fluid into the NSDD. As of March 12, 1993, the discharge of effluent from the C-400 Uranium Recovery has been halted by DOE until a treatment alternative can be implemented.

Non-radioactive Contaminants

Toluene was found at an estimated concentration of 210 ppb in the NSDD sediments near the C-400 Building. Toluene could be residual from the C-601 fuel spill of March 9, 1979. A total of 17,300 gallons of diesel was inadvertently released and then flowed to Big Bayou Creek via Ditches 008 and 015. Additionally, trichloroethylene was detected in one surface water sample in the NSDD.

Initial characterization of the NSDD indicated the presence of Aroclor 1260 (PCB) at levels as high as 11 ppm. These PCBs probably accumulated in the ditch largely due to adsorption of the PCBs on the residual coal particles from the C-600 Steam Plant. Only two of the six sediment/soil samples

collected during the Phase I and II Site Investigations were analyzed for PCBs. Potential sources of PCB contamination include dust palliative areas surrounding the C-335 and C-337 Cascade Buildings, SWMU 165, C-616-L Pipeline and Vault contamination area, and the C-535 and C-537 Switchyards.

A PCB surface water characterization project was performed at PGDP by the United States Army Corps of Engineers during August 1991 to April 1992. This study evaluated surface water PCB concentrations in an effort to identify PCB sources. The project included 16 surface water sampling events in both the plant ditches and storm sewers during both dry and wet periods. The samples were analyzed both for PCBs, radioactivity, and Total Suspended Solids (TSS). Out of the 461 samples taken, only 19 had detectable (greater than 0.1 ppb) PCBs present. The surface water data did not detect any identifiable source of PCB contamination nor did the PCB detects correlate with the TSS in the sample. There were no PCB detects downstream of PGDP outfalls in both Big and/or Little Bayou Creeks. The samples which relate to the NSDD were taken in Ditch 001 before being lifted into the NSDD and in Ditch 001 after it leaves the C-616-F Full Flow Lagoon. There were no PCB detects downstream of the C-616-F Full Flow Lagoon. PCBs were detected in one sample (0.17 ppb) in Ditch 001 prior to being lifted into the NSDD. However, there were no corresponding detects in the other three downstream sampling points.

Sampling data on surface water and sediments in the NSDD show elevated levels of some metals. These metals are most likely associated with the fly ash that accumulates in the NSDD. The level of metals present in the surface water will be evaluated through the remedy selection process for the final ROD for the NSDD and the Surface Water Integrator Operable Unit.

2.6 Summary of Site Risks

The 1991 Draft Results of the Public Health and Ecological Assessment, Phase II (PHEA), found that the critical exposure pathway is related to the offsite migration of onsite contaminant sources. The PHEA also recommended action to eliminate the offsite migration of these contaminants to the outside of the Paducah Gaseous Diffusion Plant's boundaries and recommended remedial action to eliminate this offsite movement. Based on the preliminary results of these studies, DOE, EPA, and Kentucky Department for Environmental Protection (KDEP) have decided that there is sufficient potential risk to the public and environment to warrant this action. The principal goals of this interim remedial action are to implement source control measures which will mitigate the introduction of contaminants into the ditch, decrease the migration of the contaminants which are present in the ditch, and decrease the potential for direct contact of contaminated material. Accomplishment of the goals will help stabilize and mitigate further environmental degradation within, and downgradient to, the NSDD.

Site investigations involving surface water and sediment indicated various contaminants at the NSDD which may pose a risk to human health and the environment at PGDP. The NSDD is located within the confines of the PGDP security fence and is accessible to any person with site access. The

following contaminants were detected during site investigations: Trichloroethylene, PCBs, chromium, copper, nickel, vanadium, and zinc; and in the sediment: chromium, copper, zinc, cobalt, manganese, selenium, thallium, and vanadium.

The following radioactive elements have been released into the NSDD: Technetium-99, Plutonium 239, Thorium 230, Neptunium 237, Uranium 234, Uranium 235, and Uranium 238. Elevated levels of radionuclides have been measured in the surface water and sediment within the NSDD.

If no interim action were taken to address the NSDD, the potential exists for exposure of plant maintenance personnel to the contaminants within the ditch through their routine activities. To estimate risk assume that the maintenance worker is exposed for 4 hours per event, 12 times per year, over a 25-year exposure period. Complete exposure pathways assessed for the current maintenance worker include direct gamma irradiation from contaminated sediment and soil, dermal contact with soil, sediment and debris, inhalation of re-suspended particulate during mowing, and incidental ingestion of contaminated surface water, soil, and sediment.

The estimated carcinogenic risk for maintenance worker scenario evaluated in this assessment is 1 x 10[-4], which has been determined by the EPA to be an unacceptable risk level. The majority of this risk is associated with particulate inhalation of radiological contaminants during mowing. Hazard quotients calculated for the

exposure pathways were all less than 1, indicating that the exposure intakes are less than the reference doses (RfDs) and the potential for toxicological harm is low.

Species of terrestrial and aquatic organisms reported to reside at, or visit, the site, and which can be expected to reside at or visit the site in the future, include various soil and sediment dwelling invertebrates (e.g., earthworms, chironomids), aquatic and terrestrial insects and their larvae, frogs and salamanders, small mammals (e.g., hawks). Larger terrestrial mammals and fish are not currently present at the site and there are no known Federal or State threatened or endangered species located within the PGDP perimeter area.

When evaluating the exposure of aquatic and terrestrial biota to contaminants of potential concern from site sources; soil, surface water, and sediment will be considered the primary environmental exposure media. Complete exposure pathways for aquatic organisms include contact with and ingestion of water and sediment, or by direct ingestion of biota. Terrestrial organisms are exposed to contaminants in the soil through ingestion of soil where sediments and surface water have overflowed from the NSDD during floods or through ingestion of contaminated organisms. Uptake of contaminants by plants can lead to subsequent exposure to herbivores and omnivores from ingestion of contaminated vegetation.

The risk assessment for metals, PCBs, and volatile organic chemicals relies

on aquatic and sediment toxicity data; there is no toxicity data for the contaminants of potential concern in soil. When the observed concentrations in the environment were compared to toxicity threshold concentrations, 11 of the 27 contaminants emerged as the contaminants of potential concern. Chloroform, Aroclor 1260, and 9 metals. The ecological quotients (EQs) for those contaminants of potential concern for which EQs could be calculated ranged from 1 to 922. Barium (922), Aroclor 1260 (220), aluminum (18), and cobalt (25) had the highest EQs in sediments at the NSDD. The highest EQ for a contaminant of potential concern in surface water was 4 for the metal copper. The risk from radionuclides and chloroform in surface water could not be calculated because there was no toxicity data to establish a toxicity threshold.

The contaminants of potential concern in sediment and surface water with large EQs strongly suggest that, in the absence of remediation, populations of aquatic organisms living in the NSDD will continue to be at risk from adverse effects likely to reduce population sizes. Predators of aquatic organisms may be at equivalent levels of risk due to bioaccumulation of PCBs. The risk to terrestrial organisms exposed to contaminants in the soils adjoining the NSDD is due to radionuclides, the ecological effects of which are uncertain due to the absence of terrestrial wildlife toxicity data.

2.7 Description of Alternatives

Four separate alternatives are considered for source control of the NSDD. Federal law requires the consideration of a no action alternative which is Alternative 1. Three additional alternatives consider combinations of treatment, engineering controls and institutional controls. The screening and evaluation process identified one alternative that will quickly and effectively reduce risk by controlling the sprea

of contamination in and near the NSDD and reduce the potential for further contamination entering the ditch.

Alternative 1 - No Action

Pursuant to 40 C.F.R. 300.430(e)(6) of the NCP, DOE is required to consider a no action alternative. This alternative is useful as a baseline for comparison between potential alternatives. Under this alternative no further action would be taken.

Alternative 2 - Source controls, institutional controls and engineering controls

This alternative includes the following four separate actions: (1) institutional controls utilizing posted warning signs that will notify PGDP personnel that the NSDD contains elevated levels of radionuclides, PCBs and metals; (2) construction of a silt trap gabion just beyond the contaminated portion of the NSDD; (3) construction of an ion exchange unit inside the C-400 Building that will reduce the levels of technetium and other

radionuclides in the effluent discharged to the NSDD by the Uranium Recovery Unit; and (4) construction of a source control treatment for fly ash removal from the C-600 Steam Plan effluent. Settling lagoons will be used for source control treatment of the C-600 Steam Plant fly ash effluent. However, the final design of the fly ash source control may be modified as the detailed design process proceeds. Further, the location for the effluent discharge will be determined through the remedial design process by DOE, EPA and the Kentucky Department for Environmental Protection.

Alternative 3 - Source controls, institutional controls and engineering controls including the installation of a pipeline and lift station

This alternative includes the four actions listed in Alternative 2 plus the installation of a lift station and above ground pipeline to transport runoff and effluent from the southern end of the NSDD to the area of the Outfall 001 Lift Station located just beyond the highly contaminated portion of the NSDD. This action will significantly reduce the buildup and infiltration of contaminated water in the NSDD, mitigate dispersal of contamination to areas outside of the site, and decrease the potential for plant personnel to come into contact with the contaminated surface water.

Alternative 4 - Source controls and institutional controls

This alternative includes excavation of the contaminated soil and sediment in the NSDD and initiates institutional controls by posting warning signs. Initial estimates indicate that approximately one foot of soil will be excavated over an area of approximately 74,169 ft[2] resulting in the generation of approximately 14,834 drums of waste. The drums will require storage until proper treatment and disposal can be conducted.

The implementation of Alternatives, 2, 3, or 4 would have little or no significant physical effect on the environment. These alternatives would not adversely affect any wetlands, flood plains, or historic sites. All of the alternatives could be implemented within 17 months. This time period includes design by DOE wit

approval by EPA and KDEP and the bid and award process as required by federal regulations.

2.8 Summary of the Comparative Analysis of the Interim Alternative

This section provides the basis for determining which alternative (i) meets the threshold criteria of overall protection of human health and the environment, state approval, and compliance with applicable or relevant and appropriate requirements (ARARs), and (ii) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost, and (iii) satisfies community acceptance. A summary of the comparative analysis of alternatives is included in Table 2.

Nine criteria are required by CERCLA for evaluating the expected performance

of remedial actions. The nine criteria are identified below and the interim action has been evaluated on the basis of these criteria. Because this action is intended to integrate both RCRA and CERCLA requirements, state approval has been substituted for state acceptance and listed as one of the threshold criteria. This change is necessary to reflect that this interim action will be implemented under the provisions of the Kentucky Hazardous Waste Permit and must also fulfill these RCRA requirements:

1. Overall protection of human health and the environment. Requires that the alternative adequately protect human health and the environment, in both the short and long-term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

2. Compliance with ARARs. The alternatives must be assessed to determine if they attain compliance with applicable or relevant and appropriate requirements of both state and federal law.

3. Long-term effectiveness and permanence. Focuses on the magnitude and nature of the risks associated with untreated waste and/or treatment residuals remaining at the conclusion of remedial activities. This criterion includes consideration of the adequacy and reliability of any associated containment systems and institutional controls, such as monitoring and maintenance requirements, necessary to manage treatment residuals and untreated waste.

4. Reduction of contaminant toxicity, mobility, or volume through treatment. The degree to which the alternative employs recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

5. Short-term effectiveness. The effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required until protection is achieved.

<Figure

6. Implementability. Potential difficulties associated with implementing the alternative. This may include: technical feasibility, administrative feasibility, and the availability of services and materials.

7. Cost. The costs associated with the alternatives. These expenditures include the capital cost, annual operation and maintenance and the combined net present value of capital and operations and maintenance costs.

8. State approval. The incorporation of any formal comments by the

Kentucky Division of Waste Management to the Interim Measure for the NSDD.

9. Community acceptance. The consideration of any formal comments by the community to the Proposed Plan for interim remedial action.

The criteria listed above are categorized into three groups. The first, second, and eighth categories are threshold criteria. The chosen final alternative must meet the threshold criteria to be eligible for selection. The five primary balancing criteria include criterion three through seven. The last criterion is termed the modifying criterion. The modifying criterion was evaluated following issuance of the Proposed Plan for public review and comment.

Overall Protection of Human Health and the Environment

Protection of human health and the environment is a threshold criteria. Alternatives must meet this criteria in order to be eligible for selection. Alternatives 2, 3, and 4 would provide protection of human health and the environment for the scope of this interim action.

As discussed in Section 2.6, Summary of Site Risks, there is sufficient potential risk to human health and the environment to warrant this interim action. Therefore, Alternative 1 does not meet this threshold criteria.

Alternative 2 would provide protection through source control of contaminant inputs into the NSDD, engineering controls for limiting the potential for contaminant migration, and institutional controls to limit potential direct exposure.

Alternative 3 would provide protection in the same manner as Alternative 2. However, additional protection would be provided by limiting the potential for contaminant transport and infiltration into the subsurface environment through engineering controls: a pipeline.

Alternative 4 would provide protection through the removal of contaminated materials from the NSDD. Institutional controls would also be implemented to limit potential exposure to residual contamination.

Compliance with ARAR

Compliance with ARARs is also a threshold criteria. Alternatives must meet this criteria in order to be eligible for selection. Alternatives 2, 3, and 4 would achieve ARARs. A detailed description of ARARs is included in this document only for the selected remedy. This is included in Section 2.9.

Long-term Effectiveness and Permanence

This criteria is generally not relevant to measures implemented as interim actions. However, the selected alternative is expected to be effective until a final remedial decision is implemented for the NSDD.

Alternatives 2 and 3 will not remove contaminants from the NSDD. However, they would provide some protection from potential exposure to the contaminants through institutional controls and source control. Alternative 4 would remove contaminants from the NSDD. However, other contaminated areas at PGDP and process wastewater from the active facilities may recontaminate the NSDD. Over the long term, this may result in having to excavate materials from the NSDD again in the future.

Long-term effectiveness and permanence will be addressed through a final remedial decision made for the NSDD and the Surface Water Integrator Operable Unit.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 2 and 3 would reduce the volume of contaminants through source control treatment measures. Alternative 3 would also reduce the mobility of contaminants within the NSDD by reducing the flow of water through the most highly contaminated portion of the NSDD Alternative 3 would also mitigate any potential cross contamination from the surface water system to the shallow ground water system at the NSDD. Alternative 4 would reduce the toxicity, mobility, and volume of contaminants within the NSDD by excavating the materials. However, excavated materials would not be treated to remove or destroy contaminants. Excavated materials would require storage and, or disposal at permitted facilities.

Short-term Effectiveness

Remediation of the NSDD will be a long-term process due to the contamination from halogenated hydrocarbons and radionuclides. This interim action will provide effective short-term stabilization of the contaminated NSDD. Alternatives 2, 3, and 4 would provide protection immediately upon completion of construction and calibration activities.

None of the evaluated alternatives would pose a threat to nearby communities. Alternatives 2, 3, and 4 and all require that workers perform activities in or near contaminated areas. Alternative 4 would require the handling of a large volume of contaminated materials during excavation and packaging. Workers associated with the implementation of the selected alternative will abide by the requirements of a

site-specific Health and Safety Plan (HSP). The HSP will be prepared as part of the bid package and submitted to the selected contractor prior to the award of the project. Prior to implementation of this interim actio the EPA and KDEP will be afforded the opportunity to review the HSP. The draft HSP will be modified by the contractor to reflect pertinent comments submitted by the Regulatory Agencies.

Alternatives 2, 3, and 4 would require similar time periods for installation and each would expose workers to potentially contaminated materials and work time in contaminated areas. However, the time and type of work performed

varies between the alternatives.

Implementability

Alternatives 2, 3, and 4 can be implemented using standard engineering practices with materials and equipment that is readily available. Site conditions are not expected to prevent implementation or maintenance of the alternatives.

Cost

The total projected costs presented in the Proposed Plan were Alternative 2 -- $820,862, Alternative 3 -- $1,370,862, and Alternative 4 -$19,535,860. The majority of the costs associated with Alternative 4 are related to waste management requirements for radioactive and/or hazardous waste. The cost estimate for Alternative 3 has been further refined and has a capital cost of $1,342,511 and a present worth cost of $1,419,525 as reflected in Table 2.

State Approval

The Interim Corrective Measure Work Plan developed pursuant to PGDP's hazardous waste permits, Proposed Remedial Action Plan and Draft ROD were issued for review and comments to both the Commonwealth of Kentucky and the EPA. The Kentucky Division of Waste Management concurs with this action, consistent with the requirements of the facility's Hazardous Waste Permit issued by the Commonwealth of Kentucky.

Community Acceptance

As evidenced by the comments received during the public comment period, the selected interim remedy specified in the Record of Decision for Interim Action is supported by the local community.

No comments were received by DOE from any group or organization opposing this interim action. Community response to the alternatives is presented in the Responsiveness Summary which addresses comments received during the public meeting and the public comment period.

2.9 Selected Remedy

Based upon the evaluation of the alternatives in regard to the nine criteria, the remedy which best meets the threshold, balancing, and modifying criteria for the scope and objectives of this interim action is Alternative 3. The DOE will prepare a detailed design of the treatment unit in accordance with the requirements of the ROD for this interim action, and in accordance with the Interim Corrective Measure Work Plan for the North-South Diversion Ditch, Virginia Avenue to C-616-C Lift Station. Th Interim Corrective Measure Work Plan pursuant to PGDP's Kentucky Hazardous Waste Permit and EPA Hazardous and Solid Waste Permit will be approved at the same time as this ROD is approved.

The selected remedy will consist of the following elements at a minimum:

- ù The effluent discharged from the C-400 Building shall be treated to reduce the concentration of radionuclides. The target level for treatment shall be the MCLs established under the Safe Drinking Water Act. Sufficient engineering controls shall be utilized to achieve this goal. An ion exchange unit shall be installed to treat this effluent.

- ù The effluent discharged from the C-600 Steam Plant shall be treated to remove fly ash from the effluent prior to discharge to the NSDD. Settling lagoons will be used for source control treatment of the C-600 Steam Plant fly ash effluent. However, the final design of the fly ash source control may be modified as the detailed design process proceeds. Design of the discharge routing from the steam plant will be determined through the remedial design process by DOE, EPA and the Kentucky Department for Environmental Protection.

- ù Lift station(s) shall be installed in or near the NSDD, near the C-400 Building and the C-600 Steam Plant. A pipeline shall be installed to transport permitted effluent and storm water runoff from the installed lift station(s) at the southern end of the NSDD to the Ditch 001 Lift Station.

- ù A gabion type rock structure with nonwoven geotextile material secured to the upstream side shall be installed in the NSDD at or near the Ditch 001 Lift Station. A conceptual drawing of this structure is provided in Figure 5.

- ù Signs shall be installed at intervals not to exceed 100 feet, on both sides of the ditch, from Virginia Avenue to the C-616 Lift Station. These signs shall provide notice that elevated levels of radionuclides, metals, and PCBs are present in the area.

The actions proposed in the selected alternative will not cause an increased risk to workers or PGDP personnel during their construction or use. The silt trap gabion, lift station with pipeline and warning signs will be in and near the contaminated areas. Personal protective equipment and adequate worker safety procedures will be used to ensure that implementation of these proposed measures do not pose a risk to worker

<Figure>

Figure 5. Example of a Gabion

health and safety. The selected alternative can be implemented using

standard engineering practices with materials and equipment that are readil available. Site conditions are not expected to prevent the implementation or maintenance of these proposed actions.

The proposed ion exchange unit will require a calibration period of six months or more after installation, in order to optimize the removal of the radionuclides. The source control for fly ash, silt trap gabion and lift station with pipeline will immediately reduce the volume of contaminated effluent flowing through the ditch and into the Outfall 001 Lift Station. The estimated present worth cost of the selected actions is $1,419,525. Table 3 presents a more detailed breakdown of the estimated costs for this action. This cost is within 4% of the cost presented in the Proposed Plan and is not a significant change.

Table 3. Estimated Cost of Source Control Action

Source controls, institutional controls and engineering controls including the installation of a pipeline and lift

Capital Investment:	
1. Ion Exchange unit:	$74,074
2. Warning Signs:	$1,860
3. Gabion:	$29,630
4. Fly Ash Controls:	$481,481
5. Lift Station and Pipeline:	$407,407
Subtotal	$994,452
Contingencies @ 35%:	$348,058
Total Capital Investment:	$1,342,511
Estimated Operation and Maintenance Expense (annually):	$17,000
TOTAL PRESENT WORTH COSTS[*]	

* Net Present Value assuming an inflation rate of 3.5%, a discount rate of 7% and five years of operation: $1,419,525

2.10 Statutory Determinations

The DOE, EPA and Kentucky Division of Waste Management concur that the source controls will satisfy the statutory requirements of K.R.S. 224.46-530(g) and CERCLA 121(b) for providing protection of human health and the environment, attaining applicable or relevant and appropriate requirements directly associated with this action, being cost-effective, utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable, and exhibiting a preference for treatment as a principle element.

Protection of Human Health and the Environment

The selected interim action initiates protection of human health for the PGDP employees and the public through treatment of wastes entering the NSDD, institutional controls to limit the potential for direct exposure, an engineering controls to mitigate the infiltration and migration of contaminants from the NSDD to the subsurface environment and offsite until a final action is selected and implemented. The remedy provides effective management of all residual wastes generated during implementation of the action.

Compliance with ARARs

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 was passed by Congress and signed into law on December 11, 1980 (Public Law 96-510). This act was intended to provide for "liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive waste disposal sites." Adopted on October 17, 1986 (Public Law 99-499), SARA did not substantially alter the original structure of CERCLA but provided extensive amendments to it. This amendment also renumbered Section 107(g) on Federal Facility Compliance as Section 120(a) and added several provisions affecting response actions at federal facilities in the balance of Section 120. Among these provisions is Section 120(f) which requires federal facilities to provide states with the opportunity to participate in response actions as specified in Section 121. Section 121 requires that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws which are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured.

The following is an explanation of the terms used throughout this section:

Applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (53 Fed. Reg. 51435, December 21, 1988).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (53 Fed. Reg. 51436).

"Chemical-specific requirements are usually health- or risk-based numerical

values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values" (53 Fed. Reg. 51437). These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

Location-specific requirements "generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 Fed. Reg. 51437). Some examples of special locations include floodplains, wetlands, historic places, an sensitive ecosystems or habitats.

Action-specific requirements "are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes or requirements to conduct certain actions to address particular circumstances at a site" (53 Fed. Reg. 51437). Selection of a particular remedial action at a site will invoke appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, if a requirement is not applicable it must be both relevant and appropriate for compliance to be necessary. In cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, CERCLA [Para] 121(d)(4) provides several ARAR waiver options that may be invoked, providing that the primary requirement of protection of human health and the environment is met.

In order to expedite the cleanup process, Congress exempted certain CERCLA response actions from any federal, state, or local requirement to obtain permits. 42 U.S.C. section 9621(e)(1). This section applies only to response actions "conducted entirely onsite," defined in the NCP to mean "the areal extent of contamination and all suitable areas in very close proximity [which are] necessary for implementation of the response action." 40 C.F.R. section 300.5. Although laws that would otherwise apply with full force to non-CERCLA onsite activities do apply to CERCLA response actions, they do so only to the extent that they are ARARs. Consequently, only substantive requirements apply, not procedural ones. Regulatory requirements to obtain permits are procedural or administrative in nature, not substantive, and do not apply to CERCLA onsite response actions. 55 Fed. Reg. 8666, 8756 (March 8, 1990).

In an effort to further distinguish between substantive and administrative requirements, EPA offers the following examples. Substantive ARARs include acceptable concentrations for specific chemicals under the Safe Drinking Water Act (SDWA) or technology-based requirements under RCRA. Administrative requirements involve the approval of or consultation with administrative bodies, issuance of permits, documentation, reporting, and recordkeeping (53 Fed. Reg., 51443).

Since ARARs do not exist for every chemical or circumstance likely to be found at a Superfund site, other information not meeting the definition of an ARAR may be used to determine what is protective or may be useful in developing Superfund remedies. Therefore, EPA believes it may be necessary when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR (55 Fed. Reg., 8745). Criteria or guidance developed by EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. This information is classified as to-be-considered (TBC) guidance and generally falls within three categories (health effects information, technical information on how to perform or evaluate investigations or response actions, and policy)

The EPA's treatment of state ARARs is fully consistent with the way EPA has treated federal requirements under the current NCP, in which federal guidance and nonpromulgated guidelines are put in a separate category ("other information to be considered") from potential ARARs. Like their federal counterparts, state guidance and other nonpromulgated guidelines may still be considered in determining an appropriate, protective remedy; but neither federal nor state guidance should be treated as potential ARARs (53 Fed. Reg., 51437).

The response action for the NSDD involves installation of a gabion filter system, ion exchange system, fly ash control, pipeline, and institutional controls. Selection of this alternative will allow for project execution to proceed without requiring an ARAR waiver while meeting all applicable or relevant and appropriate Commonwealth of Kentucky and federal regulations as well as DOE orders and American National Standards Institute (ANSI) standards. Proceeding with the selected remedy will meet chemical, location, and action-specific ARARs as described in the text below. An additional overview of the ARARs for the NSDD may be obtained by reviewing Table 4.

Chemical-specific

The Kentucky Water Quality Standards nondegradation policy is intended to safeguard the surface waters of the Commonwealth for designated uses, preventing the creation of any new pollution, and abating existing pollution [401 K.A.R. [Para] 5:029(2)]. The KPDES permit, KY0004049, is the implementing vehicle for this applicable regulation.

Based upon sampling results, PCB levels as high as 11,000 g/kg were detected in the sediment and soil of the NSDD; consequently, PCBs may be found in the surface water. Under 401 K.A.R. [Para] 5:055, PGDP is required to obtain a permit for the dischargeof plant waste water. Waste water discharged from PGDP is regulated by KPDES Permit No. KY0004049 which also establishes effluent limitations for PCBs at KPDES outfalls. Concentrations of PCBs discharged from the treatment system into the water should not exceed 0.000079 g/l.

Effluent from the ion exchange system will discharge into the NSDD, which in turn, ultimately flows through KPDES Outfall 001. The KPDES permit which was issued by

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the Kentucky Division of Water, to implement the requirements of 401 K.A.R. [Para] 5:055, contains limits appropriate for the surface water use classification designated by the Commonwealth of Kentucky. KPDES Outfall 001 flows into Big Bayou Creek which has been designated as a warm water aquatic habitat. Warm water aquatic habitat criteria which are allowable in-stream concentrations for specific substances are designed to protect aquatic life from acute and chronic toxicity [401 K.A.R. 5:031(4)].

Effluent limitations are applicable at outfalls where monitoring takes place and are only enforceable at KPDES outfalls. The requirements of 401 K.A.R. [Para] 5:055, as implemented through the KPDES permit No. KY0004049 would be a relevant and appropriate requirement for effluent discharged from the ion exchange because the PCB limit imposed by the permit must be met at the outfall. Therefore, if the KPDES permit limit is not exceeded in the water discharged from the ion exchange system, the system would not cause the permit limit to be exceeded at Outfall 001.

The SDWA and the Kentucky Public and Semi-Public Drinking Water Regulations are TBC guidance for this action. These regulations along with DOE's guidance to reduce exposures to radiation to levels "As Low As Reasonably Achievable" (ALARA) are being used as treatment goals to limit the introduction of radionuclides into the NSDD. The MCLs will be the target treatment levels for radionuclides being discharged from the C-400 Cleaning Building. These levels were selected for the target treatment level based upon the technical judgment of DQE, due to the limited characterization and risk information available, and the need for action to stabilize the unit and prevent further degradation. The most protective standards available, the MCLs, were selected for use in the action. The required treatment levels for radionuclides in the unit will be re-evaluated through the remedy selection process for the final ROD for the NSDD and the Surface Water

Integrator Operable Unit.

Quantities of ^{99}Tc and uranium have been found in the soil and sediment of the NSDD. DOE Order 5400.5, Radiation Protection of the Public and the Environment, limits radiation exposure to members of the public to an effective dose equivalent of less than 100 mrem/year, a dose of less than 5 mrem/year to any organ, and an effective dose of less than 4 mrem/year through drinking water. To achieve these standards, DOE Order 5400.5 also specifies derived concentration guidelines (DCGs) for radionuclides in water and air. According to DOE Order 5400.5, uranium concentrations in surface water at 0.71% 235U should not exceed 0.87 milligrams per liter (mg/l) and ^{99}Tc in surface water should not exceed 100,000 picocuries per liter (pCi/l). In addition, DOE Order 5400.5 mandates that DOE personnel and contractors strive to ensure that radiation doses to members of the public are as low as reasonably achievable (ALARA) below the appropriate limits.

DOE Orders are applicable internal requirements for DOE facilities; therefore, they are not legally enforceable requirements. DOE Order 5400.5 would be TBC guidance for the discharge of radionuclides to the NSDD.

Action-specific

Onsite construction activities may be necessary to prepare the site for implementation of the chosen alternative. These construction activities could produce airborne pollutants. Elevation of particulate concentrations resulting from earth-moving and site-grading activities may exceed the Kentucky Air Quality regulations found in 401 K.A.R. [Para] 63:010 et seq. which contain General Standards of Performance governing fugitive dust emissions.

The regulations in 401 K.A.R. [Para] 63:010(3) require the use of water or chemicals if possible and/or to place asphalt or concrete on roads and material stockpiles to control dust. The regulation also requires that visible fugitive dust in the ambient air must not extend beyond the property line of the dust originating facility. All open bodied trucks operating outside the property boundary which may emit airborne materials must be covered.

The treatment unit may generate spent ion exchange elements or other treatment residuals. The clean-up activity will generate decontamination water which is used to clean the construction equipment as well as personal protective equipment. Additionally, excavation of soil to place the gabion structure and filter will result in waste requiring management. All waste will have to be characterized to determine if the waste is hazardous [401 K.A.R. 34:020(4)], if it contains PCBs above 50 ppm (40 C.F.R. [Para] 761.60), and/or is radioactive (DOE Order 5400.5).

DOE Order 5820.2A Radioactive Waste Management establishes policies, guidelines, and minimum requirements by which DOE manages its radioactive and mixed waste and contaminated facilities. The Order ensures that radioactive and mixed wastes shall be managed in a manner which assures

protection of the health and safety of the public, DOE, contractor employees, and the environment. The management of low-level radioactive waste must be managed in such a manner that external exposure to the waste and concentrations of radioactive material which may be released to the surface water, ground water, soil, plants and animals results in an effective dose equivalent which does not exceed 25 mrem/year to any member of the public. Additionally, reasonable effort should be made to maintain releases of radioactivity in effluents to the general public as low as reasonably achievable. DOE Order 5820.2A should be evaluated as TBC guidance.

Kentucky regulations applicable to generators of hazardous waste are detailed in 401 K.A.R. [Para] 32 et seq. Onsite accumulation of hazardous waste may occur for 90 days or less without a permit or without having interim status if requirements found in 401 K.A.R. [Para] 32:030(5) are followed. This regulation details container marking requirements and KDEP notification requirements. If hazardous waste is stored for more than 90 days, requirements of 401 K.A.R. Chapter 34. Chapter 34 specifies the standards for owners and operators of hazardous waste storage, treatment and disposal facilities.

If these wastes are determined to be RCRA and Atomic Energy Act (AEA) mixed waste, then RCRA will apply to the hazardous waste component and the AEA will apply to the radioactive component of the waste [10 C.F.R. [Para] 962(b)]. Movement o

treatment residuals containing RCRA-characteristic waste and radionuclides to another unit will trigger the 40 C.F.R. [Para] 268.1 et seq. (Land Disposal Restrictions), an applicable ARAR for this alternative. DOE and EPA entered into Federal Facility Compliance Agreement Docket No. 92-03-FFR on June 30, 1992. This FFCA allows the storage of radioactive mixed waste containing an LDR prohibited hazardous waste component while treatment capacity is being developed. Whether the waste is characterized as RCRA characteristic, LLW, or mixed waste, it will be stored at an appropriate facility at PGDP which meets the substantive requirements of RCRA.

If the liquid waste contains only PCBs at concentrations greater than, or equal to, 50 ppm, then 401 K.A.R. [Para] 37:050(2)(6) prohibits the storage of such waste unless the storage facility meets the Toxic Substances Control Act (TSCA) requirements found in 40 C.F.R. [Para] 761.65. If the liquid waste contains only PCBs at concentrations less than 50 ppm, then the waste can be stored by following the requirements in 401 K.A.R. [Para] 34:180 et seq. which entails the use and management of containers. Chapter 34 establishes minimum standards for new hazardous waste sites or facilities and minimum standards for the use and management of containers.

A storage facility which contains PCBs must meet the minimum TSCA requirements found in 40 C.F.R. [Para] 761.65(b). These requirements are an adequate roof and walls to prevent rain water from reaching the stored PCBs and an adequate floor which has continuous curbing with a minimum six inch curb. These floor curbings must be made of continuous smooth and impervious

materials to prevent or minimize penetration of PCBs. Moreover, the facility must not contain drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area. Finally, the facility must not be located below the 100-year floor water elevation.

If wastes are shipped offsite for treatment and/or disposal, the following regulations will apply. 49 C.F.R. [Para] 172 et seq. lists and classifies those materials which the Department of Transportation (DOT) has designated as hazardous materials (49 C.F.R. [Para][Para] 172.101 and 172.102) for purposes of transportation and prescribes the requirements for shipping papers (Subpart C of 49 C.F.R. [Para] 172), package marking (Subpart D of 49 C.F.R. [Para] 172), labeling (Subpart E of 49 C.F.R. [Para] 172, and transport vehicle placarding applicable to the shipment and transportation of those hazardous materials (Subpart F of 49 C.F.R. [Para] 172).

Additional requirements which are applicable to the transportation of hazardous material are located in 40 C.F.R. subparts 263 et al. These regulations detail standards for which persons transporting hazardous waste in the United States must adhere, including a manifest system, recordkeeping, and hazardous waste discharges. However, these regulations do not apply to on-site transportation of hazardous waste by generators or by owners or operators of permitted hazardous waste management facilities. 49 C.F.R. subpart 271 would be considered potentially applicable since it applies to each person who offers a hazardous material for transportation and each carrier who transports the material.

There is currently no criteria for qualifying radioactive waste as clean and acceptable for offsite shipment as non-radioactive waste. Radioactive or mixed waste can, however, be shipped to approved Nuclear Regulatory Commission (NRC) licensed facilities. Waste generated from this project will be stored onsite until characterization can be completed or disposal criteria can be met.

Requirements for providing and maintaining emergency response information during transportation and at facilities where hazardous materials are loaded for transportation, stored incidental to transportation or otherwise handled during any phase of transportation are delineated in Subpart G of 49 C.F.R. [Para] 172. Training requirements for employees involved with the handling of hazardous waste (hazmat) are included in Subpart H of 49 C.F.R. [Para] 172. Training ensures that a hazmat employee has familiarity with Subpart H requirements, is able to recognize and identify hazardous materials, and has knowledge of emergency response information, self-protection measures, and accident prevention methods and procedures. Subpart I of 49 C.F.R. [Para] 173 sets forth requirements for transportation of radioactive materials by carriers and shippers. Package requirements, radiation level limitations, contamination control, and general transportation requirements are included in Subpart I. These regulations are applicable since provision and maintenance of said emergency response information is required for any contaminated material generation.

Specifications for packagings and containers used for the transportation of hazardous materials in commerce are included in 49 C.F.R. [Para] 178 et seq. Subpart K of 49 C.F.R. [Para] 178 consist of guidelines for packagings of Class 7 (radioactive) materials. 49 C.F.R. [Para] 179 et seq. prescribes specifications for tanks that are to be mounted on, or form part of, a tank car and which are used in the transportation of hazardous materials in commerce.

The NCP (40 C.F.R. [Para] 300.150) requires all response actions to comply with the provisions for response action worker safety and health found in 29 C.F.R. [Para] 1910.120. In addition, DOE Orders which address occupational safety would be applicable internal TBC guidance for DOE projects. These Orders are 5480.11, Radiation Protection for Occupational Workers and 5480.4. Environmental Protection, Safety, and Health (ES&H) Protection Standards.

DOE Order 5480.11 establishes radiation protection standards and program requirements for DOE and DOE contractor operations with respect to the protection of the worker from ionizing radiation. The Order applies to all DOE operators and contractors performing work for DOE. Furthermore, in accordance with DOE's policy, radiation protection standards must be implemented which are consistent with the Presidential approved guidance to Federal Agencies promulgated by the EPA and based on recommendations by authoritative organizations.

DOE Order 5480.4 specifies and provides requirements for the application of the mandatory environmental protection, safety, and health standards which are applicable to all DOE and DOE contractor operations while providing a list of references and sources of ES&H standards. The Order should be followed during

design, construction, operation, modification, and decommissioning. Specifically, this Order is applicable where DOE has authority to establish and enforce environmental protection, safety and health protection program requirements.

In order for construction to be conducted on the lift station, a PGDP employee will have to work in a confined space. DOE Order 5480.4 states that safety for a worker in a confined space must meet the standards documented in the American National Standards Institute's criterion entitled "Safety Requirements for Working in Tanks and Other Confined Spaces" ANSI Z117.1 (1989). ANSI standards provide minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure. This standard is intended to establish minimum requirements and procedures for the safety and health of employees who work in, and in connection with, confined spaces.

Location-specific

There are no location-specific ARARs for this alternative.

Cost Effectiveness

The interim action remedy employs a proven technology which affords overall effectiveness proportional to its costs such that the remedy represents reasonable value. This action will utilize a relatively inexpensive technology to initiate control of the source and mitigate the spread of contamination in the NSDD. This limited scale operation should reduce the cost of the overall remediation of the integrator operable unit by retarding the migration of the high concentration effluent portion of the NSDD.

Utilization of Permanent Solutions and Alternative Treatment Technologies

The objectives for this interim action are to stabilize the site by instituting source controls to decrease the introduction of contaminants into the ditch, and installing engineering controls which will decrease mobilization of the most contaminated portion of the ditch. This action should provide protection of human health and the environment. However, it does not fully address the principal threats to human health and the environment posed by the NSDD operable unit. This is not the final action planned for NSDD contamination. Subsequent actions will fully address the principal threats posed by the conditions at the PGDP. Utilization of a permanent solution will be addressed in the final decision document for the NSDD and the surface water integrator operable unit.

Preference for Treatment as a Principle Element

This interim action satisfies the statutory preference for treatment as a principal element of the action. This statutory preference will also be addressed in the final decision document for the NSDD and the Surface Water Integrator Operable Unit.

2.11 Documentation of Significant Changes

The Proposed Remedial Action Plan for Source Control at the North-Sout Diversion Ditch, was made available for public comment on November 8, 1993. The Proposed Remedial Action Plan identified Alternative 3, source controls, institutional controls and engineering controls including the installation of a pipeline and lift station, as the preferred alternative. DOE has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Remedial Action Plan, were necessary.

During the development of the final remedial alternatives for the Surface Water Integrator Operable Unit, including the NSDD, the necessity of action implemented under this ROD for interim action will be reevaluated. The final ROD for the surface water system may retain or replace portions or all of the actions conducted through this ROD. However, nothing conducted pursuant to this ROD is deemed inconsistent with likely final remedial actions.

PART 3

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The Responsiveness Summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117 (b) of CERCLA, as amended by the SARA, which requires the DOE as "Lead Agency" to respond "... to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the Proposed Plan.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures and has recommended an interim remedial action to initiate control of the contamination found in NSDD. As part of the remedial action process, a notice of availability was published in The Paducah Sun, a regional newspaper, regarding the Proposed Remedial Action Plan on November 7, 1993. This notice appeared in The Paducah Sun from November 7th until November 14th of 1993. The Proposed Remedial Plan for Source Control at the North-South Diversion Ditch was released to the public on November 8, 1993. This document was made available at both the onsite and offsite administrative records and at the Paducah Public Library. A public comment period was held from November 8, 1993 through December 8, 1993.

Specific groups which received individual copies of the Proposed Remedial Action Plan included the local PGDP Neighborhood Council, and the PGDP Environmental Advisory Committee. Informal meetings were held with each group on December 9, 1993 and December 13, 1993, respectively. At these meetings DOE personnel briefed the groups on the proposed action and solicited both written and verbal comments.

Phone calls and/or visits were made to various stakeholders, including neighbors and representatives of environmental groups, to alert them to the public comment period and briefly explain the Proposed Plan. Propose Remedial Action Plans and/or Interim Corrective Measures were mailed to those contacted.

Public participation in the CERCLA process is required by SARA. Comments received from the public are considered in the selection of the remedial action for the site. The Responsiveness Summary serves two purposes: to provide DOE with information about the community preferences and concerns regarding the remedial alternatives and to show members of the community how their comments were incorporated into the decision making process. This document summarizes both the oral and written comments during the various informal meetings and telephone calls, and the written comments received during the public comment period running from November 8, 1993 through December 8, 1993.

As evidenced from the comments received during the public comment period, the selected interim remedy specified in the Record of Decision for interim action is supported by both the community and governmental agencies. No comments were received from any group or organization opposed to this interim remedial action.

Comments received during the public comment period for the interim remedial action are summarized below. Comments and responses have been divided into two parts and are categorized by topic within the Responsiveness Summary. Part I

represents local community concerns, and Part II specific legal and technical questions. The comments below have been paraphased in order to effectively summarize them in this document. Copies of the written comments are available for review at the administrative records.

3.2 Summary and Response to Local Community Concerns

COMMENT: The United States Department of the Interior (USDOI) stated, "We support the efforts of DOE to reduce contaminant mobility and volume. To ensure this is occurring, we recommend regular monitoring of the discharge after treatment."

RESPONSE: The effluent which flows through the NSDD is discharged out the 001 KPDES Outfall. Consistent with the requirements of the KPDES permit this outfall is monitored for radionuclides on a monthly basis. Additionally, all discharges from C-400 will be sampled prior to release to ensure they comply with the target treatment goals specified in this Record of Decision.

COMMENT: "Any contamination which has left the reservation should be excavated and returned to the site. Signs and fences inside the complex will be satisfactory, unlike those placed on the offsite portion of the North-South Diversion Ditch. Fences offsite are not tall enough to restrict deer from entering portions of the ditch. This constitutes a pathway of contamination to humans who would hunt the deer or other small animals. Also, some of the fences are not fully enclosed."

RESPONSE: This interim action is intended to mitigate the movement of onsite contamination by providing source control to the contaminated portions of the NSDD which are located within the boundaries of the PGD security fence. Remedial activities for dealing with areas outside the PGDP security fence will be evaluated through a feasibility study for the surface water integrator operable unit.

On July 15, 1993, construction was completed on the signs and fencing as specified in the Interim Corrective Measure Work Plan for Institutional control of Offsite Contamination in Surface Water. The objectives of this work plan was to implement a system of institutional controls that would identify the areas of contamination through the posting of warning signs and

restrict casual public access to the creeks. This document was released for a thirty day public comment on October 30, 1992. No written comments were received.

To ensure protection of individuals which hunt in the areas adjacent to the PGDP, DOE and the WKWMA have instituted a biological sampling program. Through this program, a representative number of deer are sampled to ensure that they don't pose a health risk to personnel utilizing the WKWMA.

COMMENT: "Since there is funding of 3.1 million dollars in the FY 94 budget to correct the problems associated with the North-South Diversion Ditch and you show expenses of 2,194,724 dollars, does this reflect an attitude of the future that it's not worth the effort to remediate the site completely?"

RESPONSE: The cost estimate cited in the Proposed Remedial Action Plan For Source Control At The North-South Diversion Ditch estimated a cost of $1,370,860 for the selected interim remedial action. These estimates have been further refined to a capital cost of $1,342,511 and a present worth cost of $1,419,525. DOE believes that these interim actions are a key component towards providing protection for human health and the environment, while progressing to final remedies for each operable unit. The decision to not implement a final action at the NSDD at this point in time was not based on economic factors.

DOE is committed to proceed to final actions for each operable unit once sufficient information is known to ensure that the selected remedy will provide protection to human health and the environment and comply with all applicable or relevant and appropriate requirements. Final remedial decisions for the NSDD and the Surface Water Integrator Operable Unit will be made through the remedial investigation and remedy selection process after the nature and extent of contamination in the surface water system and the contribution of contaminants from source operable units are more fully understood.

3.3 Comprehensive Response to Specific Legal and Technical Comments

COMMENT: "The control of contaminates should start at the source. I am satisfied with the installation of the Ion Exchange unit to remove the radioactive contaminates before they reach the environment. What I am not comfortable with are the terms 'Derived Concentration Guideline Level, Best Management Practice, and As Low As Reasonably Achievable.' The contractor and the Department of Energy determine these figures. Past experience has been if the acceptable levels cannot be met, you will increase the allowable levels. Historically the levels of releases have been too high, as shown in the sediment samples of the ditch."

RESPONSE: This Record of Decision serves as a legally enforceable document. Both EPA and Kentucky's Division of Waste Management have the authority to make DOE comply with the requirements of this document. The target level for treatment for radionuclides was determined through consultation with both EPA and KDEP. DOE has selected these target treatment levels to

provide protection to human health and the environment by safeguarding both the surface water and the underlying ground water.

COMMENT: DOE "failed to mention the sewer system that consists of a network of piping that collects surface drainage and building, roof, and floor drainage that is released to nine effluent ditches leading to Big and Little Bayou Creeks. The sediments within these pipes contain PCBs and radioactive contaminants which would also constitute a source of contamination. The use of silt trap, lift station, and piping will slow the contaminates in the North-South Ditch; but by not addressing the other nine ditches which constitute another major pathway for contamination, your efforts will be minimal."

RESPONSE: This interim action at the NSDD constitutes an incremental step towards comprehensively addressing the Surface Water Integrator Operable Unit. The sewer system and ditches cited in the comment are to be investigated and

remediated as part of Waste Area Group 18. DOE, EPA, and KDEP are currently negotiating the generic baseline schedules for the Waste Area Groups. These schedules will be part of the PGDP Site Management Plan. Once agreement has been reached on the generic baseline schedule, DOE will have a projected start date available to the public for initiation of the remedial activities for WAG 18.

PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 06/15/1995
Operable Unit: 03
ROD ID: EPA/ROD/R04-95/230

Media: groundwater

Contaminant: VOCs, radionuclides, TCE

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Paducah Gas Diffusion Plant (PGDP), located in western Kentucky, is an active uranium enrichment facility owned by the US Department of Energy (DOE). It is situated on a 3,600 acre reservation approximately four miles south of the Ohio River and about ten miles west of Paducah, Kentucky. Construction of the PGDP began in 1951, and operations began in 1952. The PGDP uses gaseous diffusion to provide a physical separation process which allows for enrichment of the uranium. In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in groundwater from residential wells north of the PGDP. In response to this discovery the DOE and the EPA entered into an Administrative Order by Consent (AOC) to conduct site studies. These investigations discovered trichloroethene (TCE) contaminated groundwater within the Regional Gravel Aquifer (RGA) northeast of the plant. This plume is referred to as the Northeast Plume. The PGDP was placed on the National Priorities List (NPL) on May 21, 1994.

This interim ROD addresses the high TCE concentration in the Northeast Plume. Because groundwater serves as a pathway for contamination to move to the surrounding area, it has received the highest priority for undergoing prompt interim actions. The groundwater at the PGDP will be addressed comprehensively in an operable unit, called the Groundwater Integrator Operable Unit. The Northeast Plume is one part of the Groundwater Integrator Operable Unit. Final remedial decisions for the Northeast Plume and the Groundwater Integrator Operable Unit will be made after the nature and extent of contamination in the groundwater system and the areas contributing contaminants to the groundwater are more fully understood.

Remedy: The major components of the interim action remedy include extracting the contaminated groundwater, collecting the groundwater and piping it to a treatment system, and conducting treatability studies.

Text: Full-text ROD document follows on next page.

DOE/OR/06-1356&D2

Record of Decision
for Interim Remedial Action
at the Northeast Plume,
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

<IMG SRC 0495230>

June 1995

CERTIFICATION

Document Identification: Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/OR/06-1356&D2

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

U.S. Department of Energy
Owner and Operator

_____ _____

Jimmie C. Hodges, Paducah Site Manager Date Signed
Paducah Site Office
U.S. Department of Energy

The Department of Energy has signed as "owner and operator" and Martin Marietta Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

CERTIFICATION

Document Identification: Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/OR/06-1356&D2

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Martin Marietta Energy Systems, Inc.
Co-Operator

_____ _____

Martin Marietta Energy Systems, Inc Date Signed

The Department of Energy has signed as "owner and operator" and Martin Marietta Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the

contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), Martin Marietta Energy Systems, Inc.'s, representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

DOE /OR/06-1356&D2

Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky

June 1995

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Prepared for
U.S. Department of Energy
Environmental Management and Enrichment Facilities

PREFACE

This Record of Decision for Interim Remedial Action at the Northeast Plume, Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1356&D2) was prepared in

accordance with the requirements under both the Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act and Kentucky Revised Statutes 224.46. This work was performed under Work Breakdown Structure 1.4.12.7.1.02.05.03 (Activity Data Sheet 5302). Publication of this document follows the draft Federal Facility Agreement record of decision outline and meets a Primary Document Deliverable milestone for the Paducah Gaseous Diffusion Plant Environmental Management and Enrichment Facilities. This document provides the United States Department of Energy, the United States Environmental Protection Agency, and the Kentucky Department for Environmental Protection with a mechanism for documentation of a formal decision for selecting an interim remedial action to address the Northeast Plume.

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PAI Corporation
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NOTATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-dichloroethene
99Tc	technetium-99
235U	uranium-235
238U	uranium-238
ACO	Administrative Order by Consent
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BMP	best management practices
C.F.R.	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CWA	Clean Water Act
DNAPL	dense nonaqueous phase liquid
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
Fed. Reg.	Federal Register
FWS	Fish and Wildlife Service

ft	foot (feet)
gal	gallon(s)
HAZMAT	hazardous materials training
HSP	health and safety plan
HSWA	Hazardous and Solid Waste Amendments of 1984
ICM	interim corrective measures
K.A.R.	Kentucky Administrative Regulations
K.R.S.	Kentucky Revised Statutes
KDEP	Kentucky Department for Environmental Protection
km	kilometer(s)
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter(s)
l/sec	liters per second
m	meter(s)
MCL	maximum contaminant level
mg	milligram(s)
mi	mile(s)
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHPA	National Historic Preservation Act
NWP	nation wide permits
O&M	operation and maintenance
pCi/l	picoCuries per liter
PGDP	Paducah Gaseous Diffusion Plant
pH	hydrogen ion activity (inverse log)
PHEA	Draft Results of the Public Health and Ecological Assessment, Phase II
PRAP	proposed remedial action plan
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design
RGA	Regional Gravel Aquifer
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SHPO	State Historic Preservation Officer
TBC	to be considered
TCE	trichloroethene
TVA	Tennessee Valley Authority
UCRS	Upper Continental Recharge System
UF6	uranium hexafluoride
U.S.C.	United States Code
U.S.C.A.	United States Code Annotated
USEC	United States Enrichment Corporation
VOC	volatile organic compound
æg/l	micrograms per liter

PART 1

DECLARATION

DECLARATION FOR THE RECORD OF DECISION
FOR INTERIM REMEDIAL ACTION
AT THE NORTHEAST PLUME

SITE NAME AND LOCATION
Northeast Plume
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the Northeast Plume at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky, chosen in accordance with the Resource Conservation and Recovery Act of 1976 (RCRA), Kentucky Revised Statues (K.R.S.), the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based upon the administrative record for this site.

With the participation of the Kentucky Department for Environmental Protection (KDEP), both the United States Environmental Protection Agency (EPA) and the United States Department of Energy (DOE) entered into an Administrative Order by Consent (ACO) effective November 23, 1988, after the discovery of contamination in residential wells north of the PGDP. The ACO was drafted under Sections 104 and 106 of CERCLA. The DOE was issued a Kentucky Hazardous Waste Management Permit and an EPA Hazardous and Solid Waste Amendments Permit July 16, 1991. The KDEP portion of the RCRA permit was issued pursuant to Chapter 224 of the Kentucky Revised Statutes by authority granted from the EPA to the KDEP to administer a RCRA hazardous waste program. The EPA issued its portion of the RCRA permit pursuant to the Hazardous and Solid Waste Amendments of 1984. Hereinafter the two permits will be collectively referred to as the RCRA permits. The RCRA permits require the proper treatment, storage, and disposal of waste; corrective action (i.e., cleanup); closure of solid waste management units; and investigations of off-site contamination, including ground water contaminated by prior activities at the PGDP. On May 31, 1994, the PGDP was placed on the National Priorities List (effective date June 30, 1994). The DOE is currently negotiating a Federal Facilities Agreement with the EPA and the KDEP.

On July 2, 1993, the DOE was directed by the KDEP and the EPA to submit a workplan to implement an interim measure at the Northeast Plume. This interim remedial action will be initiated pursuant to the Interim Measure Provisions of PGDP's Kentucky Hazardous Waste Permit issued by the KDEP, the Hazardous and Solid Waste Amendments Permit issued by the EPA, and this record of decision (ROD). The Kentucky Division of Waste Management concurs with the DOE and the EPA on the selected interim action, in accordance with the requirements of the Kentucky Hazardous

Waste Management Permit. The scope of this action warrants the incorporation of the

selected remedy into Kentucky's Hazardous Waste Permit. This ROD will serve as the primary document for the modification to Kentucky's Hazardous Waste Permit. This action will serve as a step toward comprehensively addressing the Northeast Plume.

In January 1994, the Interim Corrective Measures Workplan for the Northeast Plume was submitted to the EPA and the Commonwealth of Kentucky. The workplan described the investigation and provided the path forward for an interim remedial action or a final remedial action for the contaminated ground water emanating from the northeast part of the PGDP. However, information derived from the Groundwater Monitoring Phase IV Investigation indicated the need to modify the workplan schedule. The rationale for this modification includes: the discovery of multiple plumes and sources composing the Northeast Plume including one area of acute trichloroethene (TCE) ground water contamination that emanates from the eastern margin of the plant and extends off DOE property; a better definition of the plume's boundaries; and the long-term goal to develop an efficient and cost-effective ground water strategy. Following an October 5, 1994, meeting between the DOE, the EPA, and the Commonwealth of Kentucky, the decision was made to proceed with an interim remedial action for the high TCE concentration ground water plume.

This action will retard the migration of the highest TCE concentration area within the ground water plume emanating from the eastern margin of the PGDP. Ground water will be extracted from at least one well located along Ogden Landing Road and pumped through a pipeline to a treatment facility. The extraction well(s), pipeline, and the treatment facility will be located on DOE property. Contaminated ground water will be pumped at a rate, based on current ground water modeling, adequate to initiate hydraulic control of the high TCE concentration plume which extends northeast of the plant security fence. In addition, the extraction rate may be optimized in order to minimize the movement of technetium-99 and other areas of acute TCE contamination detected near the plant's eastern boundary. Concurrent with the interim remedial action in Alternative 2 is a provision for two treatability studies which examine the following innovative technologies: (1) photocatalytic oxidation of TCE, and (2) in situ treatment of TCE-contaminated ground water.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances and constituents from the site, if not addressed by implementing the response action selected in this ROD for interim action, may present an imminent and substantial endangerment to public health, welfare, or the environment in the future.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this interim remedial action is to implement a first-phase remedial action as an interim action to initiate hydraulic control of the high concentration area within the Northeast Plume that extends outside the plant security fence. Because ground water serves as a pathway for contamination to move to the surrounding area, it has received the highest priority for undergoing prompt interim actions. The ground water at the PGDP will be addressed comprehensively in an operable unit (hereinafter defined as the "Ground Water Integrator Operable Unit"). The

Northeast Plume is one part of the Ground Water Integrator Operable Unit. Final remedial decisions for the Northeast Plume and the Ground Water Integrator Operable Unit will be made through the remedial investigation and remedy selection process, after the nature and extent of contamination in the ground water system(s) and the areas (i.e., source operable units) contributing contaminants to the ground water are more fully understood.

The major components of the interim action remedy include:

> The contaminated ground water will be extracted at a location in the northern portion of the high TCE concentration area of the plume (greater than 1,000 micrograms per liter of TCE). The contaminated ground water will be pumped at a rate of approximately 100 gallons per minute to initiate hydraulic control without changing ground water gradients enough to cause adverse effects. During operation, this pumping rate may be modified to optimize hydraulic containment, by adjusting flow from the extraction wells, and to support subsequent actions.
>
> The extracted ground water will be collected and piped to a treatment system prior to release to a Kentucky Pollutant Discharge Elimination System permitted outfall. 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 ground water. The chemicals of concern are TCE and 1,1-dichloroethene.
>
> Two treatability studies which include: (1) photocatalytic oxidation of TCE-contaminated off-gas, and (2) in situ treatment of TCE-contaminated ground water.

The KDEP and the EPA have participated in the development of this ROD, including review and comment on the content of the document. All KDEP and EPA comments issued to DOE have been incorporated into the ROD.

STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements for the scope of this limited action, is cost effective and is consistent with RCRA requirements. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and, thus, is in furtherance of that statutory mandate. Subsequent actions are planned to address the principal threats posed by the conditions at this site. Because this remedy will result in hazardous substances and constituents remaining onsite above health-based levels, a review will be conducted within five years after commencement of the remedial action, and every five years thereafter, until a final remedial alternative is selected and implemented. These reviews will be conducted to ensure that the selected remedy continues to provide adequate protection of human health and the environment. Because this is an interim action ROD, review of this

operable unit and of this remedy will be ongoing as the DOE continues to develop final remedial alternatives for the Ground Water Integrator Operable Unit.

_____ Date_____

Robert Dale Dempsey
Assistant Manager for Environmental Management
United States Department Of Energy

_____ Date_____

John H. Hankinson, Jr.
Regional Administrator
United States Environmental Protection Agency, Region IV

PART 2

DECISION SUMMARY

DECISION SUMMARY

2.1 Site Name, Location, and Description

The Paducah Gaseous Diffusion Plant (PGDP), located in western Kentucky, is an active uranium enrichment facility owned by the United States Department of Energy (DOE). Effective July 1, 1993, the DOE leased the plant's production facilities to the United States Enrichment Corporation (USEC) which in turn contracted with Martin Marietta Utility Services, Inc., to provide operation and maintenance services. Lockheed Martin Energy Systems, Inc., manages the environmental restoration and waste management activities for the DOE at the PGDP.

The PGDP is situated on a 1,457 hectare (3,600 acre) reservation approximately 6.4 kilometers (km) [4 miles (mi)] south of the Ohio River and about 16 km (10 mi) west of Paducah, Kentucky (Figure 1). About 304 hectares (750 acres) of the reservation are within a security area and buffer zone that have restricted access to the general public. Beyond the DOE-owned buffer zone is the Western Kentucky Wildlife Management Area which covers approximately 2,428 hectares (6,000 acres).

2.2 Site History and Enforcement Activities

Construction of the PGDP began in 1951, and operations began in 1952. The PGDP uses gaseous diffusion to provide a physical separation process which allows for enrichment of the uranium. Commercially produced uranium hexafluoride (UF6) is composed primarily of uranium-238 (238U), and a small percentage of uranium-235 (235U). The gaseous diffusion process is premised on the fact that UF6 with fissionable 235U is

slightly lighter than UF6 with 238U. Therefore, as the UF6 passes through the gaseous diffusion plant's cascade system, separation of 235U from 238U takes place. This separation results in enriched uranium (increased percentage of 235U). This enriched uranium is then transported to USEC's enrichment facility in Piketon, Ohio, for further enrichment.

The DOE is conducting cleanup activities at the PGDP. These cleanup efforts are necessary to address contamination that has resulted from past operations at the plant. Remedial activities are being conducted in consultation with the Kentucky Department for Environmental Protection's (KDEP's) Division of Waste Management, the Radiation Control Branch, and the United States Environmental Protection Agency (EPA).

In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in ground water from residential wells north of the PGDP. In response to this discovery, the DOE and the EPA entered into an Administrative Order by Consent (ACO) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (i.e., conduct a remedial investigation/feasibility study). The DOE then implemented the PGDP Water Policy to reduce the current risk to potential human exposure (i.e., potentially affected residence and businesses).

The CERCLA site investigations discovered trichloroethene (TCE)-contaminated ground water within the Regional Gravel Aquifer (RGA) northeast of the plant. This plume is

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referred to as the Northeast Plume. The DOE submitted an interim corrective measures (ICM) workplan for the Northeast Plume to the EPA and the Commonwealth of Kentucky in order to conduct an investigation and provide the path forward for an interim remedial action as required by the Hazardous Waste Permit or a final remedial action for the contaminated ground water emanating from the northeast part of the PGDP.

Results of the Groundwater Monitoring Phase IV Investigation, published in the Northeast Plume Preliminary Characterization Summary Report, delineated numerous plumes in the RGA that coalesce to form the Northeast Plume. One of these plumes is a zone of high TCE concentration [TCE concentrations exceeding 1,000 micrograms per liter (æg/l)] that emanates from the eastern margin of the plant and extends off DOE property (Figure 2). No technetium-99 (99Tc) contaminated ground water occurs above the current calculated MCL of 900 pCi/l within the portions of this plume that occur outside the PGDP fence. Because this TCE plume is migrating northeast toward the eastern boundary of the area served by the PGDP Water Policy, a potential risk exists; therefore, this interim remedial action is necessary.

One source of ground water contamination in the Northeast Plume is thought to be the Kellogg Building leach field (Figure 3). The Groundwater Monitoring Phase IV Investigation results indicate that this leach field may have been a significant contributor to the zone of highest TCE-contaminated ground water emanating from the eastern margin of the PGDP. Site investigations suggest the presence of free-phase TCE, a

dense

nonaqueous phase liquid (DNAPL) in the subsurface material at the PGDP which represents additional sources of ground water contamination.

2.3 Highlights of Community Participation

On March 12 and 13, 1995, a notice of availability was published in The Paducah Sun, a regional newspaper, regarding the Proposed Remedial Action Plan for Interim Remedial Action at the Northeast Plume. The Proposed Remedial Action Plan (PRAP) was released to the public March 12, 1995. The PRAP was made available for public review at the Paducah Public Library and the off-site Environmental Information Center located in the West Kentudky Technology Park in Kevil, Kentucky. A public comment period was held March 12 through April 25, 1995.

Specific groups that received individual copies of the PRAP induded the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. An informal meeting was held with the PGDP Environmental Advisory Committee on March 2, 1995. At this meeting, DOE personnel briefed the Committee on the proposed action and solicited both written and verbal comments.

Phone calls and/or visits were made to various stakeholders, including neighbors and representatives of environmental groups, to advise them of the public comment period and briefly explain the PRAP. The PRAPs were mailed to those contacted. A response to the comments received during the public participation period is included in the Responsiveness Summary, which is part of this record of decision (ROD).

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<IMG SRC 0495230C>

The PRAP contained a notice of the availability for a public meeting to discuss the Northeast Plume and proposed actions. However, no requests for a public meeting were received.

This decision document presents the selected interim remedial action for the Northeast Plume at the PGDP, chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Acts of 1986 (SARA), the EPA and Commonwealth of Kentucky permits issued under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), Kentucky Revised Statute (K.R.S.) 224.46, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for interim remedial action at this site is based upon administrative record documentation.

2.4 Scope and Role of Operable Unit

Response Action and the Site Management Strategy

The PGDP presents unusually complex problems in terms of hazardous waste

management and environmental releases. The DOE's proposed strategy is to divide the site into operable units grouped by source areas and Ground Water Integrator Operable Units. Discrete response actions will be selected and implemented for each operable unit to address the source areas (i.e., source operable units) and the integrator operable units impacted by commingled releases from source operable units. Prioritization for investigation and possible interim remedial actions has been assigned to each of the integrator operable units and source operable units depending on their potential for contributing to off-site contamination. Because ground water integrator units serve as migration pathways that transport contamination from source operable units to off-site receptors, they receive the highest priority for undergoing initial evaluation and interim remedial actions.

Consistent with the DOE's strategy, this action is intended as an incremental step toward addressing the Ground Water Integrator Operable Unit. The Northeast Plume contributes to off-site ground water contamination that will continue to migrate and may contaminate clean resources and potentially expose additional off-site receptors. Implementation of this interim remedial action will: (1) initiate hydraulic control of the high concentration area of TCE contamination within the Northeast Plume that is migrating outside the eastern margin of the plant security fence, and (2) Monitor the performance of this interim remedial action in order to track contaminant migration and assess the system's performance prior to development of a final remedy.

This action can be implemented to monitor the performance of this interim remedial action in order to track contaminant migration, and assess the system's performance prior to development of the final remedy. Remedial investigations can continue to be conducted for the remainder of the Northeast Plume and Ground Water Integrator Operable Unit. This phased approach is consistent with EPA regulations and guidance and in accordance with the Hazardous Waste Permit, which advises initiation of early actions as soon as possible after a problem is identified for which an early action is appropriate, and early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action.

Future Response Actions Associated with this Response Action

The remedial action described by this ROD is not the final action for the Northeast Plume. Following issuance of the ROD for this interim measure, additional remedial investigations and/or treatability studies will be initiated to obtain data needed for evaluating remedial alternatives to implement a final remedy which will provide protection of human health and the environment. These remedial investigations and/or treatability studies will be consistent with the requirements of both the draft Site Management Plan and the draft Federal Facility Agreement being developed by the DOE, the EPA, and the KDEP. This study may lead to a PRAP for a second interim remedial action and/or a final action for the Northeast Plume.

Although a site investigation, public health and ecological assessment, and an alternative evaluation were performed for the PGDP site as a whole, a final action cannot be recommended until further characterization activities have been completed. Before a final action can be recommended for the northeast portion of the Ground Water

Integrator Operable Unit, a baseline risk assessment must be completed, including an ecological risk assessment. Additionally, a more complete characterization of the Northeast Plume needs to be performed and the interaction of all source operable units with the Ground Water Integrator Operable Unit must be better defined. Although additional data will be needed before the selection of a final action, sufficient information is available to support recommendation of the interim remedial action presented in this document. This interim remedial action should not be inconsistent with nor preclude implementation of any currently anticipated final remedy.

2.5 Summary of Site Characteristics

Hydrogeologic Characteristics

The subsurface geologic framework at the PGDP consists of Mississippian limestone bedrock overlain by 105 meters (m) [344 feet (ft)] of unconsolidated sediments. Figure 4 presents a schematic cross section illustrating the conceptual geology at the site. The following discussion focuses on the lithologies present in the area encompassing the Northeast Plume.

The surficial deposits northeast of the plant consist of a 1.5 to 7.6 m (5 to 25 ft) thick clayey silt of wind-blown origin called loess and alluvial flood deposits of sand and silt which occur within the floodplain of Little Bayou Creek. The soils that formed in the upper 1.2 m (4 ft) of the loess and alluvial deposits are silt loams of the Calloway, Grenada, Henry, Loring, and Vicksburg Soil Series.

Underlying the surficial deposits to a depth ranging from 21 to 36 m (75 to 118 ft) below ground surface (bgs) are the continental deposits of late Tertiary and Quaternary age. These unconsolidated deposits, composed of an upward-fining sequence of gravels, sands, silts, and days, are divided into an upper and lower member. The upper continental deposits consist of sand, silt, and day with occasional discontinuous gravel lenses that range in thickness from 6 to 18 m (20 to 59 ft). The coarser textured, more permeable lenses within the upper continental deposits have been informally grouped into a ground water flow system referred to as the Upper Continental Recharge System

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(UCRS). Ground water is found in the UCRS on both a perennial and a seasonal basis. The ground water flow direction in the UCRS is ultimately downward into the underlying aquifers.

The lower continental deposits consist of chert gravel and sand deposited in a high energy, fluvial environment. Averaging 9 m (30 ft) thick, the deposits pinch out to the south against a buried escarpment called the Porters Creek terrace (Figure 4). The base of the deposits is an undulating, erosional surface created by scouring into the

underlying Porters Creek Clay and McNairy Formation. These channels were subsequently filled with a complex sequence of gravel and sand. Discrete, elongate, coarser grained, clean gravel units occur within the lower continental deposits forming high permeability zones. One such unit, less than 305 m (1,000 ft) wide, extends about 1.6 km (1 mi) northeast of the plant along the southernmost edge of the Northeast Plume.

Lithologies composing the lower continental deposits form a hydrogeologic unit informally called the RGA. The RGA is the dominant ground water flow system in the area due to its relatively high hydraulic conductivity and is the primary aquifer of interest in this interim remedial action. Ground water recharge is by downward percolation through the UCRS and via underflow through gravels located south of the Porters Creek terrace. From the site, ground water flows northward toward the Ohio River, which is the local base level for the system.

Discrete high permeability gravel units in the RGA, such as the one identified along the southern edge of the Northeast Plume, may provide local pathways for ground water and contaminant flow. The orientation of these pathways may help to explain the current geometry of the Northeast Plume, because the interpreted trend of contaminant migration contradicts the direction of apparent ground water movement derived from potentiometric contours.

The lower continental deposits are directly underlain by the Porters Creek Clay and the McNairy Formation at a depth ranging from 21 to 36 m (75 to 118 ft) bgs. The Porters Creek Clay is a homogeneous clay that forms the buried terrace face along the southern edge of the PGDP. South of the Porters Creek terrace, the Porters Creek Clay averages 26 m (85 ft) thick, and north of the terrace the clay ranges from 0 to 6 m (0 to 20 ft). This clay is generally a low permeability barrier to ground water flow.

Interbedded and interfingering clay, silt, and fine sands, with some lignite and pyrite, compose the Cretaceous McNairy Formation. This formation averages 68 m (223 ft) in thickness in the Northeast Plume area. The McNairy Flow System is a hydrogeologic unit that refers to the water-bearing sands within the McNairy Formation. Ground water within the McNairy Flow System moves in a northerly direction toward discharge areas along the Ohio River. Although the hydraulic conductivity of the McNairy sands is several orders of magnitude less than that of the RGA gravels, there is a vertical hydraulic connection between the two where they are in contact.

Directly underlying the McNairy Formation are the Cretaceous Tuscaloosa Formation and the Mississippian rubble zone which together consist of rounded to subangular chert and silicified limestone fragments up to 6 m (20 ft) thick (Figure 4). Bedrock beneath the site occurs at approximately 105 m (344 ft) bgs.

A three-dimensional ground water flow model was developed in July 1994 to simulate the regional ground water flow in the vicinity of the PGDP. The DOE selected the MODFLOW computer code, a publicly available ground water flow simulation program developed by the United States Geological Survey. In order to simulate ground water flow in the principal water-bearing units beneath the site on a regional scale, the flow model was constructed and calibrated to cover nearly 100 km2 (39 mi2). The regional model simulates ground water flow in multiple water-bearing units consisting of the UCRS, RGA, and the McNairy Flow System. A detailed presentation of the computer

model is presented in the Technical Memorandum for Interim remedial Action of the Northeast Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1318&D2)

Operable Unit Characteristics

The Kellogg Building leach field may have been a significant source for the high concentration zone of ground water contamination emanating from the eastern margin of the PGDP along the southern edge of the Northeast Plume. Located adjacent to the plant's eastern security fence line (Figure 3), the former Kellogg Building functioned as a pipe fabrication facility during the initial construction of the plant's cascade system. It is believed that TCE may have been used extensively at this facility from 1951 to 1955 when the building was demolished. Drains in the former Kellogg Building are thought to have emptied into a leach field southeast of the building. The Ground Water Monitoring Phase IV Investigation discovered elevated concentrations of TCE in the ground water in the vicinity of this leach field. As a result, the Kellogg Building leach field is considered a potential source of TCE ground water contamination for the Northeast Plume.

Additional source units likely contribute to the high concentration zone of ground water contamination emanating from the eastern margin of the PGDP along the southern edge of the Northeast Plume. These sources are probably located inside the plant's security fence to the southwest of the Kellogg Building leach field nearer to the origin of the high concentration zone of TCE contamination shown on Figure 2. Identification and further characterization of the significant source units contributing to this plume is necessary before a final remedial action is taken.

Contaminant Characteristics

The contaminants of concern in the Northeast Plume outside the plant security fence are TCE and 1,1-dichloroethene (1,1-DCE). Trichloroethene is the predominant contaminant in the Northeast Plume. The Groundwater Monitoring Phase IV Investigation measured TCE concentrations in ground water extracted from soil borings located outside the plant security fence up to 2,856 æg/l, which exceeds the maximum contaminant level (MCL) of 5 æg/l. A degradation product of TCE, 1,1-DCE, was detected above the MCL of 7 æg/l in the ground water sampled from two soil borings, D-9 and D-10, located immediately east of the PGDP fence (Figure 2). The maximum concentration of 1,1-DCE measured was 15 æg/l.

Trichloroethene is a halogenated organic chemical used widely as a metal degreaser. Although TCEis no longer used at the PGDP, past use and disposal practices resulted in soil and ground water contamination. At the PGDP, the two major forms of TCE contamination in the subsurface are: (1) dissolved phase in the ground water; and (2) free-phase product. Because it is relatively insoluble at high concentrations and has a higher specific gravity than water, free-phase TCE is a DNAPL. When spilled, free-phase TCE moves downward through the unsaturated zone and the aquifer under the influence of gravity. Lateral spreading occurs as the free-phase TCE seeks out lower capillary pressure, higher permeability pathways through heterogeneous subsurface

material. This DNAPL movement ceases when the volume of free product is insufficient to overcome the capillary pressure of the subsurface material. Free-phase TCE, distributed as residual blobs and ganglia, dissolves slowly into the ground water causing continued contamination of the downgradient aquifer.

The radionuclide 99Tc was introduced to the PGDP as a by-product of the reprocessing of uranium. This radionuclide was probably introduced into the ground water from past handling or disposal of TCE contaminated with 99Tc and scrap metal contaminated with 99Tc. Ground water sampled from the RGA in four soil borings located immediately east of the plant security fence detected 99Tc contamination at concentrations up to 58 pCi/l. The extent of this 99Tc contamination is shown on Figure 2 by the 30 pCi/l isopleth, which represents the lowest concentration for which a coherent plume boundary can be drawn. The 58 pCi/l 99Tc concentration is low with respect to the aqueous regulatory concentration of 900 pCi/l currently calculated from the MCL of 4 millirems per year. Since 99Tc is a weak beta emitter, it has been classified by the EPA as a Group A carcinogen (known human carcinogen).

Trichloroethene ground water contamination in the Northeast Plume outside the PGDP security fence occurs primarily within the RGA. Isolated instances of TCE ground water contamination occur in the McNairy Formation as well. Ground water in the RGA is contaminated in a plume complex approximately 1.2 km (0.75 mi) wide that extends about 2.4 km (1.5 mi) to the northeast of the plant (Figure 2). A narrow zone of high TCE contamination, defined by the 1,000 æg/l isopleth, occurs within the southernmost portion of the plume complex. This high concentration zone originates within the plant, emanates from the plant's eastern boundary in the vicinity of the Kellogg Building leach field, and extends at least 1.6 km (1 mi) to the northeast, north of Ogden Landing Road (Figure 2).

Both the distribution and internal stratigraphy of the RGA influence the distribution of TCE contamination. The southeastern margin of the Northeast Plume is controlled by the pinchout of the RGA against the Porters Creek terrace. The geometry of the high TCE concentration zone corresponds to the trend of the coarser-grained, well-sorted gravel unit located along the southern edge of the Northeast Plume. This gravel unit may provide a preferred pathway for contaminant migration. The vertical distribution of TCE within the high concentration zone varies with distance from probable source areas. Trichloroethene concentrations increase toward the bottom of the aquifer as the distance from source areas increases. In the vicinity of suspected source areas, such as the Kellogg Building leach field, contamination is distributed more equally throughout the RGA.

The Groundwater Monitoring Phase IV Investigation discovered TCE-contaminated ground water within sands of the upper part of the McNairy Formation. The frequency and concentration of TCE decreases to the northeast of the plant. The highest concentration reported from the McNairy Formation outside the plant security fence was 413 æg/l from soil boring D 10 (Figure 2). The sand is laterally discontinuous, pinching out 15.3 (50 ft) and 7.6 m (25 ft) to the east and west, respectively, of soil boring D 10.

2.6 Summary of Site Risks

Based on the results of investigative activities at the Northeast Plume, the DOE, the EPA, and the KDEP have decided that there is sufficient potential risk to the public and environment to warrant this action. The principal goal of this interim remedial action is to implement control measures which will mitigate migration of the contaminants.

Long-term exposure to TCE via ingestion or inhalation have produced increases in liver, lung, and kidney tumors in mice and rats. Therefore, the EPA has classified TCE as a B2 carcinogen (probable human carcinogen). This classification is currently being reviewed by the EPA.

A breakdown product of TCE is 1,1-DCE. The liver is the principal target organ of 1,1-DCE toxicity. The EPA classifies 1,1-DCE as a Class C carcinogen (possible human carcinogen).

Infiltration and downward migration of TCE may lead to ground water contamination with ground water flow as the transport mechanism to off-site locations. The primary routes of exposure include ingestion of contaminated ground water and dermal absorption and inhalation through domestic uses of contaminated ground water. Other exposure pathways, although less likely, include release of contaminated ground water into surface water and sediment with subsequent incidental ingestion and dermal absorption. Current data indicates that the Northeast Plume has not contaminated a surface water body. Notwithstanding, this exposure pathway is less certain, as significant dilution in surface water and loss of both TCE and 1,1-DCE due to volatilization may result in concentrations in surface water and sediment that are of no toxicological concern.

Risks associated with the off-site ground water have been reduced greatly by the Paducah Gaseous Diffusion Plant Water Policy. The purpose of the Water Policy is to eliminate exposure by restricting ground water use. Since municipal water is provided to affected and potentially affected residences and businesses, there are currently no significant risks to human health. If, in the future, the present water policy is no longer in effect and institutional controls are ignored, area residents could be at risk from exposure to contaminated ground water. Potential future exposures for an off-site resident include ingestion of contaminated drinking water and inhalation of volatile organic compounds during household water use.

The ACO states that monthly sampling of residential wells is required for those wells potentially affected by the contaminant plume. In accordance with the ACO under Sections 104 and 106 of CERCLA, residential wells are sampled on a routine basis for pH, temperature, turbidity, TCE, 99Tc, and gross alpha and beta activities. The ACO will not cover future off-site residents.

2.7 Description of Alternatives

The screening and evaluation process identified one remedial alternative that will quickly and effectively reduce risk by retarding the migration of contamination from the Northeast Plume.

Alternative 1 - No Action

Pursuant to 40 C.F.R. 300.430(e)(6), the DOE is required to consider a no action alternative. This alternative is useful as a baseline for comparison between potential alternatives. Under this alternative, no further action would be taken with regard to the Northeast Plume.

Alternative 2 - Hydraulic Plume Control

The hydraulic plume control interim remedial action consists of one or more extraction well(s) to be placed near the north end of the high concentration area of the Northeast Plume located near Ogden Landing Road. This action will initiate hydraulic control of the high concentration area of the Northeast Plume and mitigate the concentrations of TCE in the ground water. The wells are expected to be located on DOE property (Figure 5) within the high TCE concentration isopleth of the plume. Extracted ground water will be pumped through a pipeline at approximately 6.3 liters per second (l/sec) (100 gallons per minute) to a water treatment facility. 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 TCE-contaminated ground water (Figure 6). The sand filter may be located near the PGDP's eastern security fence. The cooling tower is located on DOE property within the security fence (Figure 5). The pipeline will be placed under existing gravel roads or within created ditches immediately adjacent to these roads. Treated water will be discharged to a Kentucky Pollutant Discharge Elimination System (KPDES) permitted outfall along the western boundary of the PGDP.

Data gathered during the Northeast Plume investigations and operations will be used to optimize the remedial action by adjusting flow rates from the extraction well(s) to control the plume to the maximum extent possible while minimizing adverse effects. Hydraulic plume control is consistent with the EPA's Office of Solid Waste and Emergency Response Directive 9283.1-03 and the Hazardous Waste Permit which sets a policy for remediation of aqueous contaminant plumes. The directive advises that the plume should be contained early, that initiation of early actions should take place as soon as possible after a problem is identified for which an early action is appropriate, and that early actions should be coordinated with final remedies such that they are the first phase of the overall remedial action. The directive further advises that remedial actions for contaminated ground water should be implemented in a phased approach.

Two innovative pilot-plant studies will be conducted during this interim remedial action. The studies will evaluate technology performance and cost effectiveness for potential full-scale implementation. The two innovative pilot-treatment studies are:

(1) Photocatalytic oxidation treatment of off-gas; and

(2) In situ treatment of TCE-contaminated ground water.

Photocatalytic oxidation treatment of off-gas is an innovative technology (Figure 7). Reduction of TCE by this technology has been demonstrated, but is unproved at the PGDP. Site-specific information is required in order to determine an appropriate cost estimate and design criteria of equipment for a future full-scale operation. A small

side

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stream volume will be varied in order to conduct the pilot study, thus testing the photocatalytic oxidation performance. A three-month pilot demonstration is expected. Benefits of this technology indude the following:

- Complete destruction of VOCs before discharge of off-gas;
- Low operation and maintenance (O&M) cost; and
- Compatible with in situ treatment technologies.

The in situ ground water treatment well is also an innovative treatment technology. This technology is appropriate for demonstration at the PGDP (Figure 8). If successful, this technology has several potential benefits, including:

- Reduction of waste generated during the remedial action;
- No contaminated water transfer to the surface; therefore, no treatment cost, disposal, or associated permits are required;
- Less intrusive in environmentally sensitive areas within the PGDP where logistics limit remedial alternatives;
- No regional lowering of the ground water level, thus reducing the effect on the regional flow system;
- The entire thickness of the aquifer may be included in circulation (radius of influence); and
- Lower cost than conventional pump and treat technology.

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One in situ ground water treatment well is proposed for this two-year pilot study. If

this technology is determined viable for operation, wells located across the high concentration portion of the plume can remediate contaminants which migrate to the wells, or the wells can be located near source area(s) for mass reduction. Other objectives include determining if the technology reduces TCE concentrations in ground water below remedial goal objectives or MCLs, estimates of the radius of influence of the treatment system, operating cost associated with the technology, and the time for remediation to acceptable levels to occur. A secondary objective would be to couple this technology with photocatalytic oxidation as the off-gas treatment, since photocatalytic oxidation could provide complete destruction of off-gas from the well. Additional secondary objectives include: documentation of selected aquifer characteristics that may be affected by oxygenation and recirculation of treated ground water; documentation of off-gas concentrations from the well bore; and documentation of other operating parameters as needed in the design phase.

2.8 Summary of the Comparative Analysis of the Interim Alternative

This section provides the basis for determining which alternative (1) meets the threshold criteria of overall protection of human health and the environment, and complies with applicable or relevant and appropriate requirements (ARARs) and is consistent with the Hazardous Waste Permit; (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; and (3) satisfies state and community acceptance criteria. Because of the limited scope of this interim remedial action, the comparative analysis focuses on the selected remedy, while considering the No Action Alternative under the appropriate criteria.

CERCLA requires nine criteria be used for evaluating the expected performance of remedial actions. The nine criteria are identified below and the interim remedial action has been evaluated on the basis of these criteria.

1. Overall protection of human health and the environment. This requires that the alternative adequately protect human health and the environment, in both the short- and long-term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks. The EPA's goal is to return usable ground water to its beneficial use within a time frame that is reasonable given the particular circumstances of the site.

2. Compliance with ARARs. The alternatives must be assessed to determine if they attain compliance with ARARs of both state and federal law.

3. Long-term effectiveness and permanence. This focuses on the magnitude and nature of the risks associated with untreated waste and/or treatment residuals. This criterion includes consideration of the adequacy and reliability of any associated engineering controls, such as monitoring

and
maintenance requirements.

4. Reduction of contaminant toxicity, mobility, or volume through treatment. This includes the degree to which the alternative employs treatment to reduce the toxicity, mobility, or volume of the contamination.

5. Short-term effectiveness. This includes the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, and the time required until protection is achieved.

6. Implementability. These are potential difficulties associated with implementing the alternative. This may include the technical feasibility, administrative feasibility, and the availability of services and materials.

7. Cost. The costs associated with the alternatives include the capital cost, annual operation and maintenance (O&M), and the combined net present value.

8. State acceptance.

9. Community acceptance. This includes the consideration of any formal comments by the community to the PRAP for interim remedial action.

The criteria listed above are categorized into three groups. The first and second criterion are threshold criteria. The chosen final alternative must meet the threshold criteria to be eligible for selection. The five primary balancing criteria include criteria three through seven. The last two criteria are termed the modifying criteria. The modifying criteria were evaluated following issuance of the PRAP for public review and comment.

Overall Protection of Human Health and the Environment

Alternative 1, No Action, would not initiate hydraulic plume control. The purpose of including the No Action Alternative is to provide a baseline to which other alternatives can be compared. Existing controls such as ground water monitoring, alternate water supply, and agreements on water-use restrictions would be continued. The water policy represents only institutional controls and does not meet EPA's bias for permanent solutions involving treatment of the contaminated media. (i.e., It does not return the ground water to beneficial use.) These controls include:

Public awareness programs that advise local residents of site conditions and potential problems resulting from ground water contamination;

An alternative water supply for residents whose wells have been affected. Also, an action memorandum was approved by the EPA to

extend a West McCracken County Water District line to all residents whose wells have the potential to be contaminated in the future. The water policy requires that these residents sign an agreement not to use their wells. Construction of the pipeline (water main) has recently been completed; and

The annual site environmental monitoring program.

Alternative 2, Hydraulic Plume Control, will initiate an effort toward returning the ground water to beneficial use by controlling the high concentration area of the plume. Future site risk will be reduced since ground water will be extracted and treated. This alternative alone is not intended to remediate the plume to MCLs; however, water that is extracted will be treated to meet compliance concentrations.

Alternative 2 would accomplish the interim remedial action objectives of initiating hydraulic control of the plume and initiating risk reduction along with facilitating collection of data needed for selecting subsequent and future final remedial actions. It would also reduce future risks associated with continued migration of the high concentration area of the plume and resulting exposures. This alternative features treatment of extracted ground water to meet effluent discharge limits which meets EPA's preference for treatment, and subsequently is preceding toward the preference for a permanent solution. Successful control of the plume in combination with existing controls (alternate water supply, monitoring, etc.) ensures protection during the period of the interim response. However, the risk cannot be quantified until a baseline risk assessment has been conducted at the Northeast Plume.

Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet this threshold criterion to be eligible for selection. Alternative 1 would not provide compliance with ARARs since migration of ground water contamination would not be reduced. Alternative 2 would provide compliance with ARARs. A detailed description of ARARs for the selected remedy is presented in Section 2.10 of this ROD.

On July 2, 1993, the DOE was directed by the KDEP and the EPA to submit a workplan to implement an interim measure at the Northeast Plume. This interim remedial action will be initiated pursuant to the Interim Measure Provisions of PGDP's Kentucky Hazardous Waste Management Permit issued by the KDEP, the Hazardous and Solid Waste Amendments Permit issued by the EPA, and this ROD. The Kentucky Division of Waste Management concurs with the DOE and the EPA on the selected interim action, in accordance with the requirements of the Kentucky Hazardous Waste Management Permit. The scope of this action warrants the incorporation of the selected remedy into the Commonwealth's Hazardous Waste permit. This ROD will serve as the primary document for the modification to the Commonwealth's Hazardous Waste permit. This action will serve as a step toward comprehensively addressing the Northeast Plume.

In ROD documentation, the CERCLA requires that the RCRA be listed as an ARAR. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

Long-term Effectiveness and Permanence

The No Action Alternative could cause potential health and environmental impacts to occur through a future exposure scenario. The extraction and treatment system is intended as an interim remedial action until sufficient information can be accumulated to formulate the final solution for this integrator operable unit. This action is intended to be consistent and appropriate with the final remedial action. The effectiveness and efficiency of this system will be evaluated for potential final actions.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternative 2, Hydraulic Plume Control, would reduce the mobility and volume of the contaminated ground water, and will reduce the toxicity within the extracted and treated water until a final action is taken. The volume of contaminant reduction will depend upon the length of time the interim remedial action is implemented. This action will be reviewed within five years after initiation. Construction is scheduled to be completed within two years, with approximately three years of operation and maintenance.

Short-Term Effectiveness

Alternative 1, No Action, would not entail new controls. Therefore, no additional impacts to short-term human health and the environment would be encountered.

Alternative 2, Hydraulic Plume Control, will not pose a threat to either nearby communities or the workers associated with the operation and maintenance of the treatment system. Workers associated with the construction and operation of the source control systems will abide by the requirements of a site-specific health and safety plan (HSP). The HSP will be prepared as part of the bid package and submitted to the selected contractor prior to the award of the project. Prior to implementation of this interim remedial action, the EPA and the KDEP will be afforded the opportunity to review the HSP. The draft HSP will be modified by the contractor to reflect pertinent comments submitted by the regulatory agencies. Standard engineering controls would also be implemented to mitigate any potential environmental impacts. Construction start-up for the alternative is possible within 15 months of the signature of this interim remedial action ROD and could be effective until a final ROD is implemented.

Implementability

Alternative 1, No Action, could be readily implemented. Additional technical and administrative procedures would not be conducted other than those currently conducted for the alternative water supply and ground water monitoring.

Alternative 2, Hydraulic Plume Control, is technically and administratively feasible. Extraction wells and monitoring wells can be readily constructed using standard equipment and technologies. Numerous services and materials for construction are readily available, and the likelihood of competitive bids would be expected. Administrative difficulties are not expected to be encountered when fulfilling the

necessary procedures for obtaining surface water discharge approval.

Costs

Cost estimates for each alternative are based upon the Northwest Plume Interim ROD and contract information and are expressed in terms of 1995 dollars. The costs for

Alternative 2, Hydraulic Plume Control, and the two treatability studies are listed below:

Present worth cost: $5,291,000;

Capital cost: $4,851,000; and

O&M costs (3 years combined): $1,283,000.

A cost estimate is included for the interim remedial action. The estimate is based upon feasibility-level scoping and is intended to aid in making project evaluations. The estimate has an expected accuracy of +50 to -30% for the proposed scope of the action. Alternative 2ÄÄCooling Towers and Treatability Studies Cost Breakdown can be found in Table 1; Alternative 2ÄÄCooling Towers Cost Breakdown, Table 2; In Situ Ground Water Study Cost Breakdown, Table 3; and Photocatalytic Oxidation Pilot Study Cost Breakdown, Table 4.

State Acceptance

The Northeast Plume Technical Memorandum, PRAP, and draft ROD were issued for review and comment to both the KDEP and the EPA. The KDEP concurs with this action, consistent with the requirements of the Commonwealth of Kentucky's Hazardous Waste Permit.

Community Acceptance

No groups and organizations opposed this interim remedial action. Community response to the alternatives is presented in the responsiveness summary which addresses comments received during the public briefing and the public comment period.

2.9 Selected Remedy

Based upon the evaluation of the alternatives in regard to the nine criteria, the remedy jointly selected by the EPA, the KDEP, and the DOE is Alternative 2, Hydraulic Plume Control. The DOE will prepare a detailed design of the treatment unit in accordance with the requirements of the ROD for this interim remedial action, and in accordance with the ICM Workplan for the Northeast Plume. The ICM Workplan, pursuant to the PGDP's Kentucky Hazardous Waste Management Permit and EPA HSWA permit, will be approved at the same time as this ROD. The selected remedy will be included in the Kentucky Hazardous Waste Permit by way of a permit modification, as a corrective action requirement.

The selected remedy will consist of the following elements at a minimum:

(1) Extraction of contaminated water from a well field location on DOE

property near the northern portion of the high concentration area of the off-site Northeast Plume;

(2) Treatment of extracted ground water contaminated with TCE and 1,1-DCE;

Table 1. Alternative 2ÄÄCooling Towers and Treatability Studies Cost Breakdowna

Project Cost Item	Costs ($ Thousands)b				
Capital Costs					
Direct Cost					
Monitoring & Extraction Wells			738		
Transfer Piping	186				
Sand Filter Building	364				
In Situ Treatability Study		493			
Photocatalytic Oxidation Pilot Study			96		
Waste Management	283				
Misc. Support & Training	98				
Construction Management	547				
Direct Total Cost					2805
Indirect Cost					
Engineering Expenses			851		
Administration Costs	514				
Contingency (Indirect & Direct)			681		
Indirect Total Cost					2046
Total Capital Cost					4851
O&M Costs					
O&M Costs (1st year):					
Administration Costs			164		
Sampling, Analysis & Operations			228		
1st Year O&M Costs					392
O&M Costs (2nd year)					
Administration Costs			190		
Sampling, Analysis & Operations			206		
2nd year O&M Costs					396
O&M Costs (3rd year)					
Administration Costs			97		
Sampling, Analysis & Operations			145		
3rd year O&M Costs					242
Total O&M Contingency					253
Total O&M Costs					1283

Total Project Cost in Escalated Dollars			6134
Present Worth Costs			
Total Alternative 2 Present Worth Costs:			5291
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]			

a Per Guidance Document EPA/540/G-89/004, Guidanec for Conducting Remedial Investigations and Feasibility Studics under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 2. Alternative 2ÄÄCooling Towers Cost Breakdowna

Project Cost Item	Costs ($ Thousands)b		
Capital Costs			
Direct Cost			
Monitoring & Extraction Wells		738	
Transfer Piping	186		
Sand Filter Building	364		
Waste Management	108		
Misc. Support & Training	98		
Construction Management	395		
Direct Total Cost			1889
Indirect Cost			
Engineering Expenses		629	
Administration Costs	432		
Contingency (Indirect & Direct)	498		
Indirect Total Cost			1559
Total Capital Cost			3448
O&M Costs			
O&M Costs (1st year):			
Administration Costs		90	
Sampling, Analysis & Operations		139	
1st Year O&M Costs			229
O&M Costs (2nd year)			
Administration Costs		95	
Sampling, Analysis & Operations		145	
2nd year O&M Costs			240
O&M Costs (3rd year)			
Administration Costs		97	

Sampling, Analysis & Operations		145	
3rd year O&M Costs			242
Total O&M Contingency		177	
Total O&M Costs			888
Total Project Cost in Escalated Dollars			4336
Present Worth Costs			
Total Alternative 2 Present Worth Costs:			3791
[Per Building Life Cycle Cost Analysis (Version 4.20-95)]			

a Per Guidance Document EPA/540/G-89/004, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 3. In Situ Ground Water Study Cost Breakdowna

Project Cost Item	Costs ($ Thousands)b		
Capital Costs			
Direct Cost			
Waste Management		175	
In Situ Treatability Study	493		
Construction Management		152	
Direct Total Cost			820
Indirect Cost			
Engineering Expenses		176	
Administration Costs		45	
Contingency (Indirect & Direct)		156	
Indirect Total Cost			377
Total Capital Cost		1197	
O&M Costs			
O&M Costs (1st year):			
Administration Costs		61	
Sampling, Analysis & Operations		58	
1st year O&M Costs			119
O&M Costs (2nd year)			
Administration Costs		95	
Sampling, Analysis & Operations		61	
2nd year O&M Costs			156

Total O&M Contingency		70
Total O&M Costs		345
Total Project Cost in Escalated Dollars		1542
Present Worth Costs		
Total Alternative 2 Present Worth Costs: [Per Building Life Cycle Cost Analysis (Version 4.20-95)]		1346

a Per Guidance Document EPA/540/G-89/004, Guidancc for Conducting Remedial Investigations and Feasibility Studies under CERCLA

b Escalated (average 3.7% escalated rate per DOE Guidance)

Table 4. Photocatalytic Oxidation Pilot Study Cost Breakdowna

Project Cost Item	Costs ($ Thousands)b		
Capital Costs			
Direct Cost			
Photocatalytic Oxidation Pilot Study		96	
Direct Total Cost			96
Indirect Cost			
Engineering Expenses		46	
Administration Costs	37		
Contingency (Indirect & Direct)		27	
Indirect Total Cost			110
Total Capital Cost		206	
O&M Costs			
O&M Costs (1st year):			
Administration Costs		13	
Sampling, Analysis & Operations	31		
(3 months) O&M Costs			44
Total O&M Contingency		6	
Total O&M Costs			50
Total Project Cost in Escalated Dollars			256
Present Worth Costs			
Total Alternative 2 Present Worth Costs:			227

[Per Building Life Cycle Cost Analysis
(Version 4.20-95)]

a Per Guidance Document EPA/540/G-89/004, Guidancc for Conducting Remedial Investigations and
Feasibility Studies under CERCLA
b Escalated (average 3.7% escalated rate per DOE Guidance)

(3) Surface discharge; and

(4) Demonstration of two innovative pilot treatment studies.

Contaminated water will be extracted from one or more wells located near the northern end of the high concentration area. Water will be pumped through underground piping to the treatment unit. Water will likely be pumped to a sand filter to remove suspended solids and then be pumped through an existing cooling tower for the removal of VOCs. Treated water will be discharged to a KPDES permitted surface water outfall. The DOE

will evaluate the concentrations of TCE, TCE degradation products, and 99Tc in the effluent from the treatment system and monitoring wells to ensure that this interim remedial action is protective of both human health and the environment.

Current 99Tc concentrations in the Northeast Plume outside the plant's security fence are at levels which do not pose a potential threat to human health or the environment upon surface discharge. Technetium-99 was detected at a maximum concentration of 58 pCi/l. However, this concentration is well below the calculated concentration allowed for drinking water (900 pCi/l). Influent water (e.g., extracted ground water) will be sampled for 99Tc during the interim action to assure that threshold limits are not exceeded. Routine sampling will be performed for 99Tc in ground water monitoring wells. The monitoring system will include those wells installed as part of this interim remedial action and existing monitoring wells located upgradient of the extraction well field. These monitoring wells should provide sufficient notification for institution of corrective measures should signification concentrations of this radionuclide be detected.

The TCE off-gas concentrations are not expected to exceed the Commonwealth of Kentucky air regulations (401 K.A.R. 63:022). Assuming ground water concentrations of 1,000 æg/l, approximately 6.3x10-6 kilograms per second (0.05 pounds per hour) of TCE will be released to the atmosphere. This level is less than the regulatory significant level, with height correction. Therefore, no off-gas treatment is proposed.

2.10 Statutory Determinations

The DOE, the EPA, and the KDEP concur that the selected remedy will satisfy the statutory requirements of K.R.S. 224.46-530 and CERCLA 121(b) and the Hazardous Waste Permit for providing protection of human health and the environment, attaining ARARs directly associated with this action, being cost effective, utilizing alternative treatment technologies to the maximum extent practicable, and exhibiting a preference

for treatment as a principal element.

Protection of Human Health and the Environment

The interim remedial action remedy initiates protection of human health for PGDP employees and the public through mitigation of contaminants from the Northeast Plume until a final action is determined. The remedy also provides protection for the environment by providing treatment of the effluent prior to discharge into the KPDES outfall, and effective management of all residual wastes generated during implementation of the action.

Compliance with Applicable or Relevant and Appropriate Requirements

Congress specified in the CERCLA 121 that remedial actions for cleanup of hazardous substances and constituents must comply with requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances and constituents or circumstances at a site. Applicable or relevant and appropriate requirements are utilized to ensure the protection of human health and the environment.

In ROD documentation, the CERCLA requires that the RCRA be listed as an ARAR. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

The following is an explanation of the terms used throughout this document:

Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (40 C.F.R. 300.5).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 C.F.R. 300.5).

Chemical-specific requirements are usually "health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values" (53 Fed. Reg. 51437, December 21, 1988). These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

Location-specific requirements "generally are restrictions placed upon the concentration of hazardous substances and constituents or the conduct of activities solely because they are in special locations" (53 Fed. Reg. 51437, December 21, 1988). Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific requirements "are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes or requirements to conduct certain actions to address particular circumstances at a site" (53 Fed. Reg. 51437, December 21, 1988). Selection of a particular remedial action at a site would invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, if a requirement is not applicable it must be both relevant and appropriate for compliance to be necessary. In the cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, CERCLA 121(d)(4) provides several ARAR waiver options that may be invoked, providing that the primary requirement of protection of human health and the environment is met.

The CERCLA remedial actions conducted entirely onsite, as defined in 40 C.F.R. 300.5, must comply with the substantive provisions of laws and regulations but not procedural or administrative requirements. Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements pertain to permitting, documenting, and processing regulatory review and decision making. Response actions conducted entirely onsite are not required to obtain federal, state or local permits. In order to ensure that CERCLA response actions proceed as rapidly as possible, the EPA has re-affirmed this position in the final NCP (55 Fed. Reg. 8756, March 8, 1990).

Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing Superfund remedies. In addition, ARARs do not exist for every chemical or circumstance likely to be found at a Superfund site. Therefore, the EPA believes it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR (55 Fed. Reg. 8745, March 8, 1990). Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. This other information is to be considered (TBC) guidance and may be used when developing CERCLA remedies. The TBC guidance generally falls within three categories: (1) health effects information; (2) technical information on how to perform or evaluate investigations or response actions; and (3) policy.

Response actions under the NCP will comply with the provisions for response action worker safety and health in 29 C.F.R. 1910.120 (40 C.F.R. 300.150). The Occupational Safety and Health Act and its corresponding regulations are applicable to the PGDP. These standards are designed to protect the health and safety of workers. However, these standards must be complied with although they are not ARARs.

Applicable or Relevant and Appropriate Requirements for Alternative 2ÄÄHydraulic PIume Control

Chemical-specific applicable or relevant and appropriate requirements

Discharges of the treated ground water into an outfall must comply with Kentucky's antidegradation statute. Surface waters of Kentucky must be safeguarded against the creation of any new pollution (401 K.A.R. 5:029 2). Furthermore, where the quality of surface water exceeds that which is necessary to support reproduction of fish and wildlife, and human recreation in and on the water, the quality shall be maintained and protected. This is an applicable standard.

Treated water discharged into an outfall, must comply with 401 K.A.R. 5:031 and 5:050. These requirements are applicable, and the substantive requirements will be implemented. The PGDP has in place a KPDES permit (KY 0004049). This permit incorporates Clean Water Act (CWA) requirements under Kentucky regulations and establishes limitations for various chemicals including TCE at KPDES outfalls. Concentrations of TCE may not exceed .081 mg/l at the outfall. The KPDES permit requires the compliance point to be at the nearest accessible point after final treatment, but prior to actual discharge to or mixture with receiving waters. Under 401 K.A.R. 5:029, the terms "surface water" or "receiving waters" do not include ditches used for water treatment which are under valid easement by a permitted discharger. In addition, pursuant to 401 K.A.R. 5:070, if any chemical will be discharged through a KPDES outfall that is not regulated by the permit, the permit must be modified to include the chemical.

Maximum contaminant levels under the Safe Drinking Water Act (40 C.F.R. 141) and Kentucky Administrative Regulations (401 K.A.R. 8:250-420) would not be relevant and appropriate to this alternative. As an interim remedial action, the scope is limited to control of the high concentration contamination area within the Northeast Plume, so treatment to MCLs would not be appropriate at this phase.

Location-specific applicable or relevant and appropriate requirements

Protected resources referred to in this section are present on the operable unit; however, no adverse impacts to these resources are currently anticipated. Consequently, although all ARARs discussed in this section are applicable, they will be met by avoidance of the resources. However, if impacts become apparent, due to construction or other plan modifications, additional requirements (e.g., consultation with the Fish and Wildlife Service (FWS) or the State Historic Preservation Officer (SHPO) concerning endangered species and cultural resources respectively, mitigation for impacts to wetlands, etc.) will need to be addressed and/or initiated to comply with the ARARs.

Wetlands and floodplains have been identified in the area of the Northeast Plume. Construction of the ground water treatment facility and extraction wells must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990, 40 C.F.R. 6.302(a), 40 C.F.R. Part 6; Appendix A, and 10 C.F.R. Part 1022]. In addition, the facilities must not be constructed in a 100-year floodplain (Executive Order 11988, and 10 C.F.R. 1022).

Construction in wetlands should be avoided unless there are no practicable alternatives [40 C.F.R. 6.302(a)]. Degradation or destruction of wetlands must be avoided to the

extent possible [40 C.F.R. 230.10 and 33 U.S.C. 1344(b)(1)]. Considerations about protection of wetlands must be incorporated into planning, regulating, and decision making [10 C.F.R. 1022.3(b)]. Any action involving the discharge of dredged or fill material into wetlands must be avoided to the extent possible (13 U.S.C. 1344, 40 C.F.R. Part 230, and 33 C.F.R. Parts 320 to 330).

Discharges of dredged or fill material for which there are practicable alternatives with fewer adverse impacts, or those which would cause or contribute to significant degradation are prohibited [40 C.F.R. 230.10(a)]. Discharges are also prohibited unless there are no practicable alternatives, and practicable, appropriate mitigation methods are available [40 C.F.R. 230.10(d)]. Further, 40 C.F.R. 230.10(b) prohibits discharges that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 U.S.C. 1317), or jeopardize threatened or endangered species or their critical habitat under the endangered species act (16 U.S.C. 1531, et seq.). If it becomes apparent that impacts to wetlands are unavoidable, due to construction plan or other modifications, the specific requirements of 33 C.F.R. 330 [nation wide permits (NWP)], or 33 C.F.R. 325

(processing of general permits), and statutes governing discharges of dredged or fill material into waters of the United States would become applicable.

Specific requirements of NWP 12 (Utility Line Backfill and Bedding) and general permits that would be applicable to this project, if impacts become apparent, include but are not limited to: (1) avoiding and minimizing impacts to the fullest extent possible, (2) incorporation of erosion control measures and best management practices (BMPs) into construction plans, (3) avoiding stockpiling of materials in waters of the United States including wetlands, and (4) keeping heavy equipment out of waters of the United States including wetlands whenever possible. If it is determined that this is not possible, heavy equipment must be placed on mats or other measures implemented to minimize soil disturbance. Specific requirements would be better defined once the nature and extent of impacts and appropriate permit(s) are determined.

Under the Endangered Species Act (16 U.S.C. 1531 et seq.), federal agencies are prohibited from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival [40 C.F.R. 6.302(h)]. All designated endangered or threatened species or their habitats must be identified [40 C.F.R. 6.302(h)]. Two federally endangered or candidate species have been documented to exist in the surrounding area: the Indiana bat and the copperbelly water snake. Sixteen additional federally listed or candidate species have been reported from surrounding McCracken and Ballard counties. Of these 18 species only the Indiana bat, copperbelly water snake, Rafinesque's big-eared bat, and southeastern myotis have possible habitats present near the treatment areas. No impacts to any of these species or their habitats are anticipated at this time. If it becomes apparent that impacts to any of these species or their habitats are unavoidable, due to construction plan or other modifications, formal consultation with the FWS must be initiated pursuant to 50 C.F.R. 402. If the consultation reveals

that the activity may jeopardize a listed species or habitat, mitigation measures should be considered [116 U.S.C. 1531-1544, 50 C.F.R. Part 402, 40 C.F.R. 6.302(h), and 16 U.S.C. 661-668]. Since the State Threatened and Endangered Species List has not been promulgated, it is TBC guidance.

Under the National Historic Preservation Act (NHPA) (16 U.S.C. 470), federal agencies are required to exercise caution to ensure that no properties that may qualify as cultural or historic be inadvertently demolished, altered, or affected. Section 106 of the NHPA requires a federal agency to take into account the effects of its undertaking on properties included in or eligible for the National Register of Historic Places, and, prior to approval of an undertaking, to offer the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking (36 C.F.R. 800). This is accomplished by following the "Section 106 process" (36 C.F.R. 800).

In general, the Section 106 process includes: reviewing existing information on historic properties potentially affected by the undertaking; requesting information from local governments, Indian tribes, public and private organizations, and other parties likely to have knowledge of or concerns with historic properties in the area; and surveying the area to determine the location of unknown properties or sites. If no properties are discovered using the above methods, the agency will provide this documentation to the SHPO and any interested parties, and no further steps are required. If historic properties are found, the properties must be assessed to determine effects pursuant to 36 C.F.R. 800.5. Generally, if no known sites are found through the review and information request process, and the area of the undertaking is undisturbed, a survey of the area is required. However, if the area of the undertaking is within a previously disturbed area, and the SHPO concurs, no further steps are required.

The areas chosen for the site of the extraction wells and water treatment facility were surveyed during a study conducted by the United States Army Corps of Engineers in 1993. No historic or cultural properties were discovered during the survey. Consequently, if the pipeline route is restricted to previously disturbed areas (i.e., under the existing road or within adjacent created ditches) and the location of the extraction wells and water treatment facility does not change, the Section 106 process is fulfilled upon concurrence with the SHPO. However, if the pipeline cannot be confined to previously disturbed areas and/or the location of the extraction wells and/or the water treatment facility changes, a survey of the new areas may be required upon consultation with the SHPO.

Under the Farmland Protection Policy Act (7 C.F.R. 658), federal agencies are required to: take into account the adverse effects of their programs on the preservation of farmlands; consider alternatives, as appropriate, to lessen adverse impacts to farmlands; and ensure that their programs, to the extent practicable, are compatible with state and local government and private programs to protect farmland.

Prime farmland soils have been identified in the area of the proposed action; however,

less than 0.01 acre is presently being considered for conversion. Consequently, consultation with the Soil Conservation Service has determined that it is not necessary to complete Form AD 1006, the Farmland Conversion Impact Rating Form, to determine the impact of the undertaking on prime farmland. If modifications are made to the current plans, more prime farmland may be impacted and Form AD 1006 would need to be completed.

Action-specific applicable or relevant and appropriate requirements

Site preparation and construction activities (i.e., extraction/monitoring wells, pipeline, and sand filters) will be conducted in order to implement the interim remedial action. Such construction activity could produce airborne pollutants. Particulate emission levels resulting from earth-moving and site-grading activities may exceed the Kentucky air quality regulations found in 401 K.A.R. 63:010 et seq. The Kentucky air quality regulations contain general standards of performance governing fugitive dust emissions. The regulations in 401 K.A.R. 63:010 3 require the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust. Visible fugitive dust may not be discharged beyond the property line where the dust originated. Additionally, all open bodied trucks which operate outside the property boundary and which may emit materials that could be airborne must be covered. This regulation would be applicable.

Storm water discharges from activities at industrial sites involving construction operation will be regulated by the KPDES Permit (KY0004049) established under 401 K.A.R. 5:055. The PGDP is exempted from the Kentucky General Permit for Storm Water Point Sources (KYR100000) under 401 K.A.R. 5:055 because it has an individual KPDES Permit. Pursuant to 401 K.A.R. 5:055, the PGDP's KPDES Permit specifies that BMPs and sediment and erosion controls be implemented at a site to control storm water runoff. The PGDP has developed a BMP plan pursuant to these requirements which are applicable.

The cooling towers meet the definition of "waste water treatment facility" under 401 K.A.R. 30:010 1(90)(t); therefore, they are exempt from RCRA regulation pursuant to 401 K.A.R. 38:010 1(2)(b)(5). The facility will be regulated under the CWA and the site's KPDES permit. Under 401 K.A.R. 5:005 7, treatment systems from industrial wastes must be designed according to specific criteria. Also, the KPDES permit will have to be modified to include the cooling towers as a waste source.

The Kentucky regulations, in 401 K.A.R. 5:005 7, specify that design criteria for any facility, including wastewater treatment units such as the cooling tower, shall be controlled by current engineering practices. Facilities must also protect those minimum conditions applicable to all waters of the Commonwealth found in 401 K.A.R. 5:031 2. Furthermore, facilities shall not cause those waters classified in 401 K.A.R. 5:035 to be of lesser quality than the numeric criteria applicable to those waters in 401 K.A.R. 5:031 3 to 9. These requirements are applicable to this action.

Additionally, 401 K.A.R. 5:005 7 of the regulations requires that a recording flow measuring device be installed at each large facility. As defined in 401 K.A.R. 5:005 8, a "large facility" means a treatment facility with an average daily design flow of 50,000 gallons (gal) per day or more and sewer lines of more than 50,000 ft. These requirements are applicable to this action.

The cooling tower will be used to remove VOCs from the ground water. As a modified source it would be regulated by the requirements in 401 K.A.R. 63:022 3, which specify that no owner or operator shall allow any source to exceed the allowable emission limit determined by the formula in Appendix A of that regulation. If the owner or operator cannot meet the allowable emission limit even after application of best available control technology, and can demonstrate this fact to the satisfaction of the Cabinet, then best available control technology shall be required. However, calculations by both the DOE and the KDEP agree that the allowable emission rate will not be exceeded.

The construction of water wells is regulated by the Commonwealth of Kentucky. Construction of water withdrawal wells will require that the wells be constructed by a certified driller under specified design criteria (401 K.A.R. 6:310 13). A permit is required when more than 10,000 gal of water per day are pumped out of the ground (401 K.A.R. 4:010 1). However, the DOE is exempt from permits and other administrative requirements under CERCLA 121 (c)(1), but will be required to record and report the recovery rate. All substantive requirements of this regulation will apply.

During well installation, investigation-derived waste and personal protective equipment could meet the definition of a characteristically hazardous waste. Operational residuals from sand filters may also be above characteristically hazardous waste levels. A determination will be made on any such waste as required under 401 K.A.R. 32:010 2. Kentucky regulations applicable to generators of hazardous waste are detailed in 401 K.A.R. Chapter 32 et seq. It should be noted that aqueous waste associated with well installation and operations will be treated in the cooling towers or another wastewater treatment unit on site. This water will be exempt from the RCRA regulations as specified in the wastewater treatment unit exemption.

Any solid waste deemed characteristically hazardous under the RCRA could be moved to a less than 90-day storage facility at the PGDP. Pursuant to 401 K.A.R. 32:030 5, on-site accumulation of hazardous waste may occur for 90 days or less without modifying the RCRA permit, if the waste is placed in containers that comply with 401 K.A.R. 35:180. Selected requirements for the use and management of containers holding hazardous waste being accumulated onsite for less than 90 days are defined in 401 K.A.R. 35:180. The regulation requires that containers holding the waste be in good condition. Also, the waste must be stored in containers lined with materials that are compatible (401 K.A.R. 35:180 3). Furthermore, containers must be managed to ensure that they are always closed during storage, except when necessary to add or remove waste; containers are not opened, handled, or stored in any manner which may rupture the container or cause it to leak; and the containers are labeled with the notation "hazardous waste" and the date the accumulation begins (401 K.A.R. 35:180 4).

These selected requirements are applicable to the management of hazardous waste stored onsite for less than 90 days. However, on-site accumulation of as much as 55 gallons of hazardous waste or one quart of acutely hazardous waste may occur for more than 90 days, provided 2, 3 and 4(1) of 401 K.A.R. 35:180 are followed and the containers are marked with the notation "hazardous waste." These requirements would be applicable to any on-site storage of hazardous waste for less than 90 days.

Generators of hazardous waste must obtain an EPA identification number. The PGDP has an identification number and a current RCRA Part B permit. Generators must keep a copy of each manifest, a signed copy of the manifest returned from the designated facility which received the waste, annual reports, and exception reports for at least three years (401 K.A.R. 32:040 1). The generator must also maintain records of any test results, waste analyses, or other determinations for at least three years from the date that the waste was last sent to an on-site or off-site treatment storage, or disposal facility (401 K.A.R. 32:040 1).

All less than 90-day accumulation areas and permitted facilities at the PGDP will go through RCRA closure when removed from operation. Applicable requirements will be adhered to at that time.

Pursuant to 401 K.A.R. 37:050 and 40 C.F.R. 268.50, the storage of hazardous wastes restricted from land disposal under 401 K.A.R. 37:030 and 40 C.F.R. 268 is prohibited, unless the generator stores such wastes in tanks, containers, or containment buildings onsite solely for the purpose of accumulating such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal. Such storage at the PGDP must be in compliance with the requirements in 401 K.A.R. 32:030 5 and 401 K.A.R. Chapters 34 and/or the requirements in 40 C.F.R. 264. Furthermore, each container must be clearly marked with the identification of its contents, the date each accumulation period began, and the quantity of each hazardous waste. These regulations apply to the management of hazardous wastes prohibited from land disposal that are stored onsite. The PGDP has a Part B permit in place which abides by these standards. Any hazardous waste from on-site wells or treatment residuals are included in the latest permit modification.

If wastes are shipped offsite for treatment and/or disposal, the regulations mandated in 49 C.F.R. 172-179 will be applicable. Off-site shipments must comply with both the substantive and administrative requirements of these regulations. Materials designated as hazardous by the Department of Transportation are listed and classified in 49 C.F.R. 172.101 and 102. Transportation, shipping requirements, package marking, labeling, transport vehicle placarding, and shipping paper(s) requirements are set forth in 49 C.F.R. Subparts C, D, E, and F.

Additional requirements which are applicable to the transportation of hazardous material are located in 401 K.A.R. Chapter 33. These regulations detail standards to which persons transporting hazardous waste in the United States must adhere including a manifest system, record keeping, and hazardous waste discharges. However, these regulations do not apply to on-site transportation of hazardous waste by generators or by owners or operators of permitted hazardous waste management facilities. The regulations in 49 C.F.R. 172 would be applicable since they apply to each person who

offers hazardous material for transportation and each carrier who transports the material. Specifications for packaging and containers used for the transportation of hazardous materials in commerce are included in 49 C.F.R. 178. The PGDP abides by all applicable regulations for off-site transportation of hazardous material.

A transporter who intends to transport hazardous waste within the Commonwealth of Kentucky must have an EPA identification number issued by the Kentucky Natural Resources and Environmental Protection Cabinet (401 K.A.R. 33:010). The transporter must also register with the Cabinet by filing an application pursuant to 401 K.A.R. 33:010. Furthermore, the transporter of hazardous waste must meet the standards for compliance with the manifest system and record keeping found in 401 K.A.R. 33:020. These administrative requirements apply only to off-site shipments within the Commonwealth of Kentucky. Those hazardous and/or low-level wastes requiring off-site treatment or disposal must be sent to a facility which meets the EPA's acceptability criteria (40 C.F.R. 300.58). Those wastes generated by the action that requires off-site treatment or disposal will be sent to one or more of the following facilities: Envirocare of Utah, Clive, Utah; Rollins Environmental Services, Dear Park, Texas; Rollins Environmental Services, Baton Rouge, Louisiana; SEG, Oak Ridge, Tennessee; and TSCA Incinerator, Oak Ridge, Tennessee. These regulations are applicable to the offsite shipment of hazardous waste.

Requirements for providing and maintaining emergency response information during transportation and at facilities where hazardous materials are loaded for transportation, stored incidental to transportation or otherwise handled during any phase of transportation, are delineated in Subpart G of 49 C.F.R. 172. However, an exemption is allowed for small quantities under the RCRA permit. Training requirements for hazardous materials training (HAZMAT) employees are included in Subpart H of 49 C.F.R. 172. Training ensures that a HAZMAT employee has familiarity with Subpart H requirements, is able to recognize and identify hazardous materials, and has knowledge of emergency response information, self protection measures, and accident prevention methods and procedures. Under CERCLA 121(e), administrative requirements for off-site transportation will be applicable.

Table 5 provides a listing of those applicable, relevant and appropriate, and TBC requirements as chemical-, location-, or action-specific.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume Hydraulic Plume Control

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
CHEMICAL-SPECIFIC				
Antidegradation	Waters of the Commonwealth must be	Discharges into waters		

of the
5:029 2

safeguarded against the creation of Commonwealth - applicable
any new pollution.

Treatment and Must apply for KPDES permit Point-source discharge to waters of
5:055
discharge of the modification for increased discharge the Commonwealth - applicable
ground water into a to an outfall or to discharge a
surface water body chemical not regulated by the permit.

The discharge must comply with the Point-source discharge to waters of
5:080 1;
KPDES effluent limitations of the Commonwealth - applicable
5:029 3

KY0004049 for an outfall.
Specifically, the discharge must not
exceed the permit limit for TCE of
0.081 mg/l at the outfall.

LOCATION-SPECIFIC

Protection of Avoid or minimize adverse impacts Any federal action that will have an 10 C.F.R.
1022;
wetlands on wetlands to preserve and enhance impact on wetlands - applicable Executive Order
11990
their natural and beneficial values.

Avoid degradation or destruction of Any action involving discharge of 10 C.F.R. 230.10;
wetlands to the extent possible. dredge or fill material into wetlands 13 U.S.C. 1022.3(b)
- applicable

Incorporate considerations about Any federal action that will have an 10 C.F.R.
1022.3(b)
protection of wetlands into planning, impact on wetlands - applicable 33 C.F.R. 330
regulating, and decision-making.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky

Actions	Requirements	Prerequisites	Federal Citation	Citation
LOCATION-SPECIFIC (continued)				
Discharge of dredged or fill material into navigable water	Discharges for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. 230.10(a)	
	Significant degradation is also prohibited unless there are practicable alternatives and practicable, appropriate mitigation methods are available.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. 230.10(c); 40 C.F.R. 230.10(d)	
	Discharges which cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions or jeopardize threatened and endangered species under the ESA.	Any action involving discharge of dredged or fill material into wetlands - applicable	40 C.F.R. 230.10(b)	
Protection of floodplains	Avoid siting or construction in any 100-year floodplains.	Any federal action within a 100-year floodplain - applicable	10 C.F.R. 1022 Executive Order 11988	
Protection of threatened and endangered species or endangered species	Avoid actions which jeopardize threatened or endangered species or take appropriate mitigation measures.	Any action which jeopardizes threatened or endangered species or their critical habitats - applicable	16 U.S.C. 1531-1544; 50 C.F.R. 402; 40 C.F.R. 6.302(h)	

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume

Hydraulic Plume Control (continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
LOCATION-SPECIFIC (continued)				
Protection of cultural resources	Ensure that no properties that may qualify as cultural or historic be inadvertently demolished, altered, or destroyed.	Any federal action that will have an impact on cultural resources - applicable	16 U.S.C.A. 47	
	Avoid or minimize impacts to cultural resources by following the Section 106 process, including consultation with the SHPO.	Any federal action that will have an impact on cultural resources - applicable	36 C.F.R. 800	
Protection of prime farmland	Take into account agency action impacts on prime farmland and consider alternatives.	Conversion of prime farmland soils to non-farmable areas - applicable	7 C.F.R. 658	
ACTION-SPECIFIC				
Site preparation and construction, construction activities	Reasonable precaution must be taken to prevent particulate matter from becoming airborne.	Handling, processing, road grading, and land clearing activities- applicable	401 K.A.R. 63:010 3	
Surface water control activities at industrial sites involving disturbance of five acres or more land - applicable if over five acres disturbed; - relevant and appropriate if less than five acres disturbed	Implement good site planning and BMPs to control storm water discharges; comply with storm water runoff requirements of KPDES Permit KY 0004049.	Construction	40 C.F.R. 122; 57 Fed. Reg. 41176 (Sept. 9, 1992)	

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for

the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky
Actions Requirements
Prerequisites Federal Citation Citation
ACTION-SPECIFIC (continued)

Waste water Exempt from RCRA under 401 K.A.R.
38:010

treatment facility 38:010 1(2)(b)(5).
(2)(b)(5)

Designed according to specific criteria Construction of a
waste water 5:005

and controlled through current treatment facility-
applicable
engineering practices.

Protect those minimum conditions
applicable to all waters of the
Commonwealth.

Install a recording measuring device
at each large facility.

Water treatment No owner or operator shall allow any Emissions from a
treatment facility
63:022
facility (modified source to exceed the allowable - applicable
source) emission levels determined in
Appendix A of 401 K.A.R. 63:022.

Protection of aquatic Water criteria of 401 K.A.R. 5:031 Action affecting the
existing water
401 K.A.R.
organisms must be maintained as well as quality-applicable
5:031
appropriate criteria for other
designated use classifications in 401
K.A.R. 5:026.

Construction of water Constructed by a certified driller Construction of
water withdrawal
6:310 1
wells under specified design criteria. wells - applicable

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for
the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky
Actions Requirements
Prerequisites Federal Citation Citation
ACTION-SPECIFIC (continued)

Waste management Generators of waste shall determine Generation of waste
material 40 C.F.R.
262.11 32:010 2
if it is hazardous. - applicable

Container storage Storage in containers for less than Onsite storage of
hazardous waste 40 C.F.R.
262.34(a) 32:030 5(1)
(onsite) 90 days. -applicable

Containers must be in good condition Storage of hazardous waste less
than 40 C.F.R.
265 35:180 4
and lined. 90 days- applicable
Subpart I

Containers must always be closed
during storage expect when necessary
to add or remove waste; containers
must not be handled in any manner
which may rupture the container or
cause it to leak; and must be labeled
with the notation "hazardous
waste."

Inspect container storage areas
40 C.F.R. 265.174 35:180 5
weekly for deterioration.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for
the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky
Actions Requirements
Prerequisites Federal Citation Citation
ACTION-SPECIFIC (continued)

Container storage Closure of 90-day accumulation areas
40 C.F.R. 262.34
35:070 2
(onsite) shall minimize the need for further
(continued) maintenance; control, minimize, or
eliminate postclosure escape of
hazardous waste; and comply with
other closure requirements in 401

K.A.R. Chapter 35

All contaminated equipment,
40 C.F.R. 262.37 35:070 5
structures, and soil shall be properly
disposed or decontaminated.

Storage in containers for more than 90 Onsite storage -
applicable 40 C.F.R. 264
34:180
days.

Containers of hazardous waste Storage of
containerized RCRA 40 C.F.R. 264.171
34:180 2
must be: hazardous waste (listed or
characteristic) not
meeting small 34:180 3
Maintained in good condition; quantity by a
generator criteria held 40 C.F.R. 264.172
for a temporary period
before
Compatible with hazardous treatment, disposal,
or storage 34:180
4
wastes to be stored; and elsewhere, in a
container [i.e., any 40 C.F.R. 264.173
portable device (in)
which a
Closed during storage (except to material is stored,
transported,
add or remove waste). disposed, or handled]
- Applicable to
treatment of residuals
or wastes
which are RCRA
hazardous wastes

Inspect container storage areas
40 C.F.R. 264.174 34:180 5
weekly for deterioration.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for
the Northeast Plume
Hydraulic Plume Control (continued)
K
entucky
Actions Requirements
Prerequisites Federal Citation Citation
ACTION-SPECIFIC (continued)

Container Storage Place containers on a sloped, crack-

40 C.F.R. 264.175
34:180 6
(onsite) free base, and protect from contact
(continued) with accumulated liquid. Provide
containment system with a capacity
of 10% of the volume containers, or,
for liquids, the volume of the largest
container, whichever is greater.
Remove spilled or leaked waste in a
timely manner to prevent overflow to
the containment system.

At closure, remove all hazardous
40 C.F.R. 264.178 34:180 9
waste and residues from the
containment system and
decontaminate or remove all
containers, liners.

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Kentucky
Actions Requirements
Prerequisites Federal Citation
Citation
ACTION-SPECIFIC (continued)

Tank storage (on site) Storage in tanks for less than 90 days. Onsite storage of
hazardous waste 40 C.F.R.
262.34(a) 32:030 5(1)
- applicable

Storage in tanks for less than 90 days. Onsite storage -
applicable 40 C.F.R. 265 35:190

Subpart J
Tanks for storage of hazardous waste
must:

Tank integrity assessment;
40 C.F.R. 265.191
35:190 2

Meet design and construction
40 C.F.R. 265.192 35:190 3
standards;

Meet containment and release
40 C.F.R.
265.193 35:190 4

detection requirements;

Meet operating procedures;
40 C.F.R. 265.194
35:190 5

Be routinely inspected;
40
C.F.R. 265.195 35:190 6

Response to leaks or spills,
40 C.F.R. 264.196
35:190 7
Disposition of unfit tanks;

Meet closure requirements;
40 C.F.R. 265.197 35:190 8

[except 265.197(c)]
[except 8(3)]

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)
K
entucky
Actions Requirements
Prerequisites Federal Citation Citation
ACTION-SPECIFIC (continued)

Disposal of treatment Land disposal restrictions for RCRA Disposal of RCRA
restricted waste 40 C.F.R.
268 Chapter 3
residuals hazardous waste may be triggered. - applicable

Hazardous waste determinations are Determination if a
waste is RCRA 40 C.F.R. 262.11
32:010 2
to be performed on treatment plant hazardous waste -
applicable
residuals.

Transportation of Transporters of waste must follow Waste exhibits a RCRA
hazardous 40 C.F.R.
263 Chapter 33
hazardous waste detailed standards. waste characteristic as
defined by
(offsite) Subpart C of 40 C.F.R.
261 and off-site
transportation occurs
- applicable

Waste must be packaged and Hazardous waste is transported 40C.F.R. 263
transported in accordance with DOT offsite - applicable Subparts A&B
requirements including: shipping
requirements, package marking,
labeling, vehicle placarding, and The waste is considered a RCRA 49 C.F.R. 172, 173,
shipping papers. hazardous waste by characteristic or 178, and 179
a hazardous substance that equals or
exceeds a reportable quantity and
transportation occurs in commerce
- applicable

Table 5. Applicable or Relevant and Appropriate Requirements (ARARs) and Guidance for the Northeast Plume
Hydraulic Plume Control (continued)

Kentuckcy

Actions	Requirements	Prerequisites	Federal Citation	Citation
ACTION-SPECIFIC (continued)				
Transportation of hazardous waste (offsite) (continued)	Emergency response information and employee HAZMAT are required. Transporter must have EPA identification number issued by the Kentucky Natural Resources and Environmental Protection Cabinet.	Transportation of hazardous materials in the Commonwealth of Kentucky - applicable	49 C.F.R. 172 33:010	

RCRA listed as an ARA is a requirement of CERCLA in ROD documentation. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

Cost effectiveness

The interim remedial action remedy employs a proven technology which affords overall

effectiveness proportional to its costs such that the remedy represents reasonable value.

This action will utilize a relatively inexpensive technology to initiate control of the spread of the highly contaminated portion of the Northeast Plume.

Utilization of permanent solutions and alternative treatment technologies

The objectives for this interim remedial action are to initiate hydraulic plume control to decrease the migration of contaminants from the high concentration zones of the Northeast Plume, and by installing innovative technologies which may provide more efficient and cost effective methods for addressing the plume. This action should provide protection for human health and the environment. However, it is not intended to fully address the principal threats to human health and the environment posed by the northeast operable unit. This is not the final action planned for the Northeast Plume contamination. Subsequent actions will fully address the principal threats posed by the conditions at the PGDP. Utilization of a permanent solution will be addressed in the final decision document for the site.

Preference for treatment as a principal element

This interim remedial action satisfies the statutory preference for treatment of the discharged effluent as a principal element of the containment system.

2.11 Documentation Of Significant Changes

The Proposed Remedial Action Plan for Interim Remedial Action of the Northeast Plume, was released for public comment on March 12, 1995. The PRAP identified Alternative 2, Hydraulic Plume Control as the preferred alternative. During the public comment period the selected remedy was further developed to decrease the project cost and time to implementation. After several discussions with the EPA, the KDEP, and the USEC, it was agreed that the DOE would utilize existing facilities to treat the ground water. Therefore, the decision was made to use the existing cooling towers for volatilization of the VOCs. This modification is consistent with the type of treatment specified in the PRAP and will result in a comparable level of treatment. As public noticed in the PRAP, the ground water extraction wells and pipeline will be used and the treated ground water will be discharged to a KPDES outfall. The DOE has reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the PRAP, were necessary.

During the development of the final remedial alternatives for the Ground Water Integrator Operable Unit, including the Northeast Plume, the necessity of action implemented under this ROD for interim remedial action will be re-evaluated. The final ROD for the Ground Water Integrator Operable Unit may retain or replace portions or all of the actions conducted through this ROD. However, nothing conducted pursuant to this ROD is deemed inconsistent with likely final remedial actions.

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(b)(iv) and 117 (b) of CERCLA, as amended by SARA, which requires the DOE as "lead agency" to respond "...to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the PRAP.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and has recommended an interim remedial action to initiate control of the contamination found in the Northeast Plume. As part of the remedial action process, a notice of availability regarding the PRAP was published March 12 and March 13, 1995, in The Paducah Sun, a regional newspaper. The PRAP for Interim Remedial Action of the Northeast Plume was released to the public March 12, 1995. This document was made available at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A public comment period began March 12, 1995, and continued until April 25, 1995.

Specific groups which received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. Informal meetings were held with the PGDP Neighborhood Council April 27, 1995 and with the PGDP Environmental Advisory Committee on April 20, 1995. At these meetings, DOE personnel briefed the groups on the proposed action and solicited both written and verbal comments.

Telephone calls or visits were made to various stakeholders, including neighbors and representative of environmental groups, to alert them to the public comment period and briefly explain the PRAP. Proposed remedial action plans and/or ICMs were mailed to those contacted.

Public participation in the CERCLA process is required by SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide DOE with information about the community preferences and concerns regarding the remedial alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process. This document summarizes both the oral and written comments during the various informal meetings and telephone calls, and the written comments received during the public comment period running from March 12 through April 25, 1995.

As evidenced from the comments received during the public comment period, the selected interim remedy specified in the ROD for interim remedial action has received concurrence by the EPA, the KDEP and the DOE.

The Environmental Advisory Committee, a panel of local businessmen and scientists

organized and supported by Martin Marietta Energy Systems, Inc., to provide feedback on environmental restoration at the PGDP, generally expressed concern that no imminent

health hazard exists and that the pump and treatment method may not halt or even impede the advancement of the plume's edge.

Comments received during the public comment period for the interim remedial action are summarized below. Comments and responses have been divided into two parts and are categorized by topic within the responsiveness summary: Part I for local community concerns, and Part II for specific legal and technical questions. The comments below have been paraphrased in order to effectively summarize them in this document. Copies of the written comments are available for review at the Environmental Information Center.

3.2 Summary and Response to Local Community Concerns

COMMENT: The pump and treat facility for the Northwest Plume has not been put into operation. Thus, the data from the Northwest Plume is not yet available. The pump and treat method may or may not halt or even impede the advancement of the plume edge. We believe that no imminent health hazard exists."

RESPONSE: Pump and treat technologies have been demonstrated to provide an effective method for containment. By addressing the high concentration areas of the plume through containment the DOE hopes to provide protection to human health and the environment, and decrease future costs associated with remedial actions. This interim remedial action will mitigate the migration of the plume while on-site sources remedies are implemented.

COMMENT: Change the present proposal to include the cooling tower treatment.

RESPONSE: The DOE will treat the extracted ground water via the cooling towers.

3.3 Comprehensive Response to Specific Legal and Technical Comments

COMMENT: Changing of the ROD to reflect removal of TCE by the use of the cooling towers as an air TCE stripper will reduced the cost and the development of such a useful, innovative technique would allow the Environmental Advisory Committee to reluctantly withdraw its objection to the pump and treat proposal. The Environmental Advisory Committee does not agree to the present proposed plan and a ROD based on its preferred alternative, and then modifying the ROD after it is signed. Any modifications should be made prior to a ROD's signing.

RESPONSE: Following a detailed review of regulatory requirements, engineering standards, PGDP operation guidelines, and comparative cost effectiveness, the DOE decided to utilize the existing cooling towers for volatilization of the TCE contained in

the extracted ground water. This decision was reached through a cooperative effort of several organizations induding the DOE, the EPA, the KDEP, and the USEC.

Northeast Plume
Interim Remedial Design Schedule

<IMG SRC 0495230I>

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JEG.0695.01

PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 08/22/1995
Operable Unit: 08
ROD ID: EPA/ROD/R04-95/235

Media: soil, groundwater

Contaminant: Trichloroethene, arsenic, silver, manganese, vanadium, beryllium, uranium, technetium-99

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, and is an active uranim enrichment facility. Effective July 1, 1993, the DOE leased the plant production operations facilities to the United States Enrichment Corporation, which in turn contracted with Lockheed Martin Utility Sevices, Inc. to provide operations and maintenance services. Lockheed Martin Energy Systems, Inc. manages EMEF Program activities for the DOE.

The PGDP is located in McCracken County in western Kentucky, approximately 3.5 acres south of the Ohio River. The PGDP facility covers about 540 hectares, with approximately 300 hectares are maintained by the DOE as a buffer zone surrounding the plant. Approximately 850 hectares of land beyond the buffer zone are leased by the DOE to the Commonwealth of Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA). The WKWMA is used extensively for recreation, primarily hunting and fishing.

The principal pathway of ground water flow at the PGDP is the Regional Gravel Aquifer (RGA) which consists of unconsolidated gravel and sand deposits occurring between 12 and 33 meters. From the PGDP, ground water within the RGA flows in a northward direction toward the Ohio River, which is the local base level for the system. Ground water contaminant plumes originating from the PGDP and extending north and northeast from the plant are located within this aquifer.

The C-749 Uranium Burial Ground is located in the west-central portion of the plant north of Virginia Avenue and on the western edge of the C-404 Low-Level Radioactive/Hazardous Burial Ground. It encompasses an area of approximately 2,970 square meters. The C-749 Uranium Burial Ground was used from approximately 1951 to 197 for the disposal of uranium and uranium containing wastes. The exact depth of the buried waste is not known. Wastes were reportedly placed in trenches and then covered with soil. Occasionally, fires were reported as a result of oxidation of pyrophoric uranium metal, but no subsidence was observed resulting from potential volume reductions due to the fires. In 1982, the C-749 Uranium Burial Ground was covered with a clay layer and a vegetative cover. It has been estimated that 270 tons of uranium, 59,000 gallons of various oils, and 350 gallons of trichloroethene (TCE) were buried in this area. Most of the waste (which consisted of pyrophoric uranium metal in the form of machine shop turnings, shavings, and sawdust. Pyrophoric uranium metal was usually placed in 20,30 or 55 gallon drums and petroleum-based or synthetic oils were used to stabilize the waste. It is possible these oils may have included some polychlorinated biphenyl-(PCB) contaminated oils. Other fomrs of uranium, including oxides of uranium, uranyl fluoride solutions, uranium-zirconium alloy, slag, and uranium tetrafluoride were buried in smaller quantities.

The C-404 Low Level Radioactive Hazardous Waste Burial Ground is located immediately east of the C-749 Burial Ground in the west-central area of the plant. It was approximately constructed in the early 1950s as an above ground holding pond, with an on-grade tamped earth floor and high clay dike. The burial ground was used from 1951 to 1957 as a primary disposal area for uranium-contaminated effluent. In 1957, all free liquids were removed, and disposal of uranium-contaminated bulk solid wastes began at the unit. In 1976, after the facility was filled with bulk solid waste, it was covered with compacted earth and the weir at the southwest corner was converted into a leachate collection sump. From 1977 until closure of the unit of 1986, the upper portion of the

area was used for the disposal of bulk and containerized uranium-contaminated solid waste. A portion of this waste, consisting of approximately 645 drums of precipitation filter cake was found hazardous in 1986. Solid Waste Management Unit 3 was subsequently covered with a RCRA multilayered cap and cetified closed in 1987. It is regulated under RCRA as a land disposal unit and is required to comply with a RCRA post-closure permit which was issued on September 1992.

Because SWMU 3 is closed with a RCRA cap and is being addressed by RCRA post-closure permit requirements, only SWMU 2 will be addressed by the interim remedial action described in this Record of Decision (ROD). Solid waste management Unit 3 will continue to be regulated under the existing RCRA permit which requires continued ground water monitoring.

Consistent with the DOE strategy, this interim action is intended as an incremental step toward addressing the source unit, SWMU 2. A potential contamination release into the RGA has been identified as the primary threat posed by SWMU 2. The objective of this interim action is to reduce infiltration of leachate through the unsaturated waste and delay the potential breadkthrough of uranium and other chemicals of concern (COCs) to the RGA. By implementation of this interim action, leaching of contaminants into the ground water will be reduced while a final remedy for SWMU 2 is being evaluated.

Several data gaps exist which prevent the DOE from evaluating a final remedial action for SWMU 2. The missing data regarding SWMU 2 relates to the depth of the waste, the volume of the waste, and the form of the waste. One of the moreimportanat data gaps is whether any of the buried wastes are saturated or in direct contact with groundwater. If the waste in fact saturated, the effectiveness of the cap is limited and the contaminats are more likely to migrate within the RGA, thus posing a risk to off-site receptors. Additional information will be collected to fill data gaps as necessary to evaluate a final action in three separate manners. Field work associated with implentation of this action will fill some data gaps. Information collected during the course of other DOE projects near SWMU 2 will also fill data gaps. In addition, the DOE will prepare a separate sampling plan currently scheudled to be sumbitted to the EPA and the KDEP in late 1995. The sampling plan will address those critical data gaps which will not be filled as a direct result of this interim action or other field projects. This interim action is an efficient, cost effective means of reducing risks posed by SWMU 2 at an early stage, whil information necessary to evaluate a final action is being collected, the DOE will evaluate and recommend a final remedial

action for SWMU 2.

Remedy: Once a determination has been made regarding the possible ground water interaction with the buried wastes, a low permeability, multilayered cap may be placed on SWMU 2, the C-749 Uranium Burial Ground, to reduce infiltration of surface water from precipitation events inot and through buried wastes. This will reduce potential leaching of contaminants to the groundwater. The cap will also decrease the gamma exposure rate to background levels and further decrease the likelihood of on-site workers and terrestrial animals coming into direc tcontact with the buried wastes. A groundwater monitoring program will be implemented in the uppermost aquifer, the Regional Gravel Aquifer, to detect any release of contaminants from SWMU 2. Institutional controls will be implemented to prevent transferal of the SWMU 2 property and prevent future intrusive activities at the unit.

Text: Full-text ROD document follows on next page.

Text:

DOE/OR/06-1351&D1

Record of Decision for Interim Remedial Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant Paducah, Kentucky

<IMG SRC 0495235>

July 1995

CLEARED FOR PUBLIC RELEASE

CERTIFICATION

Document Identification: Record of Decision for Interim Remedial Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

U.S. Department of Energy
Owner and Operator

<IMG SRC 0495235A>

_____ _____

Jimmie C. Hodges, Paducah Site Manager — Date Signed
Paducah Site Office
U. S. Department of Energy

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The

Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

CERTIFICATION

Document Indentification: Record of Decision for Interim Remedial Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Lockheed Martin Energy Systems, Inc.
Co-Operator

<IMG SRC 0495235B>

_____ _____

Lockhead Martin Energy Systems, Inc. Date Signed

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), Lockheed Martin Energy Systems, Inc.'s, representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

DOE/OR/06-1351&D1

Record of Decision for Interim Remedial Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant Paducah, Kentucky

July 1995

Prepared by
Jacobs Engineering Group Inc.
175 Freedom Boulevard Kevil, KY 42053
Under Contract DE-AC05-93OR22028

Prepared for
United States Department of Energy
Environmental Restoration Division

PREFACE

This Record of Decision for Interim Remedial Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant (DOE/OR/06-1351&D1) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation and Liability Act, Resource Conservation and Recovery Act, and K.R.S. 224.46-530 for documenting the selection of a preferred interim remedial action, or corrective measure, for a solid waste management unit. This Record of Decision has been prepared in accordance with the "Record of Decision" outline prescribed in Appendix D of the draft Federal Facility Agreement for the Paducah Gaseous Diffusion Plant dated December 22, 1993. This work was performed under Work Breakdown Structure 1.4.12.7.1.02.11.02 (Activity Data Sheet 5302, "Offsite Groundwater Contamination"). Publication of this document meets a milestone pursuant to the United States Department of Energy's fiscal year 1995 commitments to federal and state regulatory agencies. This primary milestone document provides a record of information to be considered and the rationale which the United States Environmental Protection Agency and the United States Department of Energy will utilize in the selection of a preferred remedial action, or corrective measure, at Solid Waste Management Unit 2, the C-749 Uranium Burial Ground, and will formally record the decision to implement this interim action. This document also contains a schedule for conducting remedial design phase activities for this project. Information provided in this document forms the basis for the development of the Remedial Design Report for this project.

ACKNOWLEDGMENT

Jacobs Engineering Group Inc. under prime contract to the United States Department of Energy developed this document with the assistance of the Jacobs

Environmental Restoration Team members:
Geraghty and Miller, Inc.
Lockwood Greene Technologies, Inc.
PAI Corporation
Solutions To Environmental Problems
United Science Industries
University of Tennessee
Additional support was given to the team by Lockheed Martin Energy Systems, Inc.

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ACRONYMS AND ABBREVIATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

99Tc	technetium-99
ARAR	applicable or relevant and appropriate requirement
bls	below land surface
BMP	best management practice
C.F.R.	Code of Federal Regulations
CAA	Clean Air Act of 1970
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended
cm	centimeter(s)
COC	chemical of concern
COPC	chemical of potential concern
DNAPL	dense nonaqueous phase liquid
DOE	United States Department of Energy
EMEF	Environmental Management and Enrichment Facilities
EPA	United States Environmental Protection Agency
Fed. Reg.	Federal Register
FFCA	Federal Facility Compliance Agreement
FS	feasibility study
ft	foot (feet)
gal	gallon(s)
HSWA	Hazardous and Solid Waste Amendments of 1984
in	inch(es)
J-value	qualifier indicating estimated value
K.A.R.	Kentucky Administrative Regulations
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
I	liter(s)
LDR	land disposal restriction
LLW	low-level (radioactive) waste
m	meter(s)
æg/1	microgram(s) per liter
mrem	millirem(s)
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

O&M	operation and maintenance
PCB	polychlorinated biphenyl
pCi/g	picoCurie(s) per gram
pCi/l	picoCurie(s) per liter
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
PW	Present Worth over 30-year period
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act, as amended
RGA	Regional Gravel Aquifer
RI	remedial investigation
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SWMU	solid waste management unit
TBC	to be considered
TCE	trichloroethene
U.S.C.A	United States Code Annotated
UCRS	Upper Continental Recharge System
WAG	waste area group
WKWMA	West Kentucky Wildlife Management Area
yd3	cubic yards
yr	year(s)

PART 1

DECLARATION

DECLARATION FOR THE RECORD OF DECISION FOR INTERIM REMEDIAL ACTION AT SOLID WASTE MANAGEMENT UNITS 2 AND 3 OF WASTE AREA GROUP 22

SITE NAME AND LOCATION
Solid Waste Management Units 2 and 3 of Waste Area Group 22
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for Solid Waste Management Units (SWMUs) 2 and 3 of Waste Area Group (WAG) 22 at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky, chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on the administrative record for this site.

The United States Department of Energy (DOE) entered into an Administrative Order by Consent pursuant to Sections 104 and 106 of CERCLA, effective November 23, 1988, with the United States Environmental Protection Agency (EPA). The PGDP was issued a Kentucky Hazardous Waste Management Permit and an EPA Hazardous and Solid Waste Amendments (HSWA) Permit July 16, 1991. The PGDP was placed on the National Priorities List effective June 30, 1994 (59 Federal Register 27989, May 31, 1994). Currently the DOE, the EPA, and the Kentucky Department for Environmental Protection (KDEP) are negotiating a Federal Facility Agreement for the PGDP site. On February 10, 1994, the EPA approved the DOE's January 20, 1994, proposal to issue a feasibility study report for SWMUs 2 and 3 of WAG 22. The concept of limiting the feasibility study to these two SWMUs was originally discussed among the EPA, the KDEP, and the DOE representatives during a June 11, 1992, meeting, and again during a January 5, 1994, meeting. Since SWMU 3 underwent Resource Conservation and Recovery Act (RCRA) closure in 1987, it does not require additional remedial or corrective actions at this time. Data gaps exist which prevent development and evaluation of final remedial actions at SWMU 2. In order to mitigate risks posed to ground water and the potential for direct contact, the DOE will implement an interim remedial action at SWMU 2. This interim remedial action will be initiated pursuant to the Interim Measure provisions of PGDP's Kentucky Hazardous Waste Management Permit issued by the KDEP and K.R.S. 224.46-530, the HSWA Permit issued by the EPA, and this Record of Decision (ROD). The Commonwealth of Kentucky concurs with the DOE and the EPA on the selected interim remedial action. This action will serve as an incremental step toward comprehensively addressing PGDP site problems.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from SWMU 2, if not addressed by implementing the response action selected in this ROD for interim remedial action, may present an imminent and substantial endangerment to public health, welfare, or the environment in the future.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this interim remedial action, or corrective measure, is to reduce the infiltration of precipitation into buried wastes and mitigate any leaching of chemicals of concern from the wastes while the DOE collects additional data to support evaluation of a final remedial action. The Surface Water Integrator Operable Unit and the Ground Water Integrator Operable Unit at the PGDP will be addressed comprehensively in subsequent operable units. Solid Waste Management Units 2 and 3 are identified as source units at the PGDP. This interim remedial action for a source unit constitutes an incremental step toward comprehensively addressing site-wide problems at the PGDP. Decisions regarding final remedial actions will be made through the remedial investigation and remedy selection process after the source units are more fully understood.

The principal threat associated with SWMU 2 is the potential for transport of contaminants to the ground water operable unit and subsequent threats associated with the potential contamination of an aquifer and transport of contaminants beyond DOE property. The major components of the interim action remedy include:

Once a determination has been made regarding possible ground water interaction with the buried wastes, a low permeability, multilayered cap may be placed on SWMU 2, the C-749 Uranium Burial Ground, to reduce infiltration of surface water from precipitation events into and through buried wastes. This will reduce potential leaching of contaminants to ground water. The cap will also decrease the gamma exposure rate to background levels and further decrease the likelihood of on-site workers and terrestrial animals coming into direct contact with the buried wastes.

A ground water monitoring program will be implemented in the uppermost aquifer, the Regional Gravel Aquifer, to detect any release of contaminants from SWMU 2.

Institutional controls will be implemented to prevent transferal of the SWMU 2 property and prevent future intrusive activities at the unit.

The EPA and the KDEP have participated in the development of this ROD, including review and comment on the content of the document.

STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed for this unit. This interim action also complies with federal and state applicable or relevant and appropriate requirements for this limited-scope action, and is cost effective. This interim remedial action meets Condition IV. E. of the Kentucky Hazardous Waste Management Permit relating to interim corrective measures. This interim action is not intended to fully address the statutory mandate for permanent solutions and alternative treatment technologies to the maximum extent practicable for SWMU 2. Since this action does not constitute the final remedy for SWMU 2, the statutory preference for remedies which employ treatment that reduce toxicits, mobility, or volume as a principal element will be considered during evaluation of a final response action. Subsequent actions are planned to fully address the principal threats posed by the conditions at SWMU 2. Since this interim remedy will result in hazardous substances potentially remaining above health-based levels, a review will be conducted to ensure that the remedy continues to provide

adequate protection of human health and the environment within five years after commencement of the interim remedial action. Since this is an Interim Action ROD, review of this unit and of this remedy will be ongoing, as the DOE continues to develop final remedial alternatives for SWMU 2 of WAG 22 at the PGDP.

<IMG SRC 0495235C>

_____ Date_____

Robert D. Dempsey
Assistant Manager for Environmental Management
United States Department of Energy

<IMG SRC 0495235D>

_____ Date_____

John H. Hankinson, Jr.
Regional Administrator
United States Environmental Protection Agency, Region IV

PART 2

DECISION SUMMARY

DECISION SUMMARY

2.1 Site Name, Location, and Description

The United States Department of Energy (DOE) is conducting environmental cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP) under the DOE Environmental Management and Enrichment Facilities (EMEF) Program. These cleanup efforts are required to address contamination that has resulted from past waste handling and disposal practices at the plant. The DOE is conducting the remedial activities in compliance with the requirements of the Kentucky Department for Environmental Protection (KDEP) and the United States Environmental Protection Agency (EPA).

The PGDP, located in western Kentucky, is an active uranium enrichment facility owned by the DOE. Effective July 1, 1993, the DOE leased the plant production operations facilities to the United States Enrichment Corporation, which in turn contracted with Lockheed Martin Utility Services, Inc. to provide operations and maintenance services. Lockheed Martin Energy Systems, Inc. manages EMEF Program activities for the DOE.

The PGDP is located in McCracken County in western Kentucky, approximately 3.5 miles south of the Ohio River (Figure 2-1). The PGDP facility covers about 540 hectares (1,335 acres), with approximately 300 hectares (740 acres) situated within a fenced security area; the remaining 240 hectares (595 acres) are maintained by the DOE as a buffer zone surrounding the plant. Approximately 850 hectares (2,100 acres) of land beyond the buffer zone are leased by the DOE to the Commonwealth of Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA). The WKWMA is used extensively for recreation, primarily hunting and fishing.

The principal pathway of ground water flow at the PGDP is the Regional Gravel Aquifer (RGA), which consists of unconsolidated gravel and sand deposits occurring between 12 and 33 meters (m) [40 and 100 feet (ft)] below land surface (bls). From the PGDP, ground water within the RGA flows in a northward direction toward the Ohio River, which is the local base level for the system. Ground water contaminant plumes originating from the PGDP and extending north and northeast from the plant are located within this aquifer.

Waste Area Group (WAG) 22 consists of the following solid waste management units (SWMUs):

SWMU 2, the C-749 Uranium Burial Ground;
SWMU 3, the C-404 Low-Level Radioactive/Hazardous Waste Burial Ground;

SWMU 7, the C-747-A Burial Ground; and
SWMU 30, the C-747-A Burn Area.

These four units are situated within the security-fenced area in the northwest portion of the plant (Figure 2-2). Although SWMUs 7 and 30 are contained in WAG 22, it has been mutually determined by the DOE, the EPA, and the KDEP that remedy selection at these two units will not be conducted until further characterization activities have been completed. Consequently, SWMUs 7 and 30 will not be considered further in this document. As shown in Figure 2-2, SWMUs 2 and 3 are located near the west-central portion of the security-fenced area of the PGDP. Both burial grounds have been capped, SWMU 2 with a 15-centimeter (cm) [6-inch (in)] clay cap and 46-cm (18-in) vegetative

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cover and SWMU 3 (a regulated unit) with a Resource Conservation and Recovery Act (RCRA) multilayered clay cap. The surfaces of both burial grounds are primarily grass covered. Surface elevations vary from about 113 to 119 m (370 to 390 ft) above mean sea level in the immediate vicinity of the two units. Surface runoff from the SWMUs flows into the ditches located north, south, and east of the units and discharges through Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 015 to Big Bayou Creek.

2.2 Site History and Enforcement Activities

The C-749 Uranium Burial Ground (SWMU 2) is located in the west-central portion of the plant north of Virginia Avenue and on the western edge of the C-404 Low-Level Radioactive/Hazardous Waste Burial Ground (Figure 2-2). It encompasses an area of approximately 2,970 m2 [32,000 sqare feet (ft2)] with approximate dimensions of 48.8 by 61.0 m (160 by 200 ft) and is divided into 6.1 by 6.1 m (20 by 20 ft) sections. The C-749 Uranium Burial Ground was used from approximately 1951 to 1977 for the disposal of uranium and uranium containing wastes. The exact depth of the buried waste is not known. Wastes were reportedly placed in trenches excavated to a total depth of approximately 2.1 to 5.2 m (7 to 17 ft) and then covered with 0.61 to 1.2 m (2 to 4 ft) of soil. Occasionally, fires were reported as a result of oxidation of pyrophoric uranium metal, but no subsidence was observed resulting from potential volume reductions due to the fires. In 1982, the C-749 Uranium Burial Ground was covered with a 15-cm (6-in) clay laver and a 46-cm (18-in) vegetative cover. It has been estimated that 2.44 x 105 kilograms (270 tons) of uranium, 2.23 x 105 liters (1) [59,000 gallons (gal)] of oils, and 1.70 x 103 l (450 gal) of trichloroethene (TCE) were buried in SWMU 2. Most of the waste consisted of pyrophoric uranium metal in the form of machine shop turnings, shavings, and sawdust. Pyrophoric uranium metal was usually placed in 20-, 30-, or 55-gal drums and petroleum-based or synthetic oils were used to stabilize the waste. It is possible these oils may have included some polychlorinated biphenyl-(PCB) contaminated oils. Other forms of uranium, including oxides of uranium (solid and dissolved in aqueous solutions), uranyl fluoride solutions, uranium-zirconium alloy, slag, and uranium tetrafluoride were buried in smaller quantities.

There is no documentation of technetium-99 (99Tc) disposal at SWMU 2, but its presence is suspected due to its association with operations at the PGDP. Technetium was produced at the PGDP as a by-product from reprocessing of reactor tailings. A portion

of the uranium-containing wastes disposed in burial grounds at the PGDP likely contains 99Tc from this source. In addition, detections of 99Tc in ground water samples from nearby monitoring wells indicate that it may be present in SWMU 2.

In August 1984, Area 9 [which is approximately 6.1 by 4.3 m (20 by 14 ft)] and located on the southern border of SWMU 2) of the C-749 Burial Ground was excavated in response to concern about the integrity, of the drums containing TCE reportedly disposed in this area. Little documentation is available concerning this activity. During excavation, four of the fifteen 30-gal drums believed to be in Area 9 were recovered, and three of them were in such poor condition that their content could not be determined. In addition to the four 30-gal drums, approximately 36 plastic-lined 55-gal drums were excavated. Five ot the 55-gal drums were of poor integrity. There was no record of the 55-gal drums having been buried in Area 9.

The C-404 Low-Level Radioactive/Hazardous Waste Burial Ground (SWMU 3) is located immediately east of the C-749 Burial Ground in the west-central area of the plant (Figure 2-2). It is approximately 42.7 by 115.8 m (140 by 380 ft) and was originally constructed in the early 1950s as an aboveground holding pond, with an on-grade tamped earth floor and 1.8-m (6-ft) high clay dike walls. The burial ground was used from 1951 to 1957 as a primary disposal area for 99Tc and uranium-contaminated effluent. In 1957, all free liquids were removed, and disposal of uranium-contaminated bulk solid wastes began at the unit. In 1976, after the facility was filled with bulk solid waste, it was covered with compacted earth and the weir at the southwest corner was converted into a leachate collection sump. From 1977 until closure of the unit in 1986, the upper portion of SWMU 3 was used for the disposal of bulk and containerized uranium-contaminated solid waste. A portion of this waste, consisting of approximately 645 drums of precipitation filter cake (end products from the gold dissolver process) was found to be RCRA hazardous in 1986. Solid Waste Management Unit 3 was subsequently covered with a RCRA multilayered cap and certified closed in 1987. It is regulated under RCRA as a land disposal unit and is required to comply with a RCRA post-closure permit which was issued on September 1992.

Because SWMU 3 is closed with a RCRA cap and is being addressed by RCRA post-closure permit requirements, only SWMU 2 will be addressed by the interim remedial action described in this Record of Decision (ROD). Solid Waste Management Unit 3 will continue to be regulated under the existing RCRA permit which requires continued ground water monitoring.

2.3 Highlights of Community Participation

From May 31 to June 29, 1995, a notice of availability regarding the Proposed Remedial Action Plan was published in a regional newspaper, The Paducah Sun. The Proposed Remedial Action Plan for Interim Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 (DOE/OR/06-1315&D3) was released to the public May 31, 1995.

Specific groups which received individual copies of the Proposed Remedial Action Plan include the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. A public meeting was tentatively scheduled for June 22, 1995, if requested by June 12, 1995. Since no requests were made for a public meeting, a notice of the meeting's cancellation was published in the Sunday, June 18, 1995, edition of The Paducah Sun.

2.4 Scope and Role of Operable Unit

Consistent with the DOE strategy, this interim action is intended as an incremental step toward addressing the source unit, SWMU 2. A potential contamination release into the RGA has been identified as the primary threat posed by SWMU 2. The objective of this interim action is to reduce infiltration of leachate through the unsaturated waste and delay the potential breakthrough of uranium and other chemicals of concern (COCs) to the RGA. By implementation of this interim action, leaching of contaminants into the ground water will be reduced while a final remedy for SWMU 2 is being evaluated.

Several data gaps exist which prevent the DOE from evaluating a final remedial action for SWMU 2. The missing data regarding SWMU 2 relates to the depth of the waste, the volume of the waste, and the form of the waste. One of the more important data gaps is whether any of the buried wastes are saturated or in direct contact with ground water. If the waste is in fact saturated, the effectiveness of the cap is limited and the contaminants are more likely to migrate within the RGA, thus posing a risk to off-site receptors. Additional information will be collected to fill data gaps as necessary to evaluate a final action in three separate manners. Field work associated with implementation of this action will fill some data gaps. Information collected during the course of other DOE projects near SWMU 2 will also fill data gaps. In addition, the DOE will prepare a separate sampling plan currently scheduled to be submitted to the EPA and the KDEP in late 1995. The sampling plan will address those critical data gaps which will not be filled as a direct result of this interim action or other field projects. This interim action is an efficient, cost effective means of reducing risks posed by SWMU 2 at an early stage, while information necessary to evaluate a final action is being collected. Once the proper information has been collected, the DOE will evaluate and recommend a final remedial action for SWMU 2.

2.5 Site Characteristics

Hydrogeologic Characteristics

The subsurface at the PGDP consists of approximately 103.7 m (340 ft) of unconsolidated sediments overlying Mississippian limestone bedrock. Figure 2-3 presents a general subsurface profile of the PGDP area. The following discussion focuses on those lithologies present beneath SWMU 2.

Surficial deposits in the vicinity of SWMU 2 consist of approximately 4.0 to 6.1 m (13 to 20 ft) of silt loam and silty clay loam. These deposits consist of about 1.8 m (6 ft) of soil and an underlying 2.1 to 4.3-m (7 to 14-ft) thick layer of wind-deposited, fine-grained, silty material called loess.

Underlying the surficial deposits are unconsolidated sediments consisting of interbedded and interlensing gravel, sand, silt, and clay. These deposits, divided into the Upper and Lower Continental Deposits, were lain down in the region during the late Tertiary and Quaternary periods. The Upper Continental Deposits consist primarily of clayey silt, with thin layers of sand and occasional gravel found at a depth of about 4.0 to 6.1 m (13 to 20 ft) bls. They are approximately 12.2 to 15.2 m (40 to 50 ft) thick in the vicinity of SWMU 2. The loess and the Upper Continental Deposits have been informally grouped into a ground water flow system referred to as the Upper Continental Recharge

System (UCRS). Water level measurements from a UCRS monitoring well, located at the northern edge of SWMU 2, Monitoring Well (MW) 154, indicate an area of high ground water elevations exists at SWMU 2. The ground water flow direction within the UCRS is ultimately downward through the low permeability clay, silt, or clayey silt layer separating the Upper and Lower Continental Deposits.

The top of the Lower Continental Deposits is typically found at depths of approximately 18.3 to 21.3 m (60 to 70 ft) bls. The Lower Continental Deposits consist predominantly of well-rounded chert gravel with sand and are approximately 6.1 to 9.1 m (20 to 30 ft) thick in the vicinity of SWMU 2. The principal gravel facies of the Lower Continental Deposits, the RGA, is the uppermost aquifer at the PGDP.

The Continental Deposits are underlain by the McNairy Formation at depths of approximately 25.9 to 30.5 m (85 to 100 ft) bls. The McNairy Formation in this area of the plant site has been described as brown to gray, silty, clayey, very fine to fine sand with dark gray silty clay. The total thickness of the McNairy Formation is approximately 68.6 m (225 ft). Directly underlying the McNairy Formation are the Mississippian rubble zone and the Cretaceous Tuscaloosa Formation, which consist of a 1.5 to 6.1 m (5 to 20 ft) thick layer of subangular chert and silicified limestone fragments. Deep borings at the PGDP have encountered Mississippian limestone bedrock approximately 102 to 107 m (335 to 350 ft) bls.

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Nature and Extent of Contamination at Solid Waste Management Unit 2

The results of the Phase I and Phase II Site Investigations indicate that organic, metal, and radionuclide contamination is present in surface soils, subsurface soils, and ground water in the SWMU 2 area. Sampling locations at SWMU 2 are shown in Figure 2-4. The possible source of this contamination is the low-level (radioactive) waste (LLW), pnmarily uranium and uranium-contaminated material, buried within the unit.

Over 30 chemicals of potential concern (COPCs) were identified in the Remedial Investigation Addendum for Waste Area Grouping 22, Burial Grounds, Solid Waste Management Units 2 and 3, at the Paducah Gaseous Diffusion Plant risk assessment. Nineteen of these COPCs were determined to pose a potential risk great enough to be considered COCs for the Feasibility Study for Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant. The criteria used to identify the COPCs and COCs, as well as the uncertainties associated with the identification process, are presented in the Remedial Investigation (RI) Addendum and in Appendix A of the Feasibility Study (FS).

The principal organic contaminant detected in the ground water at SWMU 2 is TCE, found primarily in the UCRS at concentrations varying from about 4 to 1,400 micrograms per liter (æg/l). Trichloroethene also has been detected in the upper RGA, at levels ranging from <5 to 98 æg/l. Trichloroethene is transported as a dissolved phase liquid in the direction of ground water flow. It also has the potential to migrate in the form of a dense nonaqueous phase liquid (DNAPL). As the buried waste containers degrade within SWMU 2, DNAPLs could potentially migrate to subsurface soils and ground water.

Metals have been detected above Phase II Site Investigation reference levels in soil and ground water samples at SWMU 2. Arsenic and silver were detected above reference levels in soil samples taken from borings located at the perimeter of SWMU 2. The

principal inorganic contaminants in the ground water at SWMU 2 are manganese, vanadium, and beryllium. Beryllium was detected in total (unfiltered) metals analyses at levels above allowable drinking water maximum contaminant levels in the UCRS. Manganese and vanadium were detected at levels above reference values in UCRS wells located near SWMU 2.

Radiological contamination has been detected in shallow soil samples from borings located at the perimeter of SWMU 2, primarily at H 221 northwest of SWMU 2 and at H 262 southwest of SWMU 2. The radionuclides 99Tc [up to 58 picoCuries per gram (pCi/g)] and total uranium (up to 89 pCi/g) have been detected in surface soils and in the ditch southwest of the unit to a depth of approximately 1.8 m (6 ft). The extent of surface radiological contamination likely extends from H 221 in the swale west of SWMU 2 and from H 262 in the ditch south of SWMU 2 to Outfall 015.

Ground water sampling indicates radiological contamination is present in the UCRS near SWMU 2. The principal radiological contaminants are 99Tc and, at lower levels, uranium. In ground water samples from the UCRS wells near the unit, 99Tc was detected at levels ranging from <25 to 2,175 picoCuries per liter (pCi/l). Uranium has been detected at varying levels in UCRS wells; the maximum values (total fraction analysis) detected in UCRS wells at SWMU 2 were 10 pCi/l (J-value) uranium-234 in MW 49, 1.0 pCi/l uranium-235 in MW 91, and 27 pCi/l uranium-238 in MW 154. In general, the radiological contamination in the UCRS is higher than that found in the RGA. The principal radiological contaminant detected in the RGA is 99Tc. Two downgradient wells in the area, MW 51 and MW 67, have reported 99Tc values up to 53.2 pCi/l in the upper RGA. Uranium has not been detected above reference levels in the RGA in the vicinity of

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SWMU 2. The RESRAD (Residual Radioactivity) computer code was used for the FS to model potential leaching of uranium from SWMU 2. Results of this modeling indicate that uranium may migrate from SWMU 2, although very slowly, taking approximately 1,900 years to migrate to the RGA.

Two radiation walk-over surveys of SWMU 2 were conducted in August 1994. Detailed information concerning these surveys can be found in the FS. The survey results indicate that a generalized, low-level gamma field exists across SWMU 2. The field may be partially attributable to the large quantities of uranium metal buried in SWMU 2. Cylinder storage yards located adjacent to SWMU 2 are also likely contributing to the elevated gamma readings. In addition, during the Phase II Site Investigation, a radiation walk-over survey of the ditch located south of SWMU 2 was conducted. The results of this survey indicate that beta and gamma emitters are present at the surface of the ditch at levels exceeding three times background.

Conceptual Site Model for Transport and Exposure Pathways at Solid Waste Management Unit 2

The conceptual site model presented in Figure 2-5 identifies the probable and potential contammant migration and exposure pathways at SWMU 2. From the source, defined as the low-level radioactive waste buried within SWMU 2, two probable pathways are identified: (1) a probable pathway to the adjacent soils; and (2) a probable pathway to ground water due to leaching and dissolution of contaminants. Consistent with the DOE strategy, DNAPL is considered a potential source beneath the buried waste since burial

records indicate that TCE, a potential DNAPL compound, was buried at SWMU 2. However, the presence of DNAPL has not been identified at SWMU 2. Potential exposure to contamination at SWMU 2 via air is currently limited since SWMU 2 is covered with a 15-cm (6-in) clay cap and a 46-cm (18-in) vegetative cover. These are the primary pathways and will be the focus of Section 2.6. The interim action presented in this document is intended to address the potential transport of contaminants to ground water via infiltration of precipitation through the buried waste materials at this SWMU. The risks that are addressed by this interim action are discussed in the following section.

2.6 Summary of Site Risks

The results of the risk assessment suggest there is sufficient potential risk to the public and environment to warrant action. A summary of the long-term risk is presented in Table 2-1. The principal goal of the interim remedial action is to implement source control measures which will diminish infiltration of surface water from precipitation events the buried waste. This will reduce potential leaching of TCE and uranium into the ground water. The interim action will also eliminate the present and future potential for direct contact with the buried waste by both humans and terrestrial animals. A summary of the risk assessment is presented below.

Human Health Risks

The data from the Site Investigation were evaluated in the human health risk assessment. To identify contaminants of potential concern, all constituents detected in the surrounding soils and ground water were evaluated using established guidelines. From this data, contaminants of potential concern included metals, organic compounds, and radionuclides. Whether the chemicals detected in the ground water beneath the unit are associated with SWMU 2 is not known due to a lack of sampling data from the waste. Since uranium and TCE are two primary waste sources in SWMU 2, source term

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Table 2-1. Summary of Long-Term Risk at Solid Waste Management Unit 2 under No Action and Interim Action

	No Action	Interim Action
	Future Unrestricted Workers	
Direct contact with waste	Direct contact with waste possible; risks from direct contact unacceptable.*	Potential for direct contact reduced by physical barrier created by the low permeability multilayered cap.
	Future Potential Ground Water User	
Ingestion of ground water	Risk posed by ground water contamination is unacceptable. Contaminant concentrations in ground water expected to increase.	Migration of contaminants reduced through reduction of water movement through unit by the cap.

* Unacceptable risk: a potential risk higher than one additional cancer case in a population of one
million people exposed to a certain level of a pollutant during a lifetime.
concentrations were estimated from disposal records as input parameters for the soil leaching models.
The exposure pathways evaluated in the human health risk assessment are shown in

Figure 2-5. As indicated by this figure, the risk assessments considered SWMU 2 to be an industrial site both under current and future conditions. However, the future resident using ground water was also evaluated for the site. For these scenarios, the principal pathways considered are inhalation potentially associated with the combustion of pyrophoric uranium, direct contact with the pyrophoric waste, and ingestion of potentially contaminated ground water. Although the contaminants in the ground water do not pose a threat at present, the potential for migration of TCE and uranium to off-site ground water does exist. As the primary contaminant migration pathway, potential future releases from SWMU 2 to ground water were evaluated using predictive models to estimate leaching.

Toxicity information used in the risk assessment was taken from approved EPA documents and data bases. The potential adverse human health effects associated with the primary contaminants of concern include carcinogenic effects and noncarcinogenic or systemic effects. Uranium exposure is associated with radiocarcinogenic and chemical toxic effects. Exposure to TCE through inhalation and ingestion causes cancer and various adverse effects on human health.

Risk characterization for workers indicated that under current conditions, the risk at the unit was not unacceptable. However, the risk characterization for workers under future conditions indicated that the risk at the unit was unacceptable due to potential direct contact with the buried waste. Also, the risk characterization for use of contaminated ground water indicated that ground water use could pose significant unacceptable risk to human health under future conditions. The primary driver of risk was ingestion of contaminated ground water. The primary contaminants contributing risk were TCE and uranium for the interim action.

Table 2-1 presents a summary of the long term risk at SWMU 2 for workers and ground water users under both the baseline (no action) condition and after the interim action is in place. As shown in this table, the interim action is effective in reducing risk from direct contact with the waste and in reducing the risk posed by the pyrophoricity of the buried uranium. Also, the interim action is effective in reducing risk from ground water use by reducing the rate of contaminant leaching from the buried waste to the underlying aquifer.

Several uncertainties, or factors that could significantly affect the results of the risk assessment, were identified in the risk assessment. Primary uncertainties included needs to estimate the quantity of buried waste at SWMU 2 and the physical and chemical makeup of the waste. The effect of having to estimate these factors is unknown; however, since the risk assessment used estimates of concentrations of uranium and TCE that were unlikely to underestimate waste volume or mass, the results of the risk assessment are not likely to be underestimates of risk.

Another uncertainty identified as being important was the fact that rates of exposure used in the assessment were likely to be overestimates for most parameters. Both methods for evaluating TCE and uranium in ground water assumed reasonable maximum leaching. Therefore, concentrations of TCE and uranium under no action may result in overestimates of risks.

A third uncertainty that affected the results of the risk assessment is the assumed pyrophoric nature of the buried uranium. To address this uncertainty, the risk assessment considered the various conditions that would need to occur for spontaneous combustion of the buried uranium. These conditions were presented to ensure that any remedial alternative selected for SWMU 2 would reduce the risk posed by the

pyrophoricity of the buried uranium.

Environmental Risks

Potential ecological effects were qualitatively evaluated in the ecological risk assessment. According to the Site Investigation, neither critical habitat nor known federal or state threatened and endangered species were located inside the PGDP boundary. Only various soil and sediment dwelling invertebrates (e.g., earthworms, chironomids), aquatic and terrestrial insects and their larvae, frogs and salamanders, and small mammals were reported. The principal source of potential adverse impacts to ecological resources at SWMU 2 was the possible failure of the buried waste containers and the subsequent release of COPCs to a subsurface environment.

The major exposure pathways for terrestrial animals include ingestion of contaminated biota and, to a lesser extent, ingestion and direct contact with contaminated soils. Ingestion of water and sediment at SWMU 2 is probably a minor pathway of exposure for terrestrial animals. Exposure to COPCs would likely have adverse effects to terrestrial animals and biota.

The risk to terrestrial animal populations and biota populations is small under the current condition. Potential risks may be associated with ingestion and direct contact with buried wastes due to possible releases of COPCs to the environment. The interim action will limit potential risks by reducing the possibility of a release of COPCs to the environment.

Remedial Action Objectives

Results of the human health risk assessment (Table 2-1) indicate that ingestion of contaminated ground water and direct contact with the buried waste pose unacceptable risks in the future. The remedial action objectives for the interim action are to mitigate migration of uranium and TCE from SWMU 2 to ground water, and to prevent

disturbance or contact with the buried waste materials. The interim action will reduce infiltration of precipitation, which will reduce potential leaching of TCE and uranium. The interim action will also reduce human health risks estimated for TCE and uranium exposure through ground water. In addition, the interim action will provide current and future protection from direct contact with the buried waste.

2.7 Description of Alternatives

The following paragraphs present a description of the five alternatives evaluated in the approved Feasibility Study for Solid Waste Management Units 2 and 3 of Waste Area Group 22 at the Paducah Gaseous Diffusion Plant (DOE/OR/06-1246&D2).

Alternative 1--No Action

Pursuant to 40 C.F.R. 300.430(e)(b) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the DOE is required to consider a no action alternative. This alternative served as a baseline to which the other alternatives were compared. Under this alternative, no further action would be taken at SWMU 2.

Since no wastes would be generated, this alternative did not include the use of any

treatment technologies, containment, or storage components. No additional costs were associated with this alternative. In addition, the alternative would not provide compliance with applicable or relevant and appropriate requirements (ARARs), and it would not reduce risk. A summary of the detailed evaluation of this alternative is presented in Section 2.8 of this ROD.

Alternative 2--Limited Action

This alternative primarily consisted of institutional controls designed to prevent access to SWMU 2. The alternative contained three primary components. First, deed restrictions would be executed to prevent property transfer, inappropriate use of the property, and any intrusive activities which could expose buried waste materials. Second, a suitable fence and warning signs would be installed around the unit to prevent unauthorized entry. Third, the DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Although this alternative does not include construction of additional piezometers or ground water monitoring wells, information collected as a result of ground water monitoring activities at the PGDP would be utilized during the review proceedings.

A minimal volume of wastes would be expected to be generated from implementation of this alternative. Soils which would potentially be generated during installation of fencing would not be expected to contain COCs, so the soils would not require any special handling. However, if the soils were determined to contain a significant concentration of any COCs following characterization, they would be handled appropriately and may require treatment, storage, or disposal. Fencing would be erected to prevent access to an area encompassing approximately 2,973 m2 (32,000 ftý) or more. This alternative would not address potential long-term risks to ground water, and potentially would not comply with ARARs. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

Alternative 3--Excavation, Treatment, and Storage/Disposal

This alternative consisted of excavation of the buried wastes, treatment, and storage/disposal options. The alternative contained three primary components. First, the buried waste materials and associated contaminated soils would be excavated. Dewatering, stabilization of pyrophoric uranium, segregation of waste types, and a temporary storage facility would likely be required. Second, the wastes would require appropriate treatments to reduce toxicity. Sampling and analysis would be required to determine if the wastes would be classified as LLW and/or RCRA characteristically hazardous waste. Any contaminated water collected during dewatering activities would also require treatment. Third, the wastes would be stored/disposed in compliance with regulatory waste management practices. One option evaluated in this alternative would include a long-term storage facility at the PGDP. At this time, the PGDP does not have such a long-term storage facility or the capacity to accept the volume of LLW and/or RCRA hazardous wastes which would be generated by this alternative. The other disposal option considered in this alternative would consist of off-site disposal at an appropriate facility likely at another DOE facility.

A significant volume of waste would be generated as a result of this alternative. Assuming an excavation depth of 5.2 m (17 ft) at SWMU 2 and potentially contaminated soils which immediately surround the unit, the volume of wastes generated was estimated to be in excess of 24,000 m3 [31,000 cubic yards (yd3)]. A significant volume of

on-site storage capacity would be required for the wastes expected to be contaminated with volatile organlc compounds and semi-volatile organic compounds, metals, radionuclides, and possibly PCBs. The wastes could either be treated or disposed at an appropriate DOE facility. In addition, dewatering would likely be required to conduct excavation activities. This alternative included construction of a treatment plant onsite to treat the extracted water. Potential treatment mechanisms included precipitation/coagulation, air stripping, ion exchange, and carbon adsorption. Treatability testing could be required to optimize treatment of wastes and/or extracted ground water. Appropriate controls would be utilized during the excavation phase to prevent adverse effects to workers and the surrounding environment. This alternative would address, or eliminate, long-term risks to the environment and could be conducted in accordance with ARARs. However, this alternative may not be safe to implement since it would include excavation of pyrophoric uranium. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

Alternative 4--Low Permeability, Multilayered Cap, Dewatering, Additional Monitoring and Institutional Controls

This alternative consisted of construction of a cap, long-term dewatering of the buried wastes, installation of additional monitoring wells and piezometers, and institutional controls. The alternative contained four primary components. First, a low permeability, multilayered cap would be constructed over SWMU 2 to significantly reduce surface water infiltration from precipitation events. Three conceptual capping options, which vary based on the type and number of layers employed, were evaluated in this alternative. The estimated cost and modeled effectiveness of each of the three capping options were compared to the estimated cost and modeled effectiveness of a RCRA cap. Second, a dewatering mechanism would be constructed to provide long-term, or continuous, dewatering of the buried waste materials. One dewatering option evaluated in this alternative would consist of approximately sixteen 9.1-m (30-ft) deep extraction wells/well points placed around the perimeter of SWMU 2. The second dewatering option evaluated in this alternative would consist of a highly permeable, approximately

9.1-m (30-ft) deep drainage trench placed around the perimeter of SWMU 2. Since the drainage trech would be placed under the edges of the cap, construction of the trench would precede construction of the cap. Treatment of liquids collected by a dewatering system would require construction of a treatment system. Third, four RGA ground water monitoring wells and two UCRS piezometers would be installed to monitor SWMU 2 and the effectiveness of this alternative at mitigating the potential for release of contaminants by reducing infiltration of precipitation. Fourth, two of the institutional controls identified in Alternative 2 (deed restrictions and periodic administrative reviews) would be enacted.

This alternative would generate solid and liquid wastes. A minimal volume of waste would be generated if well points were installed for long-term dewatering. The volume of wastes associated with installation of drainage trenches on the north, south, and west sides of SWMU 2 was estimated to be in excess of 1,350 m3 (1,840 yd3). The wastes produced during installation of either dewatering mechanism, piezometers, and ground water monitoring wells would likely be managed within the operable unit and placed on SWMU 2 as contour material for a low permeability, multilayered cap. In addition, dewatering would likely be required during trench construction activities. This alternative included construction of a treatment plant onsite to treat the extracted water.

Estimates indicated dewatering activities would produce approximately 0.50 liters per second (7.9 gallons per minute) of potentially contaminated ground water. Potential treatment mechanisms included precipitation/coagulation, air stripping, ion exchange, and carbon adsorption. Treatability testing could be required to optimize treatment of wastes and/or extracted ground water. Appropriate controls would be utilized during the construction phases to prevent adverse effects to workers and the surrounding environment. This alternative would address long-term risks to ground water and could be conducted in accordance with ARARs. However, this alternative would require a significant amount of long-term care in the form of operation and maintenance, and ground water extraction and treatment. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

Alternative 5ÄLow Permeability, Multilayered Cap, Additional Monitoring, and Institutional Controls

This alternative consisted of construction of a cap, implementation of a ground water monitoring program, and institutional controls. The alternative contained three primary components. First, a low permeability, multilayered cap would be constructed over SWMU 2 to significantly reduce infiltration of surface water from precipitation events into the unit. Three conceptual capping options, which vary based on the type and number of layers employed, were evaluated in this alternative. The estimated cost and modeled effectiveness of each of the three options were compared to the estimated cost and modeled effectiveness of a RCRA cap. Second, a ground water monitoring program would be established in the RGA to detect potential contaminant releases from SWMU 2. The monitoring program would also evaluate the cap's effect(s) on the shallow ground water level in the UCRS and fill data gaps. Third, the institutional controls identified in Alternative 2 (deed restrictions and periodic administrative reviews) would be enacted.

This alternative would generate a relatively minor volume of solid wastes; for example, installation of one RGA monitoring well at the PGDP will produce approximately 2.5 m3 185 cubic feet) of wastes. These wastes would likely be managed within the operable unit and placed on SWMU 2 as contour material for a low permeability, multilayered cap. Appropriate controls would be utilized during the construction phases to prevent adverse effects to workers and the surrounding environment. This alternative would reduce risks to ground water and could be conducted in accordance with ARARs.

Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.8 Summary of the Comparative Analysis of Alternatives

This section provides the basis for determining which alternative: (1) meets the threshold criteria of overall protection of human health and the environment, and compliance with ARARs; (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; (3) satisfies state and community acceptance; and (4) is consistent with the Kentucky Hazardous Waste Permit. Although the selected remedy is consistent with the permit, the selection of an interim corrective measure under the permit does not require the following comparative analysis of alternatives.

Nine criteria are required by Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) for evaluating the expected performance of

remedial actions. The nine criteria are identified below and the interim action has been evaluated on the basis of these criteria:

1. Overall protection of human health and the environment. This threshold criterion requires that the remedial alternative adequately protects human health and the environment, in both the short and long term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

2. Compliance with ARARs. This threshold criterion requires that the alternatives be assessed to determine if they attain compliance with ARARs of both state and federal law.

3. Long-term effectiveness and permanence. This primary balancing criterion focuses on the magnitude and nature of the risks associated with untreated waste and/or treatment residuals remaining at the conclusion of remedial activities. This criterion includes consideration of the adequacy and reliability of any associated containment systems and institutional controls, such as monitoring and maintenance requirements, necessary to manage treatment residuals and untreated waste.

4. Reduction of contaminant toxicity, mobility, or volume through treatment. This primary balancing criterion is used to evaluate the degree to which the alternative employs recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

5. Short-term effectiveness. This primary balancing criterion is used to evaluate the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required until protection is achieved.

6. Implementability. This primary balancing criterion is used to evaluate potential difficulties associated with implementing the alternative. This may include: technical feasibility, administrative feasibility, and the availability, of services and materials.

7. Cost. This primary balancing criterion is used to evaluate the estimated costs of the alternatives. Expenditures include the capital cost, annual operation and maintenance (O&M), and the combined net present value of capital and O&M costs.

8. State acceptance.

9. Community Acceptance. This modifying criterion provides for consideration of any formal comments from the community on the Proposed Remedial Action Plan.

A summary of the comparative analysis of alternatives is provided in Table 2-2.

Overall Protection of Human Health and the Environment

An alternative must meet this threshold criterion to be eligible for selection. As discussed in Section 2.6, this interim action is necessary to address risks posed by SWMU 2. Alternative 1 does not meet this criterion since it does not address the risks at SWMU 2. Alternative 2 does not meet this criterion because short-term risks associated with direct contact to contaminants would be mitigated, long-term risks associated with contamination of ground water would not be addressed. Alternative 3 would meet this criterion; removal of the contaminants, treatment, and disposal at a secure, permitted facility would eliminate nearly all risks. Alternative 4 would also meet this criterion; direct contact would be mitigated, surface water infiltration from precipitation events would be significantly reduced, and dewatering would ensure the wastes are not in contact with water in the UCRS and provide protection of the RGA. Similarly, Alternative 5 would meet this criterion; the cap and institutional controls would physically and administratively mitigate direct contact, and infiltration of precipitation would be reduced, while additional data is collected to support evaluation of a final action.

Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet this threshold criterion to be eligible for selection. Alternatives 1 and 2 would not provide compliance with ARARs since risks to ground water would not be reduced. Alternatives 3, 4, and 5 would provide compliance with ARARs. A detailed description of ARARs for the selected remedy is presented in Section 2.10 of this ROD.

Long-Term Effectiveness and Permanence

This criterion is generally not pertinent to measures implemented as interim actions. However, the selected interim remedial action is expected to prove effective until a final remedial action is implemented. Alternative 3 would meet this criterion; excavation, treatment of wastes, and disposal at a secure permitted facility would provide long-term effectiveness and permanence. Alternative 4 would meet this criterion also; a cap and continuous dewatering of the unit would provide long-term effectiveness. Alternative 5 also would meet this criterion until a final remedial action is implemented. Based on leaching model results from the FS, the estimated time it will take for TCE to migrate from the UCRS to the RGA without the proposed cap is from 35 to 156 years. Placement of a cap to reduce infiltration into the waste may significantly increase that amount of time Uranium would require an even longer period to dissolve and leach to the RGA.

Table 2-2.

Comparative Analysis of Alternatives

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Excavation, Treatment, and Storage/Disposal	Alternative 4 Low Permeability Cap, Dewatering, Additional	Alternative 5 Low Permeability Cap, Additional Monitoring,

Monitoring, and and Institutional

Institutional Controls Controls

T
hreshold Criteria

Overall Protection of No reduction in risk to Short-term,
direct All risks mitigated by Direct contact risk Direct contact
risk

Human Health and human health or the contact risk
mitigated removal of source mitigated by cap and mitigated by
cap and

the Environment environment
institutional controls institutional controls

Long-term,
ground Wastes treated and

water pathway
risk not stored/disposed in a Infiltration of Infiltration of
into

addressed
permitted, secure precipitation into wastes significantly

facility wastes significantly reduced by cap

reduced by cap

Risk to ground water

Risk to ground water significantly reduced

significantly reduced

Dewatering ensures

waste is not in contact

with UCRS water

Compliance with Would not comply with May not comply
with Would comply with Would comply with Would comply with
ARARs ARARs ARARs
ARARs ARARs ARARs

Primary
Balancing Criteria

Long-term Source would not be Interim
action, however, Source would be Interim action, however, Interim
action, however,

Effectiveness and removed or contained; source would
not be removed; maximum risk source would not be source would not
be

Permanence existing risk will removed or
contained; reduction level would removed; some risk removed; some
risk

remain existing risk
to ground be achieved would remain would remain

water will remain until final action implemented Wastes would be Source would be Does not address risk treated and partially contained to posed by wastes which stored/disposed at reduce some risks until may be in contact with permitted, secure final action implemented UCRS ground water facility(ies)

Cap and continuous Source would be dewatering would partially contained to provide long-term reduce some risks until effectiveness final action implemented; limited to Some future vadose zone contaminant migration would be possible Ground water monitoring program Ground water implemented to detect monitoring program any contaminant implemented to detect releases any contaminant releases

Table2-2. Comparative Analysis of Alternatives (continued)

Alternative 1 Alternative 2 Alternative 3 Alternative 4 Alternative 5
Evaluation Criteria No Action Limited Action Excavation, Treatment, Low Permeability Cap, Low Permeability Cap, and Storage/Disposal Dewatering, Additional Additional Monitoring,

Monitoring, and and Institutional

Institutional Controls Controls

Primary

Balancing Criteria (continued)

Reduction of Toxicity, No reduction Interim action; no Toxicity reduced Mobility reduced as a Some future Mobility, or Volume reduction through treatment result of cap and contaminant migration through Treatment dewatering would be possible

Mobility reduced by

excavation and Toxicity and volume of Interim action, however,

treatment contaminants in mobility of wastes in

extracted water reduced unsaturated zone

Volume may or may not through treatment should be reduced to

be reduced through some extent as a result

treatment of cap

Short-term Short-term risks to Short-term risks to Short-term risks to Short-term risks to Short-term risks to

Effectiveness community, workers, community and community would be community would be community not and environment not environment not minimal minimal increased increased

Although health and Risk to workers Risk to workers

Risk to workers would safety precautions mitigated with standard mitigated with standard

be mitigated with would be taken, health and safety health and safety

standard health and increased risk to precautions; precautions (poses less

safety precautions workers from installation of drainage risk than Alternative 3

pyrophoric uranium is trench poses greater or 4)

Objectives achieved in sigificant and has been risk than installation of

relatively minimal time determined to be well points Any risk to

environment

unacceptable

Risk to environment

Although risk would be

minimized by use of

engineering controls,

risk to environment

(including ground water

and surface water)

would be increased

Objectives may be

achieved within three

years

use of engineering

minimized by use of

engineering controls

Objectives may be

achieved within two to

three years, but sooner

than with Alternative 3

would be minimized by

controls

Objectives would be

achieved sooner than

with Alternative 4

Table 2-2. Comparative Analysis of Alternatives (continued)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation, Treatment, and Storage/Disposal	Alternative 3 Dewatering, Additional Monitoring, and Institutional Controls	Alternative 4 Low Permeability Cap, Additional Monitoring, and Institutional Controls	Alternative 5 Limited Action Low Permeability Cap,
Primary Balancing Criteria (continued)					
Implementability	Not applicable	Technically feasible; may require additional administrative services	Technically feasible and most services are readily feasible	Technically feasible;	Technically feasible

information/study readily available; available

construction of

Services are

readily Administratively drainage trenches (to an Administratively

available

feasible estimated depth of 30 feasible; regulatory

feet) may require approval required to

Excavation services are innovative techniques deposit any excavated

readily available; soils and/or well

treatment ,services for Administratively cuttings on unit as

some COCs are feasible; regulatory contour material for cap

available; off-site approval required to

disposal is considered deposit excavated soils

available; on-site and/or well cuttings on

disposal is unit as contour material

currently unavailable for cap

Table 2-2. Comparative Analysis of Alternatives (continued)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation, Treatment, and Storage/Disposal	Alternative 3 Low Permeability Cap, Dewatering, Additional Monitoring, and Institutional Controls	Alternative 4 Low Permeability Cap, Additional Monitoring, and Institutional Controls	Alternative 5 Limited Action
Primary Balancing Criteria (continued)					
Cost	No additional costs	$215K With on-site disposal	$3,377K Capital cost: $69,579K	Capital cost: With RCRA cap and well points	1st year O&M: $0
(K= 1,000)					
1st year O&M:	$0	Capital cost:	$6,319K	Capital cost:	$3,240K
Capital cost:	With RCRA cap	1st year O&M:	for comparison only)		

(Total cost includes 30 years of O & M)

Total cost: $5,197K

1st year O&M: $1,031K

Total cost: 1st year O&M: $165K

PW: $2,591K

Total cost: $508,511K

(PW = Present Worth over 30-year period)

PW: $236,650K

Total cost: $29,049K

Total cost: $8,337K

PW: $16,708K

PW: $5,846K

With off-site disposal

Capital cost: $69,586K

1st year O&M: $0

Capital cost: $4,923K

Totalcost: $564,311K

PW: $288,862K

Total cost: $23,224K

PW: $13,403K

With RCRA cap and drainage trench

Capital cost: $2,825K

1st yearO&M: $1,031K

Total cost: $5,380K

PW: $4,004K

With low permeability cap (Cap option 1)

1st year O&M: $76K

With low permeability cap and drainage trench

Capital cost: $3,970K

1st year O&M: $1,031K

Total cost: $22,034K

PW: $12,208K

With low permeability cap (Cap option 2)

Capital cost: $2,946K

1st year O&M: $76K

Total cost: $5,531K

PW: $4,114K

With low permeability cap (Cap option 3)

Capital cost: $2,615K

1st year O&M: $76K

Total cost: $5,117K

PW: $3,761K

Table 2-2. Comparative Analysis of Alternatives (continued)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Excavation, Treatment, and Storage/Disposal	Alternative 4 Low Permeability Cap, Dewatering, Additional Monitoring, and Institutional Controls	Alternative 5 Low Permeability Cap, Additional Monitoring, and Institutional Controls
Modifying Criteria					
State Acceptance	The KDEP concurs with implementing Alternative 5 as an interim remedial action, consistent with the requirements of the Hazardous Waste Management Permit.				
Community Responsiveness Summary, no groups or organizations opposed the proposed interim remedial Acceptance	As indicated in Part 3 of this ROD, the action, Alternative 5.				

This modeling does not account for buried wastes which may potentially be in contact with water in the UCRS. Alternatives 4 and 5 would allow sufficient time to collect additional data and evaluate a final action. Long-term effectiveness and permanence will be fully addressed when a final remedial action for SWMU 2 is evaluated and selected.

Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternative 3 would meet this criterion; mobility of contaminants would be reduced as a result of excavation; and toxicity would be reduced through treatment. Alternative 4 would not meet this criterion; although mobility would be significantly reduced as a result of dewatering. Alternative 5 would not meet this criterion either, although mobility of contaminants in the unsaturated/vadose zone would be reduced as the cap reduces infiltration. This criterion will also be addressed when a final action for SWMU 2 is evaluated and selected.

Short-Term Effectiveness

Alternative 3 would not meet this criterion; although appropriate safety measures would be utilized, excavation of wastes from SWMU 2 (including pyrophoric uranium) would produce significant risks to workers. Risks to ground water, surface water, and the environment would also be increased during implementation of Alternative 3. Alternative 4 would likely meet this criterion; utilization of appropriate safety measures during trench and cap installation should prevent significant risks to workers and the environment. Alternative 5 would meet this criterion; utilization of appropriate safety

measures and best management practices (BMPs) would mitigate risks to workers and the environment during construction of the cap and installation of the monitoring wells and piezometers. None of the five alternatives would present significant risks to a nearby community.

Implementability

Alternative 3 would be implementable; although it is technically and administratively feasible, significant health and safety concerns exist. Alternative 4 would be feasible; innovation would be required to efficiently construct the drainage trenches to the proposed depth of 9.2 m (30 ft). Alternative 5 is readily implementable; it is technically and admimstratively feasible and the services required for implementation are readily available from a number of vendors/suppliers.

Cost

Estimated capital, 30-year O&M, and 30-year present worth costs for each alternative, including the options considered for the third, fourth, and fifth alternatives, are presented in Table 2-2.

State Acceptance

This interim remedial action will be initiated pursuant to the Interim Measure provisions of PGDP's Kentucky Hazardous Waste Management Permit issued by the KDEP. An RI Addendum, FS, and Proposed Remedial Action Plan, have been approved by the KDEP and the EPA. The KDEP concurs with this interim remedial action, consistent with the requirements of the Hazardous Waste Management Permit.

Community Acceptance

As indicated in Part 3 of this ROD, the Responsiveness Summary, no groups or organizations opposed this interim remedial action.

2.9 Selected Remedy

Based upon the evaluation of the alternatives utilizing the nine CERCLA criteria, the remedy which best meets the threshold, balancing, and modifying criteria for the scope and objectives of this interim action is Alternative 5. This alternative has been refined through a series of negotiations and meetings between the DOE, the EPA, and the KDEP from that presented in the approved FS. The modifications presented in the selected remedy will allow greater flexibility, expedited field investigation activities, and promote an incremental approach to implementation of the interim remedial action. The DOE will prepare a detailed design for this interim remedial action in accordance with the requirements specified in the Declaration of this ROD. The remedial design and remedial action phase activities for the interim action will be finalized following completion of additional investigative activities planned for SWMU 2. A schedule of remedial design activities is presented in the appendix of this ROD.

The selected remedy will consist of the following elements, at a minimum:

A low permeability, multilayered cap constructed over the areal limits of SWMU 2. The cap will be designed to direct rainfall away from the unit and inhibit infiltration

of precipitation into the unit. The cap will also serve as a physical barrier to inhibit direct contact with buried waste materials and soil contamination. The conceptual capping option may consist of compacted soil as contour material, a geosynthetic clay liner, a geomembrane liner, and a drainage layer with a vegetative soil cover.

A ground water monitoring program implemented in the uppermost aquifer, the RGA, to detect the potential release of contaminants from SWMU 2. The monitoring program will also evaluate the cap's effect(s) on the shallow ground water level in the UCRS and fill data gaps. Any waste soil generated during sampling and remedial action activities will be managed within the limits of SWMU 2 and placed on the unit as contour material for the cap. All other wastes [such as personal protective equipment (PPE)] will be initially containerized and managed at the PGDP in accordance with approved protocols.

Institutional controls implemented to further prevent access to SWMU 2. Deed restrictions may be utilized to ensure the DOE retains ownership of the property which SWMU 2 encompasses. Deed restrictions also may prevent future uses of the property which could result in the spread of contamination, such as installing wells or excavating. Since contaminants will remain in the unit following this interim remedial action, the DOE will conduct administrative reviews of the action and monitoring data no less than once every five years, at least until a final remedial action has been selected and/or implemented for SWMU 2.

This action will provide overall protection of human health and the environment. It also can be implemented in compliance with ARARs. This interim action will provide effectiveness until a final remedy is enacted at SWMU 2. Although treatment will not be employed, contaminant mobility will be reduced as a result of reduced infiltration. This alternative will provide short-term effectiveness and may be readily implemented. As

shown in Table 2-3, the total estimated cost for this alternative and cap option is 55,117,000 (present value of $3,761,000).

Table 2-3. Cost Estimates for Interim Action

Direct Costs	$1,184 K	
Indirect Costs	$1,431 K	
Total Capital Costsa		$2,615 K
O&M Costsa Year 1	$76 K	
O&M Costs Years 2-30	$1,350 K	
5-Year Review Costs	$54 K	
Total O&M Costs		$1,480 K
Total Contingencyb		$1,022 K
Total Costc		$5,117 K
Present Valued		$3,761 K

K = 1,000

a - Capital costs for cap only; monitoring well and piezometer capital costs incorporated into first year O&M.
b - Total contingency is conclusive of direct, indirect, and all O&M costs associated contingencies.
c - Cost estimates intended to be consistent with EPA guidance which recommends a +50% to -30% level of accuracy.
d - Present value estimates based on a 30-year time span with a 7% discount rate.

2.10 Statutory Determinations

This interim action is protective of human health and the environment; complies with CERCLA [as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA)], statutory requirements of K.R.S. 224.46-530 and federal and state ARARs directly associated with this action; and is cost effective. This action uses permanent solutions to the maximum extent practicable, given the limited scope of the action. Because this action does not constitute the final remedy for SWMU 2, the statutory preference for remedies employing treatment that reduces toxicity, mobility, or volume through treatment as principal elements will be addressed at the time of selection of the final response action. Subsequent actions are planned to fully address the principal threats posed by SWMU 2.

Overall Protection of Human Health and the Environment

The selected interim action contributes to protection of human health for the PGDP employees and the public through institutional controls to limit the potential for direct exposure and engineering controls to mitigate the infiltration and migration of

contaminants from SWMU 2 until a final action is selected and implemented. The remedy provides effective management of all residual wastes generated during implementation of the action.

Applicable or Relevant and Appropriate Requirements

Congress specified in Section 121 of CERCLA that remedial actions for cleanup of hazardous substances must comply with requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are applicable or relevant and appropriate to the hazardous substances or circumstances at a site. Inherent in the interpretation of ARARs is the assumption that protection of human health and the environment is ensured.

The following is an explanation of the terms used throughout this section:

Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" (40 C.F.R. 300.5).

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to

a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" 140 C.F.R. 300.5).

Chemical-specific requirements are usually "health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values" (53 Fed. Reg. 51437, 1988). These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment.

Location-specific requirements "generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" (53 Fed. Reg. 51437, 1988). Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-specific requirements are usually "technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes or requirements to conduct certain actions to address particular circumstances at a site" (53 Fed. Reg. 51437, 1988). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals.

The CERCLA requires that the RCRA and other environmental laws be evaluated as ARARs [42 U.S.C.A. 9621(d)(2)(A)' and 40 C.F.R. 300.430(f)(1)(i)(A)]. This in no way limits, takes away, or negates the KDEP's RCRA authority at the PGDP.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, if a requirement is not applicable it must be both relevant and appropriate for compliance to be necessary. In the cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, CERCLA 121(d)(4) provides several ARAR waiver options that may be invoked, providing that the primary requirement for protection of human health and the environment is met.

Pursuant to CERCLA 121(e), remedial actions under CERCLA conducted entirely onsite (as defined in 40 C.F.R. 300.5) must comply with the substantive provisions of laws and regulations, but are exempt from the procedural or administrative requirements [42 U.S.C.A. 962(e)(1)]. In order to ensure that CERCLA response actions proceed as rapidly as possible, the EPA has affirmed its position on permit and administrative exemptions in the final NCP (40 C.F.R. 300). Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements facilitate their implementation (e.g., permit applications and procedural requirements).

Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing CERCLA remedies. In addition, ARARs do not exist for every chemical or circumstance likely to be found at a CERCLA site. Therefore, the EPA believes it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would

not otherwise be considered a potential ARAR (55 Fed. Reg. 8745, 1990). Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. This other information is to be considered (TBC) guidance and may be used when developing CERCLA remedies. The TBC guidance generally falls within three categories: (1) health effects information; (2) technical information on how to perform or evaluate investigations or response actions; and (3) policy.

Response actions under the NCP will comply with the provisions for response action worker safety and health in 29 C.F.R. 1910.120 (40 C.F.R. 300.150). These regulations are designed to protect the safety and health of workers; however, they are not considered ARARs. Requirements, standards, and regulations of the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.) and of state laws, not directly referenced in Section 300.150 of the NCP must also be complied with where pertinent. Federal Occupational Safety and Health Administration requirements include, among other things, construction standards, general industry standards, and general duty requirements (40 C.F.R. 300.150). In addition, Section 300.150 of the NCP specifies that all government agencies and private employers are directly responsible for the health and safety, of their own employees.

The DOE, in DOE Order 5480.4, Environmental Safety and Health Standards, establishes requirements for mandatory environmental protection, safety, and health standards for all DOE and DOE contractor operations while providing a list of references and sources of Environmental Safety and Health standards. This is an internal standard for the protection of workers within the DOE and is not an ARAR. The DOE Order should be followed during design, construction, operation, modification and decommissioning.

In addition to establishing general occupational protection standards, the DOE establishes standards for occupational radiation protection of workers at its facilities in 10 C.F.R. 835. Pursuant to this regulation, exposure of general employees resulting trom the DOE activities, other than planned special exposure or emergency exposure situations, shall be controlled so the following annual dose limits are not exceeded: total

effective dose equivalent of 5 rems; the sum of the deep dose equivalent for external exposures and the committed dose to any organ or tissue other that the lens of the eye of 50 rems; a lens of the eye dose equivalent of 15 rems; and a shallow dose equivalent of 50 rems to the skin or to any extremity. Again, DOE Orders pertaining to worker protection are internal standards and are not ARARs.

Potential chemical-, location-, and action-specific requirements which exist for this interim action are described in the following paragraphs.

Chemical-specific applicable or relevant and appropriate requirements

Radiation Protection of the Public and the Environment, DOE Order 5400.5, limits radiation exposure to members of the public to an effective dose equivalent of less than 100 millirems/year (mrem/yr) from all exposure modes and a dose of less than 5 mrem/yr to any organ. The Order regulates exposure of the public as a consequence of all the DOE activities, including routine activities, remedial actions, and naturally occurring radionuclides released by the DOE processes and operations. In addition, this Order mandates that the DOE personnel and contractors shall strive to ensure that radiation

doses to members of the public are as low as reasonably achievable below the appropriate limits. The DOE Order 5400.5 is TBC guidance for the radioactive waste that is left in place at SWMU 2. However, this Order is expected to be promulgated in the Code of Federal Regulations (C.F.R.) in August 1995 and will become an applicable requirement for the PGDP upon promulgation.

On-site activities involved with construction of the cap such as site grading and smoothing, earthmoving, and material stockpiles (i.e., clay, soil, etc.) will produce airborne pollutants. It is not expected that any radionuclide emissions will result from the site preparation of SWMU 2. However, if radionuclide emissions were to occur, emission standards for DOE facilities would apply. The regulations promulgated pursuant to the Clean Air Act of 1970 (CAA) set emission standards for radionuclides other than radon from the DOE facilities. The DOE is required to ensure that emissions from its 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 (40 C.F.R. 61.92). The regulations in 40 C.F.R. 61.92 are applicable requirements to DOE facilities. Also, Radiation Protection of the Public and the Environment, DOE Order 5400.5, and Radioactive Waste Management, DOE Order 5820.2A, which are TBC Guidance, refer to the CAA for emission level standards for radionuchdes.

Location-specific applicable or relevant and appropriate requirements

No wetlands have been identified in the area of the proposed action. However, potential wetlands have been identified in adjacent drainage ditches. These ditches run east and west parallel to Virginia Avenue, and north and south parallel to the access road east of SWMU 3. Final wetland determination for these areas was not possible due to health and safety restrictions denying access to any ditches located on the PGDP. Consequently, for the purposes of this section, these areas are considered to be wetlands. Therefore, location-specific ARARs pertaining to wetlands are included in the event these areas are identified as wetlands in the future. Also, a functions and values analysis of these wetlands was completed to assess these areas in their present condition for possible ARAR purposes should they be identified as wetlands in the future.

Although all ARARs discussed in this section are applicable, they will be met by avoidance of the resources. However, if impacts become apparent, due to construction or other plan modifications, additional requirements (e.g., final wetland determination

and meeting ARARs) will need to be addressed and/or initiated to comply with the ARARs.

Construction of the cap must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990, 40 C.F.R. 6.302(a), 40 C.F.R. Part 6; Appendix A, and 10 C.F.R. Part 1022].

Construction in wetlands should be avoided unless there are no practicable alternatives [40 C.F.R. 6.302(a)]. Degradation or destruction of wetlands must be avoided to the extent possible [40 C.F.R. 230.10 and 33 U.S.C.A. 1344(b)(1)]. Considerations about protection of wetlands must be incorporated into planning, regulating, and decision-making [10 C.F.R. 1022.3(b)]. Any action involving the discharge of dredged or fill material into wetlands must be avoided to the extent possible (33 U.S.C.A. 1344, 40 C.F.R. Part 230, and 33 C.F.R. Parts 320 to 330).

Discharges of dredged or fill material for which there are practicable alternatives with fewer adverse impacts, or those which would cause or contribute to significant degradation, are prohibited [40 C.F.R. 230.10(a)]. Discharges are also prohibited unless there are no practicable alternatives, and practicable, appropriate mitigation methods are available [40 C.F.R. 230.10(d)]. Further, 40 C.F.R. 230.10(b) prohibits discharges that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 U.S.C.A. 1317), or jeopardize threatened or endangered species or their critical habitat under the Endangered Species Act (16 U.S.C.A. 1531, et seq.). If it becomes apparent that impacts to wetlands are unavoidable, due to construction plans or other modifications, the specific requirements of 33 C.F.R. 330 (nationwide permits), or 33 C.F.R. 325 (processing of general permits), and statutes governing discharges of dredged or fill material into waters of the United States would become applicable.

Action-specific applicable or relevant and appropriate requirements

On-site construction activities involved with the construction of the cap, such as site grading and smoothing, earthmoving, and material stockpiles (i.e., clay, soil, etc.) will produce airborne pollutants. Although SWMU 2 is well within the DOE property boundary, precautions must be taken to prevent particulate emission levels caused by construction activities from exceeding the Kentucky Air Quality regulations found in 401 K.A.R. 63:010 et seq. The Kentucky Air Quality regulations contain general standards of performance governing fugitive dust emissions (401 K.A.R. 63:010 et seq.). Most roads leading to SWMU 2 are asphalt or concrete and traffic would not create dust; however, in the event that roads made of dirt or gravel were used, the regulations in 401 K.A.R. 63:010 3(1) require the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust. Visible fugitive dust must not be discharged beyond the property line of where the dust originated [401 K.A.R. 63:010 3(2)]. Additionally, all open bodied trucks which operate outside the property boundary and which may emit materials that could be airborne must be covered [401 K.AR. 63:010 3(4)]. This regulation would be applicable.

Storm water discharges from construction activities onsite at the PGDP will be regulated by the KPDES Permit (KY00004049) established pursuant to 401 K.A.R. 5:055. Remedial activities will generate storm water runoff from SWMU 2 into Outfall 015 which is regulated by the KPDES Permit. The PGDP is exempted from the Kentucky General Permit for Storm Water Point Sources (KYR 100000) under 401 K.A.R. 5:055 because it has an individual KPDES Permit. Pursuant to 401 K.A.R. 5:055, the PGDP's KPDES

Permit specifies that BMPs and sediment and erosion controls be implemented at a site to control stormwater runoff.

The interim remedial action may involve the installation of monitoring wells which are regulated under 401 K.A.R. 6:310 13. Under this regulation, monitoring wells must be installed to maintain existing natural protection against the introduction of pollutants into aquifers and to prevent the entry of pollutants through the borehole [401 K.A.R. 6:310 13(2)]. In addition, the well shall be constructed to prevent the intermingling of ground water from different aquifers [401 K.A.R. 6:310 13(2)].

Pursuant to 401 K.A.R. 6:310 13, the appropriate materials for the purpose of the well shall be used during the construction of monitoring wells. In order to prevent pollution of the ground water samples, the annular space above the sampling depth shall be

sealed with a suitable material, such as cement grout or bentonite [401 K.A.R. 6:310 13(3)]. Also, the well shall be completed at least four inches above the ground level or have a waterproof flush mount device capable of preventing surface water runoff, pollutants and contaminants from entering the well [401 K.A.R. 6:310 13(3)]. The well shall also have a locking cap within 30 days of its construction [401 K.A.R. 6:310 13(3)]. Lastly, monitoring wells must be properly abandoned within 30 days of the last sampling date or upon the determination that the well is found to be inadequate [401 K.A.R. 6:310 13(6)]. The Kentucky regulations for monitoring well construction are applicable to the well installation involved with this interim remedial action.

This interim remedial action will generate a minimal amount of waste. The waste generated from the installation of the two piezometers and ground water monitoring wells will likely be managed within the operable unit and placed on SWMU 2 as part of the low permeability, multilayered cap. However, there is a remote possibility that PPE worn by workers during site preparation and construction activities would be determined to be hazardous or radioactively contaminated waste. The remaining ARARs in this section will only apply in the event that PPE is determined to be RCRA hazardous or in the event that soil is not managed inside of SWMU 2 and is determined to be RCRA hazardous.

Although the waste will be left in place and capped, there may be excess soil and PPE from site grading and smoothing and from well installation that will need to be managed and ultimately disposed. Regardless of the amount, the excess waste will be stored in accordance with applicable ARARs. The PPE and any soil not placed in the cap will be characterized to determine if the waste is RCRA hazardous 401 K.A.R. 34:020 4 and/or radioactive. If the excess material is hazardous, then it will be containerized and stored onsite or shipped offsite for treatment or disposal.

Pursuant to 401 K.A.R. 32:030 5, on-site accumulation of hazardous waste may occur for 90 days or less without being placed in a RCRA permitted storage area, if the waste is placed in containers that comply with 401 K.A.R. 35:180. The regulation requires that containers holding the waste be in good condition (401 K.A.R. 35:180 2). Also, the waste must be stored in containers lined with materials that are compatible (401 K.A.R. 35:180 3). Furthermore, containers must be managed to ensure that: the containers are always closed during storage, except when necessary to add or remove waste; containers are not opened, handled, or stored in any manner which may rupture the container or cause it to leak; and the containers are labeled with the notation "Hazardous Waste" and the date upon which the accumulation began (401 K.A.R. 35:180 4). Also, inspections must be conducted at least weekly to determine if there are leaks or deterioration of the containers (401 K.A.R. 35:180 5). These selected requirements in 401 K.A.R. 35:180 are applicable to the management of hazardous waste

stored onsite for less than 90 days if any RCRA hazardous waste is derived from this action.

Only a remote possibility exists that excess soils and PPE would be contaminated with ignitable, reactive, or incompatible waste that would need to be managed. If such wastes are excavated during this remedial action, special precautions must be taken when managing ignitable, reactive, or incompatible wastes. Containers holding ignitable or reactive waste must be located at least 15 m (49 ft) from the facility's property line (401 K.A.R. 35:180 6). In addition, potentially incompatible wastes (as defined in 401 K.A.R. 35:030) must not be placed in the same container or be placed in an unwashed container

that previously held an incompatible waste, unless there is compliance with 401 K.A.R. 35:020 8 (2) [401 K.A.R. 35:180 7(1)-(2)]. Lastly, a container holding hazardous waste that is incompatible with any waste or other materials stored nearby must be separated from the other materials by means of a dike, berm, wall, or other device [401 K.A.R. 35:180 7(3)]. These requirements apply when ignitable, reactive, or incompatible waste is stored onsite for less than 90 days.

If waste is accumulated onsite for more than 90 days, it will be stored in a permitted facility and the requirements in 401 K.A.R. Chapter 34 and the permit requirements in Chapter 38 would apply. However, on-site accumulation of as much as 55 gal of hazardous waste or one quart of acutely hazardous waste may occur for more than 90 days, provided 2, 3, and 4(1) of 401 K.A.R. 35:180 are followed and the containers are marked with the notation "Hazardous Waste" [401 K.A.R. 32:030 5(3)(a)]. These requirements are applicable to on-site storage of hazardous waste for more than 90 days.

Radioactive Waste Management, DOE Order 5820.2A, establishes policies, guidelines, and requirements by which the DOE manages its radioactive and mixed waste and contaminated facilities. The Order ensures that radioactive and mixed wastes shall be managed in a manner which protects the health and safety of the public, DOE employees, contractor employees, and the environment. This Order requires a standard that assures that external exposure to the waste and concentrations of radioactive material which may be released into surface water, ground water, soil, plants, and animals results in an effective dose equivalent that does not exceed 25 mrem/yr to any member of the public. If excess soils and PPE derived from the installation of the low permeability, cap and monitoring wells are determined to be radioactively contaminated or mixed waste, this Order would be TBC guidance for the management of those materials. The external exposure limits of this Order would be TBC guidance for the radioactive waste left in place.

The DOE Order 5820.2A applies to the management of LLW and the design, operational, and monitoring requirements for disposal of solid LLW containing no RCRA-regulated materials. The Order specifies that waste must not be pyrophoric. Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable. While there is only the slightest possibility that pyrophoric material will be excavated for well installation, the DOE Order 5820.2A would be TBC guidance were such material encountered.

Contaminated PPE from site preparation activities or any soil not placed atop SWMU 2 may be determined to be RCRA land disposal restricted. Pursuant to 401 K.A.R. 37:050 and 40 C.F.R. 268.50, the storage of hazardous wastes restricted from land disposal under 401 K.A.R. 37:030 is prohibited, unless the generator stores such wastes in tanks, containers, or containment buildings onsite solely for the purpose of accumulating such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal. Such storage must be in compliance with the requirements in 401 K.AR. 32:030

5 and 401 K.A.R. Chapter 34. Furthermore, each container must be clearly marked wit the identification of its contents, the date each accumulation period began, and the quantity of each hazardous waste (401 K.A.R. 37:050). These regulations apply to the management of hazardous wastes prohibited from land disposal that are stored onsite. The PGDP has a Part B Permit which abides by these standards.

Movement of residuals containing RCRA characteristically hazardous waste and/or

mixed waste that are land-disposal restricted outside of SWMU 2 may trigger the land disposal restrictions (LDRs) documented in 401 K.A.R. 37:030. The DOE and the EPA entered into a Federal Facility Compliance Agreement (FFCA) Docket No. 92-03-FFR on June 30, 1992, to allow for the continued storage of radioactive mixed waste containing an LDR-prohibited hazardous waste component while treatment capacity is being develeped. The FFCA governs all wastes generated at the PGDP. The LDR requirements will only apply to restricted waste not managed within SWMU 2. In the unlikely event LDR waste is generated from this interim action and managed outside SWMU 2, the waste will be subject to and managed consistent with the FFCA.

A summary of ARARs for this remedial action is presented in Table 2-4.

Cost Effectiveness

This interim remedial action employs a remedy which provides overall effectiveness to prevent further spread of contamination while being proportional to its cost. The action represents the least expensive alternative to reduce surface water infiltration from precipitation and future migration of the contaminants while a final remedy is being devised. Compared to other cap options, such as the RCRA cap, this particular cap is the most cost effective.

Utilization of Permanent Solutions and Alternative Treatment Technologies

The objectives for this interim action are to stabilize the site by instituting the cap to reduce infiltration of leachate through unsaturated waste and to delay the potential breakthrough of uranium to the RGA. With the use of institutional controls, this remedial action should protect human health and the environment. However, since the waste is left in place, the interim remedial action does not fully address the principal threats to human health and the environment posed by this unit. Therefore, the principal threats posed by the current conditions will be fully addressed when a final action for SWMU 2 is evaluated and selected.

Reduction of Toxicity, Mobility, or Volume through Treatment

This remedial action is expected to reduce the mobility of unsaturated wastes at the unit. The volume of water infiltrating through the unit will be significantly reduced as a result of the multilayered cap. Since the waste is not treated or removed, neither the toxicity nor the volume of the waste left in place will be reduced under this interim remedial action. This criterion will be addressed fully when a final action for SWMU is evaluated and selected.

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action

Title 401
Actions Requirements Prerequisites
Federal K.A.R.,

Citation Citation

CHEMICAL-SPECIFIC

Protection of the general
by the general DOE Order
public from all sources of
all sources of ra- 5400.5
radiation
exposure at a DOE fa-

guidance for the

place

General public must not receive an effec-

tive dose equivalent greater than 100

mrem/yr or 5 mrem/yr to any organ from

all exposure modes.

Dose received

public from

diation

cility - TBC

waste left in

radioactive mate- DOE Order

DOE activities - 5400.5

for the waste

All releases of radioactive material

must be ALARA.

Release of

rial from all

TBC guidance

left in place

Emission Standards
radionuclides 40 CF.R.

radon from DOE 61.92

applicable if con-

activities at the site

airborne pollutants -

5820.24A and DOE

would also be TBC

this requirement

Emissions from DOE facilities shall not

cause members of the public to receive,

in any year, an effective dose equiva-

lent of 10 mrem/yr.

Emissions of

other than

facilities -

struction

produce

DOE Orders

Order 5400.5

guidance for

Table 2-4. Applicable or Relevant and Appropriate

Requirements

and To Be Considered Guidance for the Interim Remedial Action

(continued)

Title 401

Actions

Requirements

Prerequisites

Federal

K.A.R.,

Citation

Citation

LOCATION-SPECIFIC

Protection of wetlands			
Any federal action that will have an impact on wetlands - applicable if avoidance is not accomplished		10 C.F.R. 1022; Executive Order 11990; 40 C.F.R. 6:302 (a)	Avoid or minimize adverse impacts on wetlands to preserve and enhance their natural and beneficial values.
Any action involving discharge of dredged or fill material into wetlands - applicable if avoidance is not accomplished		40 C.F.R. 230.10; 33 U.S.C.A. 1344 (b)(1)	Avoid degradation or destruction of wetlands to the extent possible.
Any federal action that will have an impact on wetlands - applicable if avoidance is not accomplished		10 C.F.R. 1022.3(b)	Incorporate considerations about protection of wetlands into planning, regulating, and decisionmaking.

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action (continued)

Prerequisites	Actions	Federal Citation	Requirements K.A.R., Citation	
Any action involving discharge of dredged or fill material into wetlands - applicable if avoidance is	Discharge of dredged or fill material into waters of the United States	40 C.F.R. 230.10(a)	Discharges for which there are practicable alternatives with fewer adverse impacts or those which would cause or	

			contribute to significant degradation are prohibited.
Any action involving discharge of dredged or fill material into wetlands - applicable if avoidance is not accomplished		40 C.F.R. 230.10(d)	Significant degradation is also prohibited unless there are practicable alternatives and practicable, appropriate mitigation methods are available.
Any action involving discharge of dredged or fill material into wetlands - applicable if avoidance is not accomplished	16 U.S.C.A. 153	40 C.F.R. 230.10(b); 33 U.S.C.A. 1317;	Discharges which cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions, or jeopardize threatened and endangered species under the Endangered Secies Act.
Any action involving discharge of dredged or fill material into wetlands - applicable if avoidance is not accomplished	33 C.F.R. 32	33 U.S.C.A. 1344; 33 C.F.R. 330;	Unavoidable discharges can be permitted with a general or nationwide Section 404 Permit.

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401 Prerequisites	Actions Citation	Federal Requirements Citation	K.A.R.,

ACTION-SPECIFIC

Site preparation Handling, processing, construction, road grading, stockpiles, and land clearing activities applicable if it is determined that airborne dust will reach the plant fence	63:010 3	Although SWMU 2 is well within the plant boundary, precautions must be taken to prevent particulate matter from becoming airborne.
	63:010 3 (1)(a); 63:010 3 (1)(b)	A responsible party must: Use water or chemicals to control dust from construction activities and place asphalt, oil, water, or suitable chemicals on roads and material stockpiles to control dust;
	63:010 3(2)	Ensure that no visible fugitive dust is emitted beyond the property line; and
	63:010 4(1)	Ensure that all open bodied trucks are covered if any materials in truck could become airborne.
Surface water control Construction activities at industrial sites where stormwater runoff would occur-applicable	5:055	Implement good site planning and best management practices to control storm water discharge; comply with storm water runoff requirements of KPDES Permit KY0004049.

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401

Actions	Requirements	Prerequisites	Federal Citation	K.A.R., Citation
Well installation	Wells must be installed to:			
Construction or modification of a monitoring well - applicable				
	Maintain the existing natural protection against pollutants into the aquifer;			6:310 13(2)
	Prevent the entry of pollutants through the bore-hole; and			6:310 13(2)
	Prevent the intermingling of ground water from different aquifers.			6:310 13(2)
Construction or modification of a monitoring well - applicable	Certain construction requirements shall be followed, such as:			
	The annular space shall be sealed with cement grout or bentonite;			6:310 13(3)
	Completed at least 4 inches above the ground or have a waterproof mount device; and			6:310 13(3)
	Have a locking well cap within 30 days of its construction.			6:310 13(3)
	Wells should be properly abandoned within 30 days of the last sampling date or the determination is made that the well is unsuitable for use as a monitoring well.			6:310 13(6)
Waste management *	Generators of waste shall determine if it is RCRA hazardous.		40 C.F.R. 262.11	32:010 2
Generation of waste material - applicable				

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401 Prerequisites	Actions Federal Citation	Requirements K.A.R., Citation
Container storage (onsite) - for less than 90 days *		Containers of hazardous waste must be:
Storage of RCRA hazardous waste (listed or characteristic) not meeting small quantity generator criteria held for a temporary period before treatment, disposal, or storage elsewhere, in a container (i.e., any portable device in which a material is stored, transported, disposed, or handled). A generator who accumulates or stores hazardous waste onsite for 90 days or less in compliance with 40 C.F.R. 262.34 (a)(1-4) is not subject to RCRA interim or final status storage requirements - applicable to any excavated soil and PPE identified as RCRA hazardous waste	40 C.F.R. 265.171	Maintained in good condition; 35:180 2
	40 C.F.R. 265.172	Compatible with hazardous waste to be stored; and 35:180 3
	40 C.F.R. 265.173(a)	Closed during storage (except to add or remove waste). 35:180 4(1)
	40 C.F.R. 265.173Co)	Containers must not be handled, opened, or stored in any manner which may rupture the container or cause it to leak. 35:180 4(2)
	40 C.F.R. 265.174	Inspections must be conducted at least weekly to determine leaks or deterioration. 35:180 5
		Containers must be labeled with the

35:180 4(3)

notation "Hazardous Waste."

Table 2-4. Applicable or Relevant and Appropriate Requirements
and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401

Actions Requirements

Prerequisites Federal K,A.R.,

Citation Citation

Container storage (onsite) Containers holding hazardous waste Management of
ignitable, reac-
of ignitable, reactive or must be managed so that: tire or
incompatible waste - ap-
incompatible waste for plicable if any
excavated soil or
less than 90 days. * Containers are located at least 15 PPE is determined
to be ignit- 40 C.F.R. 35:180 6
meters from the property bound- able, reactive, or
incompatible 265.176
ary; and waste

Incompatible waste are not placed
40 C.F.R. 35:180 7(1)
in the same container or placed in
265.177(a
an unwashed container that pre-
viously held an incompatible
40 C.F.R. 35:180 7(2)
waste.
265.177(b

Table 2-4. Applicable or Relevant and Appropriate Requirements
and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401

Actions Requirements

Prerequisites Federal K.A.R.,

Citation Citation

Waste management * Storage of hazardous waste in RCRA permitted storage area KY 8-890-008-982	32:030 5(3)(a)	HSWA Permit	Kentucky Permit KY 8-890-008-982	Must follow tile RCRA permit for on-site storage more than 90 days.
Accumulation of hazardous waste				Hazardous waste may be accumulated for more than 90 days for as much as 55 gallons of hazardous waste or one quart of acutely hazardous waste.
Management of LLW - TBC Guidance if excavated soil and PPE is determined to be radioactively contaminated		DOE Order 5820.2A		Radioactive and mixed waste shall be managed in a manner which assures the health and safety of the public, the DOE, contractor employees, and the environment.
Management of LLW - TBC Guidance if excavated soil and PPE is determined to be radioactively contaminated		DOE Order 5820.2A		External exposure to the waste and concentrations of radioactive material which may be released into surface water, ground water, soil, plants, and animals shall not result in an effective dose equivalent that exceeds 25 mrem/yr to any member of the public.
Management of LLW - TBC Guidance if excavated soil or PPE is determined to be pyrophoric		DOE Order 5820.2A		Pyrophoric materials contained in waste shall be treated, prepared, and packaged to be nonflammable.
Movement of LDR waste from one land disposal unit to another - applicable if LDR restricted waste is excavated from the unit		40 C.F.R. 268	37:030	Movement of residuals containing RCRA characteristic waste and radionuclides to another unit will trigger LDRs.

Table 2-4. Applicable or Relevant and Appropriate Requirements and To Be Considered Guidance for the Interim Remedial Action (continued)

Title 401 Prerequisites	Actions Citation	Federal Citation	Requirements K.A.R., Citation
Waste management (continued) *	Storage of RCRA restricted hazardous waste onsite - applicable to any excavated soil or PPE that is determined to be land disposal restricted hazardous waste	40 C.F.R. 268.50	37:050 The storage of hazardous waste restricted from land disposal is prohibited, unless the generator stores such wastes in tanks, containers, or containment buildings onsite solely for the purpose of accumulating such quantities of hazardous waste as necessary to facilitate proper recovery, treatment, or disposal.
	Container storage of LDR waste - applicable if any of the excavated soil or PPE is determined to an LDR waste	40 C.F.R. 268.50	37:050 Containers of land disposal restricted waste must meet other RCRA storage requirements in addition to being clearly marked with the identification of its contents, the date the accumulation began, and the quantity of each waste.
	Storage of radioactive mixed waste onsite - applicable if excavated soil or PPE is determined to be mixed waste	FFCA Docket No. 92-03-FFR	Continued storage of radioactive mixed waste containing an LDR prohibited hazardous waste component is allowed while treatment capacity is being developed.

* These ARARs will only apply if PPE is determined to be RCRA hazardous or excess soil is not managed within the unit.

RCRA listed as an ARAR is a requirement of CERCLA in ROD documentation. By doing this, it in no way limits, takes away, or negates the Commonwealth of Kentucky's RCRA authority at the site.

Permanent Remedy

This action is an interim remedial action. The DOE will collect additional data necessary to evaluate a final remedial action for SWMU 2. The final ROD for SWMU 2 may retain or replace portions or all of the actions conducted pursuant to this ROD. However, actions conducted pursuant to the ROD are not intended to be inconsistent with likely final remedial actions. The interim action defined in this ROD will reduce the threat to human health and the environment while additional characterization information is obtained to fill data gaps. Additional characterization will allow for the evaluation of a final remedy in the future.

2.11 Documentation of Significant Changes

The Proposed Remedial Action Plan for Interim Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 (DOE/OR/06-1315&D3) was made available for a 30-day public review and comment period May 31 through June 29, 1995. The Proposed Remedial Action Plan identified Alternative 5, a low permeability, multilayered cap, additional monitoring, and institutional controls, as the preferred alternative. No written or verbal comments were received during the 30-day public comment period; therefore, no significant changes to the remedy, as identified in the Proposed Remedial Action Plan, were necessary.

2.12 Five-Year Review

This interim action at SWMU 2 will be reviewed periodically until a final remedial action is selected in a ROD. The CERCLA requires remedial actions which result in hazardous substances, pollutants, or contaminants remaining at the site above levels that do not allow for unlimited use and unrestricted exposure, be reviewed no less often than once every five years after initiation of the selected remedial action. This interim remedial action will leave waste in place which will require restricted access; therefore, SWMU 2 will be reviewed no less than once every five years. In addition to the five-year review, the ground water data will be evaluated annually. The ground water monitoring program for SWMU 2 will be specified in the forthcoming sampling and analysis plan, which will be subject to review and approval by the EPA, the KDEP, and the DOE.

PART 3

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(b)(iv) and 117 (b) of CERCLA, as amended by SARA, which requires the DOE as "lead agency" to respond "...to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the Proposed Remedial Action Plan.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and has recommended an interim remedial action to mitigate leaching of COCs from the buried wastes while the DOE collects additional data to support evaluation of a final remedial action. As part of the remedial action process, a notice of availability regarding the Proposed Remedial Action Plan was published in The Paducah Sun, a major regional newspaper of general circulation. The Proposed Remedial Action Plan for Interim Action at Solid Waste Management Units 2 and 3 of Waste Area Group 22 (DOE/OR/06-1315&D3) was released to the general public May 31, 1995. This document was made available to the public at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A 30-day public comment period began May 31, 1995, and continued through June 29, 1995. The Proposed Remedial Action Plan also contained information which provided the opportunity for a public meeting to be held, if requested. No public meeting was requested.

Specific groups which received individual copies of the Proposed Remedial Action Plan included the local PGDP Neighborhood Council, Natural Resource Trustees, and the PGDP Environmental Advisory Committee. In addition, information regarding the proposed interim remedial action and copies of the Proposed Remedial Action Plan were made available during a public workshop which the DOE held July 13, 1995.

Public participation in the CERCLA process is required by SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide the DOE with information about the community preferences and concerns regarding the remedial alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process.

3.2 Community Preferences/Integration of Comments

The Proposed Remedial Action Plan clearly indicated comments could be issued to a local DOE representative, the Kentucky Division of Waste Management, or the EPA. Neither the DOE, the KDEP, nor the EPA received either verbal or written comments during the 30-day public comment period. In addition, no substantive comments were generated during the DOE's July 13, 1995, public workshop. Since no comments were received, modifications to this ROD have not been required to integrate public concerns.

Appendix

Remedial Design Schedule

<IMG SRC 0495235J>

<IMG SRC 0495235K>

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JEG.0595.02

PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 09/29/1997
Operable Unit: 12
ROD ID: EPA/541/R-97/076

Media: Soil,Sediment(s)

Contaminant: Polychlorinated biphenyls (PCBs), metals, radiological contamination, uranium

Abstract: The Paducah Gaseous Diffusion Plant (PGDP), located in western Kentucky, is an operating uranium enrichment facility owned by the United States Department of Energy (DOE). DOE leased the plant production facilities to the United States Enrichment Corporation (USEC) in July, 1993. The USEC contracts with Lockheed Martin Utility Services, Inc., to provide operation and maintenance services. Lockheed Martin Energy Systems, Inc., provides environmental restoration and waste management services for the PGDP under the DOE's environmental management program.The 28 areas of concern (AOCs) addressed in this remedy consist of concrete rubble and the surrounding soil. The concrete rubble is believed to have originated from the PGDP where it may have served as roadways, sidewalks, curbing, buildings, transmission tower bases, cylinder supports, and construction rubble. Most of the concrete material at the waste area group (WAG) 17 AOCs is currently used for a number of purposes, including bank and erosion control, dam and structural support, and roadway stabilization. However, some of the materials are simply isolated ruble piles. The WAG 17 AOCs are accessible to the public and have been classified as nonsecure. The AOCs are located within the boundaries of the DOE reservation, the Tennessee Valley Authority (TVA) Shawnee Steam Plant reservation, the Western Kentucky Wildlife Management Area (WKWMA), the Ballard County Wildlife Management Area (BCWMA), and on private

property immediately west of the DOE reservation.The AOCs within WAG 17 are located within the Ohio River floodplain in the BCWMA and the Bayou Creek watershed. Isolated rubble piles outside of the BCWMA are not connected to any water bodies. Rubble piles in the BCWMA are inundated by the Ohio River when large-scale flooding occurs.The Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for WAG 17 organized the WAG 17 AOCs into three categories for streamlined sampling purposes. Category 1 AOCs are those that demonstrated radiological contamination of concrete or soil during the previous investigations and which, because of the polychlorinated biphenyls (PCBs) and metals associated with plant activities, were also sampled. Category 2 AOCs have indicated no evidence of radiological contamination of concrete or soil during the previous investigations, but were possibly contaminated with PCBs and metals. Category 3 AOCs were not investigated as part of this study and will not be addressed in this ROD.The Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, used field screening and analytical laboratory data to determine the nature and extent of contamination of the WAG 17 AOCs. The nature and extent of radionuclides were determined for Category 1 AOCs and the extent of potential PCB and metal contamination was determined for both Category 1 and 2 AOCs.

Remedy: Waste Area Group 17 consists of 37 areas of concern (AOCs) that were identified as suspected sources of off-site contamination in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1207&D3; therefore, a remedial investigation was conducted. Based on the results of the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-140&D2, the DOE selected no further action as the remedy.

Text: Full-text ROD document follows on next page.

<IMG SRC 970760>

DOE/OR/06-1567&D1

Record of Decision for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

<IMG SRC 97076A>

September 1997

CERTIFICATION

Document Identification: Record of Decision for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1567&D1

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine
and imprisonment.

<IMG SRC 97076B>

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

CERTIFICATION

Document Identification: Record of Decision for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1567&D1

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine
and imprisonment.

<IMG SRC 97076C>

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility), including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), Lockheed Martin Energy Systems, Inc.'s, representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

DOE/OR/06-1567&D1

Record of Decision for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

September 1997

Prepared by
Jacobs EM Team
175 Freedom Boulevard • Kevil, KY 42053
Under Contract DE-AC05-93OR22028

Prepared for
United States Department of Energy
Remediation Management Group

PREFACE

This record of Decision for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1567&D1, was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act, the Resource Conservation and Recovery Act, and the Kentucky Revised Statutes Chapter 224, subchapter 46. This work was performed under Work Breakdown Structure 7.1.09.07.03.08 (Activity Data Sheet 5309). This document follows the outline for records of decision contained in the draft Federal Facility Agreement and the Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment, EPA/540/G-89/007. Publication of this document meets a primary document deliverable milestone for the United States Department of Energy's Remediation Management Group at the Paducah Gaseous Diffusion Plant. This document provides the record of information and rationale that the United States Environmental Protection Agency, the Kentucky Department for Environmental Protection, and the DOE utilized in the selection of no further action at Waste Area Group 17.

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ACRONYMS AND ABBREVIATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

ACO	Administrative Order by Consent
AOC	area of concern
BCWMA	Ballard County Wildlife Management Area
C.F.R.	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm	centimeter(s)
cm 2	square centimeters
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern

CSOU	comprehensive site operable unit
cpm	counts per minute
DOE	United States Department of Energy
dpm	disintegrations per minute
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
ft	foot (feet)
ft 3	cubic foot (feet)
FFA	Federal Facility Agreement
gal	gallon
HSWA	Hazardous and Solid Waste Amendments
K.R.S.	Kentucky Revised Statutes
KDEP	Kentucky Department for Environmental Protection
km	kilometer(s)
KOW	Kentucky Ordnance Works
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter
m	meter(s)
m 3	cubic meter(s)
mgd	million gallons per day
NaI	sodium iodide
OU	operable unit
PCB	polychlorinated biphenyl
pCi/g	picocurie per gram
PGDP	Paducah Gaseous Diffusion Plant
ppm	parts per million
PRAP	proposed remedial action plan
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
TVA	Tennessee Valley Authority
USEC	United States Enrichment Corporation
WAG	waste area group
WKWMA	Western Kentucky Wildlife Management Area
yd 3	cubic yard(s)

PART 1

DECLARATION

DECLARATION FOR THE RECORD OF DECISION FOR WASTE AREA GROUP 17

SITE NAME AND LOCATION

Waste Area Group 17
Paducah Gaseous Diffusion Plant
United States Deparment of Energy
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for Waste Area Group (WAG) 17 at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. The remedy outlined in this document was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, the National Oil and Hazardous Substances Pollution Contingency Plan, and the Kentucky Revised Statutes (K.R.S.) Chapter 224, subchapter 46. This decision is based on the administrative record for this site.

With participation from the Kentucky Department for Environmental Protection (KDEP), both the United States Environmental Protection Agency (EPA) and the United States Department of Energy (DOE) entered into an Administrative Order by Consent (ACO) effective November 23, 1988. The ACO was drafted pursuant to Sections 104 and 106 of CERCLA, which provide authority for conducting remedial actions in response to releases of hazardous substances, pollutants, or contaminants. The PGDP was placed on the CERCLA's National Priorities List May 3 1994 (effective date June 30, 1994).

The DOE was issued a Kentucky Hazardous Waste Management Permit and an EPA Hazardous and Solid Waste Amendments of 1984 (HSWA) permit July 16, 1991. The KDEP portion of the Resource Conservation and Recovery Act (RCRA) permit was issued pursuant to Chapter 224 of the K.R.S. by authority granted from the EPA to the KDEP. The EPA issued its portion of the RCRA permit pursuant to the HSWA. The RCRA permits require the proper treatment, storage, and disposal of waste; corrective action (i.e., cleanup), closure of regulated units; and investigation of off-site contamination. The DOE is currently negotiating a Federal Facility Agreement (FFA) with the EPA and the KDEP to integrate the overlapping requirements of the CERCLA and the RCRA that apply to the PGDP. A draft of this FFA has been made available for public comment and the parties are now engaged in finalizing the agreement in light of comments submitted to them.

The EPA and the KDEP have participated in the development of this record of decision (ROD), including review and comment on the content of the document. The DOE and the EPA, with the concurrence of KDEP and the Commonwealth of Kentucky's Cabinet for Health Services Radiation Control Branch, have selected no further action for WAG 17.

DESCRIPTION OF SELECTED REMEDY: NO FURTHER ACTION

Waste Area Group 17 consists of 37 areas of concern (AOCs) that were identified as

suspected sources of off-site contamination in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paduca, Kentucky, DOE/OR/07-1207&D3; therefore, a remedial investigation was conducted. Based on the results of the Resource Conservation and

Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, the DOE selected no further action as the remedy for 28 of the 37 WAG 17 AOCs. The 28 AOCs that are selected for no further action are 103, 104, 110, 111, 112, 114, 115, 116, 117, 118, 119, 120, 121, 123, 124, 125, 126, 127, 128, 146, 147, 148, 149, 150, 151, 152, 184, and 197. The remaining nine AOCs will be transferred to WAG 25 (i.e., AOCs 93, 105, 106, 107, 108, 109, 113, and 175) and WAG 18 (i.e., AOC 129). The process that led the DOE to a no further action decision is consistent with the cleanup strategy for the PGDP, as outlined in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1207&D3. The Kentucky Hazardous Waste Management Permit (KY8-890-008-982) will be modified upon signature of this ROD by designating the previously mentioned 28 of the 37 AOCs of WAG 17 as no further action and including them in Appendix A-2 (Table A-5) of the permit. The remaining nine AOCs will be transferred into the listings for WAG 18 and WAG 25.

DECLARATION STATEMENT

The DOE, under federal authority, has eliminated a potential risk posed by WAG 17 by remediating AOC 124 through a removal action. The removal action began in July 1996 and was completed April 15, 1997.

Metals (e.g., lead) were detected at elevated concentrations in one sample at AOC 127; however, they will not be addressed under the DOE's Remediation Management Group. Area of Concern 127 is located on Western Kentucky Wildlife Management Area property. The detected metal concentrations are believed to originate from illegally dumped trash in the area and not from the PGDP. The EPA and the KDEP agree that the elevated metals detected did not originate from the WAG 17 concrete rubble or the PGDP. Consequently, AOC 127 is included in the no further action remedy.

No remedial action is necessary for protection of human health and the environment at WAG 17, and the CERCLA requirements are not triggered. Consequently, there is no need to evaluate the nine CERCLA criteria.

Under the no further action scenario, no additional action will occur at the WAG 17 AOCs. Also, no institutional controls or engineering controls will be implemented and there are no costs associated with implementing the no further action decision. This remedy will not result in hazardous substances remaining onsite above health-based levels; therefore, the five-year review requirement will not apply to WAG 17.

<IMG SRC 97076D>

PART 2

DECISION SUMMARY

DECISION SUMMARY

2.1 Site Name, Location, and Description

The Paducah Gaseous Diffusion Plant (PGDP), located in western Kentucky, is an operating uranium enrichment facility owned by the United States Department of Energy (DOE) (Figure 2-1). The DOE Leased the plant production facilities to the United States Enrichment Corporation (USEC) July 1, 1993. The USEC contracts with Lockheed Martin Utility Services, Inc., to provide operation and maintenance services. Lockheed Martin Energy Systems, Inc., provides environmental restoration and waste management services for the PGDP under the DOE's Environmental Management Program.

The 28 areas of concern (AOCs) addressed in this record of decision (ROD) consist of concrete rubble and the surrounding soil. The concrete rubble is believed to have originated from the PGDP where it may have served as roadways, sidewalks, curbing, buildings, transmission tower bases, cylinder supports, and construction rubble. Most of the concrete material at the WAG 17 AOCs is currently used for a number of purposes, including bank and erosion control, dam and structural support, and roadway stabilization. However, some of the materials are simply isolated rubble piles. The WAG 17 AOCs are accessible to the public and have been classified as nonsecure. The AOCs are located within the boundaries of the DOE reservation, the Tennessee Valley Authority (TVA) Shawnee Steam Plant reservation, the Western Kentucky Wildlife Management Area (WKWMA), the Ballard County Wildlife Management Area (BCWMA), and on private property immediately west of the DOE reservation (Figure 2-1).

2.2 Site History and Enforcement Activities

This section presents descriptions of the 28 AOCs of WAG 17, which are separated into groups based on the purpose of the rubble piles. The information provided in this section was derived from the PGDP Environmental Restoration Health Physics Special Purpose/Routine Radiological Survey Results (Survey No. 92-SP-317-S); the Preliminary Radiological Characterization of Ogden Landing Road Concrete Rubble Site, IT/NS-80-131; and the Results of the Site Investigation, Phase II, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/SUB/13B-97777C P-03/1991/1. This section also identifies any prior enforcement activities that have occurred at the 28 AOCs in this ROD. Map locations of the AOCs are presented in Figures 2-1 and 2-2.

The results of the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, are described in Section 2.6.3 of this ROD.

2.2.1 Bank Control and Erosion Control Grouping

Concrete material at AOCs 115, 116, 118, 127, 149, and 151 serves as bank and erosion control along bodies of water. The following information provides further details of the AOCs in this grouping.

<IMG SRC 97076e>

<IMG SRC 97076F>

- Area of Concern 115 is located in the TVA reservation along Little Bayou Creek and the Slough Dam, 305 m (1,000 ft) west of the old TVA ash disposal area. The material at this site is composed of concrete slabs, rubble with some steel, and conduit pipes, most of which appears to have originated from TVA activities. This material was placed on the southwest bank of Little Bayou Creek for bank support, channeling (for transport of the TVA ash-transport water), and also to serve as a levee for the "wetlands" slough. The approximate volume of rubble material is 764.1 m 3 (1,000 yd 3). Beta and gamma screenings at this AOC revealed no radiation above background levels.

- Area of Concern 116 is located in the TVA reservation on the north bank of Bayou Creek. The material at this site is composed of concrete rubble that was probably generated during PGDP road upgrades. The concrete is being used in an attempt to halt erosion at a minor tributary run-off ravine entering the creek. The approximate volume of the rubble is 22.9 m 3 (30 yd 3). Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 118 is located in the WKWMA at the Bayou Creek sampling station where West Boone Road meets Bayou Creek. The material at this site is composed of concrete rubble and slabs that likely originated from PGDP road construction. The concrete was placed on the bank above and below the sampling station to control erosion. The approximate volume of the concrete is 15.3 m 3 (20 yd 3). Radiation screening of the rubble found one slab of concrete with beta and gamma readings slightly above background levels. The slab was marked in the field with red paint.

- Area of Concern 127 is located in the WKWMA at a culvert on Gravel Pit Road, approximately 160 m (528 ft) north of Heath-Woodville Road. The material at this site includes concrete slabs that are believed to have originated from the PGDP. The concrete was used to control erosion at this

culvert. The volume of the concrete is approximately 7.6 m 3 (10 yd 3). Beta and gamma screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 149 is located within the BCWMA on a dam face at the west end of Happy Hollow Lake. The material at this site is composed of concrete slabs. The origin of this material is unknown. The concrete is used for erosion control on the dam face. The volume of concrete at the dam is approximately 11.5 m 3 (15 yd 3). Beta and gamma radiation screening revealed no radiation above background levels.

- Area of Concern 151 is located within the BCWMA at the dam on the west end of Mitchell Lake. The material at this site is composed of concrete slabs and rubble. The amount of concrete, if any, derived from the PGDP is unknown. The concrete is currently used to control erosion on the face of the dam. The total volume of the structure is approximately 2,292.5 m 3 (3,000 yd 3), of which an unknown amount is concrete rubble. Beta and gamma radiation screening revealed no radiation above background levels.

2.2.2 Dam and Structural Support Grouping

Concrete material at AOCs 103, 104, 112, 146, 147, and 150 currently is associated with dam construction and provides structural support. The following information provides further details of the AOCs in this grouping.

- Area of Concern 103 is located south of the DOE reservation boundary near the intersection of the PGDP entrance highway and Dykes Road. The material at this site is composed of concrete, soil, and gravel spoils from the construction of a cylinder storage yard south of the C-333 Process Building. It was used to construct a dam and create a fish pond in the WKWMA. The total volume of the dam is approximately 1,911.3 m 3 (2,500 yd 3) with concrete visible only at the northwest corner of the structure. Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 104 is located in the WKWMA at the south end of the fish pond referred to in the description of AOC 103. The material at this site consists of concrete spoils from an unknown source that is used as part of a levee for the pond. The volume of concrete is not known. Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 112 is located within the WKWMA at a dam on a second fish pond north of the DOE reservation. The AOC is composed of concrete slabs that partially originate from the PGDP road upgrades. The dam appears to be built of soil from the pond area with gravel and concrete rubble added for stability. The volume of concrete cannot be determined accurately due to the sporadic distribution of the concrete rubble and because it is nearly all underwater. Beta and gamma radiation screenings of the concrete above water showed no radiation above background levels.

- Area of Concern 146 is located in the BCWMA approximately 17.7 km (11 miles) west of the PGDP where a roadway crosses over a dam on Shelby Lake. The BCWMA headquarters are situated approximately 305 m (1,000 ft) to the east of the AOC. The material at this location is composed of concrete rubble with an unknown portion possibly originating from the PGDP. The concrete was used in construction of the dam and currently supports the dam face. The approximate volume of concrete at this AOC is 1,528.2 m 3 (2,000 yd 3). Elevated levels of beta radiation were measured during the screening at AOC 146. Alpha radiation scanning was also conducted, but no radiation above background levels was detected. The elevated beta radiation levels ranged from 12,000 to 70,000 disintegrations per minute (dpm)/100 cm 2. Areas with elevated radiation levels were smear tested in the field for transferable contamination, but none was detected.

- Area of Concern 147 is located within the BCWMA at Butler Lake Dam, which is located on the west end of Butler Lake. The dam is used to control the lake level and provide a roadway. The material at this site is composed of concrete rubble, which likely originates trom various sources, including the PGDP. The concrete was used in construction of the dam and now supports the dam face. The volume of the dam is approximately 1,529 m 3 (2,000 yd 3), with concrete rubble making up an indeterminate amount. Beta and gamma radiation screening of the concrete revealed no radiation above background levels at this AOC.

- Area of Concern 150 is located within the BCWMA at a dam on the west end of Caster Lake. The dam controls the lake level and provides part of a roadway. The material at this site is composed of concrete rubble with an unknown quantity, if any, originating from the PGDP. The concrete rubble was used to construct the dam and control erosion on the dam's face. The volume of the dam is approximately 2,293.5 m 3 (3,000 yd 3), of which an unknown fraction is concrete rubble. Beta and gamma radiation screening of the concrete at this unit revealed no radiation above background levels.

2.2.3 Bridge Support and Erosion Control Grouping

Concrete material at AOCs 114, 117, 119, 120, 121, and 128 is used for support and erosion control at bridges and culverts in WAG 17. The following information provides further details of the AOCs in this grouping.

- Area of Concern 114 is located on the TVA reservation north of the WKWMA boundary. The AOC is composed of concrete rubble from a PGDP source. The rubble is used for support and erosion control at a culvert bridge that crosses a small tributary of Little Bayou Creek. The approximate volume of concrete at this location is 30.6 m 3 (40 yd 3). Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 117 is located in the western part of the TVA reservation where a bridge crosses Bayou Creek. The material at this site consists of concrete rubble from a PGDP source. The rubble is used to control erosion around the bridge and to support the nearby creek bank. The approximate

volume of concrete at this location is 11.5 m 3 (15 yd 3). Beta and gamma screening of the concrete rubble found one piece with a reading of 90 cpm above background levels. The remainder of the concrete rubble had no radiation above background levels.

- Area of Concern 119 is located within the WKWMA outside the western boundary of the DOE reservation where a steel bridge crosses Bayou Creek. The material at this site appears to be demolished sidewalks that most likely originated from the PGDP. The concrete slabs have been placed along the creek banks underneath, upstream, and downstream of the bridge for erosion control. The approximate volume of concrete is 3.8 m 3 (5 yd 3). Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 120 is located on the DOE reservation at the north end of the C-611-Y Lagoon for the C-611 Water Treatment Plant. Specifically, the area involves the effluent ditch and the water line bridge. The material at this site consists of concrete slabs, rubble, and very large blocks [0.1 m 3 (4 ft 3)] from the PGDP that have been placed under the bridge and along the effluent ditch for erosion control. The approximate volume of the concrete is 7.6 m 3 (10 yd 3). Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 121 is located on the western edge of the DOE reservation where Rice Springs Road crosses one of the tributaries of Bayou Creek. The concrete rubble at this site is composed of slabs from the PGDP that now are used as an abutment of a condemned bridge. The concrete slabs were also used to construct a ford that replaced the condemned bridge. The approximate volume of concrete is 0.8 m 3 (1 yd 3). The concrete constituting the ford showed no radiation above background levels.

- Area of Concern 128 is located just inside the southern boundary of the DOE reservation near the crossing of South Acid Road with Bayou Creek. The material at this site consists of concrete slabs, gravel, and soil from a source assumed to be from within the PGDP. The concrete slabs are used for erosion control on creek banks underneath, upstream, and downstream of the bridge. A levee also exists north of the road and east of the creek and is composed of concrete slabs, gravel, and soil. There is approximately 15.3 m 3 (20 yd 3) of concrete at the AOC; however, this estimate should be considered a minimum, as it is difficult to estimate the amount of concrete in the levee. Beta, gamma, and alpha radiation screening revealed no radiation above background levels.

2.2.4 Roadway Stabilization Grouping

Concrete material at AOCs 126, 148, and 197 is used to stabilize roadways in the WKWMA and the BCWMA. The following information provides further details of the AOCs in this grouping.

- Area of Concern 126 is located in the WKWMA near the entrance road to the gravel pits. The gravel pits were a source of gravel for the former Kentucky Ordnance Works (KOW), the PGDP, and the WKWMA. Slabs of concrete

from an unknown source are visible on both sides of the entrance and may have been used to fill holes along the roadway. The approximate volume of concrete cannot be easily determined, but approximately 0.8 m 3 (1 yd 3) is visible. Beta and gamma radiation screening of the concrete and gamma radiation screening of the soil revealed no radiation above background levels.

- Area of Concern 148 is located within the BCWMA at the culverts near Burnt Slough, which is approximately 549 m (1,800 ft) south of the Ohio River. The material at this site is composed of concrete block rubble and it is unknown what fraction, if any, of this material is from the PGDP. Concrete block rubble is used at this location to stabilize the edge of the roadway. There appears to be approximately 15.3 m 3 (20 yd 3) of concrete rubble at this location. Beta and gamma radiation screening of the concrete revealed no radiation above background levels.

- Area of Concern 197 is located on private property north of the PGDP and the WKWMA on Bayou Creek. The concrete rubble serves as a roadbed at a low-water crossing of the creek. The rubble was placed at this location in the late 1980s. The concrete consists of 20 to 25 pieces within a 9.1 m x 15.2 m (30 ft x 50 ft) area. Some concrete pieces are partially submerged in the creek bed and others are located on the eastern bank of the crossing. The approximate total volume of concrete rubble at this AOC is 0.8 m 3 (1 yd 3). Radiological surveys (alpha, beta, and gamma) of accessible concrete surfaces above the water level of Bayou Creek found no radiation above background levels.

2.2.5 Isolated Rubble Piles Grouping

Areas of Concern 110, 111, 123, 124, 125, 152, and 184 consist of piles of concrete that have no specific purpose. The following information provides further details of the AOCs in this grouping.

- Area of Concern 110 is located approximately 61 m (200 ft) east of the PGDP security area but inside the DOE reservation on an abandoned construction road that once led to the C-337 Process Building. The concrete rubble is stored in piles on both sides of the roadbed and was generated from PGDP road upgrading projects. There is approximately 15.3 m 3 (200 yd 3) of concrete at this site. Beta and gamma radiation screening found radiation above background levels on expansion joint material that was still attached to various slabs of concrete. The average reading for this material was approximately 150 cpm above background levels. No radiation in the soil was detected above background levels.

- Area of Concern 111 is located inside the plant boundary and lies adjacent to the abandoned access road portion of Ogden Landing Road, which runs east to west through the DOE reservation and north of the PGDP area. The access road is abandoned and traffic use has been restricted by the dumping of concrete construction spoils at the east and west ends of the access road. Some of the concrete is from the PGDP and is in very large pieces that possibly were used as footing material for transmission towers. The approximate volume of the concrete is 1,146.8 m 3(1,500 yd 3). A detailed beta

and gamma radiation survey was conducted and surface soil samples taken at this AOC. The radiation survey was conducted on a 6 m (20 ft) grid pattern. Between the east and west areas, 28 grids were surveyed and it was concluded that 13 of the grids showed levels of radiation that exceeded Oak Ridge Operations Radioactive Contamination Control Policy for nonwork surface contamination in a nonradiological area (3,000 dpm/100 cm 2). Ten surface soil samples were taken along Ogden Landing Road. The surface soil samples contained concentrations of total uranium well below the reference concentration level of 30 pCi/g of total uranium for unrestricted access to off-site soil.

- Area of Concern 123 is located within the WKWMA, southwest of the PGDP near the intersection of South Acid Road and Rice Springs Road. It is a partially paved area in the former KOW that has received concrete from various PGDP areas and uranium hexafluoride tank supports (cylinder saddles) from the C-745-A Cylinder Yard. Other parties, such as the WKWMA, remove concrete from this site for their use. The volume of concrete at this AOC is approximately 382 m to 764 m 3 (500 to 1,000 yd 3). The beta and gamma radiation screening showed radiation above background levels only on the uranium hexafluoride storage tank supports. These readings ranged from 200 to 500 cpm from isolated areas on the supports. Those areas were marked with red paint.

- Area of Concern 124 is located within the WKWMA, 30.48 to 60.96 m (100 ft to 200 ft) directly south of AOC 123, near the intersection of South Acid Road and Rice Springs Road. The AOC is in an area where sidewalk slabs and other concrete rubble from the KOW and the PGDP have been placed. The approximate volume of concrete at the site is 15.3 m 3 (20 yd 3). During previous radiation screenings, a contaminated concrete pipe [30.5 cm inside diameter x 122 cm (12 inches inside diameter x 4 ft)] was found on the surface of the AOC. Survey readings from inside the pipe were 45,000 cpm above background levels. The pipe was removed from the site by PGDP personnel. Beta and gamma radiation screening of the concrete slabs and rubble showed no radiation above background levels. However, samples collected during the remedial investigation for WAG 17 indicated elevated levels of radionuclides in the soil. The DOE then performed a removal action during which the soil was excavated, placed in containers, and transported to a secured waste management area at the PGDP.

- The location of AOC 125 is in the WKWMA north of South Acid Road near the intersection of the road and the railroad spur leading to the PGDP. The materials at this site are comprised of rails, roadbed, and crossfies from the KOW and possibly the PGDP. Concrete curbs from parking areas in the PGDP have also been deposited along the road. Approximately 38 m 3 (50 yd 3) of railroad spoils and approximately 3.8 m 3 (5 yd 3) of concrete curbing are present at this location. Beta and gamma radiation screening of the concrete rubble found three areas with radiation above background levels. These areas are discrete rusty spots on the concrete, with readings of 2,500 cpm above background levels from one area and 250 cpm above background levels from each of the other two areas. The three areas were marked with red paint. Surveys of the soil found no radiation above background levels.

- Area of Concern 152 is located within the BCWMA near the east end of Mitchell Lake 610 m (2,000 ft) southwest of the curve on Kentucky State Highway 473. The site contains concrete rubble, used brick, and gravel that are being stored for future use at the BCWMA. An unknown fraction of this concrete rubble originates from the PGDP. The volume of waste is approximately 38.2 m 3 (50 yd 3). Beta and gamma radiation screening of the concrete revealed no radiation above background levels.

- Area of Concern 184 is located within the DOE reservation and south of the C-611 Water Treatment Plant. The AOC is composed of two chunks of concrete from an unknown source. The total volume of concrete is approximately 0.2 m 3 (0.2 yd 3). Beta and gamma radiation screening of the concrete revealed no radiation above background levels.

2.3 Highlights of Community Participation

A notice of availability was published in The Paducah Sun, a regional newspaper, July 25, 26, and 27, 1997, which announced the beginning of the 45-day public review period for the Proposed Remedial Action Plan for Waste Area Group 17 at the Paducah Gaseous Diffuslon Plant, Paducah, Kentucky, DOE/OR/06-1566&D2. The public comment period began July 26, 1997, and ended September 8, 1997. Specific groups that received individual copies of the proposed remedial action plan included the Natural Resource Trustees and the Site Specific Advisory Board.

2.4 Scope and Role of Operable Unit

The DOE's plan for addressing WAG 17 was to determine if any contamination was present at the AOCs. If contamination was present, the DOE determined whether it exceeded standards set for the protection of human health and the environment. The results of the investigation can be found in the Resourcc Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2.

In areas where previous walk-over surveys (i.e., during the site investigation) detected potential radiological contamination above background levels, concrete and soil sampling was performed to define the nature of the radiological activity. Radiation dose readings were also collected in these areas to ensure annual dose limits outlined in the DOE Order 5400.5, Radiation Protection of the Public and the Environment, were not exceeded. In addition to characterization of the sites for radionuclide contamination, samples were also collected to determine if polychlorinated biphenyls (PCBs) and/or metal contamination were present at suspected AOCs. Both of these contaminants are associated with past activities at the PGDP. The sampling ensured a thorough characterization of these AOCs and provided data from which the nature and extent of contamination could be determined.

2.5 Response Action and the Site Management Strategy

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. The DOE's proposed strategy is to divide the site into operable units (OUs) grouped by source areas and comprehensive site operable units (CSOUs) one each for ground water and surface water. Discrete response actions will be selected and implemented for each source area OU, as well as the CSOUs, which

are impacted by commingled releases from the source area OUs. Prioritization for investigation and possible remedial action has been assigned to each of the CSOUs (ground water and surface water OUs) and source area OUs depending on their potential for contributing to off-site contamination.

The identification, characterization, and, where necessary, removal of sources of contamination is consistent with the cleanup strategy for the PGDP as outlined in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1207&D3.

2.6 Summary of Site Characteristics

The following are descriptions of surface water for the PGDP and individual AOCs since it is the only suspected pathway for contamination movement in WAG 17.

2.6.1 Surface-Water Characteristics of the Paducah Gaseous Diffusion Plant Area

The sources for the following information are the Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III, KY/E-150, and the Northeast Plume Preliminary Characterization Summary Report, DOE/OR/07-1339&D2.

The PGDP is located in the western portion of the Ohio River Basin (Figure 2-1). A local drainage divide causes the plant's surface water to flow to the east and northeast toward Little Bayou Creek or to the west and northwest toward Bayou Creek. Both Bayou and Little Bayou creeks are perennial streams that discharge into the Ohio River.

Bayou Creek flows northward along the western boundary of the plant from approximately 4 km (2.5 miles) south of the plant to the Ohio River. Little Bayou Creek originates within DOE property and flows northward along the eastern boundary of the plant. Little Bayou Creek joins Bayou Creek in a marsh located approximately 4.8 km (3 miles) north of the PGDP; ultimate discharge is into the Ohio River. Other surface-water bodies located in the area surrounding the PGDP include the Ohio River, Metropolis Lake, Crawford Lake, and numerous small ponds, gravel pits, and settling basins.

At the PGDP, manmade drainage ditches receive storm water and effluent from the plant. These waters are routed through outfalls and eventually discharge into Bayou and Little Bayou creeks. The majority of the flow in these creeks can be attributed to effluent water from the plant. The 18 KPDES-permitted outfalls have a combined average daily flow of 18.5 million l/day (4.88 mgd) and are monitored by the PGDP.

The BCWMA is located in northern Ballard County in the floodplain of the Ohio River (Figure 2-1). Seven oxbow lakes are present in the area, but no creeks. The entire area is inundated by Ohio River flood water on an average of every three years.

2.6.2 Surface-Water Characteristics of Waste Area Group 17

The AOCs within WAG 17 are located within the Ohio River floodplain in the BCWMA and the Bayou Creek watershed (Figure 2-1). Isolated rubble piles outside of the BCWMA are not connected to any water bodies. Rubble piles in the BCWMA are inundated by the Ohio River when large-scale flooding occurs.

2.6.3 Area of Concern Characteristics

The Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, organized the WAG 17 AOCs into three categories for streamlined sampling purposes. Category 1 AOCs are those that demonstrated radiological contamination of concrete or soil during the previous investigations and which, because of PCBs and metals associated with plant activities, were also sampled. Category 2 AOCs have indicated no evidence of radiological contamination of concrete or soil during the previous investigations, but were possibly contaminated with PCBs and metals. Category 3 AOCs indicated no evidence of radiological contamination of concrete or soil, but are located within areas of known radiological and PCB contamination. Category 3 AOCs were not investigated as part of this study and will not be addressed in this ROD (i.e., AOCs 93, 105, and 175 will be transferred to WAG 25 and AOC 129 will be transferred to WAG 18).

The Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Reportfor Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, used field screening and analytical laboratory data to determine the nature and extent of contamination of the WAG 17 AOCs. The nature and extent of radionuclides were determined for Category 1 AOCs and the extent of potential PCB and metal contamination was determined for both Category 1 and 2 AOCs.

The AOCs are categorized as follows:

- Category 1 AOCs - 110, 111, 117, 118, 121, 123, 124, 125, 127, and 146; and

- Category 2 AOCs - 103, 104, 112, 114, 115, 116, 119, 120, 126, 128, 147, 148, 149, 150, 151, 152, 184, and 197.

Specific analytical and field methods are explained in detail in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, report. For the purposes of this ROD, beta/gamma refers to radiation detected with open window Geiger-Mueller (pancake) detectors and gamma refers to radiation detected with sodium iodide (NaI) scintillation crystal detectors. The AOCs that pose a potential risk are described in the following text.

2.6.3.1 Category 1 Site Results

The remedial investigation results identified two AOCs (124 and 127) that posed a potential risk to human health and the environment. Area of Concern 124 has since been remediated through a removal action and AOC 127 contamination is believed to have originated from a non-DOE source.

Area of Concern 124.

Historical radiation surveys (i.e., site investigations) identified a concrete pipe with elevated radiation levels at AOC 124. This pipe was removed during initial radiation surveys of the project. No other elevated radiation levels were detected at AOC 124 during the initial investigations; however, the historical survey was focused on the concrete rubble piles and not on the surrounding soils. During the remedial investigation,

several metals were detected in the soil at AOC 124 at levels slightly above background concentrations, including arsenic and mercury. Radionuclide contamination, including uranium, was also detected at AOC 124 above background concentrations. After reviewing the data, the DOE initiated a removal action in late July 1996 that is documented in the Action Memorandum for Area of Concern (AOC) 124, Waste Area Group (WAG) 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07 1477&D2. A portion of the soil was excavated, placed in containers, and transported to a secured waste management area at the PGDP. After the area was excavated, soil samples were collected and tested to verify that all contamination had been removed. The data generated from these samples indicated that additional soil needed to be removed. This additional remediation was completed April 15, 1997. By removing detected contamination, the DOE has reduced the risk to an acceptable level at AOC 124.

Area of Concern 127.

Metals (e.g., lead at 539 ppm) were detected in one sample at AOC 127. Area of Concern 127 is located on WKWMA property and the lead detected at this location has been attributed to unauthorized dumping of household trash.

2.6.3.2 Category 2 Site Results

Category 2 sites are those sites for which historical radiation walk-over data indicated no radiological contamination of concrete or soil, but which could be contaminated with

PCBs because there is no available evidence to rule out PCB contamination. For this reason, the sampling strategy for Category 2 sites included a visual inspection and PCB soil screening. If the PCB screening results suggested the presence of PCBs at a site, a soil sample was collected and sent for laboratory analysis to confirm the presence of PCBs and identify the specific PCB isomers.

The PCB screening locations are identified on site maps provided in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07 1404&D2. Positive detections were obtained at one of the 28 AOCs in WAG 17 (i.e., AOC 120). All of the detected laboratory PCB analytical results are below 1 ppm, which is the CERCLA and the KDEP screening level for residential land use.

2.7 Summary of Site Risks

Based on the information presented in the baseline risk assessment included in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, no human health risks exist at WAG 17 above acceptable levels as defined by the United States Environmental Protection Agency (EPA). Area of Concern 124 was not included in this assessment due to the removal action that was conducted at this AOC. Minimal ecological concerns were identified at AOCs 121 and 127 during the screening ecological risk assessment. A more thorough evaluation of potential ecological risks will be performed during the sitewide baseline ecological risk assessment to be performed as part of the WAGs 18 and 25 Surface Water Integrator Unit investigation. Metal contamination at AOC 127 is not associated with DOE activities.

2.7.1 Human Health Risk Assessment

Data from the site investigation and newly collected data were evaluated in the human health risk assessment included in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2. To identify chemicals of potential concern (COPCs), all constituents detected in concrete, surrounding soils, and sediments were evaluated using established guidelines. Chemicals of potential concern identified at the WAG 17 AOCs include metals, PCBs, and radionuclides.

The potential for human contact with COPCs found in concrete, soil, and sediment is evaluated in the exposure assessment of the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2. After consideration of all data, the report identifies the most appropriate scenarios for exposure to these media at all AOCs as the recreational user and industrial worker under current conditions, and the recreational user, industrial worker, rural resident, and excavation worker under future conditions.

The toxicity assessment evaluated the toxic characteristics of COPCS in relation to human health based on a review of available scientific evidence. To charactelize the potential toxicity of a particular contaminant, this type of effect it can produce and the concentration needed to produce that effect must be known. The contaminants are evaluated as a chemical or radiological hazard. Chemical and radionuclide contaminants are divided into two broad groups according to their effects on human health: contaminants that exhibit carcinogenic effects and contaminants that exhibit noncarcinogenic or systemic effects.

The risk characterization quantified the potential carcinogenic and noncarcinogenic risks for each of the defined exposure pathways for the COPCs. The dose-response characteristics of the contaminants integrated with the exposure intake estimates are used to generate estimates of excess lifetime cancer risk (ELCR) for chemicals or radionuclides and the likelihood of noncarcinogenic effects. From this information, a chemical of concern (COC) list is developed (for the list of COCs and the corresponding risk tables, refer to the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2. The criteria used to define COCs in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, is based on KDEP guidance that is appropriate for determining baseline risks. To evaluate potential risks at these AOCS, actual exposure times to potential receptors are used as discussed in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2. As noted in the report, when site-specific exposures provided by the WKWMA are used, the resultant risks are well below the KDEP's de minimis level at every AOC. Consequently, no action is required at any AOC to protect human health.

The uncertainties associated with the baseline risk assessment would generally lead to an overestimation of risks at the units. Since all risks are within acceptable limits, the

effects of these uncertainties are minimal. For a more complete discussion of the uncertainties associated with baseline risk assessment, refer to the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07 1404&D2.

2.7.2 Ecological Risk Assessment

The screening ecological risk assessment for WAG 17 evaluated chemical and radionuclide contaminants in surface soils and radionuclides in sediments. No ecological risks were found to be associated with radionuclides in stream sediments at any of the AOCs of WAG 17. Two AOCs, 127 and 121, were identified as having potential ecological risks from metals. Chromium, lead, aluminum, and zinc are chemicals of potential ecological concern (COPEC) at AOC 127; however, as previously discussed, the source of this contamination is not the WAG 17 concrete rubble or the PGDP. At AOC 121, chromium was the only COPEC identified, and it is present just slightly above background levels. These screening risk assessment results indicate that an action is not required at WAG 17 to protect ecological receptors from metal contamination deposited by DOE.

2.8 Description of the No Further Action Alternative

According to EPA guidance [Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment (EPA/540/G-89/007)], if there is no current or potential threat to human health and the environment, then no action is warranted, and the CERCLA requirements for remedial actions are not triggered. Consequently, there is no need to evaluate the nine CERCLA criteria.

Under the no further action scenario, no additional action will occur at the remaining WAG 17 AOCs. No new institutional controls or engineering controls will be implemented and there are no capital, operating, or monitoring expenses associated with implementing the no further action decision.

2.9 Explanation of Significant Changes

The Proposed Remedial Action Plan for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1566&D2, was made available for a 45-day public review and comment period that began July 26, 1997, and ended September 8, 1997. A public meeting was held August 26, 1997. The DOE identified no further action for WAG 17. All written and verbal comments submitted during the public comment period were reviewed by the DOE, and it was determined that no significant changes to the remedy were necessary.

PART 3

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(b)(iv) and 117(b) of the CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which requires the DOE as "lead agency" to respond "...to each of the significant comments, criticisms, and new data submitted in written or oral presentation" on the WAG 17 Proposed Remedial Action Plan (PRAP).

The DOE has gathered information on the types and extent of contamination found and recommends no further action. As part of the remedial action process, a notice of availability regarding the PRAP was published in The Paducah Sun, a major regional newspaper of general circulation. The Proposed Remedial Action Plan for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1566&D2, was released to the general public July 26, 1997. This document was made available at the DOE's Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A 45-day public comment period began July 26, 1997, and continued through September 8, 1997. A public meeting was held August 26, 1997, at which time the DOE presented information pertaining to WAG 17 to the public and responded to questions. Specific groups that received individual copies of the WAG 17 PRAP included the Natural Resource Trustees and the Site Specific Advisory Board.

Public participation in the CERCLA process is required by the SARA. Comments received from the public were considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: to provide the DOE with information about the community preferences and concerns regarding the remedial alternatives and to show members of the community how their comments were incorporated into the decision-making process.

3.2 Community Preferences/Integration of Comments

COMMENT: "On page four of the Proposed Remedial Action Plan for Waste Area Group 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1566&D2), it says 'A portion of the soil was excavated, placed in containers, and transported to a secured waste management area at the Paducah Gaseous Diffusion Plant. By removing detected contamination, the Department of Energy has reduced the risk to an acceptable level at Area of Concern 124.' How can that reduce the risk to put it into Waste Management, when Waste Management has been rated as the highest risk at the

facility?"

RESPONSE: The text accurately states the risk at Area of Concern (AOQ 124 has been reduced. This AOC is located outside the DOE security fence and could be accessed by the general public. The Department of Energy (DOE) has determined that off-site current and future risk is a priority for cleanup. The soil that was placed in Waste Management is securely stored and monitored in accordance with the appropriate regulations and requirements. The Waste Management facility is listed as a top priority for programmatic planning based on several factors and not risk alone.

COMMENT: "If the agency followed every procedure in the standard operating procedures for determining the 'no further action' finding then it could be justified. However, if any of the procedures for making this determination, such as strictly following all guidance for scanning for radionuclides, are not adhered to, then this determination is questionable."

RESPUNSE: The Department of Energy followed and adhered to the standard operating procedures as referenced in the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Grouping 17 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2.

COMMENT: "The commentors continue to believe that a site-wide Environmental Impact Statement (EIS) is required under the National Environmental Policy Act (NEPA). Separating these individual projects without considering the cumulative effects of all projects at the site violates the spirit and letter of the NEPA."

RESPONSE: Under the draft Federal Facility Agreement, final action decisions for integrator units will be addressed as part of the comprehensive site operable unit (CSOU). The CSOU study will include baseline risk assessments that will evaluate the impacts of any cumulative risks being contributed to the integrator units by sources. The baseline risk assessment for the CSOU will include a human health risk assessment conducted in conjunction with the Ground Water Integrator Unit [i.e., Waste Area Group (WAG) 26] and an ecological risk assessment and human health risk assessment conducted in conjunction with the Surface Water Integrator Units (i.e., WAG 18 and WAG 25) according to the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1207&D3).

National Environmental Policy Act values were incorporated into the WAG 17 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) documents, pursuant to DOE's 1994 Secretarial Policy on NEPA and DOE Order 450.1. The Secretarial Policy states that "DOE will hereafter rely on the CERCLA process for review of actions to be taken under CERCLA and will address NEPA values and public involvement procedures as provided...."

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PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

Site Information:

Site Name: PADUCAH GASEOUS DIFFUSION PLANT (USDOE)
Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 08/10/1998
Operable Unit: 15
ROD ID: EPA/541/R-98/113

Media: Groundwater, Soil

Contaminant: Inorganics, Metals, PAH, Radioactive, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, approximately 10 miles west of Paducah and about four miles south of the Ohio River. This plant is an uranium enrichment facility owned by the United States Department of Energy (DOE). The PGDP, which has been in operation since 1952, supplies fuel for commercial reactors.

Under the DOE's Environmental Management Program, cleanup activities currently are being conducted at the PGDP to address contamination that resulted from past waste-handling and disposal practices. These cleanup activities comply with the requirements of the Commonwealth of Kentucky, the United States Environmental Protection Agency (EPA), and the DOE.

Operable Unit 3 (OU3):
OU3 consists of the Northeast Plume. In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in groundwater from residential wells north of the PGDP. In response to

this discovery, the DOE and EPA entered into an Administrative Order by Consent (AOC) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The DOE then implemented the PGDP Water Policy to reduce the current risk to potential human exposure. The CERCLA site investigations discovered trichloroethene (TCE)-contaminated groundwater within the Regional Gravel Aquifer (RGA) northeast of the plant. This plume is referred to as the Northeast Plume. One source of groundwater contamination in the Northeast Plume is thought to be the Kellogg Building leach field.
A ROD addressing OU3 was completed in June 1995.

OU5:
OU5 is comprised of waste area groups (WAGs) 1 and 7. WAG1 is located within the plant security fence in the southwestern corner of the PGDP. It includes solid waste management unit (SWMU)100 (the fire training area (FTA)) and SWMU 136 (the C-740 TCE Spill Site). The FTA is located in the southwest corner of the PGDP, immediately west of Fourth Street. It consists of one large rectangular surface burn area, two circular burn pan areas, one circular electric pump area, an elevated and bermed fuel tank area, and two square burn area depressions. The burn areas are unlined and are not bermed. The FTA has been used since 1982 for staging fire training exercises involving waste oils, fuels, and other combustible liquids. Combustible liquids were not burned in the unlined areas after 1987. Fire training exercises continue to be conducted in the vicinity, but, in order to prevent any negative impacts to the environment, no burning is conducted in unlined areas and combustible liquids are no longer used.
The TCE Spill Site is a small rectangular area, approximately 15 feet by 6 feet, located in the southwest corner of the PGDP within the plant security fence. The C-740 Material Yard is an active storage yard that has been used since the early 1970s for storing various scrap metals and drums. A 55-gallon drum stored on the concrete pad leaked TCE onto the pad and into the gravel and soil adjacent to the western edge of the pad in May 1990. In October 1990, soils contaminated with TCE were excavated from a 15 foot by six foot area, to a depth of three feet. Soil samples collected from the base of the excavation pit were found to have TCE concentrations., indicating that TCE-contaminated soils had not been completely removed.
WAG 7 consists of SWMUs 130 through 134 and SWMU 8. All five underground storage tanks (USTs) located in the vicinity of the WTP currently are inactive. With the exception of SWMU 133, which is of unknown size, the C-611 USTs range in capacity from 189 to 7,571

liters. Two of the USTs were reportedly used for gasoline storage from 1942 to 1945 in support of Kentucky Ordnance Works (KOW) operations. SMU 132 was used for fuel oil storage from approximately 1942 to 1955, initially as part of the KOW, and later in support of PGDP activities. It was abandoned in place by filling the tank with sand. The dates of operation of the remaining two USTs (SWMUs 133 and 134) are unknown; both were reportedly used for diesel storage and are known to have been removed from service by 1975. The SWMU 133 tank was abandoned in place filling the tank with grout.
SWMU 8 is located southwest of the PGDP fenced security area. It is situated immediately west of Bayou Creek and north of an unnamed tributary of Bayou Creek. Records indicate that the PGDP used the landfill between 1951 and 1981 for disposal of fly ash from the plant's coal combustion boilers, uncontaminated combustible plant waste, and potentially radiologically contaminated plant waste. During operations, trenches were cut in the fly ash and used for burning trash. This practice ceased in 1967, after which waste was buried without burning. The waste, containing primarily office waste with some construction debris and kitchen waste, was placed in trenches excavated within the fly ash and covered, when necessary, with additional fly ash or soil fill. In addition to these materials, sludge from the C-615 Sewage Treatment Plant may have been buried at the unit, as it was reportedly used as fill material.
A ROD addressing OU5 was completed in August 1998.

OU6:
The North-South Diversion Ditch (NSDD) is located in the north central portion of the security area. The ditch receives stormwater runoff from the steam plant, process buildings, cooling tower, and the switchyards. The NSDD also receives wastewater from the cleaning building and residual fly ash with associated metals from the steam plant.
A ROD describing OU6 was completed in March 1994.

OU8:
OU8 is comprised of WAG 22. WAG 22 consists of the following solid waste management units (SWMUs): SWMU 2, the C-749 Uranium Burial Ground; SWMU 3-the C-404 Low-Level Radioactive/Hazardous Waste Burial Ground; SWMU 7, the C-747-A Burial Ground; and SWMU 30, the C-747-A Burn Area.
The C-749 Uranium Burial Ground was used from approximately 1951 to 1977 for the disposal of uranium and uranium containing wastes. The exact depth of the buried waste is not known. Wastes were reportedly placed in trenches excavated to a total depth of approximately seven to 17 feet and then covered with two to four

feet of soil. Occasionally, fires were reported as a result of oxidation of pyrophoric uranium metal, but no subsidence was observed resulting from potential volume reductions due to the fires. It has been estimated that 270 tons of uranium, 59,000 gallons of oils, and 450 gallons of TCE were buried in SWMU 2.
The C-404 Low-Level Radioactive/Hazardous Waste Burial Ground (SWMU 3) is located immediately east of the C-749 Burial Ground in the west-central area of the plant. It was originally constructed in the early 1950s as an aboveground holding pond, with an on-grade tamped earth floor and clay dike walls. The burial ground was used from 1951 to 1957 as a primary disposal area for TCE and uranium-contaminated effluent. In 1957, all free liquids were removed, and disposal of uranium-contaminated bulk solid wastes began at the unit. In 1976, after the facility was filled with bulk solid waste, it was covered with compacted earth and the weir at the southwest corner was converted into a leachate collection sump.
A ROD addressing OU8 was completed in August 1995.

OU12:
OU12 is comprised of the 28 areas of concern (AOCs) of WAG 17, which are separated into groups based on the purpose of the rubble piles. Concrete material at AOCs 115, 116, 118, 127, 149, and 151 serves as bank and erosion control along bodies of water. Concrete material at AOCs 103, 104, 112, 146, 147, and 150 currently is associated with dam construction and provides structural support. Concrete material at AOCs 114, 117, 119, 120, 121, and 128 is used for support and erosion control at bridges and culverts in WAG 17. Concrete material at AOCs 126, 148, and 197 is used to stabilize roadways in the WKWMA and the BCWMA. AOCs 110, 111, 123, 124, 125, 152, and 184 consist of piles of concrete that have no specific purpose.
A ROD addressing OU12 was completed in September 1997.

OU15:
The Cylinder Drop Test Area solid waste management unit 91 (SWMU 91) encompasses approximately 0.7 hectacres (1.7 acres) and is located in the extreme west-central area of the plant on the southern edge of the C-745-B Cylinder Yard. Drop Tests were conducted at the PGDP from latte 1964 until early 1965 and in February 1979 to demonstrate the structural integrity of the steel cylinders used to store and transport uranium hexafluoride (UF6) . Prior to structural testing, the cylinders went through thermal conditioning by immersing them in a concrete pit containing dry ice and TCE. During the tests, a crane lifted the cylinders to a specified height and dropped them onto a concrete and steel pad to simulate worst-case transportation accidents. The amount of TCE released at

the drop test site can be estimated based on the size of the cylinders. The cylinders are 12.2 feet long and four feet in diameter with a width of approximately five feet. The likely maximum quantity lost to the surrounding soil is approximately 430 gallons.
A ROD addressing OU15 was completed in August 1998.

Remedy: The selected remedy consists of in situ remediation or applying the Lasagna process. This process uses electroosmosis (electrical fields) to drive pore volumes of water containing trichloroethene (TCE) to treatment zones that also are located in the ground. The volume of soil proposed for treatment at Solid Waste Management Unit 91 is estimated to be 32 m long by 18 m wide by 14 m deep, which equates to roughly 7,645 meters cubed. The treatment zones are estimated to be 18 m long by 14 m deep and approximately 5 cm thick. The media used for treatment may consist of a variety of products such as iron, kaolin clay, and water with the specific treatment medium being determined during design. Electrodes will be placed at the ends of the area and most likely at evenly spaced intervals between treatment zones to supply the electrical current for treatment.

Estimated Capital Cost: $1,924,000
Estimated Annual O&M cost: $7,000
Present Worth O&M costs: $99,000
Estimated Present Worth Cost: $1,948,000

Text: Full-text ROD document follows on next page.

EPA 541-R98-113

<IMG SRC 981130>

DOE/OR/06-1527&D2
Primary Document

OU-15
Record of Decision for Remedial Action
at Solid Waste Management Unit 91 of Waste Area Group
27 at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky

<IMG SRC 98113A>

July 1998

Cleared for Public Release

<IMG SRC 98113B>

Department of Energy
Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
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September 22, 1998

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Mr. Carl R. Froede Jr., P. G.
United States Environmental Protection Agency
Region IV
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
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Atlanta, Georgia 30303

Dear Mr. Daniell and Mr. Froede:

RECORD OF DECISION FOR REMEDIAL ACTION AT SOLID WASTE MANAGEMEENT UNIT 91 OF WASTE AREA GROUPING 27 AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY DOE/OR/06-1527&D2

Enclosed for your information is the final Record of Decision (ROD) for Solid Waste Management Unit 91 of Waste Area Grouping 27 at the Paducah Gaseous Diffusion Plant. The ROD was signed by the Department of Energy (DOE) July 9, 1998, and by the United States Environmental Protection Agency August 10, 1998. The Kentucky Department for Environmental Protection (KDEP) gave conditional approval of the D1 version of the ROD on June 9,1998, pending minor modification, which DOE incorporated. Based on conversations with representatives of KDEP on September 21, 1998, the June 9, 1998, letter serves as their concurrence for the ROD.

If you have any questions or require additional information, please call Myrna E. Redfield at (502) 441-6815.

Sincerely,

<IMG SRC 98113C>

Enclosure

cc w/o enclosure:
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J.C. Massey, Bechtel Jacobs Company/Kevil
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CERTIFICATION

Document Identification: Record of Decision for Remedial Action at Solid Waste Management Unit 91 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/OR/06-1527&D2 Primary Document)

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 assure 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)
Owner and Operator
<IMG SRC 98113D>

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 assure 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.

Bechtel Jacobs Company LLC
Co-Operator
<IMG SRC 98113E>

DOE/OR/06-1527&D2
Primary Document

Record of Decision for Remedial Action at Solid Waste Management Unit 91 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

July 1998

Prepared by
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Prepared for the
U.S. Department of Energy
Office of Environmental Management

Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
Paducah, Kentucky 42001
managed by
Bechtel Jacobs Company LLC
for the
U.S. Department of Energy
under contract DE-AC05-98OR22700

PREFACE

This Record of Decision for Remedial Action at Solid Waste Management Unit 91 of Waste Area Group 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1527&D2, was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act, the Resource Conservation and Recovery Act, and Kentucky Revised Statues Chapter 224, Subchapter 46. This

work was performed under Work Breakdown Structure 1.4.12.7.1.11.07.05 (Activity Data Sheet 5311). This document follows the outline for records of decision contained in the Federal Facility Agreement For The Paducah Gaseous Diffusion Plant, DOE/OR/07-1707, and the Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Signficant Differences, The Record of Decision Amendment, EPA/540/G-89/007. Publication of this document meets a primary document deliverable milestone for the United States Department of Energy's (DOE's) Remediation Management Group at the Paducah Gaseous Diffusion Plant. This document provides the record of information and rationale that the United States Environmental Protection Agency, the Kentucky Department for Environmental Protection, and the DOE utilized in the selection of a preferred remedial action, or corrective measure, at Solid Waste Management Unit 91 of Waste Area Group 27. Information provided in this document forms the basis for the development of the remedial design report for this project.

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ACRONYMS AND ABBREVIATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

99 Tc	technetium-99
ACO	Administrative Order by Consent
amsl	above mean sea level
AR	administrative record
ARAR	applicable or relevant and appropriate requirement
AT123D	Analytical Transient 1-, 2-, 3-Dimensional Model
BHHRA	baseline human health risk assessment
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
cm	centimeter(s)
COC	chemical of concern
CPF	cancer potency factor
DNAPL	dense nonaqueous phase liquid
DOE	United States Department of Energy
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
Fed. Reg.	Federal Register
FFA	Federal Facility Agreement
ft	foot (feet)
ft 2	square foot (feet)
ft 3	cubic foot (feet)
gal	gallon(s)
HSWA	Hazardous and Solid Waste Amendments
HU	hydrogeologic unit
K.A.R.	Kentucky Administrative Regulations
KDEP	Kentucky Department for Environmental Protection

kg	kilogram(s)
km	kilometer(s)
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter(s)
m	meter(s)
m 3	cubic meter(s)
MCL	maximum contaminant level
mg	milligram(s)
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
pCi	picocurie(s)
PGDP	Paducah Gaseous Diffusion Plant
ppm	parts per million
POE	point of exposure
PORTS	Portsmouth Gaseous Diffusion Plant
PRAP	proposed remedial action plan
PRP	potentially responsible parties
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
sec	second(s)
SESOIL	Seasonal Soil Compartment Model
SWMU	solid waste management unit
TBC	to be considered
TCE	trichloroethene
TVA	Tennessee Valley Authority
U.S.C.A.	United States Code Annotated
UCRS	Upper Continental Recharge System
USEC	United States Enrichment Corporation
WAG	waste area group
yd 3	cubic yard(s)
yr	year(s)
UF 6	uranium hexafluoride
µg	microgram(s)

DECLARATION FOR THE RECORD OF DECISION FOR SOLID WASTE MANAGEMENT UNIT 91 OF WASTE AREA GROUP 27

SITE NAME AND LOCATION

Solid Waste Management Unit 91 of Waste Area Group 27
Paducah Gaseous Diffusion Plant
United States Department of Energy

Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This decision document presents the remedial action for the Solid Waste Management Unit (SWMU) 91 of Waste Area Group (WAG) 27 at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. The remedial action outlined in this document was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, the National Oil and Hazardous Substances Pollution Contingency Plan, and Kentucky Revised Statutes Chapter 224, Subchapter 46. This decision is based on the administrative record (AR) for the response action at SWMU 91.

With participation from the Kentucky Department for Environmental Protection (KDEP), both the United States Environmental Protection Agency (EPA) and the United States Department of Energy (DOE) entered into an Administrative Order by Consent (ACO) effective November 23, 1988. The ACO was drafted pursuant to Sections 104 and 106 of CERCLA, which provide authority for conducting remedial actions in response to releases of hazardous substances, pollutants, or contaminants. The PGDP was placed on CERCLA's National Priorities List (NPL) May 31, 1994 (effective date June 30, 1994).

Pursuant to the PGDP listing on the NPL, the DOE entered into the Federal Facility Agreement (FFA) with the EPA and the KDEP (signed February 13, 1998) to integrate the overlapping requirements of the CERCLA and the Resource Conservation and Recovery Act (RCRA) that apply to the PGDP. Upon signature of the FFA, the ACO was terminated and remediation at the PGDP will be conducted under the terms and conditions of the FFA.

The DOE was issued a Kentucky Hazardous Waste Management Permit and an EPA Hazardous and Solid Waste Amendments (HSWA) permit July 16, 1991. The KDEP portion of the RCRA permit was issued pursuant to Chapter 224 of the Kentucky Revised Statutes by authority granted from the EPA to the KDEP. The EPA issued its portion of the RCRA permit pursuant to the HSWA. Throughout this document, the two permits are referred to collectively as the RCRA permits. The RCRA permits require the proper treatment, storage, and disposal of waste; corrective action (i.e., cleanup); closure of regulated units; and investigation of off-site contamination.

On August 13, 1997, the DOE determined that Lasagna TM was a proven technology at the PGDP, as well as the appropriate technology for a remedial action at SWMU 91. The Lasagna TM technology uses electroosmosis to move contaminants by flushing water through treatment zones where they can be captured or chemically altered to non-toxic products. This decision was based on several documents that comprise the AR for this remedial action (e.g., the Preliminary Site Characterization/Baseline Risk Assessment/ Lasagna TM Technology Demonstration At Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128; the Feasibility Evaluation for Trichloroethene-Contaminated Soil at Solid Waste Management Unit 91 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1557&D3; and the Proposed Remedial Action Plan for Solid Waste Management Unit 91, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1499&D3). The AR includes detailed documentation

of the rationale for undertaking this remedial action at SWMU 91 of WAG 27. The remedial action will be initiated pursuant to the PGDP's, RCRA permits and this Record of Decision (ROD). Values corresponding to the 1994 DOE Policy on the National Environmental Policy Act also were incorporated in the documentation. The Commonwealth of Kentucky concurs with the DOE and the EPA on the selected remedial action. The scope of this action warrants the incorporation of the selected remedy into the Hazardous Waste Permit KY8-890-008-982. This ROD will serve as the primary document for the modification to the permit. This action will address the chemical of concern (COC) in the soil [i.e., trichoroethene (TCE)] at SWMU 91 of WAG 27 and will serve as a step toward comprehensively addressing PGDP site problems.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from SWMU 91 of WAG 27 currently do not present an imminent and substantial danger to public health, welfare, or the environment according to the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128. However, leachate and transport computer modeling [e.g, Seasonal Soil Compartment Model (SESOIL)] as presented in the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128, indicates that the COC (TCE) present in the soil could contaminate the Regional Gravel Aquifer at the point of exposure (POE) at levels that could exceed the EPA maximum contaminant levels.

DESCRIPTION OF SELECTED REMEDY

The primary objective of this remedial action is to reduce the level of TCE-contaminated soil thereby reducing the potential future concentrations in ground water that could pose a threat to human health and the environment at the POE (i.e, the DOE property boundary). The potential for migration of the contaminant from the soil to the off-site aquifer is the concern associated with this SWMU. The soil at this SWMU contains TCE with an average concentration of 84 mg/kg (ppm) that may migrate to the nearest POE at unacceptable levels. Ground-water modeling indicates that reducing the concentration of TCE in soil at SWMU 91 to less than 5.6 mg/kg will result in ground water that is less than 5 µg/l at the PGDP's security fence. The selected remedial action reduces the potential ground-water risk to human health and the environment by remediating the TCE-contaminated soil to below 5.6 mg/kg.

Alternative 2 - In Situ Remediation (Lasagna TM) is the selected remedy. The Lasagna TM technology was developed by an industrial consortium (Monsanto, DuPont, and General Electric), in cooperation with the DOE Office of Environmental Management, Office of Science and Technology (EM-50) and the EPA Office of Research and Development.

The Lasagna TM technology was developed to remediate soils and ground water contaminated with TCE and is especially suited to sites with low-permeability soils. The process uses electroosmosis to move soil contaminants by flushing multiple pore volumes of water through treatment zones where the TCE can be captured or chemically altered to non-toxic products.

The success of the technology's initial demonstration (Phase I) that began January 3, 1995, and ran for 120 days at SWMU 91, led to a full scale Phase IIA field

demonstration that was conducted at SWMU 91 from August 1996 through July 1997. The Phase IIA demonstration was executed on an area of approximately 6 m x 9 m (20 ft x 30 ft) and approximately 14 m (45 ft) deep. The demonstration used a mixture of kaolin clay and iron particles as the treatment zone medium. The treatment zone material was installed using a hollow mandrel. Iron filings were mixed with wet kaolin clay to form a slurry that was poured down the 14 m (45 ft) mandrel. As a treatment medium, iron has been, shown to reduce TCE chemically to non-toxic end products.

The components of Alternative 2 - In Situ Remediation (Lasagna TM) include these.

- Electrodes energized by direct current that cause soluble contaminants (i.e., TCE) to be transported into or through the treatment layers and heat the soil. The contaminated water in the pore volumes will flow from the anode through treatment zones toward the cathode.

- Treatment zones containing reagents that either can decompose the TCE to non-toxic products or can adsorb the TCE contaminants for immobilization, depending on the medium design.

- A water management system that recycles and returns the water that accumulates at the cathode back to the anode for acid-base neutralization.

If SWMU 91 has not reached the regulatory approved risk assessment cleanup level (i.e., soil levels) of 5.6 mg/kg within two years, the operation may be continued until cleanup levels are reached. However, if the technology is not successful, even after an extended operating time, the DOE, in agreement with the EPA and the KDEP, may proceed to remediate the unit with Alternative 3, In Situ Enhanced Soil Mixing.

The components of Alternative 3 - In Situ Enhanced Soil Mixing include the following:

- A crane or other mechanical mixing unit;

- An agent delivery system (e.g., hot air, steam, or hydrogen peroxide); and

- An off-gas; collection/treatment system (e.g., activated carbon that will be regenerated or stored onsite).

The EPA and the KDEP have participated in the development of this ROD, including review and comment on the content of the document.

STATUTORY DETERMINATIONS

Both remedial technologies [In Situ Remediation (Lasagna TM) and In Situ Enhanced Soil Mixing] are protective of human health and the environment and comply with federal and state applicable or relevant and appropriate requirements. The remedial actions also are cost effective and follow the statutory mandate for permanent solutions and

alternative treatment technologies to the maximum extent practicable. Additionally, they meet the statutory preference for remedies that employ treatments that reduce toxicity, mobility, or volume through treatment as a principal element. If unrestricted use and unlimited exposure remain at the unit after the operational period, a five-year review evaluating whether the remedy continues to provide adequate protection for human

health and the environment will be required.

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DECISION SUMMARY

2.1 Site Name, Location, and Description

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, approximately 16 km (10 miles) west of Paducah and about 6 km (4 miles) south of the Ohio River (Figure 2-1). This plant is an uranium enrichment facility owned by the United States Department of Energy (DOE). The PGDP, which has been in operation since 1952, supplies fuel for commercial reactors.

The Energy Policy Act of 1992 transferred operation of the DOE's uranium enrichment facilities to the United States Enrichment Corporation (USEC). Effective July 1, 1993, Martin Marietta Utility Services, Inc., (now Lockheed Martin Utility Services, Inc.) contracted with the USEC to provide operation and maintenance (O&M) services. The DOE continues to perform environmental restoration, decontamination and decomissioning, and waste management activities at the PGDP under its Environmental Management Program contracted to Bechtel Jacobs Company LLC.

Under the DOE's Environmental Management Program, cleanup activities currently are being conducted at the PGDP to address contamination that resulted from past waste-handling and disposal practices. These cleanup activities comply with the requirements of the Commonwealth of Kentucky, the United States Environmental Protection Agency (EPA), and the DOE.

This Record of Decision (ROD) addresses one of the solid waste management units (SWMUs), the Cylinder Drop Test Area (SWMU 91), identified at the PGDP figure 2-2). This SWMU is grouped in Waste Area Group (WAG) 27 as a potential source of trichloroethene (TCE), a dense nonaqueous phase liquid (DNAPL) that has contaminated the ground water of the Regional Gravel Aquifer (RGA). While the action described in this ROD will remediate this suspected source of ground-water contamination, any risks to human health or the environment present at the site due to contaminated groundwater will be addressed as part of the ground-water integrator operable unit evaluation (WAG 26).

2.2 Site History and Enforcement Activities

The Cylinder Drop Test Area (SWMU 91) encompasses approximately 0.7 hectares (1.7 acres) and is located in the extreme west-central area of the plant on the southern edge of the C-745-B Cylinder Yard (Figure 2-2). Drop tests were conducted at the PGDP from late 1964 until early 1965 and in February 1979 to demonstrate the structural integrity of the steel cylinders used to store and transport uranium hexafluoride (UF 6). Prior to structural testing, the cylinders went through thermal conditioning by immersing them in a concrete pit containing dry ice and TCE. During the tests, a crane lifted the cylinders to a specified height and dropped them onto a concrete and steel pad to simulate worst-case transportation accidents.

In the first test period, a brine-ice bath was used to chill one cylinder prior to its drop test. The 1979 test used a TCE- and dry-ice bath to chill one of the steel cylinders. The

concrete in-ground pit that held the TCE refrigerant for cylinder immersion leaked and resulted in contamination of the surrounding shallow soil and ground water. Although one corner of the pit was located, the exact location of the entire pit is unknown. The pit is approximately 9 m (30 ft) from the drop pad.

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The amount of TCE released at the drop test site can be estimated based on the size of the cylinders. The cylinders are 3.7 m (12.2 ft) long and 1.2 m (4 ft) in diameter with a 15.2-cm (6-inch) stiffening ring/lifting lug offset on each side, yielding a minimum tank width of 1.5 m (5 ft). The likely maximum quantity lost to the surrounding soil is approximately 1,627.5 liters (430 gals) as presented in the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128.

2.3 Highlights of Community Participation

A Notice of Availability was published in The Paducah Sun, a regional newspaper, February 22, 1998, announcing the beginning of the 45-day public review period for the Proposed Remedial Action Plan for Waste Area Group 91 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1499&D3. The public comment period began February 23, 1998, and ended April 8, 1998. Specific groups that received individual copies of the Proposed Remedial Action Plan (PRAP) include the Natural Resource Trustees and the Site Specific Advisory Board. There were no requests for a public meeting or hearing; therefore, the tentatively scheduled public meeting and the hearing on March 24, 1997, were canceled.

2.4 Scope and Role of Operable Unit

Contamination levels that could pose a threat to human health and the environment are present in the soil at SWMU 91. The Lasagna TM field demonstration previously treated a portion of the TCE contamination in the soil and shallow ground water at this SWMU. Trichloroethene is present in the subsurface soil at this unit at concentrations indicative of possible DNAPL pockets in the saturated soil. These DNAPL pockets could allow long-terms releases into the ground water. The shallow ground water beneath this unit also contains elevated concentrations of dissolved TCE. This ground water is not used for drinking water purposes, but it is hydraulically connected to the RGA and is the pathway of concern.

The DOE proposes the in situ treatment of soil containing chemicals of concern (COCs) that exceed remediation levels at SWMU 91 using the Lasagna TM process. The purpose of the selected response action is to destroy or break down TCE in situ reducing contaminant levels low remediation levels. This response action will mitigate future migration of dissolved TCE through ground water to the RGA and keep off-site releases from this unit below regulatory limits.

2.5 Response Action and the Site Management Strategy

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. The DOE's proposed strategy is to divide the site into operable units grouped by source areas and ground- and surface-water integrator operable units. Discrete response actions will be selected and implemented for each source area operable unit, as well as the integrator operable units that are impacted by commingled releases from the source area operable units. Prioritization for investigation and possible remedial action have been assigned to each of the integrator operable units and source area operable units depending on their potential for contributing to off-site contamination. As a suspected source of off-site ground-water contamination, SWMU 91 is a high priority for remediation.

The DOE already has begun to address the ground-water integrator operable units through remedial actions on the Northwest and Northeast Plumes. By addressing this future source of off-site ground-water contamination, the DOE is following the cleanup strategy for the PGDP as outlined in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1207&D3.

2.6 Summary of Site Characteristics

This section briefly describes the hydrogeology of the PGDP and discusses the local hydrogeologic and contaminant characteristics of SWMU 91. It also presents an overview of the actions conducted to date at the site.

2.6.1 Hydrogeologic Characteristics of the Paducah Gaseous Diffusion Plant Area

Unless otherwise noted, the information presented in this section is derived from the Report of the Paducah Gaseous Diffusion Plant Groundwater Investigation Phase III, KY/EM-150, and the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128.

2.6.1.1 Regional surface-water hydrology

The PGDP is located in the western portion of the Ohio River Basin (Figure 2-3). A local drainage divide causes the plant's surface-water flow either to be to the east and northeast toward Little Bayou Creek or to the west and northwest toward Bayou Creek. Bayou Creek and Little Bayou Creek are perennial streams that eventually discharge into the Ohio River.

Bayou Creek flows generally northward along the western boundary of the plant from approximately 4 km (2.5 miles) south of the plant to the Ohio River. Little Bayou Creek originates within the West Kentucky Wildlife Management Area and flows northward along the eastern boundary of the plant. Little Bayou Creek joins Bayou Creek in a marsh located approximately 4.8 km (3 miles) north of the PGDP. Other surface-water bodies located in the area surrounding the PGDP include the Ohio River, Metropolis Lake, Crawford Lake, numerous small ponds, gravel pits, and settling basins.

At the PGDP, man-made drainage ditches receive storm water and effluent from the

plant. These waters are routed through outfalls and eventually discharge into Bayou and Little Bayou Creeks. The majority of the flow in these creeks can be attributed to effluent water from the plant. The Kentucky Pollutant Discharge Elimination System (KPDES) permitted outfalls have a combined average daily flow of 18.5 million liters per day (4.88 million gallons per day) and are monitored by PGDP personnel.

2.6.1.2 Regional geology

The PGDP is located in the Jackson Purchase Region of western Kentucky, at the northern tip of the Mississippi Embayment. The stratigraphic sequence at the PGDP consists of a sequence of unconsolidated sediments unconformably overlying Paleozoic limestone bedrock at a depth of approximately 104 m (340 ft). The sediments overlying the bedrock consist of the following strata, in order of decreasing depth: the Mississippian rubble one, the McNairy Formation, the Porters Creek Clay, the Eocene Sands, the continental deposits, and surficial loess and/or alluvium. Figure 2-4 presents a schematic diagram illustrating the relationships between the geologic horizons present at the PGDP.

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The principal geologic feature in the PGDP area is the Porters Creek Clay Terrace, a large, low-angle, subsurface terrace trending approximately east-west across the southern portion of the plant. This terrace is believed to be the result of the erosion of the Porters Creek Clay by the ancestral Tennessee River. Due to the erosion, the Porters Creek Clay essentially is absent from the PGDP area north of the terrace slope.

In the PGDP area south of the terrace slope, the Porters Creek Clay directly overlies the McNairy Formation, a sequence of marine clays, silts, unconsolidated sands, and occasional fine gravel. The Porters Creek Clay is unconformably overlaid by either the Eocene Sands or the continental deposits. The principal gravel facies within the continental deposits south of the Porters Creek Clay Terrace are Miocene-Pliocene gravels, commonly referred to as Terrace Gravel deposits.

North of the terrace slope, the McNairy Formation is directly overlaid by continental deposits. The continental deposits are subdivided informally into the Lower Continental Deposits, which consist of chert gravel in a matrix of sand and silt, and the Upper Continental Deposits, which consist of thin interbedded layers of clayey silt, sand, and occasional gravel. In the PGDP area, the continental deposits commonly are overlaid by fine-grained aeolian deposits called loess; however, along rivers or creeks, the surficial deposits are typically alluvium.

2.6.1.3 Regional ground-water hydrology

Several water-bearing zones are present in the PGDP area. South of the Porters Creek Clay Terrace Slope, the principal water-bearing units, in order of increasing depth, are the Terrace Gravel, the Eocene Sands, and the McNairy Formation. The primary water-

bearing units north of the buried terrace are the RGA, the Upper Continental Recharge System (UCRS), and the McNairy Formation.

The RGA, defined as the uppermost aquifer at the PGDP, is present north of the Porters Creek Clay Terrace. The RGA consists of gravel and sand facies of the Lower Continental Deposits and also includes the sand the upper part of the McNairy Formation where they are present directly below the RGA. The unit ranges in thickness from 3 to 12 m (10 to 40 ft) and pinches out at the base of the Porters Creek Clay Terrace Slope. The hydraulic conductivity values determined by aquifer pump tests for the RGA range from 1.87 x 10 -2 to 4.23 x 10 -1 cm/sec (5.297 x 10 1 to 1.093 x 10 3 ft/day). Ground-water velocity within the RGA is estimated to range from 61 to 122 m/yr (200 to 400 ft/yr) to the north-northeast, toward the Ohio River. Recharge to the RGA primarily is via infiltration from the Upper Continental Deposits and underflow from the Terrace Gravel.

The UCRS is present north of the Porters Creek Clay Terrace and consists of the Upper Continental Deposits and overlying loess. It includes numerous sand and gravel lenses within a less-permeable, clayey silt matrix. These sand and gravel lenses occur at various elevations and their degree of interconnection is not known. The flow direction in the UCRS is primarily downward. Below the sands and gravel, a clay, silt, or clayey-silt layer separates the UCRS sands and gravels from the underlying RGA. This layer is relatively continuous across the PGDP, but its thickness varies.

Immediately south of the Porters Creek Clay Terrace slope, the principal water-bearing unit within the continental deposits is the Terrace Gravel. The Terrace Gravel consists of interbedded gravel, sand, silt, and clay. Near the Porters Creek Clay Terrace slope,

the Terrace Gravel transmits ground water laterally along the impermeable surface of the Porters Creek Clay to the continental deposits north of the slope and to the alluvial deposits of nearby streams.

2.6.2 Hydrogeologic Characteristics of Solid Waste Management Unit 91

The information presented in this section is derived from the Results of the Site Investigation, Phase III, KY/E-150, and the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration At Solid Waste Management Unit 91 of The Paducah Gaseous Diffusion Plant, KY/EM-128.

2.6.2.1 Surface features and surface water at Solid Waste Management Unit 91

The ground surface at SWMU 91 is relatively flat and ranges in elevation from 113 m (371 ft) amsl near the drop test pad to 112 m (367 ft) amsl, in the ditch to the south (Figure 2-5). Most of the ground surface is covered with approximately 1.24 m (4 ft) of gravel road base. The concrete and steel pad used during the drop tests covers an area approximately 3 m x 3 m (10 ft x 10 ft). Runoff from SWMU 91 predominately flows into the ditch immediately south of the drop test area and discharges via KPDES Outfall 015 to Bayou Creek, which is located approximately 457 m (1,500 ft) to the west.

2.6.2.2 Geology arid hydrogeology of Solid Waste Management Unit 91

The following investigations conducted in the vicinity of SWMU 91 have provided data

useful for characterizing the lithology and hydrogeology of the site:

- The Comprehensive Environmental Response, Compensation, and liability Act (CERCLA) site investigation conducted in 1991 and 1992, which included the installation of four deep soil borings (H003, H201, H202, and H203) and three ground-water monitoring wells (MW 158, MW 159, and MW 160) at the unit (Figure 2-5);

- Geophysical surveys conducted in the area in 1993, including magnetometer, resistivity, terrain conductivity, and ground penetrating radar surveys;

- Ground-water and soil sampling conducted April and May 1993 in support of the INTERA sand and gravel surfactant demonstration;

- Installation of temporary wells and piezometers for the purpose of conducting pump and slug tests during May and August 1993; and

- Three additional phases of soil sampling were conducted at the unit in May 1994, May through June 1995, and February through March 1996 in support of the Lasagna TM demonstration.

The lithologies encountered beneath the unit are as follows, in order of increasing depth: gravel fill material, loess deposits, the Continental Deposits, and the McNairy Formation. The loess deposits consist of approximately 4.6 in (15 ft) of silty clay directly underlying the surficial gravel cover at SWMU 91, as shown on cross section A-A' (Figures 2-5 and 2-6). The Upper Continental Deposits underlie the loess, at a depth of about 6 m (20 ft) bls and are from 9- to 12-m (30- to 40-ft) thick. These deposits consist of a matrix of silty clay containing sand and gravel lenses. The shallow ground-water system at the site, the UCRS, consists of the upper Continental Deposits

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and overlying loess and has been divided into the following hydrogeologic units (HUs): clay to clayey silt (HU 1), sand and gravel (HU 2), and clay or silty clay (HU 3). A pump test in the area measured the hydrologic properties of HU 2, a 3-m (10-ft) thick layer of sand and gravel encountered at a depth of 6 to 9 m (20 to 30 ft) bls. Resulting hydraulic conductivities values ranged from 3.70 x 10 -6 to 3.97 x 10 -5 cm/sec (1 x 10 -2 to

1.12 x 10 -3 ft/day) and storage coefficients ranged from 7.43 x 10 -3 to 5.9 x 10 -2 . Water level measurements taken in MW 160, which is screened in HU 2, indicate that the depth to the water table is approximately 2 m (7 ft) bls at SWMU 91. The clay aquitard at the base of the UCRS (HU 3) is approximately 4.6 m (15 ft) thick and occurs between approximately 9 to 15 m (30 to 50 ft) bls. Flow within the UCRS is predominantly downward into the uppermost aquifer, the RGA.

The RGA consists of a 4.6- to 6.1-m (15- to 20-ft) thick sand unit (HU 4) overlying 14 to 15 m (45 to 50 ft) of sandy, pebble- to cobble-sized chert gravel (HU 5) and sand (upper McNairy Formation). Two monitoring wells have been completed, in the RGA at SWMU 91: MW 159, which is screened in the upper RGA at 19 to 21 m. (63 to 68 ft) bls, and MW 158, which is screened in the lower RGA at 31 to 32.9 m (102 to 108 ft) bls. The depth to water in MW 158 was approximately 11 m (37 ft) bls [102 m (334 ft) amsl] in May 1994. Water levels in upper RGA MW 159 typically are slightly higher than those measured in MW 158, indicating predominantly horizontal flow with a small downward component of flow within the RGA. The top of the McNairy Formation is encountered at 33 m (108 ft) bls in MW 158.

2.6.3 Operable Unit Characteristics

Results of the investigations conducted at SWMU 91 indicate that organic contaminants are present in both soil and ground water at the unit. The COC is TCE with maximum levels of 1,523 mg/kg (ppm) and 943 mg/l detected in subsurface soil and shallow ground-water samples, respectively. The concentration of TCE detected in shallow (UCRS) ground-water samples approaches the solubility limit for TCE (1,100 mg/1), strongly suggesting the presence of DNAPL at the site. The concentrations of TCE in the RGA ground-water samples at the unit are much lower, ranging from 8 to 120 µg/l, indicating that DNAPL likely is confined to the shallow (UCRS) soils at the site. The areal extent of TCE-impacted soils at SWMU 91 has been estimated as approximately 558 m 2 (6,000 ft), with TCE concentrations in this area averaging 84 mg/kg. The sampling results indicate that TCE has migrated below the water table into the UCRS but has not fully penetrated through the HU 3 aquitard at the unit. Residual contamination is present in the subsurface soils to an approximate depth of 14 m (45 ft) bls.

Other organic compounds have been detected, at low concentrations, in shallow (UCRS) and deep (RGA) ground water at this unit. Those detected in UCRS ground-water samples include the following: 1,1,1-trichloroethane; cis-1,2-dichloroethene (cis-1,2-DCE); tetrachloroethylene; carbon tetrachloride; acetone; bromodichloromethane; chloroform; and bis(2-ethylhexyl)phthalate. With the exception of the TCE degradation product cis-1,2-DCE, these organic contaminants were detected only once and at concentrations less than 20 µg/l. Cis-1,2-dichloroethene and two likely lab contaminants, bis(2-ethylhexyl)phthalate and carbon disulfide, have been detected at low levels in RGA ground-water samples at the unit. Several organic compounds also were detected at low levels in soil samples at the site, including bis(2-ethylhexyl)phthalate, fluoranthene, phenanthrene, pyrene, acetone, and methylene chloride. However, the only organic compound detected at high levels in soil samples from the unit is TCE.

Six metals (alumimum, antimony, cadmium, chromium, iron, and manganese) have been detected at elevated concentrations in unfiltered ground-water samples from the unit. Of these metals, three (aluminum, iron, and manganese) were detected above regulatory limits [maximum contaminant level (MCL) or secondary maximum contaminant levels] in filtered UCRS ground-water samples. One, manganese, was detected above regulatory limits in filtered RGA ground-water samples. Two metals, cobalt (15 mg/kg) and aluminum (12,700 mg/kg), were detected at levels slightly exceeding the PGDP background values (13.3 mg/kg and 12,000 mg/kg respectively) in subsurface soil samples collected from H003. This limited occurrence of metals in the ground water and soils at the unit indicates that SWMU 91 likely is not a significant source of metals contamination.

One radionuclide, technetium-99 (99 Tc), has been detected in UCRS and RGA ground-water samples from SWMU 91. With the exception of one reported value of 336 pCi/1 from MW 160, the levels of 99 Tc detected at the unit generally are near the analytical quantification limit of 25 pCi/1. The low activities detected in ground water and the of 99 Tc from soil samples at the unit indicate its presence likely is related to more general plant activities rather than to specific-past activities at this SWMU.

2.6.4 Summary of Actions Taken to Date

In 1993, SWMU 91 was selected as the site of an innovative technology demonstration. The technology, known as Lasagna Tm, was developed by a consortium (Monsanto, DuPont, and General Electric) with the support of the DOE and the EPA. The Lasagna TM technology is an in situ technology that uses electrical voltage to move shallow ground water and contaminants in fine-grained or clayey soils. Contaminants are treated by passing contaminated ground water through in-ground treatment cells.

For Phase I of the technology demonstration, corrugated metal sheet piles were driven into the subsurface at SWMU 91 to act as electrodes on the east and west sides of the designated treatment area. The Phase I treatment area encompassed an area of 3.0 x 4.6 m (10 x 15 ft) and extended to a depth of 4.6 m (15 ft). The water treatment zones consisted of activated carbon strips that adsorbed contaminants from the ground water, including the target compounds (i.e., TCE and TCE degradation products). Sampling and analytical results documenting the Phase I study are reported in the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128. The Phase I demonstration was conducted over a four-month period ending in May 1995 and resulted in a 98.4% reduction of TCE levels in soils within the treatment area.

The success of the Phase I demonstration led to implementation, in August 1996, of a large-scale demonstration (Phase IIA). The Phase IIA demonstration was carried out on an area approximately 6.4 m x 9.1 m (21 x 30 ft) and approximately 14 m (45 ft) deep. The ground-water treatment zones consisted of a mixture of clay and iron particles that were expected to degrade TCE chemically in situ to nontoxic end products. Post-test soil sampling conducted for the Phase IIA demonstration indicated that cleanup effectiveness of TCE ranged from 50% to 140%. As anticipated, TCE did not appear to have been converted to higher concentrations of intermediate chlorinated compounds, such as cis-1,2-DCE or vinyl chloride, but it was degraded to the end products ethane, ethylene, and acetylene. The initial average TCE concentrations in soil were 18, 42, 52, 34, and 34 mg/kg at sampling locations 2A-01, 2A-02, 2A-03, 2A-04, and 2A-05, respectively. After a treatment period of 11 months, the average concentrations

had dropped to 0.87 (2A-01), 24 (2A-02), 0.16 (2A-03), 11 (2A-04), and 9.2 (2A-05) mg/kg. The cleanup objectives were achieved at locations 2A-01 and 2A-03, and significant reductions occurred at the remaining locations (Figure 2-7).

2.6.5 Contaminant Characteristics

The conceptual site model (Figure 2-8) illustrates primary and secondary contaminated media, transport pathways, exposure pathways, and receptors that may be affected by releases. This model identifies contaminant leaching from soil to ground water as the probable migration pathway from SWMU 91. The selected remedy presented in this ROD is intended to address the source of contamination, thereby decreasing migration from the unit and risks to potential receptors. It must be noted that potential receptors listed in the conceptual site model currently are protected by the PGDP's water policy, which offers an alternative water source to plant personnel and the surrounding community. Potential impacts to human health and the environment addressed by the selected remedy are discussed in Section 2.7.

2.7 Summary of Site Risks

The Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128, contains the baseline human health risk assessment (BHHRA) and an evaluation of potential ecological risks at the Cylinder Drop Test Area. This assessment employed state and federal guidance to evaluate risks resulting from exposure to ground water and soil contaminated with TCE and its breakdown products at SWMU 91. Environmental transport of TCE to ground water below SWMU 91, to the PGDP security fence, to the DOE property boundary, and to the Ohio River was considered in the baseline risk assessment using computer modeling programs: RISKPRO TM, SESOIL, and AT123D.

Specific information regarding the results of the human health and preliminary ecological risk assessments are presented in the following sections. Those elements that are the focus of the remedial action decision are discussed as appropriate.

2.7.1 Human Health Risk Assessment

Data from soil and ground-water samples collected during the SWMU 91 site characterization were evaluated and used in the BHHRA. In addition to the data evaluation, the BHHRA included an exposure assessment, a toxicity assessment, a risk characterization, and a discussion of associated uncertainties.

The potential for human contact with contaminants is evaluated in the exposure assessment. As illustrated in Figure 2-8, soil and ground water are the primary media through which exposure may occur. The only receptor evaluated for potential soil exposure in the BHHRA is a future excavation worker [assumed to be exposed to contaminants in the top 3 m (10 ft) of soil 20 days/year for one year]. Receptors

evaluated for potential ground-water exposure in the BHHRA include: a future industrial worker (assumed to come into direct contact with contaminated ground water 250 days/year for 25 years); and a rural resident [including both an adult (assumed to come into direct contact with contaminated ground water 350 days/year for 34 years) and a child (assumed to come into direct contact with contaminated ground water 350 days/year for 6 years)]. Upon completion of the exposure assessment, doses for each chemical of potential concern (COPC are calculated for integration with toxicity assessment information.

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The toxicity assessment evaluates adverse effects to human health resulting from exposure to all COPCs,; however, the only COC at SWMU 91 is TCE. Consequently, the toxicity assessment for this document focuses on TCE. During the development of the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128, TCE was still classified as a B2 chemical, which may cause cancer in humans through prolonged exposure. Since the development of this document, the classification of TCE now is considered a Class C (possible carcinogen) to B2 (probable) chemical, meaning there still is scientific uncertainty about whether TCE will cause cancer in humans through prolonged exposure. To estimate excess lifetime cancer risks (ELCRs) associated with prolonged exposure to potentially carcinogenic materials, the EPA's Carcinogenic Assessment Group developed cancer potency factors (CPFs) (also referred to as cancer slope factors). The Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, and The Record of Decision Amendment, EPA/540/G-89/007, outlines the use of CPF as follows:

> CPFs, which are expressed in units of (mg/kg-day) -1, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper bound estimate of the ELCR associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CPFs. This approach makes underestimation of the actual cancer risk highly unlikely.

The cancer potency factors for TCE used in the BHHRA assume TCE is a B2 carcinogen; they are as follows: for the oral pathway, 0.011 (mg/kg-day) -1; for the inhalation pathway, 0.006 (mg/kg-day) -1 ; and for the dermal absorption pathway, 0.073 (mg/kg-day) -1 . After assessing the toxicity of the contaminants, the results are combined with the exposure assessment and used to develop the risk characterization.

The risk characterization indicates that currently there are no unacceptable risks to human health at SWMU 91 and that risks to future workers are considered minimal. This is partially due to the fact that the unit is covered with approximately 1.2 m (4 ft) of soil and rock that eliminate the potential for direct contact with contaminated surface soil. This eliminates surface soil as a pathway of concern for current and future workers. The total cancer risk (i.e., ELCR) for exposure to subsurface soil by an excavation worker is 1 x 10 -7, which is well below Kentucky Department for Environmental Protection's (KDEP's) allowable de minimus risk level of 1 x 10 -6; therefore, the subsurface soil is not a pathway of concern. To protect ground-water users, the DOE provides an alternate water source to the PGDP and the surrounding community. Since the alternate water source used by the plant will continue to be used in the future, ground water is not it pathway of concern for current and future industrial workers. Currently, the alternate water supply is used by all residents in the surrounding area whose wells are contaminated; consequently, ground water can be eliminated as a pathway of concern for current residents. However, transport modeling indicates that the levels of TCE present in the soil at SWMU 91 will migrate to ground water below the unit and eventually may reach the nearest point of exposure (POE) above the regulatory level of 5 µg/l (i.e., the MCL), which may present a risk to future potential ground-water users.

The maximum concentration of TCE predicted to reach the PGDP northern security fence is 200 µg/l, which corresponds to a 1 x 10 -5 ELCR. Consequently, a future potential off-site ground-water user may come into direct contact with unacceptable concentrations of TCE. To protect the future potential off-site ground-water users, the

DOE will take an action that will lower the concentration of TCE in soil at the unit, which will reduce the potential for contaminant migration to the nearest POE at unacceptable levels. Ground-water modeling indicates that reducing the concentration of TCE in soil at SWMU 91 to less than 5.6 mg/kg will result in a concentration in ground water that is less than 5 µg/l at the PGDP's security fence, which reduces the ELCR to a future potential ground-water user by an order of magnitude to approximately 3 x 10 -7, thus protecting human health at the nearest POE, the DOE property boundary. Current ground-water contamination below the unit (i.e., RGA) will be evaluated more thoroughly, relative to cumulative impacts, in the WAG 27 investigation and the ground-water integrator operable unit investigation.

Uncertainties that could affect the results of the risk assessment and the ground-water modeling are detailed in Appendix G of the Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128, and are summarized as follows:

- Trichloroethene and its breakdown products were singled out for much of the sampling efforts at SWMU 91; therefore, contributions to total risk from other contaminants that may be present are not considered;

- Frequencies of contact were used in the risk assessment that exceed current

rates and may exceed expected future rates, resulting in overestimated risks,

- Uncertainties in toxicity values related to their derivation generally are addressed by applying factors that lower the values resulting in overestimated risks; and

- Uncertainties associated with the ground-water modeling performed; specifically that the modeling did not consider attenuation of TCE, which may result in lower concentrations at the nearest POE.

2.7.2 Ecological Risk Assessment

Potential ecological effects and whether SWMU 91 poses an immediate threat are qualitatively evaluated in the preliminary ecological risk assessment. The ecological evaluation concluded that currently there are no factors that pose a threat to ecological receptors. In addition, no factors indicate the possibility of future exposure to ecological receptors at SWMU 91, and it is likely there will be no exposure along contaminant migratory pathways. These conclusions are based primarily upon SWMU 91's location within the facility boundaries inside the PGDP security fence. No critical habitats, populations of, on potential habitats for federally listed, proposed, or candidate species exist within the PGBP security fence. No waterfowl or fish are present in the ditches surrounding the SWMU. The plant communities exist mostly in mowed grass and channeled ditches. Therefore, assessing direct toxic effects on wildlife populations at SWMU 91 is inappropriate due to the industrial nature and small scale of the unit. Furthermore, the cumulative effects of contamination of small areas of terrestrial habitat and contaminant migration from multiple source units to receiving areas (e.g., streams) will be assessed in the PGDP baseline ecological risk assessment for the surface-water integrator operable unit.

Based on the findings of the ecological risk evaluation, only the results of the BHHRA were used to evaluate the need for action at SWMU 91 and to develop the remedial action objective (RAO); however, implementing a technology to address human health

concerns will improve conditions in the ecosystem by accelerating the natural attenuation process.

2.7.3 Conclusions of the Risk Assessment

While the impacts of these uncertainties to the risk assessment results and ground-water modeling vary, data conclusively shows that TCE is distributed throughout the soil within SWMU 91. In addition, underlying ground water in the UCRS appears to have been impacted as a result of TCE migration. In consideration of all available information, TCE is identified as a human health COC, which is the primary emphasis for remedial decisions at SWMU 91.

2.7.4 Remedial Action Objective

Results of the human health risk assessment indicate that the concentration of TCE in the soil at SWMU 91 is not at levels that are associated with unacceptable risk. However, modeling indicates that TCE may migrate to the ground water and eventually to the nearest POE at concentrations exceeding the MCL of 5 µg/l. The RAO is intended to prevent rural residents from exposure to the only COC, TCE. Thus, the RAO for SWMU 91 is to mitigate migration of TCE beyond the SWMU boundary through the ground water by the soil leaching pathway. The Lasagna Tm technology demonstration has been shown to meet effectively the RAO for SWMU 91 by treating TCE contaminated soils present in SWMU 91 to less than 5.6 mg/kg. Remediating TCE levels in soil below 5.6 mg/kg will reduce TCE concentrations below MCLs (less than 5 µg/l), thereby protecting human health at the nearest POE in ground water.

2.8 Description of Alternatives

Twenty-one technologies were evaluated and screened in the Feasibility Evaluation for Trichloroethene-Contaminated Soil at Solid Waste Management Unit 91 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1557&D3. Three alternatives were retained for detailed evaluation. The following paragraphs present a description of the three detailed alternatives evaluated for SWMU 91.

2.8.1 Alternative 1 - No Action

Pursuant to 40 C.F.R § 300.430(e) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the DOE is required to consider a no action alternative. This alternative serves as a baseline to which the other alternatives will be compared. Under this alternative, no further action would be taken at SWMU 91.

Under this alternative, the DOE would take no action to address soil and future ground-water contamination problems or to minimize further contaminant releases from SWMU 91. The alternative would not reduce future risk. No additional costs are associated with this alternative.

2.8.2 Alternative 2 - In Situ Remediation (Lasagna Tm)

Alternative 2 consists of in situ soil treatment for TCE. The in-place soil treatment proposed is a new, yet demonstrated, technology at the PGDP that is provided under the trademark Lasagna Tm. The Lasagna TM process uses electroosmosis (electrical fields) to drive pore volumes of water containing TCE to treatment zones that also are located in the ground (Figure 2-9). The volume of soil proposed for treatment at SWMU 91 is estimated to be 32 m (105 ft) long by 18 m (60 ft) wide by 14 m (45 ft) deep, which

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equates to approximately 7,645 m 3 (270,000 ft 3 or 10,000 yd 3). The treatment zones

(approximately 20) are estimated to be 18 m (60 ft) long by 14 m (45 ft) deep and approximately 5 cm, (2 inches) thick. The media used for treatment may consist of a variety of products such as iron, kaolin clay, and water with the specific treatment medium being determined during design. Electrodes will be placed at the ends of the area and most likely at evenly spaced intervals between treatment zones to supply the electrical current for treatment.

2.8.3 Alternative 3 - In Situ Enhanced Soil Mixing

Alternative 3 consists of stripping volatile organics using a crane-mounted auger (Figure 2-10). The diameter of the soil auger ranges from 0.9 to 3.6 m (3 to 12 ft). Steam, hot air, or hydrogen peroxide is injected through the auger to assist in stripping volatile organics (i.e., TCE) from the soils. Soil vapors, contaminated with volatile organic compounds, are collected under a surface shroud and transported to an off-gas treatment system (e.g., activated carbon that would be regenerated or stored onsite). Treatment zones are overlapped to address the entire contaminated area.

This technology is particularly suited to shallow applications [i.e., effective at depths down to 12 m (40 ft:)] above the water table, but it can be used at greater depths [some commercial vendors have successfully operated this process at depths to 30.5 m. (100 ft) with the smaller diameter augers)]. This technology appears to be applicable to all types of soils (i.e., sandy, silty, or clayey). This technology may require an off-gas treatment system if the expected contaminant concentrations exceed emission standards; therefore, the cost presented in the following text includes off-gas treatment. Application of this technology at the Portsmouth Gaseous Diffusion Plant (PORTS) site indicated that removal efficiencies decreased as depths increased; however, none of the depths conducted at PORTS exceeded the 7-m (22-ft) depth interval. Removal efficiencies also increased with operation times.

2.9 Summary of the Comparative Analysis of Alternatives

This section provides the basis for determining which alternative does the following: (1) meets the threshold criteria for overall protection of human health and the environment, and complies with applicable or relevant and appropriate requirements (ARARs); (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; (3) satisfies both state and community acceptance; and (4) is consistent with the Hazardous Waste Permit.

Nine criteria are required by the CERCLA for evaluating the expected performance of remedial actions. The remedial alternatives have been evaluated based on the nine criteria that are identified as follows.

(1) Overall protection of human health and the environment. This threshold criterion requires that the remedial alternative adequately protects human health and the environment, in both the short and long term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

(2) Compliance with ARARs. This threshold criterion requires that the alternatives be assessed to determine if they attain compliance with ARARs of both state and federal law.

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(3) Long-term effectiveness and permanence. This primary balancing criterion focuses on the magnitude of residual risk and the adequacy and reliability of the controls used to manage remaining waste (untreated waste and treatment residuals) over the long term (i.e., after remedial objectives are met). Remedial actions that provide the highest degree of long-term effectiveness and permanence are those that leave little or no waste at the site, make long-term maintenance and monitoring unnecessary, and minimum the need for institutional controls.

(4) Reduction of contaminant toxicity, mobility, or volume through treatment. This primary balancing criterion is used to evaluate the degree to which the alternative employs recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

(5) Short-term effectiveness. This primary balancing criterion is used to evaluate the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required for protection to be achieved.

(6) Implementability. This primary balancing criterion is used to evaluate potential difficulties associated with implementing the alternative. This may include technical feasibility, administrative feasibility, and the availability of services and materials.

(7) Cost. This primary balancing criterion is used to evaluate the estimated costs of the alternatives. Expenditures include the capital cost, annual O&M, and the combined total present value of capital and O&M costs.

(8) State acceptance. This modifying criterion requires consideration and incorporation of any comments on the ROD from the Commonwealth of Kentucky.

(9) Community Acceptance. This modifying criterion provides for consideration of any formal comments from the community concerning the PRAP.

2.9.1 Overall Protection of Human Health and the Environment

An alternative must meet this threshold criterion to be eligible for selection. Alternative 2 would meet this criterion because it remediates the contaminated soil and reduces the

future potential for contaminants to migrate to the aquifer and offsite. Alternative 3 also meets this criterion bacause it remediates the contaminated soil and reduces the future potential for contaminants to migrate to the aquifer. Alternative 1 does not meet this criterion since it does not address the remediation of contaminants in the soil and the potential of the contaminant to migrate to the ground water and potentially off site.

2.9.2 Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet this threshold criterion to be eligible for selection. The chosen remedial action will provide compliance with ARARs. Both Alternatives 2 and 3 would meet ARARs. A detailed description of ARARs is presented in Section 2.11 of this ROD. Alternative 1 would not comply with ARARs.

2.9.3 Long-term Effectiveness and Permanence

Alternative 2 would reduce potential long-term impacts to the aquifer by treating the contaminated soil (i.e., destroy TCE). However, untreated TCE in the soil may remain and could require minor maintenance and some monitoring. The specific needs for maintenance and monitoring if any, will be determined after the operational period. Also, Alternative 3 would reduce potential long-term impacts to the aquifer by treating the contaminated soil. Untreated TCE soil contamination may remain that could require minor maintenance and some monitoring. Reliability for Alternative 1 is not applicable, since no remedial action is taken.

2.9.4 Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternative 2 will reduce toxicity, mobility, and volume through the treatment of TCE-contaminated soil. This alternative will be designed to treat the soil to an average level below 5.6 mg/kg by the Lasagna Tm process, which uses electroosmosis (electrical fields) to drive pore volumes of water to treatment zones. The Lasagn TM technology is predicted to remediate the contaminated soil to cleanup levels within two years. If the unit has not reached cleanup levels after approximately two years, the process may be allowed to continue for an extended time. However, if the process is not successful at achieving cleanup levels, DOE, in agreement with the EPA and KDEP, may use another technology (e.g., Alternative 3). Alternative 3 will also reduce toxicity, mobility, and volume through the treatment of TCE-contaminated soil. Alternative 3 would be designed to treat the soil to an average level below 5.6 mg/kg by conducting in situ soil mixing combined with vapor extraction (e.g., hot air injection) and off-gas collection/treatment. Alternative 1 will not reduce toxicity, mobility or volume through treatment.

2.9.5 Short-term Effectiveness

Short-term effectiveness is not applicable for Alternative 1. No negative impacts on the community or environment are anticipated for Alternative 2 or Alternative 3. Risk to workers by volatile emission will be controlled by engineering methods and is within acceptable limits for Alternative 3.

2.9.6 Implementability

Alternative 1 would be technically and administratively feasible to implement since no action is involved. Availability of services and materials is not applicable since construction would not take place.

Alternative 2 would be technically and administratively feasible to implement. Construction and operation of the technology on a smaller scale have been proved at the PGDP.

Alternative 3 would be technically and administratively feasible to implement. Materials and services are available and the technology has been demonstrated at other DOE facilities.

2.9.7 Costs

Estimated present worth, escalated capital costs, and 30-year O&M costs for each alternative are presented in Table 2-1. The total present worth cost and O&M costs for each alternative also are presented in the Table 2-1.

Table 2-1. Cost Estimates

Criteria	Alternative 1 - No Action	Alternative 2 - In Situ Remediation (Lasagna TM)	Alternative 3 - In Situ Enhanced Soil Mixing
Cost			
Total escalated capital cost	$0	$1,924,000	$2,879,000
Total present worth capital cost	$0	$1,849,000	$2,762,000
Annual O&M cost	$0	$7,000	$7,000
Present worth O&M costs	$0	$99,000	$102,000
Total present worth cost	$0	$1,948,000	$2,864,000

2.9.8 State Acceptance

This remedial action will be initiated pursuant to provisions of the PGDP's Kentucky Hazardous Waste Management Permit KY8-89D-008-982. The Preliminary Site Characterization/Baseline Risk Assessment/Lasagna TM Technology Demonstration at Solid Waste Management Unit 91 of the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, KY/EM-128, was issued to the KDEP and the EPA for review. The Feasibility Evaluation for Trichloroethene-Contaminated Soil at Solid Waste Management Unit 91 at the Paducah

Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1557&D3 and the Proposed Remedial Action Plan for Solid Waste Management Unit 91, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1499&D3 have been approved by the KDEP and EPA.

2.9.9 Community Acceptance

As previously discussed in Section 2.3 and later in the Responsiveness Summary, which is Section 3 of this ROD, the public has been provided the opportunity to comment on the selected remedial action. No member of the public stated opposition to the selected remedial action or any other aspect of the proposed plan.

2.10 Selected Remedy

Based upon the evaluation of the alternatives utilizing the nine CERCLA criteria, the remedy that best meets the threshold, balancing and modifying criteria for the scope and objectives of thisremedial action is Alternative 2.

The selected remedy will, at a minimum consist of the following elements.

- In situ soil treatment for TCE (Lasagna Tm).
- The Lasagna TM process uses electroosmosis (electrical fields) to drive pore volumes of water containing TCE to treatment zones located in the ground.
- The volume of saturated soil proposed for treatment at SWMU 91 is estimated to be 32 m (105 ft) long by 18 m (60 ft) wide by 14 m (45 ft) deep, which equates approximately to 7,645 m 3 (270,000 ft 3 or 10,000 yd 3).
- The treatment zones (approximately 20) will be nearly 18 m (60 ft) long by 14 m (45 ft) deep and approximately 5 cm (2 inches) thick.
- The media used for treatment may consist of products such as iron, kaolin clay, and water with the exact composition being determined during design.
- Electrodes will be placed at the ends of the area to be remediated and, most likely, at evenly spaced intervals between the treatment zone boundaries to supply the electrical current needed for treatment

The DOE will prepare a detailed design for this remedial action in accordance with the requirements specified in the Declaration of this ROD. During remedial design and remedial construction activities, some changes may be made.

This action is expected to provide overall protection of human health and the environment. It also can be implemented in compliance with ARARs. This action will serve as a remedial action for the soil at SWMU 91 of WAG 27. Contaminant mobility to the underlying aquifer will be reduced as a result of the treatment. This alternative will provide short-term effectiveness and may be readily implemented. As shown in Table 2-1, the total present worth estimated cost for Alternative 2 is $1,948,000.

The Lasagna TM process is an innovative technology. If the unit has not reached cleanup levels within two years, the process may be allowed to continue operation until cleanup is achieved. However, if the process is not successful at achieving cleanup levels, the DOE may use another technology, Alternative 3 - In Situ Enhanced Soil Mixing to remediate the unit. This technology consists of the following elements:

- A crane or other mechanical mixing unit;
- An agent delivery system (e.g., hot air, steam, or hydrogen peroxide); and
- An off-gas collection/treatment system (e.g., activated carbon that will be regenerated or stored onsite).

2.11 Statutory Determinations

This remedial action is protective of human health and the environment and complies with both federal and state ARARs. This remedial action is cost-effective, and it follows the statutory mandate for permanent solutions and alternative treatment technologies to the maximum extent practicable. Additionally, this action meets the statutory reference for remedies that employ treatments that reduce toxicity, mobility, or volume as a principal element. Since contaminants may remain at the unit, a five-year review evaluating whether the remedy's cleanup levels provide adequate protection for human health and the environment may be required.

2.11.1 Overall Protection of Human Health and the Environment

The selected action contributes to protection of human health for PGDP employees and the public through treatment, which will limit the potential for direct exposure and mitigate migration of contaminants from the SWMU. The remedy provides effective sampling and management of all residual wastes generated during implementation of the action, if unlimited use and unrestricted exposure remain after remediation.

2.11.2 Applicable or Relevant and Appropriate Requirements

The United States Congress specified in CERCLA § 121 (42 U.S.C.A. § 9621) that remedial actions for the cleanup of hazardous substances must comply with the requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are legally applicable or relevant and appropriate to the hazardous substances or circumstances at a site. The EPA categorizes ARARs as being either "applicable" or "relevant and appropriate" to a site. The terms and conditions pertinent to these categories are discussed as follows.

- Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial

action, location, or other circumstance found at a CERCLA site" (40 C.F.R. § 300.5).

- Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (40 C.F.R. § 300.5).

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. If a requirement is not applicable, then it must be both relevant and appropriate in order for it to be an ARAR. In cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, in cases where the implementation of a federal environmental program has been delegated by the EPA to a state, typically, the analogous state regulations would be used as ARARs.

Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing CERCLA remedies. In addition, ARARs do not exist for every chemical or circumstance likely to be found at a CERCLA site. Therefore, the EPA believes that it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR. Criteria or guidance developed by the

EPA, other federal agencies, or states may assist in determining, for example; health-based cleanup levels for a particular contaminant or the appropriate method for conducting an action for which no ARARs exist. This other information is to be considered (TBC information and may be used when developing CERCLA remedies.
The TBC information generally falls within three categories: (1) health effects information, (2) technical information on performing or evaluating investigations or response actions, and (3) policy. A possible fourth category of TBC information is proposed regulations, if the proposed regulation is non-controversial and likely to be promulgated as drafted.

The EPA further categorizes ARARs based on whether they are specific to the chemical(s) present at the site (chemical-specific), the remedial action being evaluated (action-specific), or the location of the site (location-specific). Terms and conditions relevant to this categorization include the following.

- Chemical-specfic ARARs usually are "health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values" [53 Fed. Reg. 51437 (December 21, 1988)]. These values establish the acceptable amount or concentration of a

chemical that may remain in, or be discharged to, the ambient environment.

- Action-specific ARARs usually are "technology- or activity-based requirements or limitations placed on actions taken with respect to hazardous wastes, or to conduct certain actions to address particular circumstances Fed. Reg. 51437 (December 21, 1988)]. Selection of a particular remedial action at a site will trigger action-specific ARARs that specify appropriate technologies and performance standards.

- Location-specific ARARs "generally are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations" [53 Fed. Reg. 51437 (December 21, 1988)). Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats.

The EPA designated these categories to assist in the identification of ARARs; however, they are not necessarily precise [53 Fed. Reg. 51437 (December 21, 1988)]. Some ARARs may fit into more than one category, while others may not fit definitively into any one category.

According to the preamble to the NCP at 53 Fed. Reg. 51443 (December 21, 1988), potentially responsible parties (PRPs) conducting remedial actions, or portions of remedial actions entirely onsite as defined in 40 C.F.R. § 300.5, must comply with the substantive portions of ARARs, but not the procedural or administrative requirements. Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements (e.g., permit applications and procedural requirements) facilitate remedial action implementation. Also, CERCLA § 121(d)(4) [42 U.S.C.A. § 9621(d)(4)] provides several ARAR waiver options that may be invoked, provided that human health and the environment are protected. Moreover, under CERCLA § 121(e) [42 U.S.C.A. § 9621(e)], PRPs are not required to obtain federal, state, or local permits in order to conduct on-site response actions.

In the NCP at 40 C.F.R. § 300-150, the EPA has addressed the relationship of ARARs to worker protection standards. The EPA states that CERCLA response actions must comply with the worker protection standards and requirements of the Occupational

Safety and Health Act of 1970 (29 U.S.C.A §§ through 678) and analogous state laws; however, the standards and requirements are not ARARs [55 Fed. Reg. 8680 (March 8, 1990)].

The DOE, in Order 5480.4, Environmental Safety and Health Standards, establishes general requirements for environmental protection, safety, and health standards for all DOE and contractor Operations. The Order is an internal standard, and, consistent with 40 C.F.R. § 300-150, is not an ARAR. Nonetheless, DOE Order 5480.4 must be followed during the design, construction operation, modification (if any), and decommissioning phases of the remedial action.

Lastly, while CERCLA requires that the RCRA and other environmental laws be evaluated as ARARs [42 U.S.C.A. § 9621(d)(2)(A) and 40 C.F.R. § 300.420(f)(1)(i)(A)], this in no way limits, takes away, or negates the KDEP's RCRA authority at the PGDP.

Chemical-, location-, and action-specific ARARs and TBC information that exist for remedial action at SWMU 91 are described in the following sections. These ARARs apply both to the preferred Lasagna TM technology and to the contingency remedy, In Situ Enhanced Soil Mixing, unless otherwise noted.

2.11.2.1 Chemical-specific applicable or relevant and appropriate requirements

Ground-water contamination.

The Kentucky Administrative Regulations at 401 K.A.R. 8:250-420 may be relevant and appropriate for contaminated ground water at SWMU 91. The MCLs defined in these regulations are legally applicable to water "at the tap" but are not applicable to the cleanup of ground water. However, they may be considered as relevant and appropriate in situations where ground water may be used for drinking water. The MCL for TCE is 0.005 mg/l (401 K.A.R. 8:420 § 3). This ARAR is relevant and appropriate to both the preferred and contingency remedy. Either technology is expected to reduce the soil contamination to a level that would no longer contribute to ground-water contamination.

2.11.2.2 Location-specific applicable or relevant and appropriate requirements

Wetlands and floodplains.

No adverse impacts to floodplains or wetlands in the vicinity of SWMU 91 are anticipated. Consequently, although all ARARs discussed in this section are applicable, those referring to floodplains and wetlands will be met by avoidance of the resource. However, if impacts become apparent, due to construction or other plan modifications, additional requirements (compliance with the substantive requirements of Nationwide Permit (NWP) 38, 33 C.F.R. § 330) will need to be addressed and/or initiated during the remedial design and/or remedial action ha to comply with the ARARs. The requirements discussed in this section will apply to both remedial technologies.

Wetlands, and a small portion of the 100-year floodplain of Bayou Creek, have been identified in a drainage ditch approximately 100 feet south of SWMU 91. Construction activities must avoid or minimize adverse impacts to wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990; 40 C.F.R. § 6.302(a); 40 C.F.R. § 6, Appendix A; and 10 C.F.R. § 10221. In addition, construction activities must minimize potential harm to the 100-year floodplain (Executive Order 11988 and 10 C.F.R. § 1022).

The DOE will avoid, to the extent practicable, the long- and short-term adverse impacts to floodplains and wetlands [10 C.F.R. § 1022.3(a)]. The DOE will undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain [10 C.F.R. 1022.3(c)].

Construction in wetlands will be avoided unless there are no practicable alternatives [40 C.F.R. § 6.302(a)]. Degradation or destruction of wetlands will be avoided to the extent possible [40 C.F.R. § 230.10 and 33 U.S.C. § 1344(b)(1)]. Considerations about protection of wetlands will be incorporated into planning, regulating, and decision making [10 C.F.R. § 1022.3(b)). Any action involving the discharge of dredged or fill material into wetlands will be avoided to the extent possible (13 U.S.C. § 1344, 40 C.F.R. § 230, and 33 C.F.R. §§ 320 to 330).

2.11.2.3 Action-specific applicable or relevant and appropriate requirements

Solid waste management unit cleanup.

The regulations that apply to the cleanup of SWMUs are applicable to Lasagna TM and In Situ Enhanced Soil Mixing. These applicable regulations do not contain specific cleanup standards, but instead they require corrective action measures that win result in the protection of human health and the environment (40 C-F.R. § 264.101 and 401 K.A.R. 34:060 § 12). Either technology would comply with this ARAR.

Site preparation activities.

Although fugitive dust associated with the implementation of either remedial action would be minimal, on-site construction activities may produce airborne pollutants. The Kentucky Air Quality standards found in 401 K.A.R. 63:010 §§ 314 contain general standards of performance governing fugitive dust emissions. The standards require the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust [401 K.A.R. 63:010 § 3(1)(b)]. The standards also require that visible dust generated from implementation of the remedial alternative not be discharged beyond the property line of the PGDP [401 K.A.R. 63:010 § 3(2)]. Additionally, all open-bodied trucks that operate outside the property boundary and that may emit materials that could become airborne must be covered [401 K.A.R. 63:010 § 4(1)]. These requirements are applicable.

Toxic air emissions.

No TCE emissions are anticipated with the Lasagna Tm technology. However, if the contingency remedy, In Situ Enhanced Soil Mixing, is implemented, the potential exists for TCE emissions to occur. The DOE must first determine if the regulations at 401 K.A.R. 63:022 apply by calculating the significant emission level for the specific toxic air pollutant (as specified in Appendix B of 401 K.A.R. 63:022). If it is determined that the toxic air regulations apply, normally, a permit would be required. However, because this is a CERCLA action, only the substantive provisions must be followed. The regulation specifies that no source is to exceed the allowable emission limit specified in Appendix A of 401 K.A.R. 63:022. If the emission limit cannot be met, even after the application of best available control technology, then best available control technology must be used (401 K.A.R. 63:022 § 3). Appropriate measures would be taken, if the contingency remedy were implemented, to comply with this ARAR.

Surface-water control for construction activities.

Storm-water discharges from construction activities onsite at the PGDP are regulated by the KPDES Permit: (KY0004049) established pursuant to 401 K.A.R. 5:055. The PGDP's KPDES Permit specifies that best management practices and sediment and erosion controls be implemented at a site to control storm-water runoff. These requirements are applicable during the construction of either remedy identified in this ROD.

Hazardous waste determination.

During construction of the remedial action, either Lasagna TM or In Situ Enhanced Soil Mixing, a minimal amount of soil will be generated. The soil must undergo a hazardous waste determination pursuant to 40 C.F.R. § 262.11 and 401 K.A.R. 32:010 § 2. If the waste is determined to be hazardous, RCRA Subtitle C requirements would be applicable (40 C.F.R. § 262.34, 401 K.A.R. 34:030 § 5). Any waste generated during implementation of the remedial action will be characterized appropriately.

Radioactive waste determination.

Any waste generated with the remedial action must be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal [DOE Order 5820.2A, III3.d(1). The DOE Order 5820.2A is TBC information to the disposition of any radioactive waste associated with this action. Waste characterization data must be recorded on a waste manifest and must include the following: the physical and chemical characteristics of the waste; volume of the waste; weight of the waste; major radionuclides and their concentrations; and packaging date, package weight, and external volume. Again, during the implementation of Lasagna TM or In Situ Enhanced Soil Mixing, appropriate characterization will occur.

Table 2-2 lists the chemical-, location-, and action-specific ARARs for remedial action at SWMU 91.

2.11.3 Cost Effectiveness

The preferred remedy provides overall effectiveness to remove and treat contaminants and to reduce potential risk while being proportional to its cost. The preferred remedy represents the least expensive remedial alternative that employs innovative treatment.

2.11.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy (Lasagna TM) meets the statutory requirement to utilize permanent solutions and treatment technologies to the maximum extent practicable. The selected remedy also satisfies the five primary balancing criteria. It provides long-term effectiveness and permanence, it provides the greatest reduction of toxicity, mobility, and volume through treatment; it provides short-term effectiveness; it is administratively and technically feasible to implement, and it is the most cost-effective remedial alternative evaluated.

Table 2-2. Applicable or Relevant and Appropriate Requirements and To Be Considered

Information for the Remedial Action
(Lasagna Tm with In Situ Enhanced Soil Mixing Contingency)

Regulatory Triggers	Requirements	Prerequisites	K.A.R. Citation	Federal Citation
		CHEMICAL-SPECIFIC		
Protection of drinking water	Treatment to MCLs: TCE 0.005 mg/l.	Contaminants that have leached into potential sources of water - Relevant and appropriate to ground-water remediation, applicable at the "tap."	401 K.A.R. 8:420 §3	40 C.F.R. § 141.60
		LOCATION-SPECIFIC		
Protection of wetlands	Avoid or minimize adverse impacts to wetlands to preserve and enhance their natural and beneficial values.	Any federal action that will have an impact on wetlands - Applicable if avoidance is achieved.		10 C.F.R.§ 1022 and Executive Order 11990
	Avoid degradation or destruction of wetlands to the extent possilble.	Any action involving discharge dredged or fill material into wetlands - Applicable if avoidance is not achieved.		40 C.F.R. § 230.10 and 13 U.S.C. § 1022.3(b)
	Incorporate considerations about protection of wetlands into regulating and decision making. Follow substantive requirements of general Nationwide Permit conditions.	Any federal action that will have an impact on wetlands - Applicable if avoidance is achieved.		10 C.F.R. § 1022.3(b) and 33 C.F.R. § 330
Protection of 100-year floodplains	Avoid siting or construction in any 100-year floodplains.	Any federal action within a 100-year floodplain - Applicable if avoidance is not achieved.		10 C.F.R. § 1022 and Executive Order 11988

Table 2-2. Applicable or Relevant and Appropriate Requirements and To Be Considered Information for the Remedial Action
(Lasagna TM with In Situ Enhanced Soil Mixing Contingency) (Continued)

Regulatory Triggers	Requirements	Prerequisites
K.A.R. Federal Citation	Citation	
		ACTION-SPECIFIC
Site preparation and construction activities 401 K.A.R. 63:010 § 3 401 K.A.R. 63:010 § 3(1)(b) 401 K.A.R. 63:010 § 3(2) 401 K.A.R. 63:010 § 4(l)	Reasonable precaution must be taken to prevent particulate matter from becoming airborne. Such precautions may include the following: · Use water or chemicals to control dust from construction activities and/or place asphalt, oil, water, or suitable chemicals on roads and material stockpiles to control dust; · Ensure that no visible fugitive dust is emitted beyond the property line, and · Ensure that all open-bodied trucks are covered if any materials in the truck could become airborne.	Handling, processing construction, road-grading, land-clearing activities - Applicable.

2.11.5 Preference for Treatment as a Principal Element

The selected remedy meets the statutory preference for treatment as a principal element This is accomplished by the Lasagna TM technology that remediates, soils by driving the TCE-contaminated pore volume water through treatment zones. The process uses electroosmosis to move contaminants in the soil water into treatment zones where the contaminants can be captured or decomposed.

2.12 Documentation of Significant Changes

The Proposed Remedial Action Plan for Solid Waste Management Unit 91 at the Paducah

Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1499&D3, was made available for a "45-day public review and comment period that began February 23, 1998, and ended on April 8,1998. No meeting was requested for the proposed plan nor were any comments received from the public; therefore, the DOE has determined that no significant changes to the remedy are necessary.

PART 3

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

3.1 Responsiveness Summary Introduction

The responsiveness summary has been prepared to meet the requirements of sections 113(k)(2)(b)(iv) and 117(b) of the CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, that requires DOE as "lead agency" to respond ". . . to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the SWMU 91 of WAG 27 Proposed Remedial Action Plan.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and recommended a remedial action that will reduce the potential migration of contaminants from the soil to the aquifer (i.e., off-site ground water to the POE). As part of the remedial action process, a notice of availability regarding the PRAP was published in The Paducah Sun, a major regional newspaper of general circulation. The Proposed Remedial Action Plan for Solid Waste Management Unit 91 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1499&D3, was released to the general public February 23, 1998. This document was made available to the public at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A 45-day public comment period began February 23,1998, and continued through April 8, 1998. The PRAP also contained information that provided the opportunity for a public meeting to be held, if requested. No request for the meeting was made by the public, so no meeting was held. Specific groups that received individual copies of the PRAP included the Natural Resource Trustees and the Site Specific Advisory Board.

Public participation in the CERCLA process is required by the SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide the DOE with information about the community preferences and concerns regarding the remedial

alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process. However, there were no public comments.

3.2 Community Preferences/Integration of Comments

No comments, written or oral, were received from the public; therefore, this document does not address public comments, except to the extent that it is assumed that the proposed plan is satisfactory to the public.

APPENDIX

Remedial Design Schedule
for Solid Waste Management Unit 91

<IMG SRC 98113Q>

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PADUCAH GASEOUS DIFFUSION PLANT (USDOE)

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Address: PADUCAH, KY

EPA ID: KY8890008982
EPA Region: 04

Record of Decision (ROD):

ROD Date: 08/10/1998
Operable Unit: 05
ROD ID: EPA/541/R-98/112

Media: Groundwater, Sediment, Soil, Surface Water

Contaminant: Base Neutral Acids, Inorganics, Metals, PAH, Radioactive, VOC

Abstract: Please note that the text in this document summarizes the Record of Decision for the purposes of facilitating searching and retrieving key text on the ROD. It is not the officially approved abstract drafted by the EPA Regional offices. Once EPA Headquarters receives the official abstract, this text will be replaced.

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, approximately 10 miles west of Paducah and about four miles south of the Ohio River. This plant is an uranium enrichment facility owned by the United States Department of Energy (DOE). The PGDP, which has been in operation since 1952, supplies fuel for commercial reactors.

Under the DOE's Environmental Management Program, cleanup activities currently are being conducted at the PGDP to address contamination that resulted from past waste-handling and disposal practices. These cleanup activities comply with the requirements of the Commonwealth of Kentucky, the United States Environmental Protection Agency (EPA), and the DOE.

Operable Unit 3 (OU3):
OU3 consists of the Northeast Plume. In August 1988, volatile organic compounds (VOCs) and radionuclides were detected in groundwater from residential wells north of the PGDP. In response to

this discovery, the DOE and EPA entered into an Administrative Order by Consent (AOC) under Sections 104 and 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The DOE then implemented the PGDP Water Policy to reduce the current risk to potential human exposure. The CERCLA site investigations discovered trichloroethene (TCE)-contaminated groundwater within the Regional Gravel Aquifer (RGA) northeast of the plant. This plume is referred to as the Northeast Plume. One source of groundwater contamination in the Northeast Plume is thought to be the Kellogg Building leach field.
A ROD addressing OU3 was completed in June 1995.

OU5:
OU5 is comprised of waste area groups (WAGs) 1 and 7. WAG1 is located within the plant security fence in the southwestern corner of the PGDP. It includes solid waste management unit (SWMU)100 (the fire training area (FTA)) and SWMU 136 (the C-740 TCE Spill Site). The FTA is located in the southwest corner of the PGDP, immediately west of Fourth Street. It consists of one large rectangular surface burn area, two circular burn pan areas, one circular electric pump area, an elevated and bermed fuel tank area, and two square burn area depressions. The burn areas are unlined and are not bermed. The FTA has been used since 1982 for staging fire training exercises involving waste oils, fuels, and other combustible liquids. Combustible liquids were not burned in the unlined areas after 1987. Fire training exercises continue to be conducted in the vicinity, but, in order to prevent any negative impacts to the environment, no burning is conducted in unlined areas and combustible liquids are no longer used.
The TCE Spill Site is a small rectangular area, approximately 15 feet by 6 feet, located in the southwest corner of the PGDP within the plant security fence. The C-740 Material Yard is an active storage yard that has been used since the early 1970s for storing various scrap metals and drums. A 55-gallon drum stored on the concrete pad leaked TCE onto the pad and into the gravel and soil adjacent to the western edge of the pad in May 1990. In October 1990, soils contaminated with TCE were excavated from a 15 foot by six foot area, to a depth of three feet. Soil samples collected from the base of the excavation pit were found to have TCE concentrations., indicating that TCE-contaminated soils had not been completely removed.
WAG 7 consists of SWMUs 130 through 134 and SWMU 8. All five underground storage tanks (USTs) located in the vicinity of the WTP currently are inactive. With the exception of SWMU 133, which is of unknown size, the C-611 USTs range in capacity from 189 to 7,571

liters. Two of the USTs were reportedly used for gasoline storage from 1942 to 1945 in support of Kentucky Ordnance Works (KOW) operations. SMU 132 was used for fuel oil storage from approximately 1942 to 1955, initially as part of the KOW, and later in support of PGDP activities. It was abandoned in place by filling the tank with sand. The dates of operation of the remaining two USTs (SWMUs 133 and 134) are unknown; both were reportedly used for diesel storage and are known to have been removed from service by 1975. The SWMU 133 tank was abandoned in place filling the tank with grout.
SWMU 8 is located southwest of the PGDP fenced security area. It is situated immediately west of Bayou Creek and north of an unnamed tributary of Bayou Creek. Records indicate that the PGDP used the landfill between 1951 and 1981 for disposal of fly ash from the plant's coal combustion boilers, uncontaminated combustible plant waste, and potentially radiologically contaminated plant waste. During operations, trenches were cut in the fly ash and used for burning trash. This practice ceased in 1967, after which waste was buried without burning. The waste, containing primarily office waste with some construction debris and kitchen waste, was placed in trenches excavated within the fly ash and covered, when necessary, with additional fly ash or soil fill. In addition to these materials, sludge from the C-615 Sewage Treatment Plant may have been buried at the unit, as it was reportedly used as fill material.
A ROD addressing OU5 was completed in August 1998.

OU6:
The North-South Diversion Ditch (NSDD) is located in the north central portion of the security area. The ditch receives stormwater runoff from the steam plant, process buildings, cooling tower, and the switchyards. The NSDD also receives wastewater from the cleaning building and residual fly ash with associated metals from the steam plant.
A ROD describing OU6 was completed in March 1994.

OU8:
OU8 is comprised of WAG 22. WAG 22 consists of the following solid waste management units (SWMUs): SWMU 2, the C-749 Uranium Burial Ground; SWMU 3-the C-404 Low-Level Radioactive/Hazardous Waste Burial Ground; SWMU 7, the C-747-A Burial Ground; and SWMU 30, the C-747-A Burn Area.
The C-749 Uranium Burial Ground was used from approximately 1951 to 1977 for the disposal of uranium and uranium containing wastes. The exact depth of the buried waste is not known. Wastes were reportedly placed in trenches excavated to a total depth of approximately seven to 17 feet and then covered with two to four

feet of soil. Occasionally, fires were reported as a result of oxidation of pyrophoric uranium metal, but no subsidence was observed resulting from potential volume reductions due to the fires. It has been estimated that 270 tons of uranium, 59,000 gallons of oils, and 450 gallons of TCE were buried in SWMU 2.
The C-404 Low-Level Radioactive/Hazardous Waste Burial Ground (SWMU 3) is located immediately east of the C-749 Burial Ground in the west-central area of the plant. It was originally constructed in the early 1950s as an aboveground holding pond, with an on-grade tamped earth floor and clay dike walls. The burial ground was used from 1951 to 1957 as a primary disposal area for TCE and uranium-contaminated effluent. In 1957, all free liquids were removed, and disposal of uranium-contaminated bulk solid wastes began at the unit. In 1976, after the facility was filled with bulk solid waste, it was covered with compacted earth and the weir at the southwest corner was converted into a leachate collection sump.
A ROD addressing OU8 was completed in August 1995.

OU12:
OU12 is comprised of the 28 areas of concern (AOCs) of WAG 17, which are separated into groups based on the purpose of the rubble piles. Concrete material at AOCs 115, 116, 118, 127, 149, and 151 serves as bank and erosion control along bodies of water. Concrete material at AOCs 103, 104, 112, 146, 147, and 150 currently is associated with dam construction and provides structural support. Concrete material at AOCs 114, 117, 119, 120, 121, and 128 is used for support and erosion control at bridges and culverts in WAG 17. Concrete material at AOCs 126, 148, and 197 is used to stabilize roadways in the WKWMA and the BCWMA. AOCs 110, 111, 123, 124, 125, 152, and 184 consist of piles of concrete that have no specific purpose.
A ROD addressing OU12 was completed in September 1997.

OU15:
The Cylinder Drop Test Area solid waste management unit 91 (SWMU 91) encompasses approximately 0.7 hectacres (1.7 acres) and is located in the extreme west-central area of the plant on the southern edge of the C-745-B Cylinder Yard. Drop Tests were conducted at the PGDP from latte 1964 until early 1965 and in February 1979 to demonstrate the structural integrity of the steel cylinders used to store and transport uranium hexafluoride (UF6) . Prior to structural testing, the cylinders went through thermal conditioning by immersing them in a concrete pit containing dry ice and TCE. During the tests, a crane lifted the cylinders to a specified height and dropped them onto a concrete and steel pad to simulate worst-case transportation accidents. The amount of TCE released at

the drop test site can be estimated based on the size of the cylinders. The cylinders are 12.2 feet long and four feet in diameter with a width of approximately five feet. The likely maximum quantity lost to the surrounding soil is approximately 430 gallons.
A ROD addressing OU15 was completed in August 1998.

Remedy: The selected remedy for Solid Waste Management Unit (SWMU 8) is Limited Action. This remedy consists of placing riprap along the northern bank of the unnamed tributary at any visible leachate seep locations to minimize the potential for exposure and along the western bank of Bayou Creek to reduce erosion during high flow events. Signs warning workers and trespassers of the potential risks to human health would be installed along the creek and at the entrance to the landfill site. Institutional controls, including groundwater and surface-water monitoring, would continue. Additional groundwater monitoring wells would be installed, as needed. In addition to installing signs and placing riprap within the creek channel, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Instituting a deed notice and restrictions would supplement institutional controls in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land use and prohibiting destruction of existing and future contaminant controls. Since SWMUs 130 through 134 and 136 do not present an unacceptable risk to human health and the environment, no further remedial action will be performed at these units. Additionally, since there are no risks to industrial workers at SWMU 100 based upon actual exposures at the unit, no further action is warranted.

Estimated Capital Cost: $340,000
Estimated O&M Cost: $60,000
Estimated Contingency Cost: $6,000
Estimated Total Cost: $406,000
Estimated Present Worth: $350,000

Text: Full-text ROD document follows on next page.

EPA-541-R98-112

<IMG SCR 981120>

DOE/OR/06-1470&D3

Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

<IMG SCR 98112A>

February 1998

Cleared for Public Release

<IMG SCR 98112B>

Department of Energy
Oak Ridge Operations
Paducah Site Office
P.O. Box 1410
Paducah. Ky 42001

August 28, 1998

Mr. Robert H. Daniell, Director
Division of Waste Management
Kentucky Department for Environmental Protection
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

Mr. Carl R. Froede Jr., P.G.

United States Environmental Protection Agency
Region IV
DOE Remedial Section
Federal Facilities Branch
Waste Management Division
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr.Daniell and Mr.Froede:

RECORD OF DECISION FOR WASTE AREA GROUPINGS 1 AND 7 AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, DOE/OR/06-1470&D3

Enclosed for your information is the final Record of Decision (ROD) for Waste Area Groupings (WAGs)1 and 7 at the Paducah Gaseous Diffusion Plant. The ROD was signed by the Department of Energy (DOE) February 20, 1998, and by the Environmental Protection Agency August 10, 1998. Concurrence with this ROD by the Kentucky Department for Environmental Protection was received in a letter dated June 24, 1998, on the subject matter.

If you have any questions or require additional information, please call Myrna E.Redfield at (502)441-6815.

<IMG SCR 98112C>

Enclosure

cc w/o enclosure:
R. Blumenfeld, CC-10
P.A. Gourieux, Bechtel Jacobs Company/Kevil
J.C. Massey, Bechtel Jacobs Company/Kevil
B.E. Phillips, JEG/Kevil
R.C. Sleeman, EM-91
T. Taylor, UKFFOU/Frankfort

CERTIFICATION

Document Identification: Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant,

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

<IMG SCR 98112D>

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility.The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibilty), including but not limited to, the following responsibilities: waste analyses and handling monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11 (d), the Department of Energy's representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

CERTIFICATION

Document Identification: Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky DOE/OR/06-1470&D3

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine

and imprisonment.

Lockheed Martin Energy Systems, Inc.
Co-Operator

<IMG SCR 98112E>

The Department of Energy has signed as "owner and operator" and Lockheed Martin Energy Systems, Inc., has signed as "co-operator" this application for the permitted facility. The Department has determined that dual signatures best reflect the actual apportionment of responsibility under which the Department's RCRA responsibilities are for policy, programmatic, funding, and scheduling decisions, as well as general oversight, and the contractor's RCRA responsibilities are for day-to-day operations (in accordance with general directions given by the Department of Energy as part of its general oversight responsibility).
including but not limited to, the following responsibilities: waste analyses and handling, monitoring, record keeping, reporting, and contingency planning. For purposes of the certification required by 40 CFR Section 270.11(d), Lockheed Martin Energy Systems. Inc.'s. representatives certify, to the best of their knowledge and belief, the truth accuracy and completeness of the application for their respective areas of responsibility.

DOE/OR/06-1470&D3

Record of Decision for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

February 1998

Prepared by
Jacobs EM Team
175 Freedom Boulevard · Kevil, KY 42053
Under Contract DE-AC05-93OR22028

Prepared for
United States Department of Energy
Remediation Management Group

PREFACE

This Record of Decision For Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1470&D3, was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act; the Resource Conservation and Recovery Act; and Kentucky hazardous waste statutes (K.R.S. 224.46-520 and K.R.S. 224-46-530). This document was prepared under Work Breakdown Structure 7.1.04.06.02 (Activity Data Sheet 5304). This document follows the outline for records of decision contained in the draft Federal Facility Agreement being negotiated for the Paducah Gaseous Diffusion Plant (PGDP) among the United States Department of Energy (DOE), the United States Environmental Protection Agency (EPA), and the Kentucky Department for Environmental Protection (KDEP). Publication of this document meets a primary document deliverable milestone for the PGDP's Environmental Management, Program. This document provides the record of information and rationale that the EPA, the KDEP, and the DOE utilized in the selection of preferred remedial actions /corrective measures at the Waste Area Groups 1 and 7 solid waste management units. Information provided in this document forms the basis for the development of the remedies selected for this project.

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ACRONYMS AND ABBREVIATIONS

The following list of acronyms and abbreviations is provided to assist in the review of this document.

237 Np	neptunium-237
238 Pu	plutonium-238
99 Tc	technetium-99
228 Th	thorium-228
230 Th	thorium-230
232 Th	thorium-232
234 U	uranium-234
235 U	uranium-235
238 U	uranium-238
ALARA	as low as reasonably achievable
amsl	above mean sea level
AR	administrative record
ARAR	applicable or relevant and appropriate requirement
bls	below land surface
C.F.R.	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and

	Liability Act
cm	centimeter(s)
COC	chemical of concern
COE	United States Army Corps of Engineers
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSOU	Comprehensive Site Operable Unit
CWA	Clean Water Act
DCA	dichloroethane
DCE	dichlorothene
DOD	United States Department of Defense
DOE	United States Department of Energy
ELCR	excess lifetime cancer risk
EPA	United States Environmental Protection Agency
Fed.Reg.	Federal Register
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Act
FS	feasibility study
ft	foot/feet
FTA	fire training area
g	gram(s)
gal	gallon(s)
gpm	gallons per minute
GPPP	Groundwater Protection Program Plan
HDPE	high-density polyethylene
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
J	qualifier indicating estimated value
K.A.R.	Kentucky Administrative Regulations
K.R.S.	Kentucky Revised Statutes
KDEP	Kentucky Department for Environmental Protection
KDOW	Kentucky Department for Environmental Protection, Division of Water
kg	kilogram(s)
km	kilometer(s)
KOW	Kentucky Ordnance Works
KPDES	Kentucky Pollutant Discharge Elimination System
l	liter
LDR	land disposal restriction
LMES	Lockheed Martin Energy Systems, Inc.
m	meter(s)
mg	milligram(s)
mgd	million gallons per day
mil	thousandths of an inch
mrem	millirem
MW	monitoring well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOV	Notice of Violation
NWP	nationwide permit
O&M	operation and maintenance
OU	operable unit

PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi	picocurie(s)
PGDP	Paducah Gaseous Diffusion Plant
pH	logarithm of the reciprocal of the hydrogen-ion concentration
PPE	personal protective equipment
PRAP	proposed remedial action plan
PRP	potentially responsible party
RCRA	Resource Conservation and Recovery Act
RH	Resource Conservation and Recovery Act facility investigation
RGA	Regional Gravel Aquifer
RI	remedial investigation
ROD	record of decision
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
sec	second
SSAB	Site Specific Advisory Board
SWMU	solid waste management unit
T&E	threatened and endangered
TBC	to be considered
TCA	trichloroethane
TCE	trichloroethene
TNT	trinitrotoluene
Tu a	acute toxicity
U.S.C.A.	United States Code Annotated
UCRS	Upper Continental Recharge System
USEC	United States Enrichment Corporation
UST	underground storage tank
VOC	volatile organic compound
WAG	waste area group
WTP	water treatment plant
yd	yard(s)
yr	year(s)
µg	microgram(s)
µmhos	micromhos: the reciprocal of resistivity

PART 1

DECLARATION

DECLARATION FOR THE RECORD OF DECISION FOR WASTE AREA GROUPS 1 AND 7

SITE NAME AND LOCATION

Waste Area Groups 1 and 7
Paducah Gaseous Diffusion Plant
United States Department of Energy
Paducah, Kentucky

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the final remedial action decisions selected for soils and sediments in each of the solid waste management units (SWMUs) of Waste Area Groups (WAGs) 1 and 7 at the Paducah Gaseous Diffusion Plant (PGDP) near Paducah, Kentucky. Waste Area Group 1 consists of SWMUs 100 and 136. Waste Area Group 7 consists of SWMUs 8 and 130 through 134. All SWMUs are located on United States Department of Energy (DOE) property. Waste Area Group 1 is located within the boundaries of the plant security fence. Solid Waste Management Units 130 through 134 also are located within the plant security fence. Solid Waste Management Unit 8 is located to the southwest of the PGDP facility, beyond the boundaries of the plant security fence.

By mutual consent among the United States Environmental Protection Agency (EPA), the Kentucky Department for Environmental Protection (KDEP), the United States Department of Defense (DOD), the United States Army Corps of Engineers (COE), and the DOE, it was agreed that the evaluation and implementation of any remedial actions required for the Kentucky Ordnance Works (KOW) SWMUs [SWMU 94 (KOW Sewage Treatment Plant), SWMU 95 (KOW Burn Area), and SWMU 157 (KOW Toluene Spill Site)], formerly included in WAGs 1 and 7, would be the responsibility of the DOD and conducted on behalf of the DOD by the COE. Correspondence outlining the agreed upon responsibilities of the DOE, the COE, and the DOD was submitted to the EPA and the KDEP April 5, 1996. Due to the agreements reached among these entities, remedial technologies for the KOW SWMUs are not discussed further in this ROD and will be evaluated as part of the WAG 10 investigation by the COE. Additionally, by written mutual consent, the EPA, the KDEP, and the DOE agreed that an evaluation of remedial alternatives for SWMU 38, the C-615 Sewage Treatment Plant, would be deferred until the unit ceases operation. Consequently, no remedial actions are discussed for these SWMUs in this ROD.

The remedies selected for each of the WAGs 1 and 7 SWMUs are intended to address the contaminants of concern presently identified and will serve as a step toward comprehensively addressing contamination found across the PGDP site. These actions are not intended to address remediation of any existing or future surface- or ground-water contamination at this site.

The DOE will evaluate the necessity for surface- and/or ground-water remedial actions for the SWMUs in WAGs 1 and 7 separately from this action during site-wide, comprehensive evaluations of surface- and ground-water contamination at this site. As part of the comprehensive evaluations, the DOE, the EPA, and the KDEP will determine whether implementing surface- and ground-water remedial actions at SWMU 8 is necessary to protect human health and the envirorunent. Through the comprehensive evaluations for surface water (WAGs 18 and 25) and ground water (WAG 26), known

also as the Comprehensive Site Operable Units (CSOUs), the remedial action alternatives for the surface water and ground water at the PGDP, including at WAGs 1 and 7, will be selected. Through the CSOU process, all data on the surface and ground water at WAGs 1 and 7 and at the other PGDP SWMUs will be evaluated. Finally, all risks to human health and the enviromnent from the surface and ground water at the PGDP, and all legally applicable or relevant and appropriate requirements, also will be evaluated.

This ROD was prepared based on the administrative record (AR) for these WAGs. The AR includes documentation of the rationale for undertaking the remedial actions at WAGs 1 and 7. Major documents included in the AR are as follows: the Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1416&D2; the Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D4; and the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Groupings 1 and 7 at Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2.

The remedial actions identified in this ROD were selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act, the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA), and K.R.S. Chapter 224, subchapter 46. The ROD was prepared in accordance with a hazardous waste management permit issued by the KDEP pursuant to K.R.S. Chapter 224, subchapter 46, and a permit for corrective action issued by the EPA pursuant to the HSWA. Both permits bear the same permit number, KY8-890-008-982, and, throughout this document, are collectively referred to as the RCRA permits. Once the ROD is signed, the permit will be modified to reflect the selected remedies of these SWMUs.

The ROD also was prepared in accordance with a draft Federal Facility Agreement (FFA) that currently is being negotiated among the DOE, the EPA, and the KDEP. A draft of the FFA agreed to by all three entities was made available for public review and comment April 19, 1997. The FFA, when issued, will coordinate the requirements of the CERCLA and the RCRA permits.

The remedial actions will be implemented pursuant to the PGDP's RCRA permits, this ROD, and the draft FFA. The Commonwealth of Kentucky concurs with the DOE on, and the EPA approves, the selected remedial actions. The selected remedial actions will address the contaminants of concern in the soils and sediments of WAGs 1 and 7 and will serve as a step toward comprehensively addressing contamination found across the PGDP site.

ASSESSMENT OF THE SITE

Actual or threatened releases from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Risks for industrial workers slightly exceed EPA thresholds at SWMUs 8 and 100 (please refer to the Feasibility Study (FS) in the WAGs 1 and 7 AR for more detail regarding risk thresholds]; however, these risks are due to direct contact with surface

water and sediments contaminated with metals. As discussed in the FS for WAGs 1

and 7, DOE/OR/06-1416&D2, the direct contact exposure pathway is associated with numerous uncertainties (such as conservative assumptions associated with absorption of metals) and, therefore, is not used as the sole pathway in making remedial decisions (refer to the FS for a more detailed discussion of the uncertainties associated with the risk assessment). Additional evaluation of potential risks at SWMU 100 indicate there are no unacceptable risks to current industrial workers based upon exposure assumptions adjusted to reflect the actual time workers spend at the unit (primarily to perform upkeep activities). Additionally, it is reasonable to assume that these exposure assumptions will remain the same in the future. Consequently, no further action, outside of maintaining institutional controls, is warranted at SWMU 100. Currently, contaminated surface water will be addressed on a site-wide basis during the surface-water CSOU investigation (WAGs 18 and 25).

While contaminant conditions at SWWs 8 and 100 are similar, there also is a risk that a human or animal could come into direct contact with acidic leachate being released from SWMU 8 into sediments above the water level in the creeks. These risks, when combined with the Notice of Violation issued by the Kentucky Department for Environmental Protection, Division of Water (KDOW), indicate that limited action is necessary at SWMU 8 to protect human health and animals.

At SWMUs 130 through 134 and the soils of SWMU 136, risks and hazard indices for human health and animals do not exceed threshold values; therefore, these units require no further action. Any contaminated ground water associated with SWMU 136 will be evaluated as part of the ground water CSOU (WAG 26).

DESCRIPTION OF SELECTED REMEDY

The primary purpose of the remedies described within this document are to reduce the risks that could pose a threat to human health and the environment associated with direct contact to acidic leachate at SWMU 8. The evaluation of human health and ecological risks posed by these units was conducted as part of the remedial investigation performed at this site.

The remedial action at SWMU 8 consists of a deed notice and restrictions and the installation of riprap and signs. The current surface-water monitoring program will continue as directed by the KDOW. Additional ground-water monitoring wells will be installed, as needed.

Since SWMUs 130 through 134 and 136 do not present an unacceptable risk to human health and the environment, no further remedial action will be performed at these units. Additionally, since there are no risks to industrial workers at SWMU 100 based upon actual exposures at the unit, no further action (outside of maintaining institutional controls) is warranted. However, since contamination will remain at SWMUs 8 and 100, and in order to evaluate the reliability of controls in providing protection, five-year reviews will be conducted for these SWMUs under the CERCLA.

All work on the WAGs 1 and 7 project has been conducted by mutual agreement among the DOE, the EPA, and the KDEP. Further, the EPA and the KDEP have participated in the development of this ROD, including review and comment on the document's content.

STATUTORY DETERMINATION

The remedial actions; described herein are protective of human health and the environment, comply with federal and state requirements that are legally applicable or

relevant and appropriate to the WAGs 1 and 7 SWMUs, and are cost effective. The selected remedies for the WAGs 1 and 7 SWMUs do not satisfy the CERCLA § 121(b) [42 U.S.C.A. § 9621(b)] statutory preference for having, as a principal element, treatment that results in a permanent and significant reduction of toxicity, mobility, or volume because risk analysis indicates that such remedies are not necessary. The selected remedies do, however, satisfy the CERCLA § 121(b) statutory preference for using permanent solutions and alternative treatment technologies to the extent practicable. The limited actions selected for SWMUs 8 and 100, and the No Further Action decisions selected for SWMUs 130 through 134 and 136, are viewed as permanent and final decisions.

Since contamination will remain at SWMUs 8 and 100 above levels that allow for unlimited use and unrestricted exposure under the industrial land-use scenario, five-year reviews will be conducted pursuant to CERCLA § 121(c) [42 U.S.C.A. § 9621(c)) and 40 C.F.R. § 300.430(f)(4)(ii)]. Five-year CERCLA reviews will not be conducted at SWMUs 130 through 134 and 136 because the selected remedial actions allow for unlimited use and unrestricted exposure.

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PART 2

DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The Paducah Gaseous Diffusion Plant (PGDP) is located in western Kentucky, approximately 16.1 km (10 miles) west of Paducah and about 6.44 km (4 miles) south of the Ohio River (Figure 2-1). It is an uranium enrichment facility that supplies nuclear fuel for commercial reactors. The plant, owned by the United States Department of Energy (DOE), began operations in 1952 and became fully operational in 1955.

The Energy Policy Act of 1992 transferred operation of the DOE's uranium enrichment facilities to the United States Enrichment Corporation (USEC). Effective July 1, 1993, Martin Marietta Utility Services, Inc., (now Lockheed Martin Utility Services, Inc.) contracted with the USEC to provide operation and maintenance (O&M) services. The DOE contracted with Martin Marietta Energy Systems, Inc., [now Lockheed Martin Energy Systems, Inc., (LMES)] to provide environmental restoration and waste management services for the PGDP under the DOE's Environmental Management Program.

This Record of Decision (ROD) addresses eight solid waste management units (SWMUs) in Waste Area Groups (WAGs) 1 and 7 at the PGDP. This ROD does not address three Kentucky Ordnance Works (KOW) SWMUs formerly used by the United States Department of Defense (DOD), which were grouped with WAGs 1 and 7 for environmental investigation purposes. However, the current draft of the PGDP Site Management Plan, DOE/OR/07-1207&D3, places the three SWMUs [SWMU 94 (Sewage Treatment Plant), SWMU 95 (Burn Area), and SWMU 157 (Toluene Spill Site)] into WAG 10. The United States Army Corps of Engineers (COE), on behalf of the DOD, has committed verbally to remediate these three sites, and the United States Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) have agreed to allow the COE to proceed with the cleanup. However, in a letter to the DOE dated May 23, 1996, (Appendix B), the KDEP also indicated that the DOE ultimately would be responsible for the cleanup of the KOW SWMUs should the COE fail to meet Kentucky cleanup standards.

In addition to the three KOW SWMUs, this ROD does not address SWMU 38 (the C-615 Sewage Treatment Plant), formerly included in WAG 1. The KDEP, the EPA, and the DOE have agreed to defer evaluation of remedial alternatives for SWMU 38 until the unit ceases operation. For this reason, SWMU 38 will be evaluated at a later date as part of WAG 29.

Finally, this ROD does not address remediation of surface or ground water at each of the SWMUs. Any risks to human health or the environment present at the site due to contaminated surface or ground water will be addressed as part of the two Comprehensive Site Operable Unit (CSOU) evaluations conducted for WAGs 18 and 25 (i.e., surface water) and WAG 26 (i.e., ground water).

The locations of the SWMUs in WAGs 1 and 7 are shown in Figure 2-2. The eight SWMUs addressed in this ROD are as follows:

- WAG 1
  - SWMU 100, the Fire Training Area (FTA); and
  - SWMU 136, the C-740 Trichloroethene (TCE) Spill Site.

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- WAG 7

  - SWMU 130, a 2,082-liter (550-gal) gasoline underground storage tank (UST) located adjacent to the C-611 Water Treatment plant (WTP);

  - SWMU 131, a 189-liter (50-gal)UST reportedly located adjacent to the C-611 WTP;

  - SWMU 132, a 7,571-liter (2,000-gal) fuel oil UST located adjacent to the C-611 WTP;

  - SWMU 133, a diesel fuel UST of unknown capacity located adjacent to the C-611 WTP;

  - SWMU 134, a 3,785-liter (1,000-gal) diesel fuel UST located adjacent to the C-611 WTP; and

  - SWMU 8, the C-746-K Sanitary Landfill.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Following are descriptions of events and legal actions pertaining to the SWMUs addressed in this ROD. Also, brief descriptions of the units themselves are provided.

2.2.1 Waste Area Group 1

Waste Area Group 1 is located within the plant security fence in the southwestern corner of the PGDP (Figure 2-2). It includes two units that will be addressed by this document. SWMU 100 (the FTA) and SWMU 136 (the C-740 TCE Spill Site).

2.2.1.1 Solid Waste Management Unit 100: the Fire Training Area

The FTA is located in the southwest corner of the PGDP, immediately west of Fourth Street (Figure 2-3). It consists of one large rectangular surface burn area, two circular burn pan areas, one circular electric pump area, an elevated and bermed fuel tank area, and two square burn area depressions. The burn areas are unlined and are not bermed. The FTA has been used since 1982 for staging fire training exercises involving waste oils, fuels, and other combustible liquids. Combustible liquids were not burned in the unlined areas after 1987. Fire training exercises continue to be conducted in the vicinity, but, in order to prevent any negative impacts to the environment, no burning is conducted in unlined areas and combustible liquids are no longer used.

2.2.1.2 Solid Waste Management Unit 136: the C-740 Trichloroethene Spill Site

The TCE Spill Site is a small rectangular area, approximately 5 m x 2 m (15 ft x 6 ft), located in the southwest corner of the PGDP within the plant security fence (Figure 2-2). It is situated at the northwest corner of a concrete pad at the northeastern edge of the C-740 Material Yard (Figure 2-3). The C-740 Material Yard is an active storage yard that has been used since the early 1970s for storing various scrap metals and drums. A 208-liter (55-gal) drum stored on the concrete pad leaked TCE onto the pad and into the gravel and soil adjacent to the western edge of the pad in May 1990. In October 1990, soils contaminated with TCE were excavated from a 5 m x 2 m (15 ft x 6 ft) area, to a depth of 1 m (3 ft). Soil samples collected from the base of the excavation pit were found to have TCE concentrations as high as 21,000 µg/kg, indicating that TCE-contaminated

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soils had not been completely removed. However, as further discussed in Section 2.5.3.2, subsequent sampling conducted in 1994 as part of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) indicates that no measurable residual TCE soil contamination remains at SWMU 136.

2.2.2 Waste Area Group 7

Waste Area Group 7 consists of SWMUs 130 through 134 (the five C-611 USTs) and SWMU 8 (the C-746-K Sanitary Landfill). It is located outside the plant security fence near the southwest corner of the PGDP (Figure 2-2). All of the SWMUs in WAG 7 are inactive units.

2.2.2.1 Solid Waste Management Units 130 through 134: the C-611 Underground Storage Tanks

The C-611 USTs (SWMUs 130 through 134) are located southwest of the PGDP security-fenced area in the vicinity of the C-611 WTP, west of Bayou Creek (Figure 2-4). The C-611 WTP was built about 1942 as part of the KOW and later was expanded to support operations at the PGDP. All five USTs located in the vicinity of the WTP currently are inactive. With the exception of SWMU 133, which is of unknown size, the C-611 USTs range in capacity from 189 to 7,571 liters (50 to 2,000 gal). Two of the USTs (SWMUs 130 and 131) were reportedly used for gasoline storage from 1942 to 1945 in support of KOW operations. However, efforts to locate the SWMU 131 UST during the Resource Conservation and Recovery Act facility investigation/remedial investigation (RFI/RI) were unsuccessful, so it is possible that it never existed. Solid Waste Management Unit 132 was used for fuel oil storage from approximately 1942 to 1955, initially as part of the KOW, and later in support of PGDP activities. It was abandoned in place by filling the tank with sand. The dates of operation of the remaining two USTs (SWMUs 133 and 134) are unknown; both were reportedly used for

diesel storage and are known to have been removed from service by 1975. The SWMU 133 tank was abandoned in place filling the tank with grout.

2.2.2.2 Solid Waste Management Unit 8: the C-746-K Sanitary Landfill

The C-746-K Sanitary Landfill (SWMU 8) is located southwest of the PGDP fenced security area, approximately 200 m (656 ft) southeast of the C-611 WTP (Figure 2-5). The landfill is roughly rectangular in shape and measures approximately 152 m x 213 m (500 ft x 700 ft). It is situated immediately west of Bayou Creek and north of an unnamed tributary of Bayou Creek. The ground surface is vegetated and slopes in a radial fashion from a maximum elevation of 119 m (392 ft) amsl near the center of the western half of the landfill to a low of approximately 110 m (360 ft) amsl near Bayou Creek at the eastern edge of the landfill. Drainage ditches located along the western and northern edges of the landfill flow to the south into the unnamed tributary and to the east into Bayou Creek, respectively.

Records indicate that the PGDP used the landfill between 1951 and 1981 for disposal of fly ash from the plant's coal combustion boilers, uncontaminated combustible plant waste, and potentially radiologically contaminated plant waste. According to the Hydrologic Investigation - Existing Sanitary Landfill Closure, Union Carbide Corporation, Gaseous Diffusion Plant, Paducah, Kentucky, conducted by Wehran Engineering in 1981, the fly ash was disposed in trenches excavated 2 to 3 m (5 to 10 ft) b1s. During operations, trenches were cut in the fly ash and used for burning trash. This practice ceased in 1967, after which waste was buried without burning. The waste, containing

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primarily office waste with some construction debris and kitchen waste, was placed in trenches excavated within the fly ash and covered, when necessary, with additional fly ash or soil fill. In addition to these materials, sludge from the C-615 Sewage Treatment Plant may have been buried at the unit, as it was reportedly used as fill material. Soil boring information indicates that up to 9 m (28 ft) of fly ash and trash were placed in the landfill. The landfill was closed in 1982 and covered with a 15- to 30-cm (6- to 12-inch) clay cap and a 46-cm (18-inch) vegetative cover.

On January 30, 1992, the PGDP personnel discovered leachate in a ditch on the southwest side of the landfill. Sampling immediately was conducted at five leachate seep locations around the landfill. Volatile organic compounds (VOCs) [TCE; 1,1-dichloroethene (DCE); 1,1-dichloroethane (DCA); and trans-1,2-DCE] and metals (aluminum, iron, manganese, and zinc) were detected above background levels in the leachate samples. Low levels of radionuclides [technetium-99 (99 Tc) and uranium] also were detected in some leachate samples. The leachate was acidic (the pH ranged from 2.3 to 5.5), and the particulate matter in the leachate was generally orange to yellow in color. The precipitation of dissolved metals (primarily iron and aluminum) from the leachate was thought to be causing the orange to yellow staining observed at various points along the creek banks. This condition was deemed in noncompliance with the water quality provisions of 401 K.A.R. 5:031. The provisions of 401 K.A.R. 5:031 that posed an issue at the landfill were those that prohibit discharges that produce "objectionable color" in waters of the Commonwealth of Kentucky. On September 15, 1992, the KDEP issued a Notice of Violation (NOV) to the PGDP for "unpermitted seepage areas from C-746-K Sanitary Landfill into waters of the Commonwealth."

As a result of the NOV, and with the approval of the KDEP and the EPA, the DOE immediately undertook an interim corrective action to address the seeps. To prevent any further release of solids to the unnamed tributary, a sandbag dam with a liner was installed in the drainage ditch southwest of the landfill. The interim action also repaired the subsidence of the existing landfill cap by recontouring the cap to promote surface-water runoff. Since the landfill cap repair was completed in October 1992, the landfill and the adjacent creeks have been inspected regularly to determine if the interim measures have been effective in reducing seepage into the creeks. In addition, a surface-water monitoring program was initiated at the landfill to monitor contaminant levels in the leachate and adjacent creeks. Through the monitoring program, samples are collected quarterly at suspected seep source sites on the banks of Bayou Creek and the unnamed tributary and locations upstream and downstream of the landfill (Figure 2-5).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The DOE issued the Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D2, June 25, 1996, and held a public comment period from June 25, 1996, until August 9, 1996. A public meeting was held July 23, 1996, at the LMES facility in Kevil, Kentucky, to brief the public on the remedial alternatives under consideration at that time. At the meeting, DOE personnel also answered questions from the public on a proposed wetland alternative at the landfill and solicited both written and verbal comments. The DOE received oral comments during the public meeting and written comments during the 45-day public comment period. These comments, and formal DOE responses to these comments, are provided in the Responsiveness Summary, which is presented in Part 3 of this ROD.

In response to comments from the public, the EPA, and the Commonwealth of Kentucky, changes were made to the Proposed Remedial Action Plan (PRAP). The revised PRAP

Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D4, was issued to the public after a Notice of Availability announcing the 45-day public review period was published

in The Paducah Sun, December 22, 1996. During the public comment period (December 23,1996, through February 5,1997), the PRAP was made available for public review at the Paducah Public Library and the off-site DOE Environmental Information Center located in the West Kentucky Technology Park in Kevil, Kentucky. Specific groups that received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, the Site Specific Advisory Board (SSAB), and the PGDP Environmental Advisory Committee. The PRAP is part of the Administrative Record (AR) File, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. § 300.825(a)(2)].

A public meeting was held January 16, 1997, to discuss the changes in the PRAP. No objections were expressed at this meeting. Upon request from the public, the comment period was extended 30 days. A response to the comments received during the public participation period for this version of the PRAP is presented in the Responsiveness Summary, which is presented in Part 3 of this ROD.

2.4 SCOPE AND ROLE OF THE OPERABLE UNITS

The PGDP presents unusually complex problems in terms of hazardous waste management and environmental releases. The DOE's proposed strategy is to divide the site into operable units (OUs) grouped by source areas, and CSOUs, one each for ground water and surface water. Discrete response actions will be selected and implemented for each source area OU, as well as the CSOUs, which are impacted by commingled releases from the source area OUs. Prioritization for investigation and possible remedial action has been assigned to each of the CSOUs (ground-water and surface-water OUs) and source area OUs depending on their potential for contributing to off-site contamination. As a suspected source of off-site contamination, SWMU 8 was a high priority for remediation.

2.5 SUMMARY OF SITE CHARACTERISTICS

Following are hydrological and geological descriptions of the PGDP and individual SWMUs.

2.5.1 Hydrogeologic Characteristics of the Paducah Gaseous Diffusion Plant Area

The sources for the following information are the Report of the Paducah Gaseous Diffitsion Plant Groundwater Investigation Phase III, KY/E-150, and the Draft Northeast Plume Preliminary Characterization Summary Report, DOE/OR/07-1339&D2.

2.5.1.1 Regional surface-water hydrology

The PGDP is located in the western portion of the Ohio River Basin (Figure 2-6). A local drainage divide causes the plant's surface water to flow to the east and northeast toward Little Bayou Creek or to the west and northwest toward Bayou Creek. Both Bayou and Little Bayou creeks are perennial streams that discharge into the Ohio River. The SWMUs within WAGs 1 and 7 are located within the Bayou Creek watershed.

Bayou Creek flows northward along the western boundary of the plant, from approximately 4 km (2.5 miles) south of the plant to the Ohio River. Little Bayou Creek originates within DOE property and flows northward along the eastern boundary of the

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plant. Little Bayou Creek joins Bayou Creek in a marsh located approximately 4.8 km (3 miles) north of the PGDP; ultimate discharge is into the Ohio River. Other surface-water bodies located in the area surrounding the PGDP include the Ohio River, Metropolis Lake, Crawford Lake, numerous small ponds, gravel pits, and settling basins.

At the PGDP, man-made drainage ditches receive storm water and effluent from the plant. These waters are routed through outfalls and eventually discharge into Bayou and Little Bayou creeks. The majority of the flow in these creeks can be attributed to effluent water from the plant. The 18 Kentucky Pollutant Discharge Elimination System (KPDES)-permitted outfalls have a combined average daily flow of 18.5 million liters per day (4.88 mgd) and are monitored by the PGDP.

2.5.1.2 Regional geology

The stratigraphic sequence in the region consists of Cretaceous, Tertiary, and Quaternary sediments unconformably overlying Paleozoic bedrock. At the PGDP, Paleozoic limestone bedrock is present at a depth of approximately 104 m (340 ft). The sequence of unconsolidated sediments overlying the bedrock consists of the following strata, in order of decreasing depth: the Tuscaloosa Formation, the McNairy Formation, the Porters Creek Clay, the Eocene Sands, the continental deposits, and surficial loess and/or alluvium. Figure 2-7 illustrates the relationships between the geologic horizons present in the vicinity of the PGDP.

The principal geologic feature in the PGDP area is the Porters Creek Clay Terrace, a large, low-angle, subsurface terrace trending approximately east-west across the southern portions of the plant. The terrace slope is located south of WAG 1 but directly underlies portions of the WAG 7 area. This terrace is believed to be the result of the erosion of the Porters Creek Clay by the ancestral Tennessee River. As a result of the erosion, the Porters Creek Clay is mainly absent from the PGDP area north of the terrace.

South of the Porters Creek Clay Terrace slope, the Porters Creek Clay is unconformably overlaid by either the Eocene Sands or the continental deposits. South of the terrace slope, the principal gravel facies within the continental deposits are Miocene-Pliocene gravels, referred to as terrace gravel deposits. The terrace gravel deposits are present overlying the Eocene Sands or, where the Eocene Sands are absent, directly on the upper surface of the Porters Creek Clay in the WAGs 1 and 7 area. North of the terrace slope, the McNairy Formation is directly overlaid by continental deposits. The continental deposits are informally subdivided into the Lower Continental Deposits, consisting of chert gravel in a matrix of sand and silt; and the Upper Continental Deposits, which consist of thin, interbedded layers of clayey silt, sand, and occasional gravel.

2.5.1.3 Regional ground-water hydrology

Several water-bearing zones are present in the PGDP area. South of the slope of the Porters Creek Clay Terrace, the principal water-bearing units, in order of increasing

depth, are the terrace gravel, the Eocene Sands, and the McNairy Formation. However, the Eocene Sands were not encountered beneath any of the SWMUs within WAGs 1 and 7 and will not be discussed further. The primary water-bearing units north of the buried terrace are the Regional Gravel Aquifer (RGA), the Upper Continental Recharge System (UCRS), and the McNairy Formation.

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The RGA, defined as the uppermost aquifer at the PGDP, is present north of the Porters Creek Clay Terrace. The RGA consists of the lower gravel and sand facies of the continental deposits and also includes the sands of the upper part of the McNairy Formation where they are present directly below the RGA. The unit ranges in thickness from 3 to 12 m (10 to 40 ft) and pinches out at the base of the Porters Creek Clay Terrace slope. According to the 1990 Phase II and 1992 Phase III aquifer test reports conducted by the Terran Corporation, the hydraulic conductivity values determined by aquifer pump tests for the RGA range from 1.87 x 10 -2 to 4.23 x 10 -1 cm/sec (5.297 x 10 1 to 1.093 x 10 3 ft/day). Ground-water velocity within the RGA is estimated to range from 61 to 122 m/yr (200 to 400 ft/yr) to the north-northeast, toward the Ohio River, as noted in the Remedial Investigation (RI) Addendum for Waste Area Grouping 22, Burial Grounds, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1141&D1. Recharge to the RGA is primarily via infiltration from the Upper Continental Deposits and underflow from the Terrace Gravel.

The UCRS is present north of the Porters Creek Clay Terrace and consists of the Upper Continental Deposits and overlying loess. It includes sand and gravel lenses as well as the less permeable day and silt matrix of the Upper Continental Deposits. The permeable lenses are relatively discontinuous laterally; hence, the flow direction in this unit is primarily vertical. A predominantly clay layer of varying thickness separates the UCRS sands and gravels from the underlying RGA in most areas of the plant's grounds. Immediately south of the Porters Creek Clay Terrace slope, the principal water-bearing unit within the continental deposits is the Terrace Gravel. The Terrace Gravel consist of interbedded gravel, sand, silt, and clay, Hydraulic conductivity values for the Terrace Gravel, determined from slug tests, range from 1 x 10 -6 to 1.4 x 10 -3 cm/sec (2.8 x 10 -3 to 4.0 ft/day).

The Porters Creek Terrace slope is located south of the three SWMUs in WAG 1 (SWMUs 38, 100, and 136) but directly underlies portions of the WAG 7 area. The amount of ground-water flow over the slope has not yet been determined, but ground-water modeling conducted in support of the WAGs 1 and 7 Feasibility Study (FS) indicates that there is some degree of hydraulic connection between the RGA north of the terrace slope and the Terrace Gravel south of the terrace slope. The amount of connection is expected to vary as a function of the continuity of the shallow sand and gravel lenses over the terrace slope. In those areas of the slope where the permeable lenses are relatively continuous, such as where streams have deposited alluvium, the Terrace Gravel would be expected to transmit ground water laterally along the

impermeable surface of the Porters Creek Clay to the continental deposits (including the RGA) north of the slope as well as to the alluvial deposits of nearby streams.

2.5.2 Hydrogeology of Waste Area Groups 1 and 7

Unless otherwise noted, the information presented in this section is derived from the Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report for Waste Area Groupings 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/07-1404&D2, and from the Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1416&D2.

2.5.2.1 Solid Waste Management Unit 100

Following are surface-water, surface-feature, and hydrogeologic descriptions for SWMU 100.

Surface features and surface water.

The ground surface at SWMU 100 is relatively flat, ranging in elevation from approximately 113 to 114 m (370 to 375 ft) amsl. Most of the ground surface is grass-covered, with the exception of the eastern part of the unit occupied by Fourth Street and a paved driveway. There are two drainage ditches at the site, a north-northeastern flowing drainage ditch located next to the railroad tracks at the western edge of the unit and a north flowing drainage ditch on the eastern edge of the unit adjacent to Fourth Street. A document issued by CDM Federal Programs Corporation in August 1994, Investigation of Sensitive Ecological Resources Inside the Paducah Gaseous Diffusion Plant, 716-0003-FR-BBRY, reports that wetlands have been identified in these drainage ditches. Runoff from the unit flows to the ditches and discharges via KPDES Outfall 016 to Bayou Creek, which is located approximately 305 m (1,000 ft) to the west.

Hydrogeology.

Eleven soil borings and two ground-water monitoring wells (MWs) were installed at SWMU 100 for the RFI/R1. The locations of these borings and monitoring wells, as well as the three soil borings (H216, H353, and H354) installed at SWMU 100 for the Phase II Site Investigation, are shown in Figure 2-3.

The following lithologies were encountered beneath the unit, in order of increasing depth: fill material, loess deposits, and the Continental Deposits. The uppermost water-bearing unit at this SWMU consists of about 8 m (25 ft) of sand and gravel in the Upper Continental Deposits. There is a clay aquitard near the base of the Upper Continental Deposits that is 2.9-m (9.5-ft) thick and occurs between approximately 17 to 19 m (54 to 63 ft) b1s. The RGA is present at depths between 19 and 31 m (63 and 103 ft) bls. It consists of 1.2 m (4 ft) of sand overlying 11 m (35 ft) of sandy, pebble- to cobble-sized chert gravel.

The Porters Creek Clay may occur beneath this unit. Although SWMU 100 is located north of the Porters Creek Clay Terrace, it may overlie the extreme northern edge of the

terrace slope where a thin layer of the clay is present. A stiff formation (possibly the Porters Creek Clay) was encountered in MW 330 at a depth of 31 m (103 ft) bls, but no lithologic sample was obtained.

According to water-level measurements collected July 15, 1994, in UCRS MW 315, the depth of shallow ground water at SWMU 100 is 2.45 m (8.04 ft) bls [111.9 m (367.22 ft) amsl]. The depth to water in MW 330, which is screened in the RGA, was approximately 12.8 m (42.1 ft) bls [101.3 m (332.3 ft) amsl].

2.5.2.2 Solid Waste Management Unit 136

Following are surface-water, surface-feature, and hydrogeologic descriptions for SWMU 136.

Surface features and surface water.

The ground surface at SWMU 136 is fairly level and ranges in elevation from approximately 113 to 114 m (371 to 374 ft) amsl. A 53-cm (21-inch) thick layer of compacted gravel covers the ground surface west and south of the pad, and plastic sheeting covers the excavated spill area. Two shallow depressions are located to the south and southwest in the C-740 Material Yard. The nearest surface-water body is Bayou Creek, which is located approximately 457 m (1,500 ft) southwest of the unit. Runoff from SWMU 136 discharges to Bayou Creek via KPDES Outfall 008.

Hydrogeology.

Solid Waste Management Unit 136 is located north of the Porters Creek Clay Terrace where the Porters Creek Clay is absent. Five soil borings and three monitoring wells were drilled at SWMU 136 (Figure 2-3). None of the soil borings or monitoring wells at this unit were drilled to the depth of the McNairy Formation.

The following lithologies were encountered beneath the unit, in order of increasing depth: gravel and sand fill material, loess, and the continental deposits. The Upper Continental Deposits, consisting of up to 15 m (50 ft) of interbedded gravel, sand, clay, and silt, are present between 4 to 20 m (13.5 to 65 ft) bls. An 8-m (25-ft) thick aquitard, consisting of clay interbedded with thin silt and sand lenses, was encountered at the base of the Upper Continental Deposits at SWMU 136. Lower Continental Deposits are present beneath the unit at depths between 20 to 27 m (65 and 90 ft) bls.

According to water-level measurements collected July 15, 1994, the depth to the UCRS piezometric surface at SWMU 136 is approximately 1 m (3.29 ft) bls at MW 304. This well was screened from approximately 5 to 8 m (16 to 26 ft) bls. The depth to water in the two upper RGA wells (MWs 325 and 326) was approximately 12.5 m (41 ft) bls, or 101 m (332 ft) amsl.

2.5.2.3 Solid Waste Management Units 130 through 134

All of the C-611 USTs were found at depths less than 6 m (20 ft) bls, with the exception of the UST at SWMU 131, which could not be located.

Surface features and surface water.

The ground surface in the vicinity of the C-611 WTP gently slopes to the south and east and ranges in elevation from 112.8 to 121.9 m (370 to 400 ft) amsl. Surface features at the unit include the C-611-H WTP Building, the C-611-C Building to the south, a storage shed to the east, and a transformer to the west. In addition, four treatment lagoons are located immediately north of the C-611 WTP. The area immediately surrounding the buildings is mainly gravel-covered, except the asphalt- or concrete-paved areas at SWMUs 130 and 131, and the fenced, grass-covered area situated near SWMU 131. No surface water, floodplains, or wetlands have been identified within the boundaries of the C-611 UST area. Bayou Creek is located approximately 370 m (1,200 ft) east of the area and the unnamed tributary of Bayou Creek is located approximately 300 m (1,000 ft) south of the area. Surface runoff from the C-611 UST area is discharged via KPDES Outfall 006 to Bayou Creek.

Hydrogeology.

The USTs overlie the Porters Creek Clay Terrace at the approximate location of the terrace slope, where the slope dips relatively steeply to the north-northeast at an approximate gradient of 0.11 ft/ft. In this area, the continental deposits have not been differentiated into upper and lower members and are informally referred to as the Terrace Gravel or the Terrace Slope Gravels. Five soil borings and two monitoring wells were drilled at SWMUs 130 through 134 (Figure 2-4).

The following lithologies were encountered beneath the units, in order of increasing depth: fill material (composed of gravel and sand), loess, the continental deposits, and the Porters Creek Clay. The continental deposits (consisting of interlensing gravely clay; sandy gravel; and silty, clayey gravel) are present at these units from 5 m (17 ft) bls to below 14.9 m (49 ft) bls. The Porters Creek Clay was encountered, though not fully penetrated, in three soil borings at the units. The depth to the top of the clay varies from 4 m (13 ft) bls in the westernmost boring at SWMU 130 to 10 m (34 ft) bls in the south-eastern boring at SWMU 134.

The two monitoring wells installed at SWMUs 130 through 134 were completed in the Terrace Gravel. According to water-level measurements collected July 15, 1994, the depths to shallow ground water were approximately 2.3 m (7.5 ft) bls at MW 318 and 2.8 m (9.32 ft) bls at MW 317. Contouring of the water levels at WAG 7 (Figure 2-8) indicates the ground-water flow direction is to the east, toward Bayou Creek.

2.5.2.4 Solid Waste Management Unit 8

Following are descriptions of the surface-water and hydrogeologic conditions at SWMU 8.

Surface water.

Drainage ditches located along the western and northern edges of the landfill flow to the south into the unnamed tributary and to the east into Bayou Creek, respectively. A portion of the 100-year floodplain of Bayou Creek and the unnamed tributary is located

within the boundary of SWMU 8. Wetlands were identified in the vicinity of SWMU 8 and are shown in Figure 2-5.

Hydrogeology.

Wehran Engineering drilled 10 soil borings at the landfill in 1980. Five of these were completed as piezometers (MWs 23 through 27) screened in the Porters Creek Clay. In addition, 10 test pits were excavated in and around the landfill, and polyvinylchloride plastic well points were installed in the backfill. As part of the Phase II Site Investigation, a soil boring (MW 183) and a monitoring well (MW 184) were installed in the Terrace Gravel at the landfill in 1991. For the RFI/RI, nine soil borings were drilled and four shallow monitoring wells (MWs 300 through 303) were installed around the perimeter of the landfill. None of the soil borings or monitoring wells at this unit fully penetrated the Porters Creek Clay. Figure 2-5 shows the locations of the sampling points at SWMU 8.

A cross section illustrating the geology at the landfill site is presented in Figure 2-9. The Porters Creek Clay Terrace slope dips relatively steeply to the north-northeast beneath the northeastern comer of the landfill. The following lithologies were encountered beneath the unit, in order of increasing depth.

- Landfill cap material occurs in the upper 0.6 to 0.9 m (2.0 to 3.0 ft) of the landfill. A 15- to 30-cm (6- to 12-inch) clay cap and a 46-cm. (18-inch) layer of subsoil and topsoil were placed on the landfill in 1982, and additional soil was added when the cap was repaired in 1992. A thin layer of stiff, highly plastic white clay that fits the description of the original clay cap was encountered in soil borings 8-SB-002 and 8-SB-002A. Results of soil

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permeability testing on samples collected from the soils (vegetative cover) overlying the landfill cap range from an average hydraulic conductivity of 1.18 x 10 -7 to 3.54 x 10 -5 cm/sec (3.34 x 10 -4 to 1.00 x 10 1 ft/day).

- Fill material, composed of fly ash mixed with soil and assorted rubbish, is found beneath the clay and vegetative cap to a maximum observed thickness

of 8.5 m (28 ft). In general, fly ash primarily consists of silt-sized particles of amorphous glass with quartz, mullite (aluminum silicate), various iron oxides such as hematite and magnetite, and lime according to the Hydrogeologic Assessment of the C-746-K Landfill and Vicinity, KY/ER-24.

- Loess and alluvial deposits are present in some areas underlying the landfill and range in thickness from 0 to 2 m (0 to 8 ft).

- Continental deposits consisting of up to 10 m (33 ft) of Terrace Gravel overlie the Porters Creek Clay Terrace at the landfill. The continental deposits consist of clayey silt containing coarse gravel and sand lenses and are difficult to distinguish from younger alluvial deposits near the creeks.

- The Porters Creek Clay underlies the landfill at varying depths. The depth to the top of the clay varies from 3.0 m (10 ft) bls in 8-SB-004 to 12.6 m (41.5 ft) bls in 8-SB-006. The Porters Creek Clay has been described as a dark, greenish gray to black clay containing varying amounts of silt and fine sand and displaying fine, hairline fractures. Results of tests conducted by Wehran Engineering in 1981 indicate that the hydraulic conductivity of the Porters Creek Clay ranges from 5.5 x 10 -9 to 1.3 x 10 -7 cm/sec (1.56 x 10 -5 to 3.68 x 10 -4 ft/day) at the landfill.

The UCRS and the RGA are not present at SWMU 8. Ground water occurs under shallow, unconfined conditions in the Terrace Gravel, loess, and alluvium overlying the Porters Creek Clay Terrace. Monthly ground-water levels measured at the landfill since 1980 indicate that ground-water levels vary seasonally, with the maximum levels typically occurring during winter and spring. Ground-water mounding occurs beneath the northwestern portion of the unit. Data collected in June 1992 indicate that the shallow water levels rise to about 115 m (377 ft) amsl beneath the western part of the landfill, indicating that the lower 2 to 3 m (5 to 10 ft) of waste at the landfill is below the water table during certain times of the year. According to water-level measurements collected July 12, 1995, the depths to shallow ground water range from approximately 1.6 m (5.4 ft) bls at MW 300 to 3.5 m (11.5 ft) bls at MW 303. Figure 2-8 presents a map of the piezometric surface at the landfill.

Underflow enters the landfill from the west within the Terrace Gravel, flows laterally to the east, and discharges into the creeks, with some unquantified amount potentially flowing into the RGA north of the terrace as recharge. North of the terrace slope, thie predominant ground-water flow direction within the RGA is north-northeast. Ground-water flow modeling conducted for the FS at SWMU 8 was used to help define the probable shallow ground-water flow conditions at the landfill and to address the uncertainties regarding potential contaminant migration from SWMU 8 over the terrace slope into the RGA. According to the modeling results, under current (no action) conditions, approximately 0.66 1/sec: (10.4 gpm) of the shallow ground water emanating from the landfill discharges to the creeks. This represents most of the shallow ground water flowing through the landfill, with the remainder of the flow, approximately 0.007 1/sec (0.10 gpm), discharging over the terrace slope into deeper layers. The results

of this modeling and the presence of the seeps in the surrounding surface water indicate that most of the shallow ground water at the landfill discharges to the surrounding creeks.

All available data have been used to describe the expected conditions at the C-746-K Sanitary Landfill. However, a degree of uncertainty remains concerning some of the site conditions at SWMU 8. These uncertainties include the degree of hydraulic connection between the Terrace Gravel and the RGA over the terrace slope and detailed information concerning the waste types and volumes at the landfill. An additional uncertainty is the exact location and condition of the KOW yellow-water line, an underground sewer line consisting of a 30.5-cm (12-inch) diameter vitrified clay pipe. The yellow-water line was used from 1942 to 1945 to transport yellow water, an acidic and trinitrotoluene (TNT)-contaminated waste water, from the KOW TNT manufacturing area to a discharge point on Bayou Creek. Maps of the KOW area indicate that sections of the KOW yellow-water line underlie the northern portion of the landfill site (Figure 2-5). The uncertainties are discussed in the FS and were considered during the development of the remedial alternatives for SWMU 8.

2.5.3 Operable Unit Characteristics

Following is a summary of the sampling results for the individual SWMUs.

2.5.3.1 Solid Waste Management Unit 100

Low levels of contamination were found in soil, sediment, surface-water, and ground-water samples collected at SWMU 100 (the FTA). Organic compounds detected at this unit include VOCs (toluene, xylene, and benzene) and polycyclic aromatic hydrocarbons (PAHs) commonly associated with waste oils and diesel fuels. They were detected at low concentrations in soil samples down to a depth of 4.6 m (15 ft) bls. However, no organic compounds were detected in ground-water, surface-water, or sediment samples indicating that these media are not impacted by organic contaminants migrating from SWMU 100. Twelve metals (aluminum, barium, cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc) were detected at elevated concentrations in ground-water, surface-water, and sediment samples from the unit. Of these 12 metals, only three (barium, manganese, and vanadium) also were detected above background levels in surface and subsurface soils at the unit. This limited occurrence of metals in the soils at the unit indicates that SWMU 100 likely is not a significant source of metals contamination.

Radionuclides 99 Tc, uranium, and thorium) were detected in soil, sediment, surface-water, and ground-water samples from SWMU 100. Their widespread occurrence and low activities indicate their presence likely is related to plant activities rather than past activities at this SWMU.

The areal extent of impacted soils at SWMU 100 has been estimated as approximately 720 m 2 (7,750 ft 2) according to the WAGs 1 and 7 FS, DOE/OR/06-1416&D2. The horizontal extent of organic and inorganic contamination in soils is restricted to depths above 4.6 m (15 ft) and 7.6 m (25 ft) bls, respectively. The limited extent and low concentrations of organics and metals contamination at this unit may represent residual contamination from the waste oils or fuels burned at the unit.

2.5.3.2 Solid Waste Management Unit 136

Results of the RI conducted at SWMU 136, the TCE Spill Site, indicate that several organic contaminants are present above background levels in soil and ground water at

the unit. Soil samples from SWMU 136 were found to contain low levels of VOCs [TCE, 1,1-DCE, 1,1,1-trichloroethane (TCA), and 1,2-DCA] and several PAHs. Ground-water samples at the unit also contained organic contaminants. The maximum concentration of TCE in ground water was detected in a UCRS hydraulic probe sample collected from soil boring 36-SB-004 at 442 µg/l. The highest TCE concentration observed in the RGA wells at the unit (110 µg/l) was detected in a sample from a downgradient well (MW 325). Another organic compound detected in the ground-water samples was 1,1,1-TCA, (4,472 µg/l), which was detected in a UCRS temporary well sample, but was not detected at concentrations above 5 µg/l in samples from the adjacent UCRS monitoring well (MW 304).

Soil and ground-water samples were also found to contain metals and radionuclides at levels above background. Four metals [antimony (1-7 mg/kg), chromium (29 mg/kg), barium (439 mg/kg), and mercury (3.2 mg/kg)] were detected above background concentrations in soils at the unit. Several metals were detected above background levels in ground water. Samples from UCRS MW 304 contained iron, manganese, silver, zinc, sodium, and aluminum above background concentrations. Ground-water samples collected from the RGA wells contained barium, manganese, and zinc above background levels. The radionuclide 99 Tc was found above background values in the samples collected from all three monitoring wells at the unit. The levels of 99 Tc ranged from 1.27 to 12.21 pCi/l.

The observed contamination in soil and ground water at the unit indicates that the spill site is a likely source of organic contamination. Trichloroethene and other chlorinated hydrocarbons have migrated below the water table at the unit into the UCRS and the RGA, leaving residual contamination in the surface and subsurface soils at the unit. However, the low concentrations of TCE detected in ground-water samples at the unit do not indicate the presence of dense nonaqueous phase liquid. The areal extent of the organic and metals contamination at the unit has been estimated as approximately 17.7 m 2 (190 ft 2) according to the WAGs 1 and 7 FS, DOE/OR/06-1416&D2.

2.5.3.3 Solid Waste Management Units 130 through 134

A sample was collected from the tank residuals of both SWMUs 130 and 134. The location of SWMU 131 could not be determined, and SWMUs 132 and 133 had been filled with sand and grout, respectively. Both samples contained lead, benzene, toluene, ethylbenzene, and xylene as well as other VOCs and PAHs associated with petroleum products. Low levels of lead, VOCs, and PAHs also were detected in soil samples from the C-611 UST area. The only VOC detected was 1,4-dichlorobenzene (3 µg/l), which was detected in ground-water samples collected from MW 317, the downgradient (eastern) shallow monitor well. The only PAH detected was naphthalene (70 µg/l), and it was found in the well upgradient of the site (MW 318). Lead, the only metal for which analysis was completed in the two monitoring wells, was not detected in ground water.

Low levels of radionuclides, including uranium-235 232 (235 U), uranium-238 (238 U), neptunium-237 (237 Np), thorium-228 (228 Th), thorium-232 (232 Th), 99 Tc, and plutonium-238 (238 Pu), were detected in soil and ground-water samples collected in the area. No radionuclides were detected above background levels in the UST liquids. The presence of these radionuclides in soils and ground water is likely unrelated to any of the USTs, but the presence more likely is the result of plant-wide activities. The organic and lead

contamination observed at SWMUs 130, 132, 133, and 134 appears to be limited in areal

extent [35.3 m 2 (380 ft 2)] and may be indicative of past gasoline, diesel, or fuel-oil spills in the area.

2.5.3.4 Solid Waste Management Unit 8

Soil, ground-water, surface-water, sediment, and leachate sampling was conducted at the landfill for the RFI/RI. Eight soil borings and four shallow ground-water monitoring wells, MWs 300 through 303, were installed around the perimeter of the landfill. Five surface-water samples, seven sediment samples, and three leachate samples were collected during the RFI/RI from the locations shown in Figure 2-5.

Results of the RI conducted at the landfill indicate that low levels of various organic compounds, metals, and radionuclides are likely leaching from the wastes buried in the landfill into the nearby streams and to ground water. Leachate samples collected from two shallow holes on the bank of the unnamed tributary south of the landfill indicate that the pH of the leachate ranges from 2.3 to 3.4 prior to mixing with stream water. Where the acidic leachate from the landfill enters the creeks, the pH rises to approximately 6, indicating that the leachate only slightly lowers the stream pH when they mix. The low pH causes dissolved metals, particularly iron and aluminum, to form a precipitate. The precipitation of iron and aluminum oxy-hydroxides is the suspected cause or the orange to yellow staining observed seasonally at various seep sites at the landfill. The staining is most intense during dry periods (late summer to early fall) when stream flow is low. Specific conductance values for the stream samples are also typically higher during the dry season and range up to approximately 2,000 µmhos/cm. The measured hardness for surface-water samples at the landfill varies from 36 to 1,085 mg/l calcium (carbonate (CaC0 3). The detailed results of the sampling can be found in the RFI/RI for WAGs 1 and 7.

Inorganics.

Numerous metals (including aluminum, antimony, beryllium, chromium, cobalt, iron, magnesium, manganese, selenium, thallium, and vanadium) were detected above background levels in soils at the unit. The metals aluminum, beryllium, cobalt, iron, magnesium, manganese, nickel, and zinc also were detected above background levels in all four monitoring wells. (The concentrations of these metals were lower in the upgradient well, MW 302, than in the downgradient wells.) Many metals (aluminum, beryllium, calcium, cobalt, iron, magnesium, manganese, mercury, nickel, sodium, and zinc) also were detected above background levels in the leachate samples, indicating that the landfill likely is one source of the metals. Surface-water samples collected for the RFI/RI contained numerous metals at concentrations above background levels; however, according to the United States Geological Survey report, Study and Interpretation of the Chemical Characteristics of Natural Water, only two, antimony and cadmium, were present at concentrations above those typical of natural waters. The elevated antimony concentration was detected in an upstream surface-water sample and, therefore, likely is not due to the landfill. Cadmium was detected in surface-water sample 08-SW-003, as well as in some leachate samples, at concentrations higher than the expected range for natural waters. This suggests that the landfill is a probable source of the elevated cadmium levels. Although several metals were detected in sediment samples from SWMU 8, the only metal detected above background levels was iron (47.3 mg/kg). The extent of the metals contamination in surface water appears limited to the areas upgradient of sampling location 08-SW-003.

The cause of the acidic pH of the landfill leachate has not been firmly established. A study by the Illinois State Geological Survey indicates that low pH, under some conditions, is due to the presence of high concentrations of sulfate in the fly ash. The pH of the leachate is low enough to cause the dissolution of metals. The source of some of the metals detected at elevated levels in ground water and leachate samples at the landfill is likely due to the fly ash. However, the elevated levels of iron and manganese also may be a result of the interaction of the acidic pH with the Terrace Gravel deposits, which often have a dark brown coating, or patina, of iron and/or manganese oxides in the PGDP area.

Radionuclides.

Low levels of the radionuclides, 99 Tc, 235 U, uranium-234 (234 U), 238 U, 228 Th, thorium-230 (230 Th), 232 Th, and 237 Np were detected levels in soils. The radionuclides 237 Np, 238 Pu, 99 Tc, 228 Th, 232 Th, 234 U, 235 U, and 238 U were detected above background levels in the leachate samples from SWMU 8. The highest activities were detected at a seep on the northern bank of the unnamed tributary, south of the landfill. Surface-water samples from two locations at SWMU 8 contained radionuclides: 233/234 U (0.45 pCi/l), 235 U (0.31 pCi/l), and 238 U (0.2 pCi/l) at 08-SW-003 and 233/234 U (0.32 pCi/l) at 08-SW-005. Very low levels of radionuclides were detected in the downgradient shallow ground-water samples from MWs 300, 301, and 303. (No radionuclides were detected above background levels in the upgradient well, MW 302.) The contaminated rubbish reportedly disposed in the landfill is a potential source of these contaminants.

Organics.

Very low levels of VOCs were detected in the surface and subsurface soil samples at the landfill. Benzene (21 µg/kg) was detected in surface and subsurface soils at soil boring 08-SB-001 at the northeastern edge of the landfill. A possible source of the benzene, as indicated by old photographs, was the bulldozers parked in the area during landfill operations. Additional VOCs, including 1,2-DCE, carbon tetrachloride, and toluene, were detected but at concentrations below the quantitation limit. Numerous PAHs were detected in shallow soils but, with the exception of the PAHs detected in 08-SB-001, the concentrations of the PAHs were less than the quantitation limit. The surface-soil sample at soil boring 08-SB-001 had a total PAH concentration of 9,160 µg/kg. Two polychlorinated biphenyls (PCBs) were detected at the landfill: (1) Aroclor-1254, detected from the 1.52 to 3.05 m (5.0 to 10.0 ft) bls intervals in SB-006 at a concentration of 2,082 µg/kg; and (2) Aroclor-1260, detected in the surface soils at 08-SB-004 at a concentration of 183 µg/kg. Although these appear to be isolated occurrences of PCBs at the landfill, PCBs are still considered potential landfill contaminants.

The VOCs TCE (27 µg/l); 1,1-DCA (23 µg/l); 1,1-DCE (18 µg/l); and 1,2-DCE (330 µg/l) were detected in MW 300 during RFI/RI sampling activities. Two of these VOCs (1,1-DCA and 1,2-DCE) also were detected in MW 301. Additional sampling of MWs 300 through 303 was conducted in March 1995 and results indicated the presence of cis-1,2-DCE (790 µg/l); 1,1-DCE (72 µg/l); 1,1-DCA (61 µg/l); and TCE (52 µg/l). Two of the leachate samples contained the organic compounds TCE; 1,2-DCA; xylene; 1,1-DCE; and 1,2-DCE. No organic compounds were detected in the sediment samples or surface-water samples collected during the RFI/RI at the unit. However, one organic

[cis-1,2-DCE (9 µg/l)] has been detected in a surface-water sample collected from PGDP stream sampling point C-746-K-3A, located southeast of the landfill within the unnamed tributary. The presence of VOCs in the ground-water and leachate samples indicate they likely are leaching from the landfill.

2.5.4 Contaminant Characteristics

The conceptual site model presented in Figure 2-10 illustrates source area contamination, primary and secondary contaminated media, transport pathways, exposure pathways, and receptors that may be associated with releases of contamination from SWMU 8. The source at SWMU 8 consists of fly ash; uncontaminated, combustible waste; potentially-contaminated rubbish; and trash. From the source at SWMU 8, contamination has migrated to primary contaminated media, soil and shallow ground water, via infiltration, leaching, erosion, and runoff. From the primary media, contaminants are migrating to sediments adjacent to SWMU 8, a secondary contaminated medium. Migration pathways also may transport contaminants to other secondary contaminated media including air, leachate, soil, surface water, and deep ground water. As illustrated in the conceptual site model, contamination from SWMU 8 is migrating primarily through the release of leachate at seeps next to the unnamed tributary. The environmental exposure contaminant pathways of potential concern are illustrated in Figure 2-11.

Ground water is included in the conceptual site model to identify it as a contaminated medium. However, receptors and exposure pathways are not identified in the model since the preferential pathway of contaminant transport from the unit is via the shallow ground-water system to the surface. Additionally, while the remedial action taken does not impact ground water, any future remedial action, if necessary, will be undertaken as part of the ground water CSOU. Air is included in the model to identify it as a secondary contaminated medium; however, there are no receptors or exposure pathways identified, since SWMU 8 is outdoors and the likelihood of exposure to contamination via the air pathway outdoors is minimal.

Potential current exposuxe to contaminants in the source or other primary media at SWMU 8 is limited since the unit is capped. However, potential risks to industrial workers exist at SWMU 8 through direct contact with the secondary contaminated medium (sediments). Additionally, there is a potential for humans or animals to come into direct contact with acidic leachate being released from the landfill into sediments above the water level in the creeks (Figure 2-10 is based on risk assessment results and does not include potential risks to any receptor that may come into direct contact with the acidic leachate). The selected remedial action for SWMU 8 is intended to reduce the potential for direct contact with contaminated sediments and acidic leachate associated with the unit, thereby reducing associated risks. The risks addressed by the selected remedy are discussed in the following section.

2.6 SUMMARY OF SITE RISKS

Solid Waste Management Unit 38 is an operating facility, therefore, an evaluation of remedial options for the unit will be deferred until it ceases operation. At SWMUs 130 through 134 and the soils of SWMU 136, risks and hazard indices (HIs) for human health and animals do not exceed threshold values; therefore, these units require no further action. Any contaminated ground water associated with SWMU 136 will be evaluated as part of the ground water CSOU (WAG 26).

Risks for industrial workers slightly exceed EPA thresholds at SWMUs 8 and 100 (please refer to the FS in the WAGs 1 and 7 AR for more detail regarding risk thresholds); however, these risks are due to direct contact with surface water and sediments contaminated with metals. As discussed in the FS for WAGs 1 and 7, DOE/OR/06-1416&D2, the direct contact exposure pathway is associated with

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numerous uncertainties (such as conservative assumptions associated with absorption of metals). This uncertainty causes an overestimation of risks. For example, only dissolved metals are variably absorbed through the skin. The RI assumed that the total concentration of metals (including both dissolved and suspended is available for absorption). Therefore, the dermal pathway typically should not be used as the sole pathway in making remedial decisions (refer to the FS for a more detailed discussion of the uncertainties associated with the risk assessment). Additional evaluation of potential risks are considered in the following paragraphs.

As discussed in Appendix C, actual exposures to workers in the ditches at SWMU 100 (approximately 2 days/yr for 8 hours/day, for 25 years) are significantly less than the default exposures used in the baseline risk assessment (i.e., 250 days/yr for 8 hours/day for 25 years). This exposure is consistent with very limited activities such as those associated with periodic maintenance of drainage ditches (i.e., weed eating). Under this assumption, cancer risk to industrial workers potentially exposed to contaminated sediments and surface water at rates consistent with actual exposure rates at SWMU 100 approach de minimus (i.e., 1x10 -6) at 2x10 -6 (which means 2 additional cancers out of a population of 1,000,000 could occur following prolonged exposure). Further, the maximum concentrations of the primary contaminant (beryllium) in the two ditches surrounding SWMU 100 (called SWMU 100a and SWMU 100b in the RI report), contributing most to the above risk estimate, are below or only slightly exceed the natural background level for beryllium (0.83 mg/kg in SWMU 100a and 0.64 mg/kg in SWMU 100b, compared to a background level of .67 mg/kg). These concentrations do not indicate gross contamination related to activities associated with the PGDP. Finally, since these areas are ditches, activities at SWMU 100 are expected to remain consistent with the actual exposure rate in the future. Consequently, no further action, outside of maintaining institutional controls, is required to protect workers at SWMU 100. Currently contaminated surface water will be addressed on a site-wide basis during the surface-water CSOU investigation.

While contaminant conditions at SWMUs 8 and 100 are similar, there also is a risk that a human or animal could come into direct contact with acidic leachate being released from SWMU 8 into sediments above the water level in the creeks. These risks, when combined with the NOV issued by the Kentucky Department for Environmental Protection, Division of Water (KDOW), indicate that limited action is necessary at SWMU 8 to protect human health and animals.

2.6.1 Human Health Risk Assessment

As previously discussed, SWMU 100 does not require action, other than maintaining land use and activity patterns. Therefore, this section summarizes risk information relative to SWMU 8 that does require some form of remedial action to address contamination.

Data from the site investigation are evaluated in the human health risk assessment. To identify chemicals of potential concern (COPCs), all constituents detected in the surrounding sediments, soils, surface water, and ground water are evaluated using established guidelines. From this data, COPCs have been identified including metals, organic compounds, and radionuclides.

The potential for human contact with contaminants is evaluated in the exposure assessment. Since PGDP security limits access by the general public to SWMU 8 with signs and a security patrol and the area is anticipated to remain industrialized in the future, exposure is most appropriately characterized under an industrial scenario. For this scenario, the primary exposure pathway is dermal absorption as a result of industrial workers coming into direct contact with contaminated sediments in the creeks for extended periods of time (8 hours/day, 250 days/year, for 25 years). Since SWMU 8 is located outside the main industrial plant, a revised exposure rate (i.e., an actual exposure rate as for SWMU 100) is not considered. Potential future releases from the unit to ground water are evaluated using predictive models to estimate leaching.

The toxicity assessment evaluates adverse effects to human health resulting from exposure to chemicals of concern (COCs). Chemicals of concern in sediment at SWMU 8 are antimony, arsenic, beryllium, iron, manganese, and vanadium. Arsenic and beryllium exhibit characteristics of carcinogens and noncarcinogens and may cause cancer and various other adverse effects through prolonged exposure. Antimony, iron, manganese, and vanadium are noncarcinogens, but may cause various adverse health effects through prolonged exposure.

The risk characterization indicates that under current conditions, only SWMU 8 warrants an action. Table 2-1 provides a summary of carcinogenic risks and noncarcinogenic HIs at SWMU 8 and the exposure pathways of concern. The risks and HIs for sediment for both the current and future worker exceed EPA threshold values (please refer to the FS in the WAGs 1 and 7 AR for more detail regarding risk thresholds). The COCs identified for sediment are those that contribute most of the risks and HIs; for a pathway of concern.

Table 2-1. Summary of Risks at Solid Waste Management Unit 8

Exposure Pathways	Current Industrial Worker	Future Industrial Worker
	Excess Lifetime Cancer Risk	
Sediment		
Dermal Absorption	3 x 10 -4	3 x 10 -4
Sum of Pathways	3 x 10 -4	3 x 10 -4
	Chronic Hazard Index	
Surface-Water		
Dermal Absorption	1	1

Sediment		
Dermal Absorption	5	5
Sum of Pathways	7	7

2.6.2 Ecological Risk Assessment

The screening ecological risk assessment for SWMU 8 indicates that current ecological impacts in Bayou Creek are minimal. No analytes exceed benchmark values (please refer to the RI included in the WAGs 1 and 7 AR for more information regarding ecological benchmarks) used to assess potential impacts to aquatic species in surface water; however, sediments in Bayou Creek contain elevated concentrations of arsenic, chromium, and manganese.

While concentrations of these analytes exceed benchmark levels, adverse impacts appear to be very low, which may indicate a level of sediment contamination that can be tolerated by most benthic organisms. The leachate in Bayou Creek also exceeds terrestrial benchmarks for the ingestion of surface water, but this calculation assumed 100% ingestion from the seeps. Risks associated with Bayou Creek should decrease as remedial actions are taken to prevent direct contact with the leachate and contaminated sediments. Analyte concentrations in sediments also should decrease as less-contaminated sediments are deposited. Also, since contaminant concentrations in landfill soils exceed terrestrial benchmarks, the current landfill cap should be maintained in order to protect terrestrial wildlife from exposure.

Uncertainties are associated with the screening ecological risk assessment for SWMU 8. While evaluation may suggest adverse impacts to ecological receptors, no measurable effects are seen in the field. Screening assessments are considered final assessments only when they indicate that there are no potential hazards to ecological receptors. However, any cumulative effects of small losses or contamination of terrestrial habitat will be more fully assessed on a facility-wide basis in the PGDP baseline ecological risk assessment for the surface-water CSOU.

2.6.3 Remedial Action Objectives

Results of the risk analysis indicate that SWMU 8 poses an unacceptable risk to industrial workers and animals via direct contact with acidic leachate emanating from the unit. The remedial action objectives for this unit are to control the release of COCs from the unit, limit direct contact by humans, and reduce overall risks to ecological receptors. The action implemented at SWMU 8 will satisfy these objectives by limiting human and animal exposure to contaminated sediments and acidic leachate associated with the unit. The reduction of human risks will be accomplished by posting warning signs and by placing a deed notice and restrictions on the SWMU 8 property. The reduction of ecological risks will be accomplished by installing riprap over exposed acidic leachate seeps.

2.7 DESCRIPTION OF ALTERNATIVES

The following paragraphs present a description of the alternatives evaluated for each of the SWMUs of concern in WAGs 1 and 7.

2.7.1 Description of Alternatives for Solid Waste Management Unit 8 (C-746-K

Sanitary Landfill)

The following subsections provide descriptions of individual alternatives evaluated for SWMU 8.

2.7.1.1 Alternative 1 - No Action

Pursuant to 40 C.F.R. § 300.430(e) of the NCP, the DOE is required to consider a no action alternative. This alternative serves as a baseline to which the other alternatives are compared. Under this alternative, current institutional actions (i.e., existing ground- and surface-water monitoring, landfill cap maintenance, etc.) would be continued; however, no further remedial actions would be conducted at this SWMU.

This alternative would not include implementation of any treatment technologies, contaminant containment, institutional controls, or storage of wastes or residual materials. Costs associated with this alternative include the preparation of five-year review reports, mandated by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 121(c) [42 U.S.C.A. 9621(c)], at those sites where contamination remains at levels that allow for unlimited use and unrestricted exposure.

2.7.1.2 Alternative 2 - Upgradient Subsurface Barrier

This alternative consists of the installing a subsurface barrier upgradient of the landfill in order to divert uncontaminated ground water from landfill wastes. In addition, a deed notice and restrictions would be placed upon the landfill property to restrict future land use.

Since hydrogeologic data from the Hydrogeologic Assessement of the C-746-K Landfill and Vicinity suggests that the current ground-water table saturates up to 1.2 m (4 ft) of the landfill wastes, implementation of subsurface barrier technology would result in a reduction of the volume of landfill leachate generated. In addition, diversion of ground water around the landfill may decrease contaminant transport through the ground-water migration pathway. The subsurface barrier design calls for approximately 427 m (1,400 linear ft) of 60 mil (0-15 cm or 0.06 inch) high-density polyethylene (HDPE) sheeting installed to a maximum depth of 9.1 m (30 ft). The wall would be anchored into the Porters Creek Clay unit, which has a permeability on the order of 10 -9 cm/sec (2.55 x 10 -5 ft/day). Low-permeability slurries, such as a bentonite slurry, would be placed at the lower 0.6-m (2-ft) interval at the bottom of the excavation to alleviate the potential for ground water to flow under the barrier wall.

Most of the residual soil generated from trenching would be used as trench backfill. Remaining trench soil generated from the trenching would require treatment, storage, or disposal, as the potential exists that these residual materials may be contaminated with landfill wastes. Current estimates indicate 222 m 3 (290 yd 3) of soil generated from trench excavation would require management as a nonhazardous waste.

In addition to constructing a subsurface barrier, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement containment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application

(e.g., farming and residential use) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and upgradient barrier). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

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2.7.1.3 Alternative 3 - Downgradient Leachate Collection System

This alternative consists of the installation of a downgradient leachate collection svstem, composed of a French drain system located downgradient of the landfill, and a filter for treatment of the collected leachate. Construction of a leachate collection system would reduce the migration of leachate escaping from the landfill by accumulation, treatment, and subsequent discharge to surface water. The leachate collection system would consist of approximately 427 m (1,400 linear ft) of trench excavated to a depth of 7.3 m (24 ft) bls. Perforated HDPE pipe would be embedded in a column of gravel (nonreactive river stone or pea gravel), wrapped by a layer of filter fabric, and then backfilled with a 1.2-m (4-ft) thick layer of clay at the top of the trench to minimize infiltration. Two 1.2-m (4-ft) polyethylene manhole sumps would be installed to collect the leachate. The perforated laterals would be welded to the manholes to transport leachate to the sumps. Leachate would be removed from the sumps using submersible pumps,which are activated by leachate elevation.

The leachate would then be pumped through a dual-stage filter to remove particulate matter. The filter stages would consist of a limestone stage to buffer the leachate and precipitate the metals, and a packed-sand stage to remove the particulate matter prior to discharge. Treated leachate would be discharged to Bayou Creek. Discharge would be monitored to meet the substantive requirements of a KPDES-permitted outfall.

Current estimates indicate 633 m 3 (827 yd 3) of soil generated from trench excavation likely may be contaminated with landfill wastes; therefore, this material would require management as a nonhazardous waste. Any remaining uncontaminated trench residuals would be spread on SWMU 8 and seeded.

In addition to the construction of a leachate collection system, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement containment actions in achieving reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and leachate collection system). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in

Section 2.8 of this ROD.

2.7.1.4 Alternative 4 - Full Perimeter Subsurface Barrier

This alternative consists of the installation of a full perimeter subsurface barrier and two RGA monitoring wells downgradient of the landfill. Since hydrogeologic data from the Hydrogeologic Assessment of the C-746-K Landfill and Vicinity suggests that the current ground-water table saturates up to 1.2 m (4 ft) of the landfill wastes, implementing subsurface barrier technology would result in a reduction of the volume of landfill leachate generated. In addition, the diversion of ground water around the landfill may decrease contaminant transport through the ground-water migration pathway. The subsurface barrier wall would be installed to a depth of 6.1 m (20 ft) on the western portion of the landfill, and 9.1 m (30 ft) on the eastern portion of the landfill to tie the

bottom of the wall into the confining clay layer underlying the landfill. Approximately 823 m (2,700 linear ft) of subsurface barrier would be necessary to fully encompass the wastes. The wall would be anchored into the Porters Creek Clay unit, which has a permeability on the order of 1 x 10 -9 cm/s (2.5 x 10 -5 ft/day). Low-permeability slurries, such as a bentonite slurry, would be placed at the lower 0.6-m (2-ft) interval at the bottom of the excavation to alleviate the potential for ground water to flow under the barrier wall.

Most of the residual soil generated from trenching would be used as trench backfill. Remaining trench soil generated from the trenching would require disposal, as the potential exists that these residual materials could be contaminated with landfill wastes. Current estimates indicate that 621 m 3 (812 yd 3) of soil generated from trench excavation would require management as a nonhazardous waste.

The current ground-water monitoring program would be expanded to include the two new RGA ground-water monitoring wells; sampling and analytical event frequency and parameters for these two new wells are anticipated to be the same as for the ground-water monitoring wells currently used for environmental assessment at the site.

In addition to the construction of a subsurface barrier, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Instituting a deed
notice and restrictions would supplement containment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and full-perimeter barrier). Current DOE administrative controls, including requirements for work permits, would be continued. Current surface-water monitoring and landfill cap maintenance activities would be continued. The existing ground-water monitoring program may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.5 Alternative 5 - Constructed Wetland Treatment System

This alternative consists of installing a constructed wetland treatment system

downgradient of the landfill within the channels of the adjacent creeks to intercept and treat landfill leachate. The wetland treatment system would consist of a sheet-pile wall constructed beyond the northern and western embankments of the adjacent creeks which would contain the wetland treatment system. This downgradient location would allow the treatment system passively to intercept and treat the landfill leachate. The base of the treatment system would be contoured, and soil amendments (e.g., mushroom compost, organic material, and limestone) to buffer pH would be installed as a wetland substrate. Wetland substrate would be built-up within the containment wall so that seepage from the bank of the landfill to the wetland system would remain subsurface, and initial treatment would occur during flow through the reactive substrate.

The wetland treatment system would be seeded with native wetland vegetation; volunteer vegetation also would be allowed to emerge within the treatment system. In order to maintain hydrologic connection between the creeks and the wetland, "weep" holes would be cut intermittently in the sheet piling above the elevation of the wetland. A weir would be placed at the downgradient end of the wetland to allow discharge from any impounded water within the wetland system. Discharge would be monitored to

evaluate compliance with the substantive requirements of a KPDES outfall. In addition to constructing a wetland treatment system within the creek, the opposing channel bank will be cut and filled, as necessary, to straighten the channel and minimize erosion. No residual materials would be generated from such bank work, as any excavated material would be used as fill material within the channel.

In addition to the installation of a constructed wetland treatment system, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Institution of a deed notice and restrictions would supplement treatment actions in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land application (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (e.g., existing landfill cap and constructed wetland). Additionally, warning signs will be posted notifying the public of the potential risks at the site.

This alternative would be implemented as a full-scale treatability study for the first two years of operation. As such, the treatment system would be monitored for specific parameters at a set frequency to determine its effectiveness. Current ground-water monitoring may be modified, if required, to include the installation of additional monitoring wells as part of this remedial action. The current surface-water sampling and analysis program would be modified from quarterly monitoring at five locations to monthly monitoring at one location at the effluent point of the treatment system, and one in-stream location downgradient of the treatment system within Bayou Creek. Current DOE administrative controls, including requirements for work permits, would be continued. The DOE would conduct reviews of the action no less than once every five years, since contaminants would remain in the unit. Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.1.6 Alternative 6 - Limited Action

This alternative consists of placing riprap along the northern bank of the unnamed tributary at any visible leachate seep locations to minimize the potential for exposure, and along the western bank of Bayou Creek to reduce erosion during high flow events. Signs warning workers and trespassers of the potential risks to human health would be

installed along the creek and at the entrance to the landfill site. Institutional controls, including ground-water and surface-water monitoring would continue. Additional ground-water monitoring wells would be installed, as needed.

In addition to installing signs and placing riprap within the creek channel, a deed notice and restrictions would be placed in the chain of title to restrict the use of the property. Instituting a deed notice and restrictions would supplement institutional controls in achieving a reduction of contaminant exposure pathways for potential receptors by restricting land use (e.g., farming and residential) and prohibiting destruction of existing and future contaminant containment controls (i.e., the existing landfill cap). Estimated costs and a summary of the detailed evaluation of this alternative are presented in Section 2.8 of this ROD.

2.7.2 Description of Alternatives for Solid Waste Management Units 100, 130 through 134, and 136

Risks under the industrial land use scenario for human receptors at SWMU 100 are associated with many uncertainties, and remediating environmental media at this unit would not be practicable for this reason. Currently, institutional controls enacted at the PGDP include security fencing and patrols to prevent unknowing and unauthorized entry to the plant and risk management procedures to prevent worker exposure to contaminated media. A risk management evaluation indicated that these institutional controls reduced exposure potential to acceptable levels for plant workers (see the risk evaluation provided as Appendix C). Therefore, the remedy for this unit is the continuation of plant institutional controls.

The risk analysis indicated that no unacceptable risks exist for all use scenarios for human receptors at SWMUs 130 through 134 and for the soils of SWMU 136. Potential risks for the ecological receptors are limited since all these SWMUs are located within a fenced industrial area, and habitat for terrestrial wildlife and plants is limited. Therefore, no further action will be required for SWMUs 130 through 134 and 136.

Since contamination will remain in place at SWMU 100 and in order to evaluate the reliability of controls in providing protection, five-year reviews will be required at this unit as mandated by CERCLA § 121(c) [42 U.S.C.A. § 9621 (c)]. No five-year reviews will be conducted for the remaining SWMUs as the risk assessment concludes no residual risks exist at these sites.

2.8 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides the basis for determining which alternative: (1) meets the threshold criteria of overall protection of human health and the environment, and compliance with applicable or relevant and appropriate requirements (ARARs); (2) provides the best balance between effectiveness and reduction of toxicity, mobility, or volume through treatment, implementability, and cost; (3) satisfies state and community acceptance; and (4) is consistent with the Kentucky Hazardous Waste Management Permit.

Nine criteria are required by the CERCLA for evaluating the expected performance of remedial actions. The remedial alternatives have been evaluated based on the nine criteria, which are identified in the following list.

(1) Overall protection of human health and the environment. This threshold criterion requires that the remedial alternative adequately protect human health and the environment, in both the short and long term. Protection must be demonstrated by the elimination, reduction, or control of unacceptable risks.

(2) Compliance with ARARs. This threshold criterion requires that the alternatives be assessed to determine if they attain compliance with ARARs of both federal and state law.

(3) Long-term effectiveness and permanence. This primary balancing criterion focuses on the magnitude of residual risk and the adequacy and reliability of controls used to manage remaining waste (untreated waste and treatment residuals) over the long term (i.e., after remedial objectives are met). Remedial actions that afford the highest degree of long-term effectiveness and permanence are those that leave little or no waste at the site, make long-term maintenance and monitoring unnecessary, and minimize the need for institutional controls.

(4) Reduction of contaminant toxicity, mobility, or volume through treatment. This primary balancing criterion is used to evaluate the degree to which the alternative employs recycling or treatment to reduce the toxicity, mobility, or volume of the contamination.

(5) Short-term effectiveness. This primary balancing criterion is used to evaluate the effect of implementing the alternative relative to the potential risks to the general public, potential threat to workers, potential environmental impacts, and the time required until protection is achieved.

(6) Implementability. This primary balancing criterion is used to evaluate potential difficulties associated with implementing the alternative. This may include technical feasibility, administrative feasibility, and the availability of services and materials.

(7) Cost. This primary balancing criterion is used to evaluate the estimated costs of the alternatives. Expenditures include the capital cost, annual O&M, and the combined net present value of capital and O&M costs.

(8) State acceptance. This modifying criterion requires consideration and incorporation of any comments on the ROD from the Commonwealth of Kentucky.

(9) Community acceptance. This modifying criterion provides for consideration of any formal comments from the community on the PRAP.

2.8.1 Overall Protection of Human Health and the Environment

An alternative must meet this threshold criterion to be eligible for selection. As discussed in Section 2.6, this final action is necessary to address potential risks posed by SWMU 8. Alternative 1 does not meet this criterion since it does not address the risks at these units. Alternative 2 would meet this criterion because it reduces the release of COCs and chemicals of potential ecological concern (COPECs) to surface water via leachate

seepage. Alternatives 3 and 4 would meet this criterion by preventing the migration of COCs and COPECs into Bayou Creek and the unnamed tributary. Alternative 5 would meet this criterion by limiting direct contact with the waste and by eliminating the release of COCs and COPECs into Bayou Creek and the unnamed tributary. Finally, Alternative 6 would meet this criterion by limiting direct contact with contaminated sediments and acidic leachate associated with the unit.

2.8.2 Compliance with Applicable or Relevant and Appropriate Requirements

An alternative must meet the CERCLA threshold criterion of complying with ARARs, or be waived, to be eligible for selection as a remedial action. The remainder of this section describes how well each of the alternatives addressed in this ROD meets this criterion. No ARAR will be waived for any alternative addressed in this ROD. However, consistent with the deferral of the potential remedial actions for the surface water and ground water at WAGs 1 and 7 to the CSOUs for surface water and ground water, respectively, the ARARs for the remediation of these water bodies will be addressed in the CSOUs. A detailed description of ARARs; for the selected remedy is presented in Section 2.10 of this ROD.

2.8.2.1 Solid Waste Management Unit 8

For SWMU 8, Alternatives 2 (Upgradient Subsurface Barrier), 3 (Leachate Control), 5 (Constructed Wetland), and 6 (Limited Action) would meet all chemical-, action-, and location-specific ARARs. Alternative 4 (Full-Perimeter Subsurface Barrier) would not meet all action-specific ARARs, as the alternative would result in an increased flow of

contaminants to the RGA. This would run counter to the intent of 401 K.A.R. 5:037, which is to prevent the pollution of ground water. Finally, Alternative 1 (no action) was not evaluated for ARARs compliance because the action does not meet the first threshold criterion of protecting human health and the environment.

The FS for WAGs 1 and 7 stated that Alternative 2 would not meet chemical-specific ARARs. The statement was made because Alternative 2 would not prevent all leachate from reaching Bayou Creek and its unnamed tributary. Since the 1992 NOV from the KDEP (discussed further in Section 2.2.2.2 of this ROD) indicated that it considered the leachate to be violating Kentucky standards for protecting the environment, the DOE concluded that the alternative would not meet chemical-specific ARARs. However, as is further discussed in Section 2.10.1.1 of this ROD, the KDEP does not now consider the leachate to be harming the creeks.

2.8.2.2 Solid Waste Management Units 100, 130 through 134, and 136

Pursuant to the CERCLA guidance document, ARARs Q's & A's, EPA Office of Solid Waste and Emergency Response, 9234.2-01FS, May 1989, an evaluation of compliance with ARARs for a No Further Action decision is not required to be included in a ROD. This is because a no action decision may only be made when the site being evaluated has been determined to be protective of human health and the environment. Since it has been determined that SWMUs 130 through 134 and 136 are already protective of human health and the environment, no action will be undertaken at these SWMUs, and ARARs compliance evaluations for the SWMUs are not included in this ROD.

Since the continuation of controls is necessary at SWMU 100 to protect human health

and the environment adequately under an industrial land-use setting, the SWMU must undergo an ARARs analysis. As is further discussed in Section 2.10.4, the selected remedy for SWMU 100 meets all ARARs.

2.8.3 Long-Term Effectiveness and Permanence

Alternatives 2, 3, 4, 5, and 6 are designed to limit exposure to site-related contaminants in the soil and from leachate generated by the landfill. Alternative 1 would produce the greatest residual risk since no action would be taken.

Alternatives 2, 3, 4, 5, and 6 would provide adequate reliability and controls if properly designed and installed. Alternative 5 may require maintenance of the wetland treatment system if significant hydrologic events at the unit were to erode the system. Since no action is involved, Alternative 1 would produce the least reliability and control.

The deed notice and restrictions that would be implemented as part of Alternatives 2, 3, 4,5, and 6 would limit how the DOE or any successive owner of the SWMU 8 property could use the land. Additionally, under Alternative 6, the DOE would post and maintain warning signs around the landfill to inform workers and any trespassers of the potential risks posed by the site.

Long-term monitoring of surface and ground water is required for all the alternatives. As mandated by the CERCLA, five-year reviews are required for Alternatives 1, 2, 3, 4, 5, and 6 because untreated waste would remain onsite.

2.8.4 Reduction of Contaminant Toxicity, Mobility, or Volume

Alternative 5 achieves a reduction of toxicity, mobility, and volume of contamination by treatment in a wetland. Alternative 3 would reduce the volume, mobility, and toxicity of contaminants by capturing and treating the landfill leachate reaching the creeks. Alternatives 2 and 4 would reduce the mobility and volume of the landfill leachate; however, Alternative 4 increases the mobility and volume of contaminants reaching the RGA. Alternatives 2, 4, and 6 do not include treatment. While Alternative 6 does not provide a reduction of the toxicity, mobility, or volume of the contaminants, it reduces the exposure potential by limiting site use and exposure potential.

2.8.5 Short-Term Effectiveness

Negative impacts to community protection are not anticipated for Alternatives 2, 3, 4, 5, or 6. Alternatives 2, 3, 4, 5, and 6 may pose minimal risks to workers during implementation. The probability of an accident would be rather low due primarily to the short lengths of time involved in construction activities. In considering exposure routes, consistent with the baseline risk assessment for a future excavation worker, short-term risks are not expected to exceed acceptable limits for Alternatives 2, 3, 4, 5, or 6.

Alternatives 2, 3, and 4 would not pose unacceptable environmental impacts during implementation since best management practices would be enacted and sensitive resource areas would be avoided. Wetlands associated with the unnamed tributary and Bayou Creek for Alternatives 5 and 6 could be disturbed during construction; this disturbance would be permissible under. Nationwide Permit (NWP) 38 (Cleanup of Hazardous and Toxic Wastes).

Since no action is involved, Alternative 1 would not require any time to complete. For Alternatives 3, 5, and 6, remedial action objectives would be achieved subsequent to construction activities. For Alternatives 2 and 4, a decrease in the volume of leachate generated by the landfill would occur subsequent to diverting ground-water flow; a reduction in the volume of leachate generated would require draining of the saturated wastes.

2.8.6 Implementability

Alternatives 2, 3, 4, 5, and 6 would require readily available services and materials and would be technically and administratively feasible to implement. No permits would be required for Alternatives 2, 3, 4, 5, and 6. Alternative 5 would require coordination with the COE due to construction activities within wetlands associated with the unnamed tributary and Bayou Creek; less than one acre of wetlands would be impacted by implementation of this alternative. This disturbance is permissible under NWP 38. Additionally, for Alternatives 3, 5, and 6 the substantive requirements of the KPDES program would have to be met.

2.8.7 Cost

Estimated capital, 30-year O&M, and total contingency costs for each alternative are presented in Table 2-2. The total cost and 30-year present worth values for each alternative also are presented in the table.

Table 2-2. Preliminary Cost Estimates

($ in Thousands)

Remedial Alternative	1	2	3	4	5	6
Capital Cost	$0	$1,909	$3,140	$2,521	$2,322	$340
O&M Cost	$48	$48	$2,827	$805	$637	$60
Contingency Cost	$12	$489	$1,493	$831	$443	$6
Total Cost	$60	$2,446	$7,460	$4,157	$3,402	$406
Present Worth*	$22	$2,405	$5,203	$3,527	$2,951	$350

*Present worth assumes a 7% discount rate.

2.8.8 State Acceptance

The remedial action described herein will be conducted in compliance with the PGDP Hazardous Waste Management Permit, KY8-890-008-982, issued by the KDEP, and with federal environmental requirements. The DOE has issued the WAGs 1 and 7 RI, FS, PRAP, and this ROD to the KDEP and the EPA for review. Pursuant to Section 121(e)(2) [42 U.S.C.A § 9621(e)(2)] and the draft FFA, the EPA must approve the ROD prior to its implementation and the KDEP may provide its concurrence.

2.8.9 Community Acceptance

As further discussed in Section 2.3 and the Responsiveness Summary of Section 3 of this ROD, the public has been provided the opportunity to comment on the selected remedial action, and it has done so. No member of the public stated opposition to the selected remedial action; however, public comments on the effectiveness, cost, and compliance

with the CERCLA were received. All comments from the public were considered in the selection of the remedital action. A summary of the public's comments and the DOE's responses to them are contained in the Responsiveness Summary.

2.9 SELECTED REMEDY

Based upon the evaluation of the alternatives utilizing the nine CERCLA criteria, the remedy for SWMU 8 that best meets the threshold, balancing, and modifying criteria for the scope and objectives is Alternative 6, limited action. This remedial action provides for overall protection of human health and the environment, complies with ARARs, poses no additional risks to the community during implementation and is cost effective. Impacts to workers and sensitive resources are limited during implementation.

The selected remedy for SWMW 8 will consist of the following elements, at a minimum.

(1) Install warning signs. Signs will be posted at the entrance to the landfill site and along the creeks, visible at any access point to the landfill, that dearly state the potential risks to human health posed by the leachate seeps and contaminated sediments in the creeks. The signs will be designed to be resistant to the elements. Figure 2-12 depicts the approximate locations of the signs at the landfill site.

(2) Place riprap. Riprap will be placed along the creek banks at the apparent seep locations along the unnamed tributary and Bayou Creek to minimize erosion. The riprap will be sized appropriately to reduce the potential to be displaced during high flow events.

(3) Institute a deed notice and restrictions. A deed notice and restrictions will be placed in the chain of title to the deed of the property to inform potential buyers and/or users of the potential risks to human health and the environment posed by the leachate seeps and the controls implemented at the site to minimize potential exposure. Additionally, the deed restrictions legally will bind the buyer to restricted uses of the property.

(4) Continue the existing surface-water monitoring program. As part of the interim corrective measures taken at SWMU 8, surface-water monitoring includes four sampling points along Bayou Creek and the unnamed tributary adjacent to the landfill (Figure 2-12). Samples are collected at various periods ranging from once per week to once per quarter and are reported to the EPA and the KDEP on a semiannual basis. The surface-water parameters tested for include aluminum, arsenic, barium, cadmium, gross alpha and beta, hardness, hexavalent chromium, pH, and iron. (For more information on surface-water sampling at SWMU 8, see the C-746-K Sanitary Landfill semiannual reports available to the public through the DOE Environmental Information Center, 175 Freedom Boulevard, Kevil, Kentucky 42053.)

Also, as part of the interim corrective measures taken at SWMU 8, DOE will continue to monitor four sampling points along Bayou Creek and the unnamed tributary adjacent to the landfill. Further interim actions will be

implemented if monitoring indicates that additional remedial activity is necessary. These measures will continue until such time as the Division of Water implements a discharge permit that allows for monitoring of landfill discharges and protection of the environment afforded by the permit conditions. At that time, criteria set forth in the permit for monitoring will be adhered to, and current monitoring practices will be discontinued.

(5) Modify the ground-water monitoring program. Ground-water monitoring at the C-746-K Sanitary Landfill currently includes quarterly sampling of five shallow ground-water wells located around the periphery of the unit (MWs 300 through 303 and MW 184). The results of the ground-water sampling conducted at the unit are reported in the C-746-K Sanitary Landfill Semiannual Reports, which are issued in accordance with the Interim Corrective Measures Workplan for the C-746-K Sanitary Landfill.

In support of the limited action remedy, the following modifications to the ground-water monitoring program at the landfill will be implemented.

Monitoring Well 303 no longer will be monitored and a replacement well, MW 303A, will be installed. Monitoring Well 303 was not screened at the appropriate depth to sample the lower portion of the Terrace Gravel deposits. The new well will be located in the vicinity of MW 303 and will be screened to the base of the Terrace Gravel deposits. Initially, samples will be collected from the new monitoring well on a quarterly basis in order to

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- discern seasonal variations in contaminant levels. In accordance with the Sampling and Analysis Plan (SAP) Addendum, KY/ER-2, the new well will be monitored for the parameters established under the environmental surveillance (new monitoring well) program. The parameters analyzed and frequency sampled will be reevaluated after one year and any necessary modifications will be documented in the annual update to the SAP Addendum.

- Monitoring Well 184 no longer will be monitored. This well was installed in 1991 in support of the Phase II Site Investigation. There are two reasons for ceasing the monitoring of MW 184: (1) the well is usually dry, and (2) the sampling is unnecessary due to the four high-quality wells (MWs 300, 301, 302, and 303A) that will be monitored at the landfill.

The ground-water monitoring results will be reported to the EPA and the KDEP in the PGDP semiannual reports prepared by the DOE management and the operating contractor. If ground-water monitoring detects contamination, an assessment will be conducted to determine if an interim remedial action is necessary. The final remedial action for the landfill's impact to the Ground Water Integrator Unit will be selected and implemented as part of WAG 26, which is the Ground Water Integrator Unit

investigation. The RI/FS workplan for WAG 26 is due to the regulatory agencies May 15, 2007.

In addition to those actions outlined in the preceding paragraphs, the current landfill cap maintenance program will be continued. The DOE will prepare a detailed design for this remedial action in accordance with the requirements specified in the Declaration of this ROD. During design and construction activities, some changes may be made to the remedy, as described here, as a result of the design and construction processes. Changes such as these modifications can result from the engineering design process.

This action will provide overall protection of human health and the environment. It also can be implemented in compliance with ARARs. Potential human and animal exposure to contaminated sediments and the acidic landfill leachate will be reduced as a result of implementation of this remedial action. As shown in Table 2-2, the total estimated cost for Alternative 6, limited action, is $406,000.

2.9.1 Statutory Determination

The remedial actions, described herein are protective of human health and the environment, are cost effective and comply with federal and state requirements that are legally applicable or relevant and appropriate to the WAGs 1 and 7 SWMUs. The selected remedies for the WAGs 1 and 7 SWMUs do not satisfy the CERCLA § 121(b) [42 U.S.C.A. § 9621(b)) statutory preference for having as a principal element, treatment that results in a permanent and significant reduction of toxicity, mobility, or volume, because risk analysis indicates that such remedies are not necessary. The selected remedies do, however, satisfy the CERCLA § 121(b) statutory preference for using permanent solutions and alternative treatment technologies to the extent practicable.

Since contamination will remain at SWMUs 8 and 100 above levels that allow for unlimited use and unrestricted exposure under the industrial land-use setting of the affected properties, five-year reviews will be conducted pursuant to CERCLA § 121(c) [42 U.S.C.A. § 9621(c)] and 40 C.F.R. § 300.430(f)(4)(ii). Five-year CERCLA reviews will not be conducted at SWMUs 130 through 134 and 136 because the selected

remedial actions allow for unlimited use and unrestricted exposure. Finally, because the remedial action decision for SWMU 38 is being deferred, five-year reviews for the SWMU are not herein addressed.

2.9.2 Protection of Human Health and the Environment

The selected action at SWMU 8 protects PGDP employees and the public by posting warning signs and plant security patrols of the landfill area. The limited action remedy also will reduce risks to humans and animals through limiting leachate exposure by placing riprap over acidic leachate being released above the water level in the creeks and by restricting future land use.

Continuation of controls at SWMU 100 protects the public by ensuring that current exposure assumptions are maintained in the future through institutional controls, including the PGDP perimeter security fence.

2.10 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section of the ROD discusses the concepts of ARARs and to be considered (TBC) information, as created by the CERCLA, and how the selected remedial action is expected to fare against the ARARs and TBC information.

2.10.1 Introduction to Applicable or Relevant and Appropriate Requirements and To Be Considered Information

Congress specified in CERCLA § 121(42 U.S.C.A.§ 9621) that remedial actions for the cleanup of hazardous substances must comply with the requirements, criteria, standards, or limitations under federal or more stringent state environmental laws that are legally applicable or relevant and appropriate to the hazardous substances or circumstances at a site. The EPA defines and explains ARARs using two categories. First, the EPA categorizes ARARs as being either "applicable" or "relevant and appropriate" to a site. The terms and conditions pertinent to this category are detailed in the following paragraphs.

- "Applicable" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site (40 C.F.R. § 300.5).

- "Relevant and appropriate" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility siting laws that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site (40 C.F.R. § 300.5).

- Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. If a requirement is not applicable, it must be both relevant and appropriate in order for it to be an ARAR. In cases where both a federal and a state ARAR are available, or where two potential ARARs address the same issue, the more stringent regulation must be selected. However, in cases where the implementation of a federal environmental program has been delegated by the EPA to a state, it would be the analogous state regulations which would be considered ARARs.

- Other information that does not meet the definition of an ARAR may be necessary to determine what is protective or may be useful in developing CERCLA remedies. In addition, ARARs do not exist for every chemical or circumstance that may be found at a CERCLA site. Therefore, the EPA believes it may be necessary, when determining cleanup requirements or designing a remedy, to consult reliable information that would not otherwise be considered a potential ARAR. Criteria or guidance developed by the EPA, other federal agencies, or states may assist in determining, for example, health-based levels for a particular contaminant or the appropriate method for conducting an action for which there are no ARARs. The CERCLA categorizes this other information as TBC. The TBC information may be used as guidance when developing CERCLA remedies. Materials considered TBC

information generally fall within three categories: (1) health effects information, (2) technical information on how to perform or evaluate investigations or response actions, and (3) policy. A possible fourth category for TBC information is proposed regulations, when they are noncontroversial and likely to be promulgated as drafted.

The second EPA categorization for ARARs is based on whether the ARARs are specific to the chemical(s) present at the site (i.e., chemical-specific), the remedial action being evaluated (i.e., action-specific), or the location of the site (i.e., location-specific). The terms and conditions pertinent to this second category are detailed in the following paragraphs.

- "Chemical-specific" ARARs usually are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment [53 Fed. Reg. 51437 (December 21, 1988)].

- "Action-specific" ARARs usually are technology- or activity-based requirements or limitations placed on the remedial action being evaluated. Selection of a particular remedial action at a site will trigger action-specific ARARs which specify appropriate technologies and performance standards [53 Fed. Reg. 51437 (December 21, 1988)].

- "Location-specific" ARARs generally are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats [53 Fed. Reg. 51437 (December 21, 1988)].

Examples of chemical-, action-, and location-specific ARARs:

- Chemical-specific ARARs - Maximum contaminant levels, KPDES effluent limits, etc.;

- Action-specific ARARs - Performance and design standards; and

- Location-specific ARARs - Preservation of historic sites, regulations pertaining to activities within or near wetlands or floodplains, etc.

As discussed in the preamble to the NCP, potentially responsible parties (PRPs) conducting remedial actions, or portions of remedial actions, entirely onsite, as defined in 40 C.F.R. § 300.5, must comply with the substantive portions of ARARs but not the procedural or administrative requirements [53 Fed. Reg. 51443 (December 21, 1988)]. Substantive requirements pertain directly to the actions or conditions at a site, while administrative requirements (e.g., permit applications) are paperwork requirements that could delay remedial action implementation.

The CERCLA § 121(d)(4) [42 U.S.C.A. § 9621(d)(4)] provides several ARAR waiver options that may be invoked, provided that human health and the environment are

protected. Finally, under CERCLA § 121(e) [42 U.S.C.A. § 9621(e)], PRPs (such as the DOE) are not required to obtain federal, state, or local permits in order to conduct on-site response actions.

In addition to ARARs and TBC information, the EPA has addressed other standards pertinent to CERCLA cleanups. In the NCP, at 40 C.F.R. § 300.150, the EPA has addressed the relationship of ARARs to worker protection standards. The EPA states that CERCLA response actions must comply with the worker protection standards and requirements of the Occupational Safety and Health Act of 1970 (29 U.S.C. §§ 651 through 678) and analogous state laws; however, the standards and requirements are not ARARs [55 Fed. Reg. 8680 (March 8,1990)].

Likewise, the DOE, in Order 5480.4, Environmental Safety and Health Standards, establishes general requirements for envirorunental protection, safety, and health standards for the DOE and DOE contractor operations. The Order addresses DOE activities during the design, construction, operation, modification (if any), and decommissioning phases of the remedial action.

Finally, in 10 C.F.R. § 835, the DOE sets forth occupational standards for radiation protection at its facilities. Pursuant to this regulation, exposure of general employees from DOE activities, other than planned special exposure or emergency exposure situations, are to be controlled so that the following annual radiation dose limits are not exceeded: a total effective dose equivalent of 5 rem; the sum of the deep dose equivalent for external exposures and the committed dose to any organ or tissue, other than the lens of the eye, of 50 rem; an eye lense dose equivalent of 15 rem; and a shallow dose equivalent of 50 rem to the skin or any extremity.

2.10.2 Relationship Between the Scope of the Selected Remedial Action, Regulatory Authorities, and Applicable or Relevant and Appropriate Requirements

The remedial actions identified in this ROD are intended to protect human health by minimizing exposure to acidic leachate seeping from the landfill banks into adjacent surface-water bodies. These actions are not intended to address remediation of any existing or future surface- or ground-water contamination at this site. The DOE will evaluate the necessity for surface- and/or ground-water remedial actions for the SWMUs in WAGs 1 and 7 separately from this action during site-wide, comprehensive evaluations of surface- and ground-water contamination at this site.

As part of the comprehensive evaluations, the DOE, the EPA, and the KDEP will determine whether implementing surface- and ground-water remedial actions at SWMU

8 is necessary to protect human health and the environment. Through the comprehensive evaluations for surface water (WAGs 18 and 25) and ground water (WAG 26), known also as the CSOUs, the remedial action alternatives for the surface water and ground water at the PGDP, including at WAGs 1 and 7, will be selected. Through the CSOU process, all data on the surface and ground water at WAGs 1 and 7, and at the other PGDP SWMUs will be evaluated. Finally, all risks to human health and the environment from the surface and ground water at the PGDP, and all legally ARARs also will be evaluated.

While CERCLA § 121(d)(2)(A) [42 U.S.C.A. § 9621(d)(2)(A)] requires that the RCRA

(42 U.S.C.A. §§ 6901 to 6992k) and other environmental laws be evaluated as ARARs, this, in no way, limits or negates the Commonwealth of Kentucky's authority pursuant to K.R.S. Chapter 224, subchapter 46 and the PGDP Kentucky Hazardous Waste Management Permit, KY8-890-008-928. This subchapter provides the KDEP with statutory authority to regulate hazardous waste in Kentucky.

The chemical-, action-, and location-specific ARARs and TBC information for the selected remedial actions are described in the following paragraphs.

2.10.3 Chemical-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the chemical-specific ARARs and TBC information for the selected remedial action. All chemical-specific ARARs will be met through implementation of the selected remedial action.

2.10.3.1 Leachate discharges

Since discharges of leachate from the C-746-K Sanitary Landfill into waters of the Commonwealth have been documented, the substantive requirements applicable to point source discharges under the Clean Water Act (CWA) (33 U.S.C.A. §§ 1251 to 1387) are legally applicable to the site under the CERCLA. The EPA has authorized the KDEP to operate its KPDES program in lieu of the CWA. The KPDES program must be administered consistently with CWA requirements. Typically, at non-CERCLA sites, the KDEP issues a KPDES permit to regulate point source discharges. Such KPDES permits contain effluent discharge limits to ensure compliance with the water quality criteria found in 401 K.A.R. Chapter 5.

However, because the PGDP is a CERCLA site, the permit exemption of CERCLA § 121(e)(1) [42 U.S.C.A. § 9621(e)(1)] applies. This provision of the CERCLA exempts portions of remedial actions conducted onsite from having to comply with administrative requirements, such as the acquisition of a KPDES permit. The provision is written into the CERCLA not to lessen the burden of any substantive environmental requirements, but to reduce paperwork requirements that Congress believed potentially could delay the implementation of remedial measures. Thus, even though the acquisition of a KPDES permit is not being incorporated as part of the remedial action, the remedial action still will comply with the substantive requirements of the KPDES program.

The substantive requirements of the KPDES program are contained in various sections of 401 K.A.R. §§ 5:031, 5:065, and 5:070. Additionally, 401 K.A.R 5:029 § 2 is the KDEP's nondegradation policy for surface waters. The policy states that current uses of surface water must be protected. The substantive requirements of the KPDES program and the KDEP's nondegradation policy are applicable requirements under the CERCLA. These requirements are discussed in the following text.

The KDEP regulation 401 K.A.R. 5:031 § 2 contains the minimum water quality criteria for all surface waters in the Commonwealth. The KDEP regulation 401 K.A.R. 5:031 § 4(1) contains the water quality criteria for surface waters, including Bayou Creek, which are suitable for warm-water aquatic species. Pursuant to 401 K.A.R. 5:065 § (2)(4), point source discharges from the C-746-K Sanitary Landfill cannot result in violations of the applicable water quality criteria within the stream. After consultation with the EPA and the KDEP, the DOE has determined that discharges from the landfill currently are not violating substantive KPDES standards (see Appendix B). Thus, the DOE has

concluded that the selected remedial action will meet all water quality ARARs for surface waters.

The requirement that CERCLA actions comply with environmental monitoring requirements is contained in the preamble to the NCP at 55 Fed. Reg. 8757 (March 8, 1990). As part of the remedial action, and pursuant to 401 K.A.R. 5:065 § 1(12)(d) and 5:070 § 3, instream monitoring of Bayou Creek will be conducted to document compliance with KPDES requirements. The monitoring of Bayou Creek is further discussed in Section 2.9 of this ROD. The monitoring will continue, as described, in Section 2.9 unless and until the DOE and the KDEP agree to a modification, or a court of competent jurisdiction so orders.

2.10.3.2 Radiation protection of the public and the environment

The DOE Order 5400.5 applies to radiation exposure to the general public from all DOE activities, including routine activities, remedial actions, and naturally occurring radionuclides released by DOE processes and operations and is TBC information. The DOE Order 5400.5 limits radiation exposure to members of the public to a total effective dose equivalent of less than 100 mrem/yr, or 5 mrem/yr to any organ. The Order also specifies derived concentration guidelines for inhaled radionuclides and mandates that DOE personnel and contractors strive to ensure that radiation doses to members of the public are as low as reasonably achievable (ALARA) below the appropriate limits.

2.10.3.3 Radionuclide emission standard

On-site activities involved with the construction and/or implementation of the remedial action could produce airborne pollutants. It is not expected that any radionuclide emissions would result from these activities; however, if radionuclide emissions were to occur, emission standards for DOE facilities would apply. Federal regulation 40 C.F.R. § 61.92 promulgated pursuant to the Clean Air Act of 1970, as amended by the Clean Air Act of 1990, [42 U.S.C.A. §§ 7401 to 7671(q)] sets a total emission standard for radionuclides, other than radon, from DOE facilities. The regulation requires the DOE to ensure that emissions from its facilities do not exceed those amounts that would cause any member of the public to receive, in any given year, an effective dose equivalent of 10 mrem/yr. The regulation is an applicable requirement for the remediation of SWMU 8.

The chemical-specific ARARs and TBC information for the selected remedial action are contained in Table 2-3.

2.10.4 Location-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the location-specific ARARs and TBC information for the selected remedial action. All location-specific ARARs will be met through implementation of the selected remedial action.

Table 2-3. Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information
for Solid Waste Management Unit 8 of Waste Area Group 7

Kentucky

Medium	Requirements	Federal Citation	Citation	Prerequisites
Leachate releases into waters of the Commonwealth - Applicable.	Current uses of surface water must be protected.	5:029 § 1	Discharges or discharges	401 K.A.R.
Discharges or releases into waters of the Commonwealth - Applicable.	Discharges must not exceed discharge limits set pursuant to the KPDES program.	5:031 §§ 2 and 4(1)	Discharges or discharges	5:065 § 2(4)
Discharges or releases into waters of the Commonwealth - Applicable.	Discharges must be monitored to document compliance with the KPDES program.	5:065 § 1(12)(d) 5:070 § 3	Discharges or discharges	
Exposure of the general public from any source of radiation exposure at a DOE facility - TBC on a facility-wide basis.	General public must not receive an effective dose equivalent greater than 100 mrem/yr, or 5 mrem/yr to any organ from all exposure modes.	DOE Order 5400.5	Radionuclides - all exposure pathways	
Release of radioactive material from DOE activities - TBC.	All releases of radioactive material must be ALARA.	DOE Order 5400.5		
Emissions of radon from DOE facilities - Applicable on a facility-wide basis.	Emissions from DOE facilities shall not cause members of the public to receive, in any year, an effective dose equivalent greater than 10 mrem/yr.	40 C.F.R. § 61.92	radionuclides other than	

Wetlands and a 100-year floodplain have been identified in the vicinity of SWMU 8. Construction activities must avoid or minimize adverse impacts on wetlands and act to preserve and enhance their natural and beneficial values [Executive Order 11990; 40 C.F.R. § 6.302(a); 40 C.F.R. § 6, Appendix A; and 10 C.F.R. § 1022]. In addition, construction activities must minimize potential harm to the 100-year floodplain (Executive Order 11988 and 10 C.F.R. Part 1022).

The DOE will avoid, to the extent possible, the long- and short-term adverse impacts

associated with the occupancy and modification of floodplains and wetlands [10 C.F.R. 1022.3(a)]. The DOE will undertake a careful evaluation of the potential effects of any DOE action conducted in a floodplain [10 C.F.R. 1022.3(c)]. Construction in wetlands should be avoided unless there are no practicable alternatives [40 C.F.R. § 6.302(a)]. Degradation or destruction of wetlands must be avoided to the extent possible [40 C.F.R. § 230.10 and 33 U.S.C. § 1344(b)(1)]. Considerations about the protection of wetlands must be incorporated into planning, regulating, and decision making [10 C.F.R. § 1022.3(b)]. Any action involving the discharge of dredged or fill material into wetlands must be avoided to the extent possible (13 U.S.C. § 1344, 40 C.F.R. § 230, and 33 C.F.R. §§ 320 to 330).

Discharges of dredged or fill material for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited [40 C.F.R. § 230.10(a)]. Discharges are also prohibited unless there are no practicable alternatives, and practicable, appropriate mitigation methods are available [40 C.F.R. § 230.10(d)]. Further, 40 C.F.R. § 230.10(b) prohibits discharges that cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions (33 U.S.C. § 1317), or jeopardize threatened and endangered (T&E) species or their critical habitat under the Endangered Species Act (16 U.S.C. § 1531, et seq.). If it becomes apparent that impacts to wetlands are unavoidable, due to the construction plan or other modifications, the specific requirements of 61 Fed. Reg. 65920 NWPs or 33 C.F.R. § 325 (Processing of General Permits), and statutes governing discharges of dredged or fill material into waters of the United States would become applicable. The NWP applicable to the selected remedy is NWP 38.

Nationwide Permit 38 is applicable to this project. Nationwide permits are permits authorized by the COE on a nationwide basis for activities deemed to have little to no adverse effects on waters of the United States. Specific requirements applicable to all NWPs must be followed. These requirements are defined in 61 Fed. Reg. 65920 (December, 13 1996). However, notification is not required for CERCLA actions and, consequently, not required for this action [61 Fed. Reg. 65905-65906 (December 13, 1996)].

As required by 401 K.A.R. 4:060, activities or structures exempted by 401 K.A.R. 4:020, which include activities authorized by the COE NWP, may be placed within the regulatory floodway limit of a stream only if they are not of such nature as to result in increases in flood elevations. Riprap and MW 303-A will be placed within the 100-year floodplain. The ARARs for floodplains will be met as long as construction equipment remains on the bank and the original contours are reconstructed as much as practicable, thereby eliminating any possible flood elevation changes. If construction plans are modified, those ARARs, listed in Table 2-4 for wetlands may become applicable. Consequently, if construction plans change, or different remedial actions are chosen in the future, the action would require reevaluation for location-specific ARARs.

Table 2-4. Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information
for Solid Waste Management Unit 8 of Waste Area Group 7

Kentucky

Actions	Requirements	Prerequisites

Federal Citation	Citation		
401 K.A.R.			
Protection of wetlands	Avoid or minimize adverse impacts on wetlands to preserve and enhance their natural and beneficial values.	Any federal action that will have an impact on wetlands - Applicable if avoidance is not met	10 C.F.R. § 1022; Executive Order 11990
	Avoid degradation or destruction of wetlands to the extent possible.	Any action involving discharge of dredged or fill material into wetlands - Applicable if avoidance is not met.	40 C.F.R. § 230.10; 13 U.S.C. § 1022.3(b)
	Incorporate considerations about protection of wetlands into planning, regulating, and decision making.	Any federal action that will have an impact on wetlands - Applicable if avoidance is not met.	10 C.F.R. § 1022.3(b); 33 C.F.R. § 330 61 Fed. Reg. 65920
Discharge of dredged or fill material into navigable water	Discharges for which there are practicable alternatives with fewer adverse impacts or those which would cause or contribute to significant degradation are prohibited.	Any action involving discharge of dredged or fill material into wetlands - Applicable if avoidance is not met.	40 C.F.R. § 230.10(a)
	Significant degradation is prohibited unless appropriate steps are taken to minimize impacts on the aquatic ecosystem.	Any action involving discharge of dredged or fill material into wetlands - Applicable if avoidance is not met.	40 C.F.R. 230.10(c)and(d)

Table 2-4. Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Kentucky

Actions	Requirements	Prerequisites	Federal Citation	Citation
Discharge of dredged or fill material into navigable water (continued)	Discharges which cause or contribute to violations of state water quality standards, violate toxic effluent standards or discharge prohibitions, or jeopardize species under the Endangered Species Act.	Any action involving discharge of dredged or fill material into wetlands - Applicable if avoidance is not met.	40 C.F.R. § 230.10(b)	401 K.A.R.
Protection of floodplains	Avoid construction in any 100-year floodplain.	Any federal action within a 100-year floodplain - Applicable.	10 C.F.R. § 1022 Executive Order 11988	
	Avoid activities or structures within the regulatory floodway limits of a stream if they result in an increase in flood elevations.	Any action within the regulatory floodway limits - Applicable.		4:060 § 4(2)

2.10.5 Action-Specific Applicable or Relevant and Appropriate Requirements

The following discussion describes the action-specific ARARs and TBC information for the selected remedial action. All action-specific ARARs will be met through implementation of the selected remedial action.

2.10.5.1 Solid waste management unit corrective action

The regulations that apply to the cleanup of SWMUs are ARARs for the selected remedial action. Pursuant to the RCRA [42 U.S.C.A. §§ 6901 through 6992(k) and K.R.S. Chapter 224, subchapter 46] the regulations that apply are 40 C.F.R. § 264.101 and 401 K.A.R. 34:060 § 12. These laws and regulations do not contain specific cleanup standards. Rather, the regulations require that the corrective action measures taken must result in the protection of human health and the environment. These regulations are applicable requirements under the CERCLA.

2.10.5.2 Environmental performance standards

The environmental performance standards of 401 K.A.R. 47:030 set minimum numeric and narrative criteria for all solid waste sites and facilities located in Kentucky. The standards establish minimum criteria for the protection of the environment. Included are standards for floodplains (§ 2), wetlands (§ 13), endangered species (§ 3), air (§ 10),

surface water (§ 4), ground water (§§ 5 and 6), and food chain crops (§ 7). The standards also contain provisions to ensure safety (§ 11), prevent the site or facility from becoming a public nuisance (§ 12), and restrict practices related to the disposal of PCBs (§ 8) and disease carrying vectors (§ 9). Finally, Section 14 of the regulation requires that no solid waste site or facility violates any provision of K.R.S. Chapter 224. Except for the provisions related to the contamination of surface water and ground water (§§ 4 through 6), the standards, which first took effect in 1990, are relevant and appropriate to the C-746-K Sanitary Landfill, which closed in 1982. The surface-water and ground-water contamination provisions are not relevant and appropriate because any cleanup of the surface water and ground water at or adjacent to SWMU 8 would be beyond the scope of the selected remedial action.

2.10.5.3 Ground-water protection

As required by 401 K.A.R 5:037, any person conducting certain waste-handling activities must implement practices to prevent the pollution of ground water. The regulation is an applicable requirement under the CERCLA; thus, the substantive provisions of the regulation are ARARs even though ground-water remediation is beyond the scope of the remedial action.

Section 3(7) of the regulation states that ground-water protection practices may be incorporated by other federal, state, and local regulatory programs that contain the following three standards: (1) management and design standards; (2) mandatory monitoring for ground-water pollution or methods of detecting discharges, spills, or releases to ground water; and (3) specific corrective action criteria. Through the CERCLA, the RCRA, Kentucky's hazardous waste management program, and the PGDP Groundwater Protection Program Plan (GPPP) (MMES, KY/ER-2 Rev. 1, January 1992), the three standards will be met by the selected remedial action. First, the design parameters for the remedial action technology have been reviewed by the EPA and the KDEP. Second, the CERCLA, the RCRA, and the KDEP's hazardous waste programs require ground-water monitoring to evaluate the effectiveness of the remedial action and the GPPP defines how the KDOW will implement such monitoring. Finally, the specific corrective action criteria for ground water will be addressed by the ground water CSOU for the PGDP and incorporated into a ROD and/or the PGDP RCRA Permits.

2.10.5.4 Ground-water monitoring plan

Section 4 of 401 K.A.R. 48:300 requires a ground-water monitoring plan which contains: (a) the number, location, and depth of proposed monitoring points; (b) preoperational data showing existing ground-water quality; and (c) a ground-water SAP. The provisions of Section 4, which first took effect in 1990, are relevant and appropriate for the selected remedial action at the C-746-K Sanitary Landfill, which closed in 1982. Moreover, the provisions of Section 4 have and will continue to be complied with through the RFI Workplan, interim corrective measures at the SWMU, and the semiannual reporting on the unit that the DOE provides to the KDEP and the EPA. Documentation on these activities may be obtained through the Administrative Record for the Cleanup of the PGDP, 175 Freedom Boulevard, Kevil, Kentucky 42053, (502) 462-2550.

2.10.5.5 Design requirements for ground-water monitoring systems

Section 5 of 401 K.A.R. 48:300 contains design requirements for ground-water monitoring systems. Section 5 requires a reference or background well and at least three monitoring wells at a point hydraulically downgradient from where the waste was disposed. Like Section 4, Section 5 of the regulation also is relevant and appropriate, and documentation on the ground-water monitoring program at the C-746-K Sanitary Landfill can be obtained through the AR.

2.10.5.6 Monitoring well construction

Ground-water monitoring well construction requirements of 401 K.A.R 48:300 § 6 are relevant and appropriate requirements under the CERCLA because a ground-water monitoring well will be installed as part of the remedial action. The well, tentatively planned as MW 303A, will be used to determine whether any contaminants from SWMU 8 are entering the Terrace Gravel. Monitoring Well 303A will become part of the existing ground-water monitoring program discussed more fully in Section 2.9 of this ROD.

The following is a discussion of each legally applicable requirement of 401 K.A.R. 48:300 § 6.

- Precautions must be taken during the drilling and construction of the monitoring well to avoid introducing contaminants into the borehole. Only potable water will be used in drilling the well and drilling muds will not be used [401 K.A.R. 48:300 § 6(l)].

- All equipment to be placed into the boring will be decontaminated prior to use at the site [401 K.A.R. 48:300 § 6(2)].

- Monitoring wells must be cased to maintain the integrity of the monitoring well borehole; have a minimum diameter of four inches, unless otherwise approved by the KDEP; have screens and appropriate gravel or sand packing; protrude at least one foot above the ground; be four inches smaller than the outside diameter of the drill hole; produce an annular space above the sampling depth that is sealed to prevent contamination of samples and the ground water; and if the casing is plastic, be threaded and gasket seated, unless otherwise approved by the KDEP [401 K.A.R. 48:300 § 6(3)].

- The monitoring well casing must be enclosed in a protective cover that: (1) includes a protective barrier; (2) is installed into firm rock; (3) is grouted and placed with a cement collar below the frost line; (4) is numbered and painted in a highly visible color; (5) protrudes at least one inch higher above grade than the monitoring well casing; (6) has a locked cap; and (7) is made of steel or any other material of equivalent strength [401 K.A.R. 48:300 § 6(4)].

- The monitoring well must have a concrete pad extending two feet around the well and be sloped away from the well [401 K.A.R. 48:300 § 6(5)].

2.10.5.7 On-site activities

On-site excavation activities may produce airborne pollutants. Particulate emission levels from earth-moving and site-grading activities are not expected to exceed Kentucky

Division of Air Quality regulations for fugitive dust emissions, found in 401 K.A.R. 63:010. The following provisions of this regulation are applicable under the, CERCLA.

A requirement of 401 K.A.R. 63:010 §3 is that reasonable precautions be taken to prevent particulate matter from becoming airborne. Such precautions include the use of water or chemicals, if possible, and/or placement of asphalt or concrete on roads and material stockpiles to control dust [401 K.A.R. 63:010 § 3(l)(b)]. Visible fugitive dust must not be dischared beyond the property line where the dust originated [401 K.A.R. 63:010 § 3(2)]. Additionally, all open-bodied trucks that operate outside the property boundary and that may emit materials that could be airborne must be covered (401 K.A.R. 63:010 § 4(1)].

2.10.5.8 Deed notice

As part of the remedial action for SWMU 8, the DOE will file a notice and deed restrictions with McCracken County, Kentucky, authorities to restrict the uses of the property and to let prospective purchasers and others know that the property was used for waste disposal activities.

In so doing, the DOE will be complying with 401 K.A.R 48:170 § 3(5) which requires the filing only of the deed notice. The regulation, which first took effect in 1990, is relevant and appropriate for the action being taken at the landfill, which closed in 1982.

2.10.5.9 Hazardous waste determination

Soils excavated during the construction of the selected remedy are expected to be laid across the base of the landfill and seeded or used as on-site backfill material so as not to invoke any land disposal or storage concerns [55 Fed. Reg. 8759 (March 8, 1990)]. However, in the unlikely event that any excavated soil is to be transported beyond SWMU 8 boundaries, a determination of whether the soil is hazardous will be made pursuant to 40 C.F.R. § 262.11 and 401 K.A.R. 32:010 § 2. If the soil to be transported is determined to be hazardous, RCRA Subtitle C and analogous state requirements for the management of hazardous waste would be complied with as applicable requirements under the CERCLA

2.10.5.10 Radioactive waste determination

Pursuant to DOE Order 5820.2A, in the unlikely event any soil is transported beyond SWMU 8 boundaries, the soil would be tested to determine if it is radioactive. The DOE Order 5820.2A establishes internal policies, guidelines, and requirements under which the DOE manages its radioactive and mixed (hazardous and radioactive) waste. Subsequent management of radioactive soil would be conducted in accordance with the DOE order and the Land Disposal Restriction (LDR) Federal Facility Compliance Agreement (FFCA) entered into between the DOE and the EPA Region IV June 30, 1992. Subsequent management of mixed waste would be conducted in accordance with the DOE Order, the LDR-FFCA, Subtitle C of RCRA, and K.R.S. Chapter 224, subchapter 46. The Order ensures that radioactive and mixed wastes are managed in a manner which assures the health and safety of the public, the DOE and its contractor employees, and the environment. The Order requires that external exposures to radioactive material released into surface water, ground water, soil, plants, and animals do not result in an effective dose equivalent which exceeds 25 mrem/yr to any member of the public. As an internal order, it is TBC information under the CERCLA.

2.10.5.11 Construction along streams

Construction materials used in or along either Bayou Creek or the unnamed tributary will be stable and inert, free from pollutants and floatable objects, and meet all appropriate engineering standards, pursuant to 401 K.A.R. 4:060 § 7. The regulation is an applicable requirement under the CERCLA. The action-specific ARARs and TBC information for the selected remedial action are contained in Table 2-5.

2.10.6 Applicable or Relevant and Appropriate Requirements and To Be Considered Information for Solid Waste Management Units 100, 130 through 134, and 136

Under the CERCLA guidance document, ARARs Q's & A's, EPA Office of Solid Waste and Emergency Response, 9234.2-01FS, May 1989, an ARARs compliance evaluation is not required for a no action decision because the site already is protective of human health and the environment. Thus, an ARARs analysis for SWMUs 130 through 134 and 136 is not provided because the SWMUs already are protective of human health and the environment.

Tables 2-6 and 2-7, respectively, contain the chemical- and action-specific ARARs and TBC information for SWMU 100, which has as its selected remedial action, the continuation of controls. There are no location-specific ARARs for SWMU 100. The continuation of controls at SWMU 100 would meet all chemical- and action-specific ARARs.

2.11 COST EFFECTIVENESS

The preferred alternative will provide overall effectiveness in reducing the potential for exposure by limiting future land use at the site and limiting exposure to landfill leachate by covering visible seeps with riprap. This preferred remedial action represents the least expensive remedial alternative evaluated that achieves all remedial action objectives. Selection of this remedy provides the greatest cost efficiency for the DOE.

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information
At Solid Waste Management Unit 8 of Waste Area Group 7

Actions	Requirements	Prerequisites	Kentucky Citation	Federal Citation
SWMU corrective action	Protect human health and the environment.	Release of hazardous waste or constituents from a SWMU	401 K.A.R. 34:060 § 12 - Applicable.	40 C.F.R. § 264.101
Environmental	Meet minimum requirements for the	Any solid waste site or		

facility performance standards		47:030 §§ 2,3, and 7 through 14	protection of the environment. - Applicable.
Ground-water activities protection	Implement practices to ensure protection of ground water.	5:037 § 3(7)	Waste-handling which have the potential to alter ground-water characteristics - Applicable. However, substantive requirements are incorporated into the CERCLA, RCRA, and Kentucky hazardous waste management programs, and the PGDP GPPP.

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To B Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Kentucky Federal Citation	Citation
Ground-water monitoring plan	A ground-water monitoring plan must include • The number, location, and depth of proposed monitoring points; • Preoperational data showing existing ground-water quality; and • A ground-water sampling and analysis plan.	Ownership or operation of a solid waste site or facility - Relevant and Appropriate. (Note: Compliance with this ARAR has already been achieved through prior submittals.)	48:300 § 4 48:300 § 4(1) 48:300 § 4(2) 48:300 § 4(3)	401 K.A.R.
Design	The ground-water quality monitoring	Ownership or operation of a	48:300 § 5	

requirements for ground-water monitoring system	system must consist of • At least one reference or background monitoring well; and • At least three downgradient monitoring wells.	48:300 § 5(l) 48:300 § 5(2)	solid waste site or facility - Relevant and Appropriate.
Ground-water monitoring well construction	Monitoring well must be constructed with • Precautions to avoid introducing contaminants into the borehole; • Potable water; and • Decontaminated equipment.	48:300 § 6 48:300 § 6(l) 48:300 § 6(l) 48:300 § 6(2)	Ownership or operation of a solid waste site or facility - Relevant and Appropriate.

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Kentucky Federal Citation	Citation
				401 K.A.R.
Ground-water monitoring well construction (continued)	Monitoring well casing must • Maintain the integrity of the monitoring well borehole; • Have a minimum diameter of 4 inches; • Have screens and appropriate		48:300 § 6(3) 48:300 § 6(3)(a) 48:300 § 6(3)(b) 48:300 § 6(3)(c)	

	gravel or sand packing;	
	• Protrude at least one foot above the ground;	48:300 § 6(3)(d)
	• Be 4 inches smaller than the outside diameter of the drill hole;	48:300 § 6(3)(e)
	• Produce an annular space above the sampling depth to prevent contamination of samples and the ground water; and	48:300 § 6(3)(f)
	• Be threaded and gasket sealed (if plastic).	48:300 § 6(3)(g)

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Kentucky Citation	Federal Citation
			401 K.A.R.	
Ground-water monitoring well construction (continued)	Monitoring well casing must be enclosed in a protective cover that			48:300 § 6(4)
	• Includes a protective barrier;			48:300 § 6(4)(a)
	• Is installed into firm rock;			48:300 § 6(4)(b)
	• Is grouted and placed with a cement collar below the frost line;			48:300 § 6(4)(c))
	• Is numbered and painted in a highly visible color;			48:300 § 6(4)(d)
	• Protrudes at least one inch higher above the monitoring well casing;			48:300 § 6(4)(e)

	• Has a locked cap; and	48:300 § 6(4)(f)	
	• Is made of steel or a material of equivalent strength.	48:300 § 6(4)(g)	
	The monitoring well must have a concrete pad extending two feet around the well and be sloped away from the well.	48:300 § 6(5)	

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Kentucky Citation	Federal Citation
			401 K.A.R.	
On-site activities	Precaution must be taken to prevent particulate matter from becoming airborne. Such precautions may include: • Using water or a chemical to control dust; • Placing asphalt or concrete on roads and material stockpiles to control dust; • Ensuring that no visible fugitive dust is emitted beyond the property line; and • Ensuring that all open-bodied trucks are covered if any materials in the truck could become airborne.		63:010	
Hazardous waste determination	A hazardous waste determination must be made for excavated soil being transported beyond SWMU boundaries. If the soil is determined to be hazardous, other RCRA Subtitle C requirements would be	Generation of waste - Applicable.	32:010 § 2	40 C.F.R. § 262.11

applicable.

Table 2-5. Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information at Solid Waste Management Unit 8 of Waste Area Group 7 (Continued)

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation
Radioactive waste determination	A radioactive waste determination must be made for excavated soil being transported beyond SWMU boundries If the soil is determined to be radioactive, or contain mixed waste, the soil will be managed according to appropriate standards.	Generation of waste: RCRA - Applicable; K.R.S. 224 - Applicable; DOE Order 5820.2A- TBC; and LDR-FFCA- TBC.	42 U.S.C.A. §§ 6921 through 6939(e); DOE Order 5820.2A LDR-FFCA	K.R.S. Chapter 224, subchapter 46
Construction along streams	Construction materials used in or along either Bayou Creek or the unnamed tributary must be stable and inert, free from pollutants and floatable objects, and must meet all appropriate engineering standards.	Use of construction materials in stream construction projects - Applicable.		401 K.A.R. 4:060 § 7
Deed notice and restrictions	Provide notice to prospective purchasers of the property that waste is buried on site. Restrict uses of the property so that the landfill cap and riprap along the stream banks are not disturbed.	Implementation of the remedial action - and appropriate.		401 K.A.R. 34:070 § 10(2) Relevant

Pursuant to the CERCLA, the RCRA is listed as an ARAR in this ROD. This in no way limits or negates the Commonwealth of Kentucky's hazardous waste management authority pursuant to K.R.S. Chapter 224, subchapter 46.

Table 2-6. Applicable or Relevant and Appropriate Requirements and To Be Considered Information

For Solid Waste Management Unit 100 of Waste Area Group 1

Contaminant/Medium	Requirements	Prerequisites	Federal Citation	Kentucky Citation
				401 K.A.R.
		CHEMICAL-SPECIFIC		
Radionuclides - all exposure pathways	General public must not receive an effective dose equivalent greater than 100 mrem/yr, or 5 mrem/yr to any organ from all exposure modes.	Exposure of the general public from any source of radiation exposure at a DOE facility - TBC on a facility-wide basis.	DOE Order 5400.5	
	All releases of radioactive material must be ALARA.	Release of radioactive material from DOE activities - TBC.	DOE Order 5400.5	
	Emissions from DOE facilities shall not cause members of the public to receive, in any year, an effective dose equivalent greater than 10 mrem/yr.	Emissions of radionuclides other than radon from DOE facilities - Applicable on a facility-wide basis.	40 C.F.R. § 61.92	
		LOCATION-SPECIFIC		
		None		
		ACTION-SPECIFIC		
SWMU corrective action waste or	Protect human health and the environment.	Release of hazardous constituents from a SWMU - Applicable.	40 C.F.R. § 264.101	34:060 § 12

Table 2-7. Action-Specific Applicable or Relevant and Appropriate Requirements for Solid Waste Management Units 130 through 134 and 136 of Waste Area Groups 1 and 7

Actions	Requirements	Prerequisites	Federal Citation	Kentucky Citation

401 K.A.R.				
SWMU corrective action	40 C.F.R. § 264.101	Protect human health and the environment.	34:060 § 12	Release of hazardous waste or constituents from a SWMU - Applicable.

Pursuant to the CERCLA, the RCRA is listed as an ARAR in this ROD. This in no way limits or negates the Commonwealth of Kentucky's RCRA authority at the site.

2.12 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES

The objectives for this remedial action are to limit exposure to the landfill leachate by covering visible seep locations with riprap, limiting future land use, and preventing destruction of current containment measures (i.e., the existing landfill cap) by placing a deed notice and restrictions on the property. The effectiveness of the remedial action will be assessed through ground-water and surface-water monitoring. Implementing this remedial action is intended to be the final action taken at this site, as it provides an acceptable level of protection from potential exposure to contaminants present in the landfill leachate. Should monitoring conducted at this site indicate an unacceptable risk to human health or environment in the future, implementing additional remedial actions will be assessed.

2.13 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The CERCLA statutory preference for treatment is not adhered to by the selected remedial action because treatment of the leachate was not deemed necessary or cost effective. This action does satisfy the statutory requirement for protection of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes were made.

PART 3

RESPONSIVENESS SUMMARY

3.1 RESPONSIVENESS SUMMARY INTRODUCTION

This responsiveness summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). These CERCLA provisions require the DOE, as "lead agency," to respond "to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on the WAGs 1 and 7 PRAP.

The DOE has gathered information on the types and extent of contamination found, evaluated remedial measures, and recommended remedial actions that will minimize direct contact with contaminated soil and mitigate migration of contaminants through surface and ground water. As part of the remedial action process, a Notice of Availability regarding the PRAP was published in The Paducah Sun, a major regional newspaper of general circulation. The Proposed Remedial Action Plan for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D2, was released to the general public June 24, 1996. This document was made available to the public at the Environmental Information Center in the West Kentucky Technology Park in Kevil, Kentucky, and at the Paducah Public Library. A 45-day public comment period began June 25, 1996, and continued through August 9, 1996. The PRAP also contained information which provided the opportunity for a public meeting to be held, if requested. Specific groups which received individual copies of the WAGs 1 and 7 PRAP included the local PGDP Neighborhood Council, the Natural Resource Trustees, the SSAB, and the PGDP Environmental Advisory Committee.

In response to comments from the public, the EPA, and the Commonwealth of Kentucky, changes were made to the PRAP. The revised PRAP (Proposed Remedial Action Plan for Waste Area Groups I and 7 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1428&D4) was issued to the public after a Notice of Availability announcing the 45-day public review period was published in The Paducah Sun December 22, 1996. During the public comment period (December 23, 1996, through February 5, 1997), the PRAP was made available for public review at the Paducah Public Library and the off-site DOE Environmental Information Center located in the West Kentucky Technology Park in Kevil, Kentucky. The review period was extended 30 days to March 7, 1997, due to public request. Specific groups which received individual copies of the PRAP included the local PGDP Neighborhood Council, Natural Resource Trustees, the SSAB,and the PGDP Environmental Advisory Committee.

3.2 COMMUNITY PREFERENCES/INTEGRATION OF COMMENTS

Public participation in the CERCLA process is required by the SARA. Comments received from the public are considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: (1) to provide the DOE with information about the community preferences and concerns regarding the remedial alternatives, and (2) to show members of the community how their comments were incorporated into the decision-making process. The following are conunents received from the public on the WAGs 1 and 7 PRAP during the public comment periods. The first comment and response refers to the first PRAP and the remaining comments and responses refer to the second PRAP.

Comment: I wish to comment on the proposed remedial action plan for SWMU 8. The alternatives listed do show some promise, but I wish there was a more substantial solution. I understand that funds are limited for this project. I think Alternative 3, the leachate collection system would be the most reliable long term solution. I understand the cost is higher than the proposed Alternative 5 wetland treatment system at half the cost. I have concerns the wetland treatment system will not work. The fact that the wetland is to be evaluated over a two-year period suggests doubt of its effectiveness. It's a 3.5 million dollar bet which translated [into] still higher costs if the problem is not solved. I believe that removing the source of the contamination is the only solution.

Response: In response to this comment, informal public comments, and comments from the EPA and KDEP, the proposed alternative was reevaluated and changed to the current proposed alternative. Risks to human health and uncertainties in performance of the wetland alternative were evaluated, and it was determined that costs for implementation and were not commensurate with the risks posed at the site. Based upon this same rationale, invasive technologies (i.e., excavation) also were screened from further consideration. The current remedy was selected based upon its ability to maintain overall protection of human health and the environment, comply with ARARs, pose no additional risks to the community, and provide cost-effectiveness in remedy selection.

Comment: Is it possible for certain members of the public to be added to a mailing list to receive documents published by the United States Department of Energy? This will further facilitate the public participation process.

Response: The DOE publishes a Notice of Availability for documents available for public review and notices of public meetings for PRAPs in The Paducah Sun. The DOE also provides 45-day public comment period which provides citizens time to review each FS and PRAP. Additionally, all reports which document the remedial action process are available to the public in the AR located in the Jacobs Technical Center at 175 Freedom Boulevard, Kevil, Kentucky. The telephone number for the AR is (502) 462-2550 and the facsimile number is (502) 462-2551. The DOE also has established a SSAB to keep the public involved in the decision-making process at the PGDP. In addition to these mechanisms, the DOE will strive in future document releases to ensure public notice is sufficient to provide ample review time. However, due to cost and concerns that DOE would not be treating all members of the public equally if DOE were to selectively distribute the documents, including to members of the public on a DOE mailing list, this is not the practice of DOE at this time.

Comment: The public is extremely concerned about the leachate from the landfill. We don't agree that allowing this leaching to continue complies with CERCLA. It is an uncontrolled release that is prohibited by CERCLA.

Response: The CERCLA does not prohibit uncontrolled releases when they meet CWA requirements and are not harming the environment [42 U.S.C.A. § 9621(b)(1), (d)(1), and (d)(2)(A)(ii)]. The EPA and the KDEP have agreed that a limited action would meet all CERCLA and CWA requirements because landfill discharges are not harming Bayou Creek or the unnamed tributary or violating ARARs. Also, the creek and ground water in the vicinity of the landfill will continue to be monitored with the results reported to the KDEP. This process will ensure that further action would be evaluated if the landfill began releasing significant new discharges.

Comment: There are organics, metals, and radionuclides in the leachate. These contaminants are entering the creek and traveling to the river. This must be having a negative, long-term, cumulative impact on the wildlife in and around the creek and those humans utilizing the water from the river downstream. It is these cumulative effects from all of the discharges at the plant, including air, water, land, and waste storage, which pose the most serious risk to human health and the environment. Yet, it is those cumulative effects from the entire situation at the site which has never been given a hard look by the agency.

Response: The WAGs 1 and 7 investigation indicates that risks associated with SWMU 8 (the C-746-K Sanitary Landfill) in the creeks are not present above unacceptable levels. Additionally, the screening ecological risk assessment indicates that there are minimal impacts to ecological receptors in the creeks. The KDOW also has indicated that the landfill is having no adverse impacts on the creeks. Cumulative impacts will be evaluated thoroughly on a site-wide basis after completion of individual SWMW investigations. The sitewide approach for addressing cumulative risks has been approved by the EPA and KDEP. Finally, as discussed in the previous comment response, the creek and ground water in the vicinity of the landfill will continue to be monitored with the results reported to the KDEP. This process will ensure that further action would be evaluated if the landfill began releasing significant new discharges.

Comment: Commercial landfills now have to install leachate collection systems. This leachate is then removed and treated. While not perfect and without problems, this system is preferable to allowing the contaminants into the environment uncontrolled.

Response: The landfill was closed before leachate control systems became mandatory for landfills. Additionally, the RI and FS indicate that the risks associated with the landfill leachate do not warrant a remedial alternative such as a leachate collection system. A limited action will meet the CERCLA's requirements, which include being protective of human health and the environment.

Comment: The no action alternative for the other sites (in addition to SWMU 8) in the proposal is questionable. These areas need to be blocked off from the public, and runoff from the area needs to be controlled. The five-year review is too long of a period for reviewing the environmental effects of

such uncontrolled releases of contaminants. There needs to be ongoing review, including attempts to find out what is in the landfill which is causing radionuclides, organics, and metals to be released uncontrolled into the environment.

Response: With the exception of SMWU 38, which has been deferred until the unit ceases operation, and the KOW SWMUs, for which the DOD has agreed to accept responsibility, the remaining SWMUs within WAGs 1 and 7 do not present an unacceptable risk. The DOE, KDEP, and EPA have agreed that risk levels present at these units require no additional action. With regard to the landfill, as stated previously, surface-water and ground-water monitoring will continue, over the next 30 years and beyond if necessary, to ensure protection of human health and the environment.

Comment: The risk assessments which purportedly were done in conjunction with this proposal should be issued to the public in draft form and subjected to public view. Why should the public accept conclusionary statements in a summary that there is no unacceptable risk? Show us your calculations and let us comment on them.

Response: The baseline risk assessment for WAGs 1 and 7 was performed in accordance with KDEP and EPA Region 4 guidance. The DOE presents the results of the baseline risk assessment in the Resource Conservation and Recovery Act Facility Investigation Remedial Investigation Report for Waste Area Groups 1 and 7 at the Paducah Gaseous Diffusion Plant, Paducah Kentucky, DOE/OR/07-1404&D2. Further, risk management decisions and a summary of the baseline risk assessment are included in the Feasibility Study for Waste Area Groups 1 and 7 and Kentucky Ordnance Works Solid Waste Management Units 94, 95, and 157 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/OR/06-1416&D2. The public has access to these documents through the AR and the Paducah Public Library.

Comment: Exactly how can doing next to nothing cost $400,000? What exactly is that money being spent on? What accounts is the money being drawn from, and how does the money match up with the requests submitted in the outyear budget requests when made for these WAGs.

Response: The limited action being taken through the ROD will be in place over the next 30 years and the $400,000 reflects that fact. The $400,000 is the total cost of the project, which includes installing rip-rap, posting warning signs, placing a deed notice and restrictions on the landfill property, and maintaining the landfill over the 30-year time frame. Additionally, two existing wells will be abandoned and replaced with a new well to the base of the terrace gravel. The new well will provide more information about whether SWMU 8 is contaminating ground water beneath the unit. The money for this action is coming from a line item account in the DOE Paducah budget.

APPENDIX A

Schedule

<IMG SRC98112ET>

<IMG SRC98112EU>

<IMG SRC98112EV>

APPENDIX B

Letter from the Division of Water

JAMES E. BICKFORD
SECRETARY

<IMG SRC 98112W>

PAUL E. PATTON
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY RD
FRANKFORT KY 40601

September 11, 1996

Jimmie C. Hodges, Site Manager
Paducah Site Office

United States Department of Energy
P.O. Box 1410
Paducah, Kentucky 42001

Re: C-746-K Landfill
KPDES Permit No.: KY0004049
Paducah Gaseous Diffusion Plant
Paducah, McCracken County

Dear Mr. Hodges:

The UK-Federal Facilities Oversight Unit of the Division of Waste Management, the US Department of Energy and Water Quality and Field operations Branches of the Division of Water have had several discussions regarding the 1992 Division of Water Notice of Violation for unpermitted discharge and iron staining from the referenced facility. To data the current monitoring program has not revealed an adverse impact on either Big Bayou Creek or the unnamed tributary as a result of this seepage from the landfill. Therefore, it is the consensus of the aforementioned parties that the current monitoring program should be continued in lieu of the installation of treatment. However, should the monitoring program reveal at a future date degradation of either stream's water quality then additional actions may be necessary.

Should you have any questions concerning this matter, please contact me at (502) 564-2225, extension 472.

<IMG SRC 98112X>

LJS:js

c: Division of Water Files
Paducah Regional Office
Tuss Taylor

APPENDIX C

Solid Waste Management Unit 100
Exposure Assessment

EVALUATION OF EXPOSURE AT SOLID WASTE MANAGEMENT UNIT 100

Solid Waste Management Unit (SWMU) 100 (the Fire Training Area) is located within the Paducah Gaseous Diffusion Plant's (PGDP's) perimeter security fence which is identified in the Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE /OR/07-1207&D3, (SMP) as a secured industrial area. Consequently, it is appropriate to evaluate risks to current and future industrial workers based on the amount of time they actually would be in contact with contaminated media at SWMU 100 (i.e., surface water and sediments).

Default exposure assumptions for an industrial worker assume contact with contaminated media for 250 days/yr for 25 years as documented in a United States Environmental Protection Agency (EPA) document, Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment. Actual exposures to current industrial workers at SWMEU 100 are significantly less. Actual exposures at the unit are due to grass mowing, weed-eating, ground-water sampling, and routine inspections according to information provided by Lockheed Martin Energy Systems, Inc. While each activity likely is performed by a different individual, all activities combined only account for approximately 10 hours of exposure for the entire year. To be conservative, 2 days/yr were used as the actual exposure at the unit for the 25 year time frame [note: all other factors cancel in the equation and are not presented in the attached tables]. The resultant excess lifetime cancer risk (ELCR) and hazard index (HI) risks are well below EPA risk assessment guidance for determining scenarios of concern (i.e., a 1 x 10 -4 ELCR and an HI of 1) and are, very near de minimus (i.e., 1 x 10 -6) with an ELCR of 2 x 10 -6 at SWMU 100a and 100b. Consequently, there are no unacceptable risks to current industrial workers at SWMU 100; however, risks to future industrial workers also must be evaluated.

Further evaluation of the ELCR and HI risks at SWMU 100 indicate a risk to a future industrial worker (albeit highly uncertain) exposed to surface-water and sediment contamination for more than 75 days/yr at SWMU 100a, and for more than 130 days/yr at SWMU 100b. Activities in the future are anticipated to be similar to current ones. The reason for this is that the risks at SWMU 100 are from contaminated sediments and surface water in the drainage ditches surrounding the unit. The SMP identifies the PGDP as future industrial facility; therefore, only existing upkeep activities reasonably can be expected to occur in the future, which indicates the site-specific exposure frequency (2 days/yr) would be appropriate under future industrial use. Additionally, institutional controls (i.e., the perimeter security fence, patrol by security) ensure that exposures are limited to industrial workers and provide safeguards (i.e., personal protective equipment) to limit exposures to an industrial worker. Therefore, no further action is required to address the current contamination found at SWMU 100. However, it should be noted that this decision does not mean that current actions do not need to be maintained. Most importantly, this decision rests upon the observation that SWMU 100 and the surrounding area will remain industrialized in the foreseeable future and that SWMU 100a and 100b remain in operation as drainage ditches at which upkeep activities performed do not exceed aforementioned exposure times. These observations are consistent with the expected future use of the area as described in the feasibility study and the SMP.

SWMU 100a
CARCINOGENS

Chemical	Default ELCR*	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual ELCR
Sediment				
Ingestion	7.00E-06	250	2	5.60E-08
Dermal Absorption	3.00E-03	250	2	2.40E-05
Inhalation	2.00E-08	250	2	1.60E-10
External Exposure	1.00E-06	250	2	8.00E-09
Sum of Pathways	3E-03			2E-05

SWMU 100a NON-
CARCINOGENS

Chemical	Default HI*	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual HI
Surface Water				
Dermal Absorption	4.00E-00	250	2	3.20E-02
Sediment				
Ingestion	3.00E-01	250	2	2.40E-03
Dermal Absorption	4.82E+01	250	2	3.86E-01
Inhalation	2.00E-02	250	2	1.60E-04
Sum of Pathways	5E+01			4E-01

* From the FS report
** Based on EPA guidance

Equation used to complete
the table:

ARH = (E a (Ea x RHd)/Ed

Where:

ARH = Actual ELCR (risk) or HI (hazard) based on actual exposures
Ea = Actual exposure frequency (i.e., 2 days/yr)
RHd = ELCR or HI value from the FS (based on default exposure assumptions)
Ed = EPA's default exposure assumption (i.e., 250 days/yr)

SWMU 100b CARCINOGENS

Chemical	Default ELCR*	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual ELCR
Surface Water				
Dermal Absorption	2.00E-06	250	2	1.60E-08
Sediment				
Ingestion	6.00E-06	250	2	4.80E-08
Dermal Absorption	2.00E-03	250	2	1.60E-05
Inhalation	2.00E-08	250	2	1.60E-10
External Exposure	8.00E-07	250	2	6.40E-09
PATHWAY	2E-03			2E-05

SWMU 100b NON-CARCINOGENS

Chemical	Default	Default Exposure** (days/yr)	Actual Exposure (days/yr)	Actual HI
Surface Water				
Dermal Absorption	3.00E-01	250	2	2.40E-03
Sediment				
Ingestion	2.00E-01	250	2	1.60E-03
Dermal Absorption	2.69E+01	250	2	2.15E-01
Inhalation	8.00E-03	250	2	6.40E-05
PATHWAY SUM	3E+01			2E-01

* From the FS report
** Based on EPA guidance

Equation used to complete the table:

$$ARH = (Ea \times RHd)/Ed$$

Where:

ARH = Actual ELCR (risk) or HI (hazard) based on actual exposures
Ea = Actual exposure frequency (i.e., 2 days/yr)
RHd = ELCR or HI value from the FS (based on default exposure assumptions)

Ed = EPA's default exposure assumption
(i.e., 250 days/yr)

DISTRIBUTION

The distribution sheet that is included in this signed Record of Decision has become obsolete since the signing of this Record of Decision. We have included this current revised version by which we now distribute documents.

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FISH AND WILDLIFE
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