Revised Proposed Plan for Solid Waste Management Units 1, 211-A, 211-B, and Part of 102 Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

August 2011

INTRODUCTION

The U.S. Department of Energy (DOE) is conducting cleanup activities at the Paducah Gaseous Diffusion Plant (PGDP), Paducah, Kentucky, to address contamination resulting from past waste-handling and disposal practices at the plant. As part of these cleanup activities, DOE, the U.S. Environmental Protection Agency (EPA), and the Commonwealth of Kentucky Energy and Environment Cabinet (KEEC) request public review and comment on this Proposed Plan (PP) for trichloroethene (TCE) sources to the Southwest Plume. DOE is the lead agency for conducting this action, and EPA and KEEC are supporting regulatory agencies providing oversight. This PP was developed consistent with the PGDP Federal Facility Agreement (FFA).

The Groundwater Operable Unit (OU) scope includes the Southwest Plume TCE sources in subsurface soil at both the Oil Landfarm and the C-720 Building areas.

The Southwest Plume consists of groundwater in the Regional Gravel Aquifer (RGA) contaminated primarily with TCE, a volatile organic compound (VOC), and is located within the DOE property, west of the C-400 Building and south of the larger groundwater contamination area identified as the Northwest Plume (Figure 1). This PP presents the preferred alternatives for remediation of VOCs in the Upper Continental Recharge System (UCRS) subsurface soils at three solid waste management units (SWMU) that are sources of contamination to the Southwest Plume (see Figures 2 and 3):

- *SWMU 1—Oil Landfarm,*
- *SWMU 211-A—C-720 Building TCE Northeast Spill Site, and*
- *SWMU 211-B—C-720 Building Southeast Spill Site.*

The basis for this decision is documented in the "Revised Focused Feasibility Study for Solid Waste Management Units 1, 211-A, and 211-B Volatile Organic Compound Sources for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/LX/07-0362&D2, dated May 2011 (hereafter referred to as the Revised FFS); "Remedial Investigation Report for Waste Area Grouping 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/OR/07-1777&D2; and the "Site Investigation Report for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky," DOE/OR/07-2180&D2/R1, dated June 2007 [hereafter referred to as the Site Investigation (SI) Report]. The SI Report also included a discussion

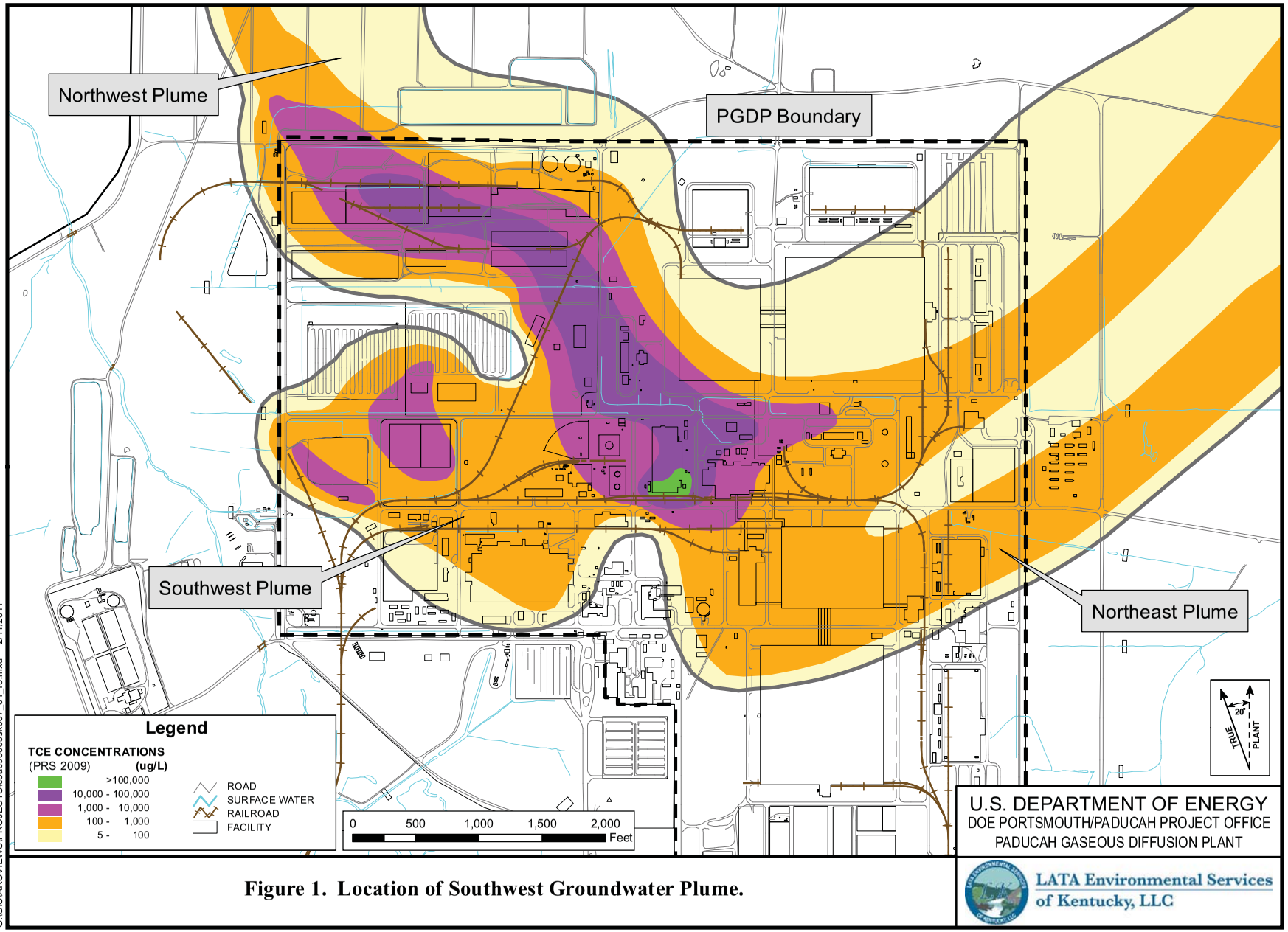

Figure 1. Location of Southwest Groundwater Plume.

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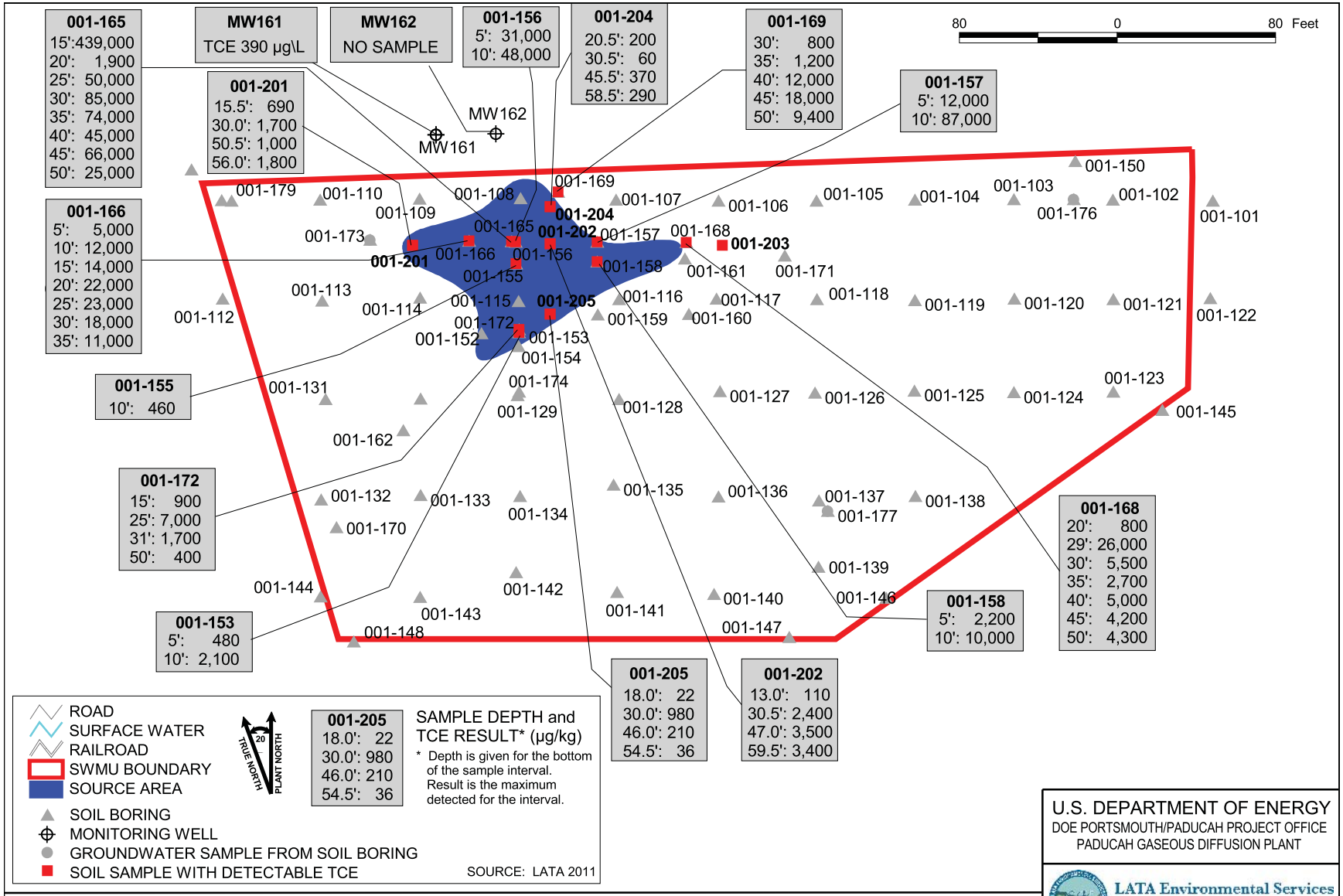

Figure 2. TCE Results from Oil Landfarm Sampling (2004)

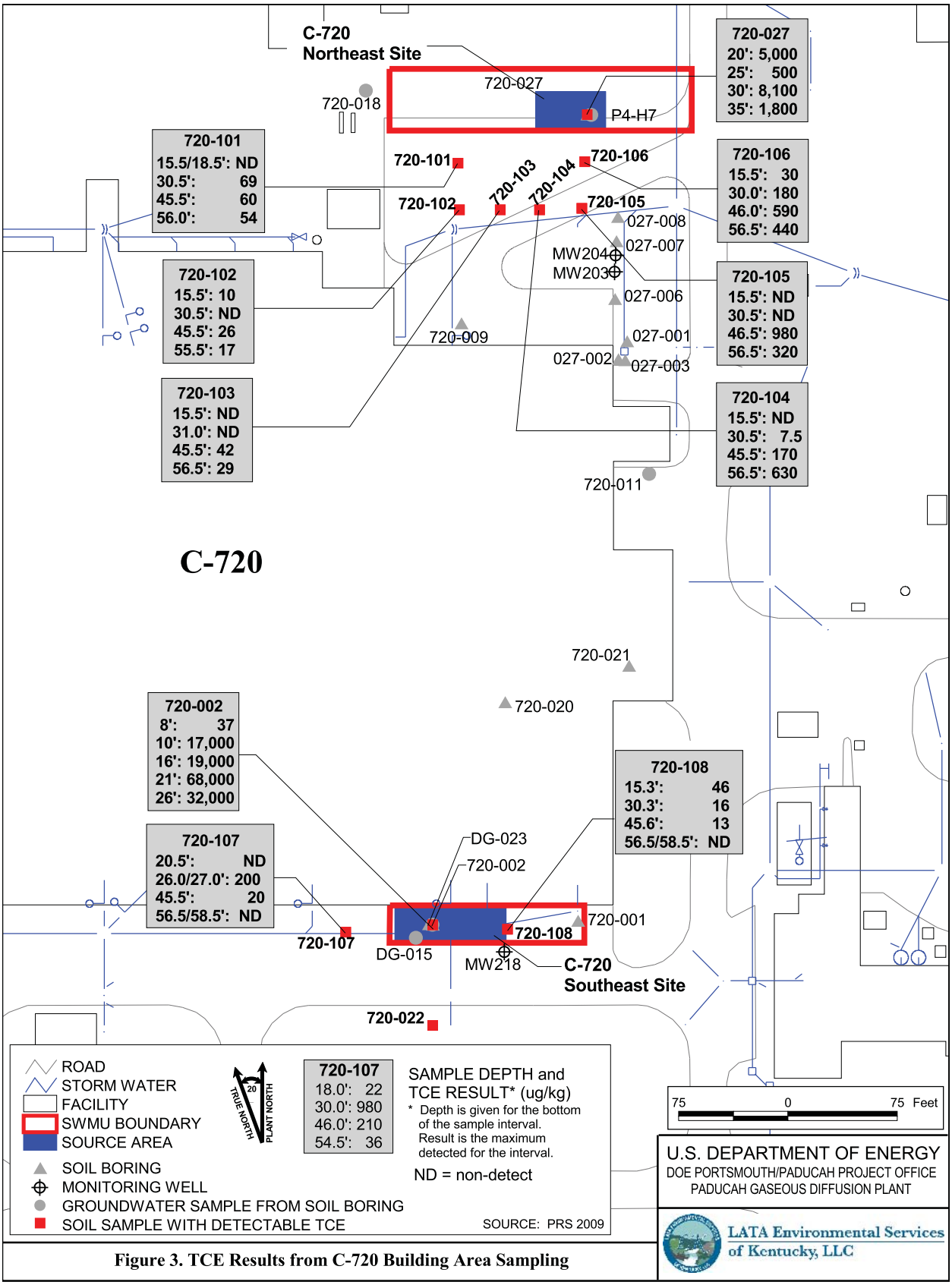

Figure 3. TCE Results from C-720 Building Area Sampling

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of a storm sewer (part of SWMU 102) leading from the C-400 Building to Outfall 008 thought to be a possible TCE source. The SI Report concluded that the storm sewer was not a source of TCE contamination; therefore, no further action is proposed for that area. This PP presents the ***Preferred Alternatives****, all of which include groundwater monitoring, for SWMU 1 and for SWMUs 211-A and 211-B.*

- *SWMU 1—Oil Landfarm—In Situ Source Treatment Using Deep Soil Mixing with Interim Land Use Controls (LUCs) (Alternative 3),*

- *SWMU 211-A—C-720 Building TCE Northeast Spill Site—Final Characterization (FC) of source extent and magnitude followed by either In Situ Source Treatment Using Enhanced In Situ Bioremediation with Interim LUCs (Alternative 8) or Long-term Monitoring with Interim LUCs (Alternative 2), and*

- *SWMU 211-B—C-720 Building Southeast Spill Site—Final Characterization of source extent and magnitude followed by either In Situ Source Treatment Using Enhanced In Situ Bioremediation with Interim LUCs (Alternative 8) or Long-term Monitoring with Interim LUCs (Alternative 2).*

Field data collection will be performed for SWMUs 211-A and 211-B. Existing current data at SWMUs 211-A and 211-B document historic releases of VOCs, primarily TCE, in soil; however, significant uncertainty remains about the extent and magnitude of the releases to allow for definitive remedy selection. The preferred alternative includes a final effort to delineate the lateral and vertical extent of contamination and the magnitude of the releases at the C-720 Building. Soil and groundwater data will be collected and analyzed, both to support a determination about whether to implement Alternative 2 or Alternative 8 and to provide design data in the event that Alternative 8 is implemented at one or both SWMUs.

This FC data collection initiative also will serve as the Remedial Design Support Investigation (RDSI) for Alternative 8. Based on the results of the FC/RDSI, the FFA parties will determine if active treatment is warranted for each of the C-720 sites, and Alternative 8 or Alternative 2 will be selected accordingly. The selection will be based on whether the extent and magnitude of contamination present in the subsurface soils warrant treatment or whether long-term monitoring and LUCs will be sufficient. The selected remedial action will be documented in an FFA Primary Document by the FFA parties. The results of the field data collection will be submitted to EPA and the Commonwealth of Kentucky in an FFA Primary D1 document.

Each of the Preferred Alternatives is composed of specific components.

SWMU 1

Preferred Alternative 3 for SWMU 1 will consist of the following components:

- *RDSI*

- *Injection and mixing of a reagent in the UCRS from the start of contamination (approximately 10 ft bgs) down to the lowest depth of VOC contamination. Use of steam to facilitate VOC removal may be part of this alternative.*

- *Confirmatory sampling*

- *Secondary waste management*

- *Site restoration*

- *Interim LUCs*

- *Groundwater monitoring*

SWMU 211-A and SWMU 211-B

Preferred alternative of characterization consists of the following:

- *Field data collection/RDSI*

- *Determination regarding use of Alternative 8 or Alternative 2 at SWMU 211-A and SWMU*

211-B, based on the results of the collected data. The determination may be different at each SWMU.

Alternative 8 consists of the following:

- *Installation and operation of in situ bioremediation (EISB) system*
- *Introduction of bioamendment*
- *Confirmatory sampling*
- *Secondary waste management*
- *Site restoration*
- *Interim LUCs*
- *Groundwater monitoring*

Alternative 2 consists of the following:

- *Interim LUCs*
- *Groundwater monitoring*
- *Secondary waste management*

This PP mitigates potential risk from exposure to VOC and non-VOC contamination found in source areas through interim LUCs during and after source treatment and addresses TCE contamination, identified as a potential principal threat waste (PTW) in the Revised FFS. PTW is described in the EPA document, "A Guide to Principal Threat and Low-Level Threat Wastes," 9830.3-06FS, November, 1991. Per the National Contingency Plan (NCP) at 40 CFR § 300.430(a)(1)(iii), treatment is expected to address principal threats posed by a site, wherever practicable. Principal threats for which treatment is most likely to be appropriate include liquids, areas contaminated with high concentrations of toxic compounds, and/or highly mobile materials. Other sources to the Southwest Groundwater Plume, such as SWMU 4, will be evaluated as part of other OUs.

This plan fulfills the public participation requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980; the Resource Conservation and Recovery Act (RCRA) of 1976; and Kentucky Revised Statute 224.01-524 by summarizing the Revised FFS and SI Reports and requesting public comments on the Preferred Alternatives identified. This PP also serves as a "Statement of Basis" for the modification of the Kentucky Hazardous Waste Management Permit, KY8-890-008-982. The preferred alternatives represent the recommendation by DOE, subject to public comment. The Administrative Record "file" for this action is available for review at the DOE Environmental Information Center (see page 20).

*DOE, EPA, and KEEC encourage public review and comment on these proposed Preferred Alternatives for addressing the TCE contamination in subsurface soil at the Oil Landfarm (SWMU 1) and the C-720 Building area (SWMUs 211-A and 211-B). The public comment period for this PP is scheduled from **TBD**, 2011, through **TBD**, 2011. The "Responsiveness Summary" section of the Record of Decision (ROD) will address public comments received on this PP. Public comments also will become part of the record of modification for the Kentucky Hazardous Waste Management Permit, KY8-890-008-982. These Preferred Alternatives represent the recommendation by DOE, subject to public comment. The eventual remedial action(s) selected in the ROD may be different from the Preferred Alternative presented in this document, depending upon public comments. Additional information regarding the public participation process can be found in the "Community Participation" section of this PP.*

SITE BACKGROUND

PGDP is located in McCracken County in western Kentucky, about 3.5 miles south of the Ohio River and approximately 10 miles west of the city of Paducah. It is an operating uranium enrichment facility owned by DOE. PGDP was placed on the National Priorities List on May 31, 1994. In accordance with Section 120 of CERCLA, DOE entered into an FFA with EPA and the Commonwealth of Kentucky on February 13, 1998. The FFA established one set of consistent requirements for achieving comprehensive site remediation in accordance with RCRA and CERCLA, including stakeholder involvement.

The Southwest Groundwater Plume was identified in the *Remedial Investigation* (*RI) Report for Waste Area Grouping 27 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1777&D2, in 1998. Subsequent work to characterize the plume was performed as part of the *Remedial Investigation Report for Waste Area Grouping 3 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1895&D1, and the *Data Report for the Sitewide Remedial Evaluation for Source Areas Contributing to Off-Site Groundwater Contamination at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1845/D1, in 2000. In 2007, DOE developed the *Site Investigation Report for the Southwest Groundwater Plume at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-2180&D2, that documented the SI, conducted in 2004, of the Southwest Groundwater Plume and potential source areas. As discussed in these reports, the primary contaminant defining the plume is TCE. The *Feasibility Study for the Groundwater Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1857/D2, was conducted for the Groundwater OU unit in 2001. Data from all of these reports were used to form the basis of the Revised FFS, DOE/LX/07-0362/D2.

SWMU 1 Oil Landfarm. SWMU 1 (C-747-C Oil Landfarm) is located in the southwest portion of the plant (Figure 1) and has a total area of approximately 8,947 m^2 (96,300 ft^2 or 2.2 acres). The Oil Landfarm was used from 1973 to 1979 for landfarming of waste oils contaminated with TCE; 1,1,1-trichloroethane; uranium; and polychlorinated biphenyls (PCBs). Soil contaminants remaining at the Oil Landfarm are residuals from the waste oils.

In 1991 and 1992, potential soil and groundwater contamination at the Oil Landfarm was investigated as part of the CERCLA SI, Phase II. Sampling performed in 1996 better defined the PCB and dioxin contamination in surface soils at the unit. In 1998, DOE excavated 23 yd^3 of contaminated surface soils as a non-time-critical removal action. Subsurface soil samples from the Waste Area Group (WAG) 27 RI in 1998 identified a VOC source zone at the Oil Landfarm. The SI confirmed that TCE was the primary VOC present in the source zone and delimited the source area. No previous remedial actions have been taken to address groundwater or subsurface soils contamination at the Oil Landfarm.

SWMU 211-A and 211-B C-720 Building Area. The C-720 Building area is located in the southwest portion of PGDP (Figure 1) and occupies an area of approximately 82,962 m^2 (893,000 ft^2 or 20.5 acres). It has been used since the early 1950s (and still is active) for fabrication, assembly, cleaning, and repair of process equipment. Most areas adjacent to the C-720 Building are covered by concrete or asphalt pavement. Any areas not covered are small (less than 19 m^2 or 200 ft^2) and widely spaced. The C-720 Building area initially was identified as a possible source of TCE contamination during the Phase IV Groundwater Investigation as documented in the *Northeast Plume Preliminary Characterization Summary Report*, DOE/OR/07-1339&D2, completed in 1995.

The WAG 27 RI identified five areas of subsurface soil contamination (primarily characterized by VOCs, with TCE being the most common) around the perimeter of the C-720 Building, including the area previously known as the C-720 TCE Spill Site—Northeast (SWMU 211-A). The Southwest Groundwater Plume SI further investigated the two primary areas of subsurface soil contamination located adjacent to the northeast (SWMU 211-A) and southeast (SWMU 211-B) corners of the building.

Subsurface soil contamination found to the northeast of the C-720 Building is believed to have been a result of routine equipment cleaning and rinsing with solvents. The source of VOC contamination found to the southeast of the C-720 Building is uncertain, but may have originated from spills. Receiving and storage facilities are located in the southeast corner of the C-720 Building. No previous remedial actions have been taken to address soil and groundwater contamination at the C-720 Building area.

Storm Sewer Leading from C-400 to Outfall 008. Rainfall runoff at the south end of the C-400 Building drains through a storm water sewer line system to the Outfall 008 ditch on the west side of the plant (Figure 1). During the 1998 WAG 6 RI of the area around the C-400 Cleaning Building, VOC contamination of subsurface soils was identified near two of the lateral lines that feed

into the main storm sewer. TCE that leaked from the C-400 area to the surrounding soils has been identified as a source of groundwater contamination. Additionally, there was a possibility that some of the TCE was transported down the lateral lines to the main storm sewer (then west toward Outfall 008), encountered a breach in the storm sewer, and leaked to the surrounding soils to become a source of TCE to the Southwest Groundwater Plume. No remedial actions, except the 2010 C-400 Interim Remedial Action, have been taken in the area of the storm sewer extending from C-400 to the Outfall 008 ditch. The C-400 remedial action area is approximately 100 ft north of the storm sewer.

SITE CHARACTERISTICS

The following provides a description of the physical characteristics associated with the three source areas. A composite description of the geology and hydrogeology is provided for the source areas.

SWMU 1, Oil Landfarm. SWMU 1 generally has a flat topography with ground elevations ranging from approximately 112.8 to 114.3 m (370 to 375 ft) above mean sea level (amsl). The Oil Landfarm is grass covered and is bordered by drainage ditches on the north, south, and west sides. Storm water runoff from the Oil Landfarm flows to these perimeter ditches, which discharge via the Outfall 008 ditch to Bayou Creek.

SWMU 211-A, C-720 Building Area. The ground surface of 211-A, like the area surrounding the C-720 Building area, is covered by concrete, asphalt, or gravel. The area is generally flat with ground elevations of approximately 112.8 to 114.3 m (370 to 375 ft) amsl. Drainage from the C-720 Building SWMU 211-A area is via a storm sewer that discharges through Outfall 008 to Bayou Creek.

SWMU 211-B, C-720 Building Area. SWMU 211-B ground surface is covered by concrete or asphalt. The area is generally flat with ground elevations of approximately 112.8 to 114.3 m (370 to 375 ft) amsl. Drainage from the C-720 Building SWMU 211-B area is via storm sewers that discharge through Outfalls 008 and 009 to Bayou Creek.

Storm Sewer Leading from C-400 to Outfall 008. Groundcover over the storm sewer extending from the C-400 Building to the Outfall 008 ditch varies from predominately gravel and pavement on the east half to mostly grass on the west half of this segment of the storm the three areas are similar. The area is generally flat with ground elevations of approximately 112.8 to 114.3 m (370 to 375 ft) amsl.

General Geology and Hydrogeology. A sequence of silt and clay layers, with interbedded sand and gravel lenses, occurs to an average depth of 16.8 to 18.3 m (55 to 60 ft) below ground surface. These units comprise the UCRS. The variable lithology of the UCRS has the potential to impact remedy effectiveness. For example, the frequent occurrence of low permeability silt and clay-rich layers at SWMU 1 is generally regarded as greater than at SWMUs 211-A and 211-B, thereby influencing the evaluation of how effective *in situ* technologies would be versus more active remedies. Additional detail can be found in Section 1.2.1.5, including Figures 1.9–1.12 of the Revised FFS, DOE/LX/07-0362/D2. The RGA, a highly permeable layer of gravelly sand and gravel, typically extends from its top at approximately 16.8 to 18.3 m (55 to 60 ft) deep to a base as much as 32.0 m (105 ft) deep.

At the Oil Landfarm, the depth to the water table in the UCRS averages approximately 4.26 m (14 ft), but can be as shallow as 2.13 m (7 ft) due to seasonal variability. In the area of the Oil Landfarm and the C-720 Building, the RGA is approximately 9.1-m (30-ft) thick. RGA water levels in the area of the Oil Landfarm are approximately 45–50 ft below ground surface.

In the C-720 Building Area, the depth to water in the UCRS ranges from 1.83 to 13.7 m (6 to 45 ft) below surface with an average of 8.8 m (29 ft). Water within the UCRS tends to flow downward to the RGA.

Groundwater flow in the RGA in the Southwest Groundwater Plume below PGDP generally is to the west-northwest. Information collected from all site investigations in the area of the downgradient Southwest Groundwater Plume indicates the Southwest Groundwater Plume has not migrated beyond the DOE property line, which is 914 m (3,000 ft) and 1,460 m (4,789 ft) along the groundwater model migration flow path from the

source areas at the Oil Landfarm and the C-720 Building area, respectively. The investigations, however, do indicate that TCE and other VOCs are contaminants of concern (COCs). See text box, "What are the Contaminants of Concern?" on page 25. From the DOE property line, the distance along the Southwest Groundwater Plume flow path to the first point of discharge to surface water (near the Ohio River) is approximately 6.4 km (4 miles).

Nature and Extent of Contamination

The following section presents summaries of the investigation of the Oil Landfarm, the C-720 Building area, and the storm sewer leading from C-400 to the Outfall 008 ditch and the nature and extent of VOC soil contamination, primarily TCE, found in source areas at each location. More detailed information is included in the WAG 27 RI Report and the Southwest Plume Sources SI Report.

The assessments of contaminant nature and extent contained in the Southwest Groundwater Plume SI concluded that TCE is present at the Oil Landfarm and the C-720 Building area potentially as isolated ganglia/droplets dispersed in the soil of the UCRS. Groundwater samples collected from the RGA beneath SWMU 1 and the C-720 area, as part of WAG 27 RI and the SI, contained TCE as a dissolved constituent.

SWMU 1 Oil Landfarm. TCE soil contamination at the Oil Landfarm underlies an area of approximately 809 m^2 (8,700 ft^2/0.2 acres) throughout the thickness of the UCRS, to a depth of approximately 16.8 m (55 ft). Of the 108 soil analyses for the Oil Landfarm from the WAG 27 RI, 71 analyses report detected levels of TCE up to 439 mg/kg. The results of TCE soil analyses (having concentrations above 1 mg/kg), from the Oil Landfarm area were used to calculate an estimated average TCE concentration in the TCE source by depth. The average TCE concentrations within the source zone vary from 5.74 mg/kg at 15.2 to 16.8 m (50 to 55 ft) deep to 110.8 mg/kg at 3.0 to 6.1 m (10 to 20 ft) deep. The total TCE remaining in the soils of the Oil Landfarm source zone was approximately 187 L (49 gal). A complete discussion of the source term development is included in the SI.

SWMU 211-A and SWMU 211-B C-720 Building Area. The primary area of TCE contamination in the soils around the perimeter of the C-720 Building is in the parking lot located southeast of the C-720 Building. These contaminated soils underlie an area of approximately 4,572 m^2 (15,000 ft^2/0.3 acres) to a depth of approximately 18.3 m (60 ft). Using TCE soil analyses from the C-720 source areas (having concentrations above 1 mg/kg), an estimated average TCE concentration in the TCE source by depth was calculated. The average TCE concentrations within the source zone vary from 0.10 mg/kg at 15.2 to 18.4 m (50 to 60 ft) deep to 11.9 mg/kg at 6.1 to 9.2 m (20 to 30 ft) deep. The total TCE remaining in the soils of the C-720 Building area source zone was estimated at approximately 76 L (20 gal). Additionally, there was a high concentration (450,000 µg/kg in soil) of *trans*-1,2-dichloroethene (DCE) identified at SWMU 211-B in the WAG 27 RI Report. A complete discussion of the source term development is included in the SI.

Storm Sewer Leading from C-400 to Outfall 008. Both the camera inspection of 910 m (2,986 ft) of the storm sewer and the soil sample analyses for the storm sewer line leading from the C-400 Building to the Outfall 008 ditch confirm that the integrity of the storm sewer remains intact. TCE levels in the soil samples were nondetectable (less than 0.001 mg/kg) to 0.220 mg/kg. The SI concluded that the storm sewer is not a source of TCE to the Southwest Groundwater Plume.

SCOPE AND ROLE OF THE RESPONSE ACTION

As described in the *Site Management Plan, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0348&D2/R1, Annual Revision—FY 2011, June 2011, the Groundwater OU strategy includes a phased approach consisting of the following goals: (1) prevent human exposure to contaminated groundwater; (2) prevent or minimize further migration of contaminant plumes; (3) prevent, reduce, or control contaminant sources contributing to groundwater contamination; and (4) restore the groundwater to its beneficial uses wherever practicable.

The goals are supported through the identification

and implementation of remedial actions, including the preferred alternatives for the C-720 sites and Oil Landfarm site that address sources of contamination and effectively result in the return of groundwater to its beneficial uses within a reasonable time frame, given the particular circumstances of the PGDP site.

The Groundwater OU is one of five media-specific OUs at PGDP being used to evaluate and implement remedial actions. For these OUs, DOE, EPA, and KEEC have agreed upon five strategic cleanup initiatives, as discussed in the Site Management Plan:

- Burial Grounds OU Strategic Initiative,
- Decontamination and Decommissioning OU Strategic Initiative,
- Groundwater OU Strategic Initiative,
- Soils OU Strategic Initiative, and
- Surface Water OU Strategic Initiative.

Multiple VOC source areas have resulted in the development of three groundwater plumes in the RGA. The VOC source areas addressed in this proposed action (Oil Landfarm and C-720 Building Area) are assigned to the Groundwater OU at PGDP.

Early Groundwater OU actions already have been implemented to prevent exposure and to reduce further off-site migration of contaminant plumes. These include the implementation of the DOE Water Policy and an ongoing operation of the groundwater treatment systems for the Northwest and Northeast Plumes. The operation of the Northeast and Northwest groundwater pump-and-treat activity is being conducted under an Interim Remedial Action (IRA) ROD. This groundwater IRA was enhanced in 2010 with the Northwest Plume Optimization. DOE currently is implementing an IRA to remove source material from the subsurface near the C-400 Building area. The Water Policy, which is not part of the Preferred Alternative, provides access to municipal water to residents within a designated area in the vicinity of PGDP. It is expected that the Water Policy will continue for the foreseeable future.

Remedial alternatives were developed in the Revised FFS in support of a final action for VOCs in the UCRS subsurface soils, which is to reduce the migration of VOCs, primarily TCE, from source areas at the Oil Landfarm and the C-720 Building; mitigate risk to potential receptors; and treat or remove PTW consistent with the NCP. Risks posed by direct contact with contaminated surface soil or sediment at the Oil Landfarm and C-720 Building Area (211-A and 211-B) or remaining risks from potential use of contaminated groundwater will be addressed later as part of the decisions for the Surface Water, Soils, or Groundwater OUs. Non-VOC soil contamination at the source areas will be addressed by the Soils OU, as described in the 2011 Site Management Plan. Groundwater contamination outside of these source areas will be addressed through the Dissolved-Phase Plumes Remedial Action. Interim LUCs consisting of the PGDP Excavation Penetration Permit (E/PP) Program (administrative control) and warning signs (physical control) will be implemented. These interim LUCs will be implemented to provide notice and warning of environmental contamination and are necessary for any residual or remaining VOC and non-VOC contamination that is not treated by this remedial action and whose concentrations prevent unrestricted use/unlimited exposure in the Southwest Groundwater Plume source areas. The interim LUCs will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.

Existing security/access controls, including fencing and security patrols that are established and maintained outside of CERCLA, are effective at preventing public access. Additionally, groundwater protection measures described in the *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant*, which is an ongoing CERCLA action, protects residents from the risks associated with using contaminated groundwater. These controls are not LUC components of the Preferred Alternatives. They are effective at preventing public access and unwanted trespassers to contaminated areas of PGDP.

SUMMARY OF SITE RISKS

This section of the PP presents a summary of the baseline risk assessment. The Southwest Groundwater Plume SI includes a baseline risk assessment, which is consistent with the requirements of the NCP at 40 *CFR* § 300.430(d)(4) and Section XI of the PGDP FFA. The human health and ecological risk posed by the site determine whether a remedial action is warranted. This summary describes the risk to human health and the environment by the VOC contamination found at the Southwest Groundwater Plume source areas that will be addressed by the proposed action. This discussion is presented in two subsections: human health risks and ecological risks. Further information on risk is contained in the text box entitled, "What Is Risk and How Is It Calculated?" on page 25 of this PP.

Human Health Risks

In the baseline human health risk assessment, it was assumed no restrictions are in place to prevent human exposure to site contaminants in place. The baseline human health risk assessment considered both the current and several potential future uses of each of the Southwest Plume source areas and areas to which contaminants from the source may migrate. Risks calculated for consumption of groundwater drawn from the RGA at the source areas by a hypothetical resident exceeded the lower limit of EPA's acceptable cancer risk range (10^{-6}) and/or the noncancer hazard index (HI) value (HI=1). An HI greater than 1 or an excess lifetime cancer risk above the upper limit of EPA's acceptable cancer risk range (10^{-4}) is a "priority COC."

Currently, restrictions are in place to prevent human exposure to site contaminants, except during monitoring activities; therefore, currently there are no completed exposure pathways. Each of the Southwest Plume source areas lies within the industrialized areas of PGDP. Under current plans, these areas are expected to remain industrial, with use restrictions in the future.

SWMU 1, Oil Landfarm. For groundwater use by the adult resident at the Oil Landfarm, VOC COCs include TCE; *cis*-1,2-DCE; chloroform; and 1,1-DCE, all of which are priority COCs, except for 1,1-DCE. The SWMU boundary for SWMU 1 is assumed to be 56 ft from the center of the source area. Risks to the Future Excavation Worker exceeded the lower limit of EPA's acceptable cancer risk range (10^{-6}) and/or the noncancer HI value (HI=1) for exposure to soil at the Oil Landfarm. Based on the previous and current modeling results, neither metals nor radionuclides are COCs for contaminant migration from the sources at the Oil Landfarm. Risks to a hypothetical resident from the inhalation of volatiles as a result of vapor intrusion into home basements exceeded the lower limit of EPA's acceptable cancer risk range (10^{-6}) and/or the noncancer HI threshold value of 1 from the source at area and the Oil Landfarm.

SWMU 211-A and SWMU 211-B, C-720 Building Area. At the C-720 Building Area, the VOC COCs for groundwater use by the adult resident include TCE; *cis*-1,2-DCE; vinyl chloride; and 1,1-DCE. All except vinyl chloride are priority COCs. The risks to the Future Excavation Worker at the C-720 sites for exposure to soil also exceeded the acceptable cancer risk range, but did not exceed the noncancer HI threshold value of 1. Previous and current modeling results identified neither metals nor radionuclides as COCs for contaminant migration from the sources at the C-720 area. Risks to a hypothetical resident from the inhalation of volatiles as a result of vapor intrusion into home basements exceeded the lower limit of EPA's acceptable cancer risk range (10^{-6}) and/or the noncancer HI threshold value of 1 from the source at the C-720 area and the Oil Landfarm.

Storm Sewer Leading from C-400 to Outfall 008. The Storm Sewer was determined not to be a source of TCE contamination to the Southwest Groundwater Plume; therefore, no further action is proposed for that area.

Ecological Risks

A screening ecological risk assessment indicated that no ecological impacts were likely to occur from exposure to the VOC sources areas addressed by this PP. This was based upon the location of the contamination being addressed (i.e., in the subsurface and for the C-720 source areas below significant cover such as a building or cement pad), the relatively small size of the contaminant source areas, and the industrial nature of the units.

Additionally, groundwater flow modeling predicted the first location that TCE in groundwater from the Oil Landfarm and the C-720 Building area could discharge is approximately 6.4 km (4 miles) away near the Ohio River. No organic compounds were identified as chemicals of potential ecological concern at the sites.

Conclusion

It is DOE's judgment that the Preferred Alternatives identified in this PP or one of the other active measures considered is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Furthermore, it is DOE's judgment that remedial action of the VOC source areas is critical to protecting and restoring groundwater to its beneficial use(s) within a reasonable time frame.

REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) describe what the proposed site cleanup is expected to accomplish. The RAOs for the Oil Landfarm and the C-720 Building (SWMUs 211-A and 211-B) that were used to screen the remedial alternatives in the FFS are the following:

(1) Treat and/or remove the PTW consistent with the NCP.

(2a) Prevent exposure to VOC contamination in the source areas that will cause an unacceptable risk to excavation workers (< 10 ft).

(2b) Prevent exposure to non-VOC contamination and residual VOC contamination through interim LUCs within the Southwest Plume source areas (i.e., SWMU 1, SWMU 211-A, and SWMU 211-B) pending remedy selection as part of the Soils OU and the Groundwater OU.

(3) Reduce VOC migration from contaminated subsurface soils in the treatment areas at the Oil Landfarm and the C-720 Northeast and Southeast Sites so that contaminants migrating from the treatment areas do not result in the exceedance of maximum contaminant levels (MCLs) in underlying RGA groundwater.

Two types of remediation goals (RGs) were developed to support the RAOs. Worker protection RGs are VOC concentrations in soils present at depths of 0-10 ft that would meet RAO 2a. The RG for TCE for worker protection is 0.0585 mg/kg. Groundwater protection RGs are VOC concentrations in subsurface soils that would meet RAO 3. These values for TCE were calculated to be 0.073 mg/kg and 0.075 mg/kg for the Oil Landfarm and C-720 Northeast and Southeast sites, respectively. Alternatives were evaluated with respect to their effectiveness at attaining RGs and meeting the RAOs based on previous source removal demonstrations at PGDP; literature reports of previous actions at other sites; modeling of VOCs to determine exceedances of MCLs; and engineering judgment. A discussion of RG development and application is contained in Section 2.2 and Appendix C of the D1 Revised FFS.

SUMMARY OF ALTERNATIVES

Eight remedial alternatives were assessed for application to the Southwest Groundwater Plume source areas at the Oil Landfarm (SWMU 1) and the C-720 Building (SWMUs 211-A and 211-B) area. The SI determined that the storm sewer is not a source of TCE to the Southwest Groundwater Plume; therefore, no alternatives were developed to address the soil surrounding the storm sewer.

Several common elements are included in all alternatives except Alternative 1—No Further Action. These common elements include groundwater monitoring and interim LUCs. Groundwater monitoring is included as a component of the alternatives and will be used to assess remedy performance and determine progress toward attainment of RAO 3. The length of time for required monitoring is alternative dependent. Because contamination above levels that would prevent unrestricted use and limited exposure would remain on-site after implementation of each alternative, DOE will review the final remedial action for SWMU 1—Oil Landfarm and for SWMU 211-A and SWMU 211-B—C-720 Building Area no less than every

five years per CERCLA Section 121(c) and the NCP at 40 *CFR* § 300.430(f)(4)(ii).

The interim LUCs are controls in the form of physical and administrative restrictions. Specifically, they are the PGDP E/PP program and posting of warning signs for the Southwest Groundwater Plume source areas. These interim LUCs would be implemented to provide notice and warning of environmental contamination and are necessary for any residual or remaining VOC and non-VOC contamination that is not addressed by this remedial action and whose concentrations prevent unrestricted use/unlimited exposure in the Southwest Groundwater Plume source areas. The interim LUCs will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media. Existing security/access controls that were established and are maintained outside of CERCLA will prevent public access and unwanted trespassers to contaminated areas of the facility.

The following paragraphs provide the specific components of the alternatives developed for the detailed evaluation.

- **Alternative 1: No Further Action.**

- **Alternative 2: Long-term Monitoring with Interim LUCs** (Preferred Contingency Alternative for SWMU 211-A and 211-B). This alternative consists of monitoring and interim LUCs. Groundwater monitoring wells would be installed at the source areas to monitor TCE concentrations attributed to contamination leaching from the UCRS into the RGA. Groundwater sampling and testing would be performed prior to, during, and following the remediation to determine how groundwater contaminant levels are changing.

  Alternative 2 also would institute interim LUCs, which are restrictions associated with the E/PP program, and physical controls in the form of warning signs. These interim LUCs would prevent the completion of the worker exposure pathways.

  Secondary wastes would be generated from monitoring well installation and monitoring activities over time and be managed in accordance with applicable or relevant and appropriate requirements (ARARs).

  Alternative 2 would be applicable to all three source areas and would have total project cost as shown below in Table 1.

Table 1. Alternative 2

Cost element[1]	C-720 Northeast Site ($M)	C-720 Southeast Site ($M)	Oil Landfarm ($M)
Unescalated cost			
Capital cost	$1.0	$1.0	$0.9
O&M	$1.2	$1.2	$1.1
Subtotal	$2.3	$2.3	$2.1
Escalated cost			
Capital cost	$1.1	$1.1	$1.0
O&M	$2.1	$2.1	$1.9
Subtotal	$3.2	$3.2	$2.9
Present Worth[2]			
Capital cost	$1.0	$1.0	$0.9
O&M	$0.9	$0.9	$0.8
Subtotal	$1.9	$1.9	$1.8

[1] Includes general and administrative fee and 25% contingency.

[2] Present worth costs are based on an assumption that outyear costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.

O&M = operation and maintenance

  The estimated time to attain RGs at SWMU 1 and C-720 is estimated at >100 and 97 years, respectively.

  Attenuation processes (e.g., degradation, migration, and dispersion) as currently understood are expected to have limited impact on VOC contamination in the UCRS. Migration and dispersion are physical processes in the groundwater and are continuous in nature. Both aerobic and anaerobic conditions most likely are present in the UCRS; however, these processes were not accounted for in the model-based analysis of time required to meet RGs. The data are indicative of the presence of TCE degradation products, which are largely a result of natural degradation.

- **Alternative 3: *In Situ* Source Treatment Using Deep Soil Mixing with Interim LUCs** (Preferred Alternative for SWMU 1). This alternative consists of an RDSI to refine the

extent of VOC contamination and quantify parameters for selecting and applying treatment reagents, including the possible use of steam. The VOC contamination would be treated utilizing large diameter augers to mix the soil with a chemical reagent to destroy the VOC contamination. Also included in the alternative would be waste management, confirmation sampling and site restoration activities. Deep soil mixing would be performed using a large diameter auger (LDA). As the auger is advanced into the soil, a slurry would be pumped through the hollow stem of the shaft and injected into the soil at the tip. The auger would be rotated and raised and the mixing blades on the shaft would blend the soil and the slurry. When the design depth is reached, the auger would be withdrawn, and the mixing process would be repeated on the way back to the surface. This mixing technique would be repeated, as necessary, in each boring. Confirmation sampling, site restoration, and waste management activities will be performed during the alternative's implementation.

Groundwater monitoring and LUCs similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the water. Alternative 3 is applicable only to SWMU 1 (Oil Landfarm) and would have total project cost as shown in Table 2.

Table 2. Alternative 3

Cost element[1]	Oil Landfarm ($M)
Unescalated cost	
Capital cost	$9.5
O&M	$1.1
Total	$10.6
Escalated cost	
Capital cost	$10.0
O&M	$1.9
Total	$11.9

Table 2. Alternative 3 (Continued)

Present Worth[2]	Oil Landfarm ($M)
Capital cost	$9.5
O&M	$0.8
Total	$10.3

[1] Includes general and administrative fee and 15% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 68 years.

- **Alternative 4: Source Removal and *In Situ* Chemical Source Treatment with Interim LUCs.** This alternative consists of an RDSI for source area refinement, excavation of the sources utilizing large diameter augers, and treating the bottom 10 ft to 13 ft *in situ* with reagents for VOC destruction. The excavated soils would be managed and disposed of according to ARARs. Also included in the alternative would be confirmation sampling and site restoration activities. Groundwater monitoring and LUCs, similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the water. Alternative 4 is applicable only to SWMU 1 (Oil Landfarm) and would have total project cost as shown in Table 3.

Table 3. Alternative 4

Cost element[1]	Oil Landfarm ($M)
Unescalated cost	
Capital cost	$25.0
O&M	$1.1
Total	$26.1
Escalated cost	
Capital cost	$26.3
O&M	$1.9
Total	$28.3
Present Worth[2]	
Capital cost	$25.0
O&M	$0.8
Total	$25.8

[1] Includes general and administrative fee and 15% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 38 years.

- **Alternative 5: *In Situ* Thermal Treatment with Interim LUCs.** This alternative consists of an RDSI for source refinement, treatment using *in situ* thermal technology with vapor extraction, treatment of recovered vapor and groundwater, process monitoring, confirmation sampling, groundwater discharge to an outfall, waste management, and site restoration. Groundwater monitoring and LUCs, similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the water. Alternative 5 is applicable to all three source areas and would have total project cost, as shown in Table 4.

Table 4. Alternative 5

Cost element[1]	C-720 Northeast Site ($M)	C-720 Southeast Site ($M)	Oil Landfarm ($M)
Unescalated cost			
Capital cost	$12.8	$6.8	$17.0
O&M	$1.2	$1.2	$1.1
Total	$14.0	$8.0	$18.1
Escalated cost			
Capital cost	$13.5	$7.1	$17.9
O&M	$2.1	$2.1	$1.9
Total	$15.6	$9.2	$19.8
Present Worth[2]			
Capital cost	$12.8	$6.8	$17.0
O&M	$0.9	$0.9	$0.8
Total	$13.7	$7.6	$17.8

[1] Includes general and administrative fee and 25% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 39 and 20 years for SWMU 1 and C-720, respectively.

- **Alternative 6: *In Situ* Source Treatment Using Liquid Atomized Injection with Interim LUCs.** This alternative consists of an RDSI for source refinement and to quantify soil parameters for selecting and applying treatment reagents. Treatment would occur by applying the reagent mixture in the subsurface in an atomized/aerosol form by high pressure injection. Alternative 6 would include confirmation sampling, waste management, and site restoration. Alternative 6 is applicable only to the C-720 Building Northeast (SWMU 211-A) and Southeast (SWMU 211-B) source areas. Groundwater monitoring and LUCs, similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the water. The total estimated project cost for Alternative 6 is shown in Table 5.

Table 5. Alternative 6

Cost element[1]	C-720 Northeast Site ($M)	C-720 Southeast Site ($M)
Unescalated cost		
Capital cost	$3.5	$3.0
O&M	$1.2	$1.2
Subtotal	$4.7	$4.2
Escalated cost		
Capital cost	$3.6	$3.2
O&M	$2.1	$2.1
Subtotal	$5.8	$5.3
Present Worth[2]		
Capital cost	$3.5	$3.0
O&M	$0.9	$0.9
Subtotal	$4.3	$3.9

[1] Includes general and administrative fee and 25% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 52 years.

- **Alternative 7: *In Situ* Soil Flushing and Source Treatment Using Multiphase Extraction with Interim LUCs.** This alternative consists of an RDSI for source refinement and to quantify soil and source parameters for surfactant selection and vapor extraction. Multiphase extraction would be utilized to remove the source material from the subsurface. Surfactant soil flushing will be utilized to enhance the removal and recovery of vapors and water with entrained VOC contamination. Vapor and liquid phases will be treated and surfactant microemulsions

recovered and reutilized. Alternative 7 would include confirmation sampling, waste management, and site restoration. Alternative 7 is applicable only to the C-720 Building Northeast (SWMU 211-A) and Southeast (SWMU 211-B) source areas. Groundwater monitoring and LUCs, similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the water. The total estimated project cost for Alternative 7 is shown in Table 6.

Table 6. Alternative 7

Cost element[1]	C-720 Northeast Site ($M)	C-720 Southeast Site ($M)
Unescalated cost		
Capital cost	$2.3	$2.1
O&M	$2.0	$2.0
Subtotal	$4.3	$4.1
Escalated cost		
Capital cost	$2.4	$2.2
O&M	$2.9	$2.9
Subtotal	$5.4	$5.1
Present Worth[2]		
Capital cost	$2.3	$2.1
O&M	$1.6	$1.6
Subtotal	$3.9	$3.7

[1] Includes general and administrative fee and 25% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 39 years.

- **Alternative 8: *In Situ* Source Treatment Using EISB with Interim LUCs (Preferred Alternative for SWMU 211-A and 211-B).** Alternative 8 was not evaluated for SWMU 211 in the Revised FFS due to the presence of infrastructure near C-720; however, subsequent to the final evaluation, DOE has determined that EISB will be applicable to this SWMU using pressure injection methods as opposed to gravity injection and infiltration. Enhanced bioremediation will be implemented by installing multiple injection points to inject bioamendment mixture in the soil formation. This treatment approach adds nutrients to stimulate bacterial activity resulting in degradation of VOCs. DOE also may add specialized microbes to ensure adequacy of treatment. The quantity and sequence of amendment injections would be determined during the remedial design development. Included in Alternative 8 are activities for waste management, confirmation sampling, and site restoration.

  Groundwater monitoring and LUCs, similar to those described in Alternative 2 will be performed to determine the effects of treatment on the contaminant concentrations in the groundwater. Alternative 8 has a total estimated project cost, as shown in Table 7.

Table 7. Alternative 8

Cost element[1]	C-720 Northeast Site ($M)	C-720 Southeast Site ($M)	Oil Landfarm ($M)
Unescalated cost			
Capital cost	$2.3	$3.0	$3.6
O&M	$1.3	$1.4	$1.4
Total	$3.7	$4.4	$5.0
Escalated cost			
Capital cost	$2.5	$3.2	$3.8
O&M	$2.2	$2.2	$2.3
Total	$4.7	$5.4	$6.1
Present Worth[2]			
Capital cost	$2.3	$3.0	$3.6
O&M	$1.0	$1.0	$1.1
Total	$3.3	$4.0	$4.7

[1] Includes general and administrative fee and 25% contingency.
[2] Present worth costs are based on an assumption that out-year costs will be financed by investments made in year 0 and are provided for purposes of comparison only. Escalated costs are used by DOE for planning and budgeting.
O&M = operation and maintenance

The estimated time to attain RGs is 93 years.

EVALUATION OF ALTERNATIVES

The following discussion summarizes the comparison of alternatives in the context of the

threshold and balancing criteria. A more extensive evaluation is located in the Revised FFS. A brief description of the evaluation criteria is shown on Page 26.

Overall Protection of Human Health and the Environment

Protection of human health and the environment would be afforded by implementation of interim LUCs and treatment or attenuation of the contamination at the sources to meet RGs for all alternatives (2 through 8) at applicable source areas except Alternative 1. Alternative 1 (No Further Action) would not meet this threshold criterion because no action would be implemented.

Compliance with ARARs

Alternatives 2 through 8 are compliant with location- and action-specific ARARs and meet this threshold criterion. There are no chemical-specific ARARs. The MCL for TCE was utilized to determine how much TCE could be left in the UCRS soils and not exceed the MCL in the RGA groundwater. This value of TCE in the UCRS is the RG for this source control action. Although Alternative 1 would be compliant with ARARs, it would not meet both threshold criteria. A complete listing of ARARs is contained in Section 4 of the D2 Revised FFS.

Long-Term Effectiveness and Permanence

The overall ranking, highest to lowest, of the alternatives with respect to Long-Term Effectiveness and Permanence is as follows:

- SWMU 1, Oil Landfarm—4, 5, 3, 8, 2, and 1
- SWMUs 211-A and 211-B—5, 7, 6, 8, 2, and 1

Oil Landfarm—Alternatives 4 and 5 provide the best Long-Term Effectiveness and Permanence because they would attain the RAOs in the shortest time frame, approximately 38–39 years. Alternative 8 attains the RAOs within 93 years and, as such, is moderately effective when time to attain RGs is a primary consideration. Alternative 2, without active treatment, is expected to attain RGs in > 100 years for SWMU 1.

C-720 Sites—The RAOs are estimated to be attained in 20 years with Alternative 5 and 39 years with Alternative 7. Alternative 2, without active treatment, is expected to attain RGs in 97 years for C-720; this is similar to active treatment remedies included in Alternatives 3 to 8.

Reduction of Toxicity, Mobility, or Volume through Treatment

The overall ranking, of highest to lowest, of alternatives is as follows:

- SWMU 1, Oil Landfarm—4, 5, 3, 8, 2, and 1
- SWMUs 211-A and 211-B—5, 7, 6, 8, 2, and 1

Oil Landfarm—Alternative 4 is expected to result in the greatest reduction in contaminant volume and is estimated to be 100% for the excavated areas in the Oil Landfarm; while Alternative 5 is expected to destroy 98% of the contaminant mass in the Oil Landfarm. Alternatives 3 and 8 would achieve less reduction. Although Alternative 3 would accomplish less contaminant removal, it would facilitate the destruction of contaminants or a reduction of mobility based upon the amendment utilized. Alternatives 1 and 2 would achieve no reductions through treatment and would rely upon degradation, dispersion, and source depletion.

C-720 Sites—Similar reductions in volume from Alternative 5 are expected at C-720 as at the Oil Landfarm. Alternative 7 would achieve an estimated 95% volume reduction. Alternative 6's reduction is estimated at approximately 90%. Alternative 8 will be expected to reduce contaminant levels to a minimum of 60%. As at the Oil Landfarm, Alternatives 1 and 2 would achieve no reductions through treatment and would rely upon degradation, dispersion, and source depletion.

Short-Term Effectiveness

Short-term effectiveness for all but the remediation workers is similar for Alternatives 2 through 8 due to the use of interim LUCs. The combination of existing security/access controls established and maintained outside of CERCLA and the Interim LUCs would maintain protectiveness of the public and the environment from exposure to the site; therefore, only worker

risks, risks to the public from remedy implementation, and time required to attain RAOs are considered in this Short-Term Effectiveness analysis. The overall ranking of the alternatives from highest effectiveness to lowest is as follows:

- SWMU 1, Oil Landfarm—3, 5, 4, 8, 2, and 1
- SWMUs 211-A and 211-B—5, 7, 6, 8, 2, and 1

Oil Landfarm—SWMU 1, alternative 1 does not meet the short-term effectiveness criterion because it does not achieve short-term protectiveness through interim LUCs. Alternative 3 has reduced short-term risk due to its being an *in situ* technology; its overall duration of treatment is approximately four months. Alternative 5 has a faster field implementation schedule than Alternative 3; however, there are increased risks to workers from drilling, construction of electrodes, and the presence of electrical and thermal hazards. Alternative 4 has increased worker risk due its *ex situ* handling, treatment, hauling, and disposal of the contaminated soils. Alternative 4 may pose some risks to the public should contaminated soils be conveyed to an off-site disposal location. Because of the extended time to meet the RAOs, Alternatives 8, 2, and 1 have lower short-term effectiveness than the other alternatives. These risks from lengthy implementation would be managed by interim land use controls.

C-720 Sites—The alternatives applicable to the C-720 Northeast and Southeast sites have relative Short-Term Effectiveness rankings (highest to lowest) of 5, 7, 6, 8, 2, and 1. Although Alternatives 5 and 7 do present risks associated with implementation, these are mitigated somewhat by the shorter implementation time and RAO attainment time when compared to the other alternatives. For Alternative 6, although it is implemented quickly, RAOs are not attained for 52 years, which results in increased monitoring risks. Alternatives 1 and 2 have the lowest short-term effectiveness due to the extended time (exceeds 97 years) to attain RAOs. With Alternative 2, short-term risks, however, are reduced as compared to Alternative 1 because interim LUCs are implemented. With Alternative 8, although short-term risks are reduced because of the generally benign field activities, it will take a long time to reach RGs that will provide for more potential activities to result in risk.

Implementability

All alternatives are implementable as evaluated for the sites. Some alternatives have increased implementability due to use of standard construction techniques and reduced waste generation. The ranking (from highest to lowest) of alternatives with respect to implementability for each SWMU is as follows:

- SWMU 1, Oil Landfarm—1, 2, 8, 3, 5, and 4
- SWMUs 211-A and 211-B—1, 2, 8, 6, 7, and 5

Oil Landfarm—For SWMU 1, Alternatives 1 and 2 are the most implementable since, respectively, one has no action at all, and the other has no active treatment. Alternative 8 follows Alternatives 1 and 2 because it has reduced intrusive activities and utilizes readily available services and industrial techniques. The implementability of Alternative 3 ranks lower than 8, because it will generate more waste and has increased need for coordination of more complex fieldwork. Alternative 4 has reduced implementability due to health and safety issues and waste generation quantities. Alternative 5 is the least implementable at the Oil Landfarm due to the reduced number of vendors who offer this technology, the technical complexity of the technology, and worker protection issues.

C-720 Sites—As listed above, the C-720 Northeast and Southeast applicable alternatives rank in implementability (from highest to lowest) at 1, 2, 8, 6, 7, and 5. Alternatives 1, 2 and 8 have the highest implementability due to the same reasons as for the Oil Landfarm. Alternative 8 is highly implementable because it will utilize wells, nonhazardous compounds, and generally all naturally occurring subsurface activities. Alternative 6 has the highest implementability for alternatives with intrusive type active treatment for the C-720 sites. The implementability is high because it utilizes high pressure jetting and injection, which use standard equipment and technology. It does have some reduced implementability due to limited availability of vendors. Alternative 7 has reduced implementability due to the need for application of the technology for an extended period of time to reach the RAOs. Alternative 5's implementability issues are the same as discussed for application at the Oil Landfarm.

Cost

The estimated lifecycle costs were calculated and are presented as escalated values in fiscal year 2010 dollars for capital, operating and maintenance, and periodic costs for each alternative. The overall ranking of costs, lowest to highest, for the alternatives is as follows:

- SWMU 1, Oil Landfarm—1, 2, 8, 3, 5, and 4
- SWMUs 211-A and 211-B—1, 2, 8, 7, 6, and 5

Table 8 provides a breakdown of the escalated cost for each alternative with respect to the three source areas. Alternative 5 is the most expensive of the 8 alternatives at $44.6M; Alternative 1 is the least, at no cost, as expected for a no further action alternative. Alternative 8 is the least expensive, at $16.2M for the alternatives that implement active source reduction operations for all sites. The combination of Alternatives 6 for C-720 sites and 8 for SWMU 1 has a slightly higher cost at $17.2M. Table 9 provides the estimated present-value costs for each alternative by site.

Table 8. Alternative Escalated Cost by Site, M$

Alternative	C-720-Northeast (211-A)	C-720-Southeast (211-B)	Oil Land-farm	Total
1	0	0	0	0
2	3.2	3.2	2.9	9.3
3	n/a	n/a	11.9	11.9*
4	n/a	n/a	28.3	28.3*
5	15.6	9.2	19.8	44.6
6	5.8	5.3	n/a	11.1*
7	5.4	5.1	n/a	10.5*
8	4.7	5.4	6.1	16.2

- Costs are in millions of dollars, M$.
- n/a indicates alternative not applicable to the specific source area.
- Discussion of escalated, present-value and unescalated costs is contained in the FFS.
- Estimate accuracy is -30% to +50%.
- * Total costs do not apply a remedy to all three source areas.

Table 9. Alternative Present-Value Cost by Site, M$

Alternative	C-720-Northeast (211-A)	C-720-Southeast (211-B)	Oil Land-farm	Total
1	0	0	0	0
2	1.9	1.9	1.8	5.6
3	n/a	n/a	10.3	10.3*
4	n/a	n/a	25.8	25.8*
5	13.7	7.6	17.8	39.1
6	4.3	3.9	n/a	8.2*
7	3.9	3.7	n/a	7.6*
8	3.3	4.0	4.7	12.0

- Costs are in millions of dollars, M$.
- n/a indicates alternative not applicable to the specific source area.
- Discussion of escalated, present value and unescalated costs is contained in the FFS.
- Estimate accuracy is -30% to +50%.
- * Total costs do not apply a remedy to all three source areas.

PREFERRED ALTERNATIVES

These are the Preferred Alternatives.

Oil Landfarm (SWMU 1)

- Alternative 3—*In Situ* Source Treatment using Deep Soil Mixing with Interim LUCs.

C-720 Building Sites (SWMUs 211-A and 211-B)

Preferred Alternative consists of the following:

- Field data collection/RDSI.
- Determination regarding implementation of Alternative 8 or Alternative 2 at SWMU 211-A and SWMU 211-B by the FFA parties will be based on the results of the collected characterization data. The determination may be different at each SWMU and may result in implementation of either
  - — Alternative 8, *In Situ* Source Treatment Using Enhanced *In Situ* Bioremediation with Interim LUCs, or
  - — Alternative 2, Long-Term Monitoring and Interim LUCs.

As part of both remedies for SWMUs 211-A and 211-B, field data collection as a part of FC will be

performed prior to the beginning of remedial design. This investigation also will serve as the RDSI for Alternative 8. The results of the field data collection will be reviewed by the FFA parties and a determination will be made as to whether Alternative 8 or Alternative 2 will be implemented.

Alternative 3—Oil Landfarm—SWMU 1

Alternative 3 at SWMU 1—Oil Landfarm is composed of the following major components.

Remedial Design Support Investigation

An RDSI would be performed at the Oil Landfarm to better determine the extent and distribution of VOCs and source material. The investigation will determine UCRS soil and groundwater parameters specific to the reagent being injected during the soil mixing operations. The extent and distribution of VOCs in the UCRS would impact the spacing/locations and depths of the augered areas. The amount and type of reagent chosen would be based on RDSI sampling results. In addition, steam injection will be considered for use to enhance the reagent's ability to treat VOCs. Based on the calculated RGs for VOC concentrations in source area soil, the RDSI would include field data collection to delineate the lateral and vertical extent of VOC contamination at the Oil Landfarm are described below.

Injection and mixing of reagent

Deep soil mixing would be performed using an LDA. A single auger mixing process is assumed for costing purposes. At the Oil Landfarm, an approximate depth of 60 ft would be required. As the auger is advanced into the soil, a slurry would be pumped through the hollow stem of the shaft and injected into the soil at the tip. The auger would be rotated and raised and the mixing blades on the shaft would blend the soil and the slurry. When the design depth is reached, the auger would be withdrawn, and the mixing process would be repeated on the way back to the surface. This mixing technique would be repeated, as necessary, in each boring. Use of steam to facilitate VOC removal may be part of this alternative.

Confirmatory sampling

Confirmatory sampling in the treatment area would be required to determine post-treatment TCE soil concentrations. A confirmatory sampling plan would be prepared during Remedial Action Work Plan (RAWP) development. The conceptual design for confirmatory sampling includes soil coring using direct push technology and analysis for VOCs using EPA SW-846 Method 8260B or equivalent. Depths and locations of cores would be determined based on the results of the RDSI.

Secondary waste management

The addition of material to the subsurface could cause expansion of *in situ* material during deep soil mixing. This expansion could result in the generation of secondary waste spoils (e.g., soil, reagent, grout, and water mixture). All secondary wastes would be managed in accordance with ARARs.

Site restoration

Surface restoration following this remedial action would include placement of topsoil and vegetation at the Oil Landfarm. The site would be graded to promote runoff, and a land survey would be conducted to produce topographic as-built drawings.

Groundwater monitoring

Groundwater monitoring would be used to determine the effectiveness of the remedy. One upgradient and three downgradient wells, screened in the shallow RGA, were used for cost estimating purposes at each source area. The actual well quantity, location, and screened interval would be included in the Remedial Design Report and RAWP so that monitoring network design can make use of information made available from the RDSI.

Interim LUCs

Interim LUCs (E/PP program and warning signs) would be implemented.

Alternative 3 will individually meet the RAOs. RAO 1 would be met by removal of the source material and also via *in situ* destruction by a

reagent. RAO 2a would be met by removing VOCs to levels within EPA's generally acceptable cancer risk range for site-related exposures of E-04 to E-06, and reducing the VOCs lowers the noncancer HI for VOCs to less than 1. The attainment of RAO 2a also is supported by interim LUCs. RAO 2b would be met by implementing interim LUCs. RAO 3 would be met by reducing VOC soil concentrations to groundwater protection RGs either through treatment by destruction using a reagent or by removal through mixing. Groundwater modeling results indicate that, after completion of the active remedial treatment, residual VOC mass still will leach to groundwater in the RGA and result in TCE concentrations above the MCL at SWMU 1 for Alternative 3. It is expected that implementing only Alternative 3 will result in a reduced time to attain RGs. The time necessary to reach the UCRS soil RG for TCE is dependent on the TCE attenuation rate in the UCRS (TCE half-life in UCRS years) and is shown in the Table 10. The range of time in years (half-life) utilized to assess TCE attenuation is intended to bracket the expected rate of natural reduction in TCE concentrations in the UCRS due to natural attenuation.

Table 10. Alternative 3 TCE Attenuation Rate in the UCRS

TCE Half-Life in UCRS, Years	Time to Reach MCL in RGA after Alternative 3 Treatment Years
	SWMUs 211-A & 211-B
5	25
25	68
50	87

Alternative 3 applied to SWMU 1 meets the threshold criteria (overall protection of human health and the environment and compliance with ARARs) and provides the best balance of trade-offs among the alternatives with respect to the balancing and modifying criteria for remedy selection for SWMU 1. Alternative 3 would provide for good long-term effectiveness and permanence because it removes a significant amount of TCE source from affected media. The cost of Alternative 3 in escalated dollars at SWMU 1 is $11.9M. Alternative 3 has the best short-term effectiveness (i.e., time to meet RAOs), but is further supplemented with interim LUCs. The risks to workers can be managed throughout the extended implementation period. Alternative 3 has the second-best rank in the area of implementability for any of the alternatives that have active treatment.

Alternative 8—C-720 SWMUs 211-A and 211-B

If FC data from C-720 SWMUs indicate that the extent and magnitude of contamination present in the subsurface soil warrants treatment, Alternative 8 will be implemented. Alternative 8 at SWMUs 211-A and 211-B is composed of the following major components:

- **RDSI—**Results from the investigation will be used to refine the source areas to be treated and to quantify soil, groundwater, and contaminant parameters to be utilized in the design of the bioremediation treatment

- **Enhanced *In Situ* Bioremediation System**—A bioamendment composed of microbes, nutrients, and/or reductants, as necessary, will be injected into the subsurface under pressure. Periodically, additional bioamendment will be added to the system. The amendment will enhance subsurface biological activity, which will result in the destruction of the TCE contaminant by the microbes. Testing and monitoring will include measuring of bioamendment concentrations and soil and groundwater parameters during the *in situ* operation.

- **Groundwater monitoring—**Groundwater sampling and testing will be performed prior to, during, and following the remediation to determine how groundwater contaminant levels are changing and if the treatment is having an impact on the RGA groundwater concentration.

- **Confirmatory sampling for VOCs—**Results from soil sampling will be used to determine if the remedial actions have met the RGs.

- **Secondary waste management—**The remedial action will generate waste materials that will require disposition including contaminated water, drill cuttings, soils, bioamendment, and general construction

debris. These materials will require management and disposal in accordance with ARARs.

- **Site restoration**—Following completion of the remedial actions (active treatment and excavation), injection wells and infiltration galleries will be abandoned and treatment systems will be removed. The areas will be returned to original contours and seeded. Groundwater monitoring wells will remain in place until RAOs are attained.

- **Interim LUCs—**Interim LUCs, as described in the Evaluation of Alternatives Section, will consist of the E/PP program and placement of warning signs to provide notice and warning of environmental contamination and are necessary for any residual or remaining VOC and non-VOC contamination that is not treated by the remedial action contained in both Alternative 8 or 2 and whose concentrations prevent unrestricted use/unlimited exposure in the Southwest Groundwater Plume source areas. The interim LUCs will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.

Alternatives 8 will individually meet the RAOs. RAO 1 would be met by removal of the source material via *in situ* destruction by bacteria. RAO 2a would be met by removing VOCs to levels within EPA's generally acceptable cancer risk range for site-related exposures of E-04 to E-06 and reducing the VOCs lowers the noncancer HI for VOCs to less than 1. The attainment of RAO 2a also is supported by interim LUCs. RAO 2b would be met by implementing interim LUCs. RAO 3 would be met by reducing VOC soil concentrations to groundwater protection RGs either through treatment by biological remediation of the source material or attenuation and excavation as part of monitoring. Groundwater modeling results indicate that, after completion of the active remedial treatment, residual VOC mass still will leach to groundwater in the RGA and result in TCE concentrations above the MCL at SWMUs 211-A and 211-B for Alternative 8. It is expected that implementing only Alternative 8 will result in a reduced time to attain RGs. The time necessary to reach the UCRS soil RG for TCE is dependent on the TCE attenuation rate in the UCRS (TCE half-life in UCRS years) and is shown in the Table 11. The range of time in years (half-life) utilized to assess TCE attenuation is intended to bracket the expected rate of natural reduction in TCE concentrations in the UCRS due to natural attenuation.

Table 11. Alternative 8 TCE Attenuation Rate in the UCRS

TCE Half-Life in UCRS, Years	Time to Reach MCL in RGA after Alternative 8 Treatment Years
	SWMUs 211-A & 211-B
5	28
25	83
50	> 100

Alternative 8 applied to the C-720 Building SWMUs 211-A and 211-B sites meets the threshold criteria (overall protection of human health and the environment and compliance with ARARs). Depending on the results of the characterization, Alternative 2 or Alternative 8 provides the best balance among the alternatives evaluated with respect to balancing and modifying criteria for remedy selection. Alternative 8 would provide for good long-term effectiveness and permanence because it removes a significant amount of TCE source from affected media. The cost of Alternative 8 in escalated dollars at the two C-720 SWMUs is ($10.1M). Alternative 8's low short-term effectiveness (i.e., time to meet RAOs) is addressed through interim LUCs. The risks to workers can be managed throughout the extended implementation period. For those alternatives that contain active treatment, Alternative 8 ranks most favorably in regard to implementability.

Criteria for discontinuing enhanced *in situ* bioremediation will be developed. Two parameters available for determining completion are groundwater concentrations and confirmation soil sampling. Specific parameters and values will be defined for completion criteria by the FFA parties in subsequent CERCLA documents (e.g., RAWP).

Alternative 2—C-720 SWMUs 211-A and 211-B

If FC data from the C-720 SWMUs indicate that the extent and magnitude of contamination present in the subsurface soil do not warrant treatment,

Alternative 2 will be implemented. Alternative 2 is composed of the following major components.

- **RDSI—**Results from the investigation will be used to refine the presence of source areas and contaminant concentrations that will allow the time to attain RGs to be determined.

- **Groundwater monitoring—**Groundwater sampling and testing will be performed prior to, during, and following the remediation to determine what concentration and type of contaminants are present in the groundwater and if groundwater contaminant levels are changing.

- **Interim LUCs—**Interim LUCs, as described in the Evaluation of Alternatives Section, will consist of the E/PP program and placement of warning signs to provide notice and warning of environmental contamination. They are necessary for any VOC and non-VOC contamination at the sites and where concentrations prevent unrestricted use/unlimited exposure in the Southwest Groundwater Plume source areas. The interim LUCs will remain in place pending final remedy selection as part of a subsequent OU that addresses the relevant media.

Alternative 2 would meet the aforementioned RAOs, except for RAO 1 related to the treatment/removal of PTW consistent with the NCP. If the FC/RDSI analysis shows the extent and magnitude of contamination present in the subsurface soil do not warrant treatment, then active remediation will be determined by the FFA parties to not be necessary. RAO 2a and 2b would be met by the placement of the interim LUCs. RAO 3 would be met through the use of natural processes.

The range of time in years (half-life) utilized to assess TCE attenuation is intended to bracket the expected rate of natural reduction in TCE concentrations in the UCRS due to attenuation (see Table 12).

If FC data from the C-720 SWMUs indicate that the extent and magnitude of contamination present in the subsurface soil do not warrant treatment, then Alternative 2 would meet the threshold criteria (overall protection of human health and the environment and compliance with ARARs). Depending on the results of the characterization, Alternative 2 or Alternative 8 provides the best balance among the alternatives evaluated with respect to balancing and modifying criteria for remedy selection. Alternative 2 provides for acceptable long-term effectiveness and permanence because it achieves RAOs, to the extent practicable, in a reasonable time frame.

Table 12. Alternative 2 TCE Attenuation Rate in the UCRS

TCE Half-Life in UCRS, Years	Time to Reach MCL in RGA after Alternative 2, Years
	SWMUs 211-A & 211-B
5	35
25	97
50	> 100

The cost of Alternative 2 at the two C-720 SWMUs in escalated dollars is a combined $6.4M. Alternative 2's short-term effectiveness is established through interim LUCs. Some short-term risk exists to workers associated with the sampling work during the extended monitoring period. Risks to workers will be managed throughout the extended implementation period via health and safety plans. Alternative 2 has the best rank in the area of implementability and cost for any of the alternatives, other than Alternative 1.

The No Further Action alternative is appropriate for the storm sewer leading from the C-400 Building area to the Outfall 008 ditch because it is not contributing TCE to the Southwest Groundwater Plume.

This document serves as a Statement of Basis, as discussed in the Introduction section, where the requirements fulfilled by the PP are discussed. The Preferred Alternatives contained in this PP can change in response to public comment or new information such as that to be gained from the field data collection to be performed at SWMUs 211-A and 211-B and the RDSI at SWMU 1.

Based on information currently available, DOE believes that the Preferred Alternatives meet the

threshold criteria and provide the best balance of trade-offs among the other alternatives with respect to the balancing criteria. DOE expects each Preferred Alternative to satisfy the following statutory requirements of CERCLA Section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The Preferred Alternatives represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable and cost-effective manner at the site, consistent with the NCP.

Five-Year Review Requirements

During active treatment and during the period of attenuation, hazardous substances will remain on-site above levels that allow for unlimited use and unrestricted exposure. DOE will review the final remedial action no less than every five years per CERCLA Section 121(c) and the NCP at 40 *CFR* § 300.430(f)(4)(ii). The five-year reviews will be conducted to ensure that the remedy is or will be protective of human health and the environment. If results of the five-year reviews reveal that the remedy's integrity is compromised and protection of human health is insufficient, then additional remedial actions would be evaluated by the parties and implemented by DOE. The statutory reviews will be conducted in accordance with CERCLA 121(c), the NCP, and EPA guidance.

COMMUNITY PARTICIPATION

Community involvement is a critical aspect of the cleanup process at PGDP. DOE, EPA, and KEEC encourage the public to read and comment on this PP. The Preferred Alternatives discussed in this document represent a preliminary decision that is subject to public comment. A Notice of Availability will be published in *The Paducah Sun* announcing the 45-day public review period for this document. The public comment period for this PP is scheduled from **TBD** through **TBD**, 2011.

A public meeting will be conducted if requested in writing. All public comments at the meeting will be recorded. The Kentucky Department for Environmental Protection, Division of Waste Management, will conduct a public hearing following the public meeting, if requested. A hearing is a formal gathering during which public comments are recorded officially by a hearing officer (to be designated by KEEC), as required by RCRA and Kentucky hazardous waste regulations. Written requests for a public hearing should state the issues to be discussed.

If either a meeting or a hearing is requested, a notice will appear in *The Paducah Sun*. To request a public meeting and/or submit comments on this PP, please contact the Paducah DOE Site Office, P.O. Box 1410, Paducah, KY 42001, phone (270) 441-6800. To request a public hearing and/or submit comments on this "Statement of Basis," please contact Tony Hatton, Kentucky Department for Environmental Protection, Division of Waste Management, 200 Fair Oaks Lane, 2nd Floor, Frankfort, KY 40601, phone (502) 564-6716.

WHAT IS RISK AND HOW IS IT CALCULATED?

A CERCLA human health risk assessment estimates "baseline risk." This is an estimate of the likelihood of health problems occurring under current and expected future use if no cleanup action is taken at a site. To estimate the baseline risk at a CERCLA site, a four-step process is followed.

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the risk assessor looks at the concentrations of contaminants found at a site, as well as at past scientific studies on the effects these contaminants have had on people (or animals, when human health studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies enable the risk assessor to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the risk assessor considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, the risk assessor calculates dose from a "reasonable maximum exposure" (RME) scenario, which represents an estimate of the highest level of human exposure that reasonably could be expected to occur within a given time period.

In Step 3, the risk assessor uses the information from Step 2, combined with the information of the toxicity of each chemical, to assess potential health risks. Two types of risk are considered: cancer risk and noncancer risk. The likelihood of any kind of cancer resulting from a CERCLA site generally is expressed as an upper bound probability: for example, a "1 in 10,000 chance." In other words, for every 10,000 people exposed under the RME scenario, one extra cancer *may* occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than normally would be expected from all other causes. For noncancer health effects, the risk assessor calculates a "hazard index." The key concept for noncancer health effects is that a "threshold level" (measured as a hazard index of 1) exists; below this level, noncancer health effects are not expected.

In Step 4, the risk assessor determines whether the site risks are great enough to cause unacceptable health problems for people exposed at or near a site. To do this, the risk assessor combines and summarizes the risk results for the individual chemicals and routes of exposure within the RME scenario and compares the resulting scenario risk estimates to the generally acceptable risk range for site-related exposures.

WHAT ARE THE CONTAMINANTS OF CONCERN?

DOE has identified several contaminants of concern (COCs) in subsurface soil and groundwater at the three locations. However, fate and transport modeling, combined with sampling of groundwater in the Southwest Plume, confirmed that TCE is the primary groundwater COC for potential exposure by receptors. Discussions of the fate and transport modeling and the other COCs are in Appendices F and G, respectively, of the Southwest Plume Site Investigation Report, DOE/OR/07-2180&D2.

TCE is a halogenated organic compound used in the past at PGDP for a variety of purposes. Exposure to this compound has been associated with deleterious health effects in humans, including anemia, skin rashes, liver conditions, and urinary tract disorders. Based on laboratory studies, TCE is considered a probable human carcinogen. Over time, TCE naturally degrades to other organic compounds, including 1,2-dichloroethene and vinyl chloride, which also will be of interest. TCE currently is not used at the PGDP.

CRITERIA FOR REMEDIAL ALTERNATIVES EVALUATION

Nine criteria developed by the EPA are used to compare alternatives and select a cleanup plan or remedy that meets the statutory goals of protecting human health and the environment, maintaining protection over time, and minimizing contamination. These nine criteria make up the assessment process regulated under CERCLA Section 121 and regulations promulgated in the NCP and are the standard criteria used for all Superfund sites. The following list highlights these nine criteria and some questions that must considered in selecting a final cleanup plan. More detailed definitions are contained in Section 4 of the FFS.

Threshold Criteria

1. **Overall protection of human health and the environment:** Will the alternative protect human health and plant and animal life on and near the area? The chosen cleanup plan must meet this criterion.
2. **Compliance with applicable or relevant and appropriate requirements (ARARs):** Does the alternative meet all pertinent federal and state environmental statutes, regulations, and requirements? The chosen cleanup plan must meet this criterion.

Balancing Criteria

3. **Long-term effectiveness and permanence:** How reliable will the alternative be at long-term protection of human health and the environment? Is contamination likely to present a potential risk again?
4. **Reduction of toxicity, mobility, or volume through treatment:** Does the alternative incorporate treatment to reduce the harmful effects of the contaminants, their ability to spread, and the amount of contaminated material present?
5. **Short-term effectiveness:** How soon will risks be adequately reduced? Are there short-term hazards to workers, the community, or the environment that could occur during the cleanup process?
6. **Implementability:** Is the alternative technically and administratively feasible? Are the goods and services needed to implement the alternative (e.g., treatment machinery, space at an approved disposal facility) readily available?
7. **Cost:** What is the total cost of constructing and operating the alternative? Costs presented in this document represent the present worth costs of construction, operations, and monitoring for the anticipated lifetime of the alternative.

Modifying Criteria

8. **State acceptance:** Do state environmental agencies agree with the recommendations? What are their preferences and concerns?
9. **Community acceptance:** What suggestions or modifications do residents of the community offer during the comment period? What are their preferences and concerns?

Of these nine criteria, the two threshold criteria (protection of human health and the environment and compliance with ARARs) must be met for a candidate cleanup alternative to be selected. The five balancing criteria are used to evaluate and compare the elements of the alternatives that meet the threshold criteria. This comparison evaluates which alternative provides the best balance of trade-offs with respect to the balancing criteria outlined above (3-7). State and community acceptance are considered modifying criteria and are factored into a final evaluation of all criteria to select a remedy. Consideration of state and community comments may prompt aspects of the preferred alternative to change or that another alternative provides a more appropriate balance.

This document serves both as a Proposed Plan and as a Statement of Basis.

To send written comments or obtain further information about this Proposed Plan, contact:
Dave Dollins
U.S. Department of Energy
Paducah Site Office
P.O. Box 1410
Paducah, KY 42001
(270) 441-6800

To send written comments about this Statement of Basis, contact:
Tony Hatton
Kentucky Department for Environmental Protection
Division of Waste Management
200 Fair Oaks Lane, 2nd Floor
Frankfort, KY 40601
(502) 564-6716

Administrative Record Availability

Information about this site considered during the response action determinations for this project, including the Proposed Plan, is available for review at the DOE Environmental Information Center, 115 Memorial Drive, Barkley Centre, Paducah, KY 42001 (270) 554-6979

Hours: 8:00 A.M. to 12:00 P.M. Monday through Friday

The Proposed Plan also is available at the
McCracken County Public Library
555 Washington Street, Paducah, KY 42001
(270) 442-2510

Hours: 9:00 A.M. to 9:00 P.M. Monday through Thursday
9:00 A.M. to 6:00 P.M. Friday and Saturday
1:00 to 6:00 P.M. Sunday

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Regulatory Contacts

Kentucky Department for Environmental Protection
Division of Waste Management
200 Fair Oaks, 2nd Floor
Frankfort, KY 40601-1190
Attention: Edward Winner
(502) 564-6716

(Record reviews at the Kentucky Department for Environmental Protection are by appointment only.)

U. S. Environmental Protection Agency
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960
Attention: Turpin Ballard (4 WD-FFB)
ballard.turpin@epa.gov
(404) 562-8550

The ROD and the proposed modification to the Kentucky Hazardous Waste Management Permit will be made available at the Environmental Information Center and at the Paducah Public Library after they have been signed by the United States Department of Energy and the United States Environmental Protection Agency and concurred with by the Kentucky Department for Environmental Protection.

The United States Department of Energy, the United States Environmental Protection Agency, and the Kentucky Energy and Environment Cabinet do not discriminate upon the basis of race, color, national origin, sex, age, religion, or disability in the provision of services. Upon request, reasonable accommodations will be provided. These accommodations include auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all services, programs, and activities. To request appropriate accommodations for a public hearing or meeting (such as an interpreter) or alternate formats for printed information, contact Matthew Hackathorn at (502) 564-6716 or the LATA Environmental Services of Kentucky, LLC, Public Information Officer at (270) 441-5000.

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