5. HAZARD-SPECIFIC CONTEXT RBES DESCRIPTION

This chapter contains discussions identifying and explaining the variances between the current planned end state and the RBES. To set the context for this discussion, maps, CSMs, and treatment trains for each of the hazard areas under the current planned end state are presented and discussed. Subsequently, a table (Table 5.1) summarizing variances by hazard area is presented. This table includes a description of the variances; descriptions of impacts in terms of scope, cost, schedule, and risk; barriers to achieving the RBES; and recommendations/next steps.

In addition to the table that presents the variances by hazard area, a table (Table 5.2) summarizing variances over hazard areas also is presented. This table is presented because several variances were found to be common to multiple hazard areas.

(Note that stakeholders have not had an opportunity to provide input to the RBES report, including the variances identified here. Once stakeholder input is received, this variance report will be modified as appropriate.)

5.1 CURRENT PLANNED END STATE DESCRIPTIONS

This section presents the maps, CSMs, and treatment trains for each of the hazard areas under the current planned end state. In addition, a short narrative is included for each of the hazard areas that states the major assumptions used to complete the current planned end state figures. This narrative includes the following information:

- Hazards under current conditions;
- Pathways to the environment, including discussions of barriers and actions that eliminate those pathways under the current planned end state; and
- Projected risk levels for affected receptors when the current planned end state is achieved.

As with the RBES descriptions presented in Chap. 4, risk estimates for the current planned end state are presented using qualitative statements that compare the risks at the current planned end state to those unmitigated and mitigated risks found under the current state. For additional information on current state risks, please refer to the discussions in Chap. 4.

5.1.1 Hazard Area 1 – GWOU

5.1.1.1 Sources

This hazard area is composed of the facilities and SWMUs listed below. Please see Sect. 4.1.1 for a description of these facilities and SWMUs and their contaminant levels.

- C-720 Maintenance and Storage Building
- C-400 Cleaning Facility
- SWMU 1: C-747-C Oil Land Farm
- SWMU 2: C-749 Uranium Burial Ground
- SWMU 4: C-747 Contaminated Burial Ground
- SWMU 201: Northwest Groundwater Plume
- SWMU 202: Northeast Groundwater Plume

- SWMU 210: Southwest Groundwater Plume
- Little Bayou Creek Groundwater Plume Seeps

5.1.1.2 Pathways

In the current CSM for the GWOU (see Fig. 4.1a2), solvents existing as DNAPLs in subsurface soil and in groundwater are identified as the current sources of contamination. These liquids can go into solution with groundwater and be transported to areas off DOE property. In addition, groundwater could be discharged to surface water. Once in surface water, contaminants could affect ecological receptors or enter the food chain. (^{99}Tc is not discussed in the CSM because it is not found at concentrations greater than its MCL in areas off DOE property [see Fig. 1.2]).

Using this model, the media of concern are subsurface soil, groundwater, and surface water. Receptors potentially exposed to subsurface soil are workers. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain.

Barriers to exposure at the current planned end state (see Figs. 5.1c1 and 5.1c2) are continued access controls to prevent exposure to subsurface soil ① and continuation of the PGDP Water Policy ②, which provides an alternate water supply to residences affected by the dissolved phase plumes. Source actions are planned under the current planned end state to reduce DNAPL concentrations in subsurface soil and the aquifer ⑧ and to remove the potential DNAPL source at two burial grounds ⑧. A plume action also is planned to reduce contaminant concentrations in the dissolved phase plume ⑨. Discharges to surface water currently are planned to be addressed through natural attenuation ④, and monitored natural attenuation will be used to address residual contamination in source zones and groundwater after completion of the source actions ⑥.

Under the current planned end state, potential receptors affected during implementation of the response actions (see Fig. 5.1c3) are the environmental sampler, maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The environmental sampler could be exposed during sampling activities. The maintenance worker could be exposed while maintaining controls. The remediation worker and ecological receptors could be exposed during completion of source actions (anticipated to be a heating technology for subsurface soil and groundwater and excavation for burial ground waste) and completion of the dissolved phase plume action (anticipated to be an oxidation technology such as C-Sparge™). The general site worker could be exposed during implementation of the source actions. The disposal worker could be exposed while accepting waste derived from the burial ground excavation and derived from implementing the source actions. The transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

5.1.1.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels using barriers to prevent exposure. In addition, source concentrations and plume concentrations would be reduced; however, preliminary modeling indicates that even after implementation of a heating technology in source zones, contributions to groundwater would be such that MCLs still would be exceeded. Because contamination would continue to exist at levels above MCLs after the source actions, monitored natural attenuation would be required until MCLs are met. (MCLs are assumed to be the contaminant concentration in groundwater below which no further action would be required.)

5.1.2 Hazard Area 2 – Surface Water Operable Unit

5.1.2.1 Sources

This hazard area is composed of the facilities and SWMUs listed below. Please see Sect. 4.2.1 for a description of these facilities and SWMUs and their contaminant levels.

- SWMUs 60, 61, 62, 63, 66, 67, 68, 69, 168, and 526: Internal plant ditches and outfalls
- SWMUs 58 and 59: NSDD
- SWMU 64: Little Bayou Creek
- SWMU 65: Bayou Creek
- SWMU 179: Storm sewer systems
- SWMUs 13, 14, 15, 16, and 520: Scrapyards

5.1.2.2 Pathways

The current CSM for the SWOU (see Fig. 4.2a2) identified sediment and waste from past enrichment operations (includes scrap) as current sources of contamination. Contaminants found in these sources of contamination are available for direct contact onsite or for transport to areas outside the industrialized area of PGDP. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, scrap, sediments, and surface water are of concern. Receptors potentially exposed to scrap are workers, visitors, and ecological receptors. Receptors potentially exposed to sediment and surface water also are workers, visitors, and ecological receptors. The resident, visitor, and ecological receptor are potentially exposed through the food chain.

The barriers to exposure at the current planned end state (see Figs. 5.2c1 and 5.2c2) are continued access controls to prevent exposure to source material ①. Source actions are planned under the current planned end state to remove the sources of surface water contamination (i.e., scrap and sediments) ④. To ensure that migration to areas outside the industrialized area is slowed, migration controls (i.e., sediment control basins) ⑤ would be employed. Finally, monitoring of effluents would continue to ensure any future releases are identified quickly ②.

Under the current planned end state, potential receptors during implementation of the response actions (see Fig. 5.2c3) are the environmental sampler, maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The environmental sampler could be exposed during sampling activities. The maintenance worker could be exposed while maintaining controls. The remediation worker and ecological receptor could be exposed during completion of source actions (anticipated to be characterization and disposal of scrap and excavation of sediments). The general site worker also could be exposed during implementation of the source actions. The disposal worker could be exposed while accepting waste from the scrap disposal and excavation activities. The transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

5.1.2.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels due either to the presence of barriers that prevent exposure or to the removal of source material. The risk target for cleanup levels under the current planned end state in locations both inside and outside the industrialized area is a residential risk of 1E-06. The PCB concentration target in all areas is 1 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as

the 95% upper confidence limit of the mean concentration) within the exposure unit. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

5.1.3 Hazard Area 3 – Burial Grounds Operable Unit (Group 1)

5.1.3.1 Sources

This hazard area is composed of the SWMUs listed below. Please see Sect. 4.3.1 for a description of these SWMUs and their contaminant levels.

- SWMU 3: C-404 Low-level Radioactive Waste Burial Ground
- SWMU 6: C-747-B Burial Ground
- SWMU 145: Residential/Inert Landfill Borrow Area (and old NSDD Channel)

5.1.3.2 Pathways

The current CSM for the BGOU (Group 1) (see Fig. 4.3a2) identified waste materials from plant operations and surface and subsurface soil as current sources of contamination. Contaminants found in waste and soil are available for direct contact on-site. Migration of contamination from these burial grounds is not expected due to the nature of the wastes. Ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas.

Using this model, the waste materials, surface soil, and subsurface soil are of concern. Receptors potentially exposed to waste material and soil are workers, visitors, and ecological receptors. In addition, the ecological receptor is potentially exposed through the food chain.

The barriers to exposure at the current planned end state (see Figs. 5.3c1 and 5.3c2) are continued access controls to prevent exposure to waste and soil ①. Excavation and off-site disposal of waste and soil also are planned under the current planned end state ③.

Under the current planned end state, potential receptors during implementation of the response actions (see Fig. 5.3c3) are the maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptor. The maintenance worker could be exposed during site maintenance activities performed as part of access controls. The remediation worker, general site worker, and ecological receptor could be exposed during the burial ground excavations. The disposal worker could be exposed while accepting waste, and the transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

5.1.3.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels due either to the barriers to prevent exposure or to the removal of waste and soil. Risk targets for cleanup levels during excavation have not been established at this time.

5.1.4 Hazard Area 4 – Surface Soils Operable Unit

5.1.4.1 Sources

This hazard area is composed of surface soils found within the industrialized areas of PGDP. Please see Sect. 4.4.1 for a description of this hazard area.

5.1.4.2 Pathways

The current CSM for the SSOU (see Fig. 4.4a2) identified past spills and releases from operations as the primary source of contamination, and surface soil as the current source of contamination. Contaminants found in soil are available for direct contact on site. Migration of contamination from the SSOU areas is not expected (i.e., uncertain pathway); however, it is possible that ecological receptors could contact contaminants within source areas resulting in contamination entering the food chain.

Using this model, the media of concern is surface soil. Receptors potentially exposed to soil are workers, visitors, and ecological receptors. In addition, the ecological receptor potentially is exposed through the food chain.

The barriers to exposure at the current planned end state (see Figs. 5.4c1 and 5.4c2) are continued access controls to prevent exposure to waste and soil ①. In addition, source actions to remove the waste and soil ③ also are planned under the current planned end state.

Under the current planned end state, potential receptors during implementation of the response actions (see Fig. 5.4c3) are the maintenance worker, remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptors. The maintenance worker could be exposed during site maintenance activities performed as part of access controls. The remediation worker, general site worker, and ecological receptor could be exposed during the excavation of contaminated waste and soil. The disposal worker could be exposed while accepting waste, and the transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

5.1.4.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels due to the barriers to prevent exposure or removal of source material. The risk target for cleanup levels under the current planned end state is a residential risk of 1E-06. The PCB concentration target is 1 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

5.1.5 Hazard Area 5 – Permitted Landfills

5.1.5.1 Sources

This hazard area is composed of the following three SWMUs and a planned facility. Please see Sect. 4.5.1 for a description of the SWMUs and their contaminant levels. A short description of the planned facility, a potential CERCLA Cell, is in Sect. 4.5.2.

- SWMU 9: C-746-S Residential Landfill
- SWMU 10: C-746-T Inert Landfill
- SWMU 208: C-746-U Landfill
- Potential CERCLA Cell

5.1.5.2 Pathways

The current CSM for the Permitted Landfills (see Fig. 4.5a2) identified buried waste and soil as current sources of contamination. Contaminants from these sources may migrate to both the groundwater and surface water; however, these are uncertain pathways. Once in surface water, contaminants could affect ecological receptors or enter the food chain; however, this pathway is uncertain as well.

Using this model, buried waste, subsurface soil, groundwater, and surface water are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially could be exposed through the food chain.

Barriers to exposure at the current planned end state match those currently in place. (See Figs. 5.5c1 and 5.5c2.) These barriers are the current land cover ① and access controls ②, which prevent exposure to waste and soil; continuation of the PGDP Water Policy ④, which provides an alternate water supply to any residences affected by contaminated groundwater; and the landfill cap and leachate collection system ③, which minimizes potential for contaminant migration. In addition, the landfills are monitored to ensure that these systems are working properly.

Under the current planned end state, potential receptors that are part of the treatment train (see Fig. 5.5c3) are the maintenance worker and environmental sampler. The maintenance worker could be exposed while maintaining the access controls and landfill containment systems. The environmental sampler could be exposed during routine sampling activities.

5.1.5.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels because barriers prevent exposure.

5.1.6 Hazard Area 6 – Burial Grounds OU (Group 2)

5.1.6.1 Sources

This hazard area is composed of the SWMUs listed below. Please see Sect. 4.6.1 for a description of these SWMUs and their contaminant levels.

- SWMU 5: C-746-F Burial Ground
- SWMU 7: C-747-A Burial Ground
- SWMU 8: C-746-K Landfill
- SWMU 30: C-747-A Burn Area

5.1.6.2 Pathways

In the current CSM for the BGOU (Group 2) (see Fig. 4.6a2), waste materials from plant operations and surface and subsurface soil are identified as current sources of contamination. Contaminants found in waste and soil are available for direct contact onsite. For all but the C-746-K Landfill (SWMU 8), migration of contamination from these burial grounds to surface water or groundwater is not expected due to the nature of the wastes. Similarly, for all but the C-746-K Landfill, ecological receptors potentially could contact contaminants at the burial grounds resulting in contamination entering the food chain, but impacts from this pathway would be limited because the burial grounds are located in industrialized areas. For the C-746-K Landfill, releases to surface water are known to have occurred in the past and these releases may impact ecological receptors in Bayou Creek in an area outside the industrialized portion of PGDP.

Using this model, the waste materials (soil, groundwater, and surface water) are of concern. Receptors potentially exposed to waste and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface

water are workers, visitors, and ecological receptors. In addition, the visitor, resident, and ecological receptor potentially could be exposed through the food chain.

Barriers to exposure at the current planned end state are depicted in Fig. 5.6c1 and 5.6c2. These barriers are the current land cover ① and access controls ② that prevent exposure to waste and subsurface soil; continuation of the PGDP Water Policy ③ that provides an alternate water supply to any residences affected by contaminated groundwater; and the landfill cap ④, which mitigates contaminant migration.

Under the current planned end state, potential receptors in the treatment train (see Fig. 5.6c3) are the maintenance worker, remediation worker, environmental sampler, and ecological receptor. The maintenance worker could be exposed while maintaining the access controls and current cover. The remediation worker and ecological receptor could be exposed while installing the landfill cap. The environmental sampler could be exposed during routine sampling activities.

5.1.6.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels because barriers limit exposure or mitigate contaminant migration.

5.1.7 Hazard Area 7 – Legacy Waste and DOE Material Storage Areas

5.1.7.1 Sources

This area consists of the legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DMSAs located throughout PGDP. The following facilities hold containerized legacy waste in storage.

C-746-A	C-746-V	C-310	C-337
C-746-B	C-746-M	C-331	C-752-A
C-746-H3	C-752-C	C-333	C753-A
C-746-Q	C-733	C-335	

Facilities containing DMSAs, including 18 outside locations, are as follows.

Outside – Locations 1-18	C-333 – Locations 1-43	C-409 – Locations 1-2
C-310 – Locations 1-5	C-337 – Locations 1-45	C-720 – Locations 1-4
C-331 – Locations 1-24	C-400 – Locations 1-8	

Please see Sect. 4.7.1 for a description of these areas and their contaminant levels.

5.1.7.2 Pathways

Under the current CSM for Legacy Waste and DMSAs (see Fig. 4.7a2), stored waste and surface soil are identified as current sources of contamination. Contaminants found in either location are available for direct contact onsite. Additionally, contaminants in surface soil potentially could migrate to surface water

and sediment, but this is an uncertain pathway. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, waste, soil, sediments, and surface water are of concern. Receptors potentially exposed to stored waste are workers and ecological receptors. Receptors potentially exposed to soil are workers and ecological receptors. Receptors potentially exposed to sediment and surface water are workers, visitors, and ecological receptors; however, this is an uncertain pathway. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain, another uncertain pathway.

No barriers to exposure are required at the current planned end state (see Figs. 5.7c1 and 5.7c2) because all legacy waste and materials in the DMSAs would have been characterized and disposed of in an off-site location or in a permitted landfill at PGDP ②. Additionally, any contaminated surfaces are decontaminated ③ and contaminated soil is excavated and disposed of in an off-site location or in a permitted landfill at PGDP ④

Under the current planned end state, potential receptors during implementation of the response actions (see Fig. 5.7c3) are the remediation worker, general site worker, disposal worker, transportation worker, the public, and ecological receptor. The remediation worker, general site worker, and ecological receptor could be exposed during the characterization and disposal of waste, decontamination of surfaces, and excavation of soil. The landfill worker and disposal worker could be exposed while accepting waste, including excavated soil. The transportation worker, public, and ecological receptor could be exposed during transportation of waste and soil to an off-site disposal location.

5.1.7.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels due to characterization and disposal of waste and soil. The risk target for cleanup levels for soil under the current planned end state is a residential risk of 1E-06. The PCB concentration target is 1 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

5.1.8 Hazard Area 8 – Cylinder Yards and DUF_6 Conversion Facility

5.1.8.1 Sources

This hazard area is composed of 20 cylinder yards and the DUF_6 Conversion Facility that will be built, operated, and undergo D&D as part of the EM mission at PGDP. Please see Sect. 4.8.1 for a description of these areas and their contaminant levels.

5.1.8.2 Pathways

The current CSM for the Cylinder Yards and DUF_6 Conversion Facility (see Fig. 4.8a2) identified the facility infrastructure, cylinders, and associated soils as current sources of contamination. Contaminants found associated with the facility infrastructure, cylinders, and soil are available for direct contact onsite. Additionally, contaminants in surface soil potentially could migrate to surface water and sediment, but this is an uncertain pathway. Once in the environment, contaminants could directly affect ecological receptors or enter the food chain.

Using this model, contaminants from the facility infrastructure and cylinders and in soil, sediments, and surface water are of concern. Receptors potentially exposed to facility infrastructure, cylinders, and associated soil are workers and ecological receptors. Receptors potentially exposed to sediment and

surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor potentially could be exposed through the food chain.

At the current planned end state (see Figs. 5.8c1 and 5.8c2), all sources of contamination are removed. The completion of the conversion mission ③ includes offsite disposal of converted uranium; D&D of infrastructure, followed by on-site disposal ④, and excavation of any contaminated soil ⑤. In addition, any contamination in runoff is attenuated naturally by the time it reaches surface water ②.

Under the current planned end state, potential receptors during implementation of the response actions (see Fig. 5.8c3) are the industrial worker, remediation worker, landfill worker, general site worker, and ecological receptor. The industrial worker would be exposed while working in the conversion facility. The remediation worker, general site worker, and ecological receptor could be exposed during the D&D of the facility infrastructure and excavation of soil. The landfill worker and general site worker could be exposed while waste is transported to, and accepted at, the potential on-site CERCLA Cell.

5.1.8.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels due to D&D of facility infrastructure, completion of the conversion mission, and excavation of any contaminated soils. The risk target for cleanup levels for soil under the current planned end state is a residential risk of 1E-06. The PCB concentration target is 1 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

5.1.9 Hazard Area 9 – GDP Facilities

5.1.9.1 Sources

This hazard area is composed of the buildings and infrastructure leased to USEC for the enrichment of uranium. The buildings are listed below. Please see Sect. 4.9.1 for descriptions of these buildings.

- C-331, C-333, C-335, and C-337 process buildings and associated switchyards and cooling towers
- C-710 Technical Service Building
- C-720 Building
- C-724/725 Paint Shop
- Sewage Treatment Plant
- Water Treatment Plants
- C-400 Cleaning Building.

This hazard area also includes 2 large buildings and 15 smaller facilities that are currently slated for D&D as part of the D&D Operable Unit (see Chap. 1). These two large buildings are the C-410/420 Feed Plant and the C-340 Metals Plant. Please see Sect. 4.9.1 for additional information about these buildings and their associated contamination.

5.1.9.2 Pathways

The current CSM for the GDP Facilities (see Fig. 4.9a2) identified contaminated infrastructure and soils as current sources of contamination. Contaminants associated with infrastructure and soil may migrate to groundwater and be transported to areas off DOE property. Additionally, contaminants may migrate to surface water and sediment and be transported to locations off DOE property. Finally, groundwater could be discharged to surface water. Once in surface water, contaminants could affect ecological receptors or enter the food chain.

Using this model, the contaminated infrastructure, soil, groundwater, surface water, and sediments are of concern. Receptors potentially exposed to contaminated infrastructure and soil are workers, visitors, and ecological receptors. Receptors potentially exposed to groundwater are workers and residents. Receptors potentially exposed to surface water are workers, visitors, and ecological receptors. In addition, the resident, visitor, and ecological receptor are potentially exposed through the food chain.

Barriers to exposure at the current planned end state (see Figs. 5.9c1 and 5.9c2) are continued access and excavation restrictions, which prevents exposure to contaminants in soil ①, and continuation of the PGDP Water Policy ②, which provides an alternate water supply to affected residences. Source actions are planned to meet the current planned end state. These source actions include D&D of infrastructure with disposal in a potential on-site CERCLA Cell ⑥, excavation of soil with disposal in the potential CERCLA Cell ⑨, and treatment to reduce DNAPL concentrations in subsurface soil and the aquifer ⑩. Discharges to surface water are addressed through natural attenuation ④, and monitored natural attenuation will be used to address residual contamination in source zones and groundwater after completion of the source actions ⑧.

Under the current planned end state, receptors potentially exposed during implementation of the response actions (see Fig. 5.9c3) are the general site worker, environmental sampler, remediation worker, landfill worker, ecological receptor, and, if off-site disposal is required, the transportation worker, disposal worker, and the public. (Off-site disposal of wastes derived from D&D of the C-340 and C-410/420 Buildings is possible if the D&D occurs before the potential CERCLA Cell is constructed and operating.) The general site worker and ecological receptor could be exposed during infrastructure D&D, excavation of soil, and disposal of waste. The environmental sampler could be exposed during sampling activities. The remediation worker could be exposed during completion of infrastructure D&D, soil excavation, and source actions to address groundwater contamination (anticipated to be a heating technology for subsurface soil and groundwater). The landfill and disposal workers could be exposed while accepting D&D waste, soil, and other waste derived when implementing the source actions for groundwater. Finally, the transportation worker, public, and ecological receptor could be exposed during transportation of waste to an off-site disposal location.

5.1.9.3 Projected Risk Levels

At the current planned end state, risks to all potential receptors would be at *de minimis* levels using barriers to prevent exposure. In addition, source concentrations and plume concentrations would be reduced; however, preliminary modeling indicates that even after implementation of a heating technology in source zones, contributions to groundwater would be such that MCLs still would be exceeded. Because contamination would continue to exist at levels above MCLs after the source actions, monitored natural attenuation would be required. (MCLs are assumed to be the contaminant concentration in groundwater below which no further action would be required.) The risk target for cleanup levels for soil under the current planned end state is a residential risk of 1E-06. The PCB concentration target is 1 ppm. Attainment of the target risk will be determined using the average contaminant concentration (defined as the 95% upper confidence limit of the mean concentration) within the exposure unit. Similarly, the PCB concentration target will be the average concentration within the exposure unit.

5.2 VARIANCES BETWEEN CURRENT PLANNED END STATE AND RBES

This section presents tables identifying the variances between the current planned end state and the RBES. As noted earlier, the first table (Table 5.1) identifies variances within a given hazard area, and the second table (Table 5.2) identifies variances over hazard areas. When combined over hazard areas, the relative importance of each of the variances, as indicated by the number of hazard areas affected, are as follows: (In this list, the current planned end state action is listed first and the RBES action is listed

second. Also, note that the cost, schedule, and risk discussions do not appear in Table 5.2 because these discussions are hazard area specific.)

- Variance 6 (V-6): Cleanup levels for soil and sediment in industrial areas set at targets of 1E-06 (residential) and PCBs of 1 ppm versus targets of 1E-04 (industrial) and PCBs of 25 ppm; Cleanup levels for sediment in recreational areas set at targets of 1E-06 (residential) and PCBs of 1 ppm versus targets of 1E-04 (recreational) and PCBs of 1 ppm – Hazard Areas 2, 4, 8, and 9.
- Variance 1 (V-1): Continuation of PGDP Water Policy versus Enhanced institutional controls – Hazard Areas 1, 6, and 9
- Variance 2 (V-2): Treatment of groundwater source areas versus monitored natural attenuation – Hazard Areas 1 and 9.
- Variance 3 (V-3): Excavation of groundwater source areas versus monitored natural attenuation – Hazard Area 1.
- Variance 4 (V-4): Treatment for the dissolved phase plume versus monitored natural attenuation – Hazard Area 1.
- Variance 5 (V-5): Actions to reduce surface water discharges versus continued monitoring – Hazard Area 1.
- Variance 7 (V-7): Construction of sediment control basins versus no construction – Hazard Area 2.
- Variance 8 (V-8): Excavation of burial grounds versus capping of burial grounds – Hazard Area 3.
- Variance 9 (V-9): Construction of potential CERCLA Cell versus no construction – Hazard Area 5.
- Variance 10: (V-10): Cleanup levels for soil and/or decontamination of surfaces in industrial areas set at targets of 1E-06 (residential) and PCBs of 1 ppm versus targets of 1E-04 (industrial) and PCBs of 25 ppm – Hazard Area 7.

The relative importance of the varying cleanup levels discussed in Variances 6 and 10 in Table 5.2 is illustrated in Fig. 5.10 and 5.11. Figure 5.10 shows where PCBs have been sampled for, but have not been detected at concentrations greater than 1 ppm (grey dot), have been detected at a concentration greater than 1 ppm but less than 25 ppm (blue dot), and have been detected at a concentration greater than 25 ppm (red dot). Figure 5.11 shows where ^{238}U has been sampled for, but have not been detected at concentrations greater than 1.71 pCi/g (grey dot), has been detected at a concentration greater than 1.71 pCi/g but less than 171 pCi/g (blue dot), and has been detected at a concentration greater than 171 pCi/g (red dot). (Note that 1.71 pCi/g and 171 pCi/g equate to cancer risk targets to an industrial worker of 1E-06 and 1E-04, respectively.) By comparing the size of the "blue dot" areas to the "red dot" areas in the figures, the areas that would require excavation under a 1 ppm PCB cleanup level or a 1E-06 target cancer risk are easily seen to be much greater than those that would require excavation under a 25 ppm PCB cleanup level or a 1E-04 target cancer risk. Similarly, the counts of analyses performed and the number of results falling within each of the categories shown on the map also can be used to indicate the potential variance in potential excavation amounts. These counts are as follows:

PCBs:

Total analyses (equals sum of grey, blue and red dots) is 2,529.
PCBs < 1 ppm (equals number of grey dots) is 2270 (90% of all samples).
PCBs > 1 ppm (equals number of blue and red dots) is 259 (10% of all samples).
PCBs > 25 ppm (equals number of red dots) is 36 (1.4% of all samples).

^{238}U:

Total analyses (equals sum of grey, blue and red dots) is 1,951.
^{238}U < 1.71 pCi/g (equals number of grey dots) is 919 (50% of all samples).

^{238}U > 1.71 pCi/g (equals number of blue and red dots) is 976 (50% of all samples).
^{238}U > 171 pCi/g (equals number of red dots) is 56 (2.9% of all samples).

Based upon these counts, it can be estimated that 7 times (10%/1.4%) as much soil would need to be excavated using a 1 ppm versus 25 ppm PCB target, and 17 times (50%/2.9%) as much soil would need to be excavated using 1E-06 cancer risk target versus a 1E-04 cancer risk target. Note, however, that these results are uncertain, because both PCB and ^{238}U sampling results are lacking for large portions of PGDP.

Table 5.1 Variance report by hazard area

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
Hazard Area 1: Groundwater Operable Unit				
V-1.1	**Current Planned End State**: Continuation of PGDP Water Policy **RBES**: Enhanced institutional controls	Scope: The current planned end state includes continuation of the current PGDP Water Policy[a]. The RBES includes enhanced institutional controls[b], which would supercede the current PGDP Water Policy. Under both end states, the goal would be to reduce risks to residents from exposure to groundwater to *de minimis* levels[c]. Cost: The cost variance has not been determined to date. The current PGDP Water Policy costs range from $70,000 to $100,000 per year. Depending upon the specific enhanced institutional controls, the cost variance of the enhanced institutional controls could include some cost avoidance (if the PGDP Water Policy is terminated). However, the implementation of enhanced institutional controls would include costs for acquisition of rights to restrict groundwater use and continued monitoring to ensure continued long-term effectiveness of the enhanced institutional controls. Schedule: The PGDP Water Policy is currently in place. Implementation of the enhanced institutional controls would be a future planned CERCLA response action. Risk: The expected risk variance is zero under both the PGDP Water Policy and enhanced institutional controls because each would prevent exposure to contaminated groundwater, resulting in no risk. Enhanced institutional controls, however, would be more sustainable and, therefore, would result in greater long-term effectiveness because they would involve legally enforceable property restrictions and deed notices. (The agreements with landowners under the PGDP Water Policy do not restrict groundwater use, but only commit DOE to provide municipal water to replace the groundwater in return for the property owner's commitment not to use the groundwater. Thus, current or future property-owners could return to using groundwater in the home, completing this exposure pathway, and potentially raising risk from *de minimis* levels[c].)	DOE policy may limit options available under the enhanced institutional controls.	Initiate further discussions with the public and regulators. Revisit DOE policy.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
V-1.2	**Current Planned End State**: Treatment to attain source reduction **RBES**: Monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1.1)	Scope: The current planned end state assumes implementation of DNAPL source reduction actions using *in situ* heating technologies in combination with monitored natural attenuation. The RBES does not assume source actions and consists solely of monitored natural attenuation with a point of exposure established at the DOE property boundary or at a downgradient location in accordance with the requirements of CERCLA. Cost: The combined cost of implementing *in situ* heating technology at the DNAPL source areas (i.e., C-400, C-720, and oil landfarm) is estimated to range from $75,000,000 to $140,000,000. The cost per year for monitored natural attenuation essentially would be the same under both the current planned end state and RBES; however, the duration of the monitoring/attenuation period could differ between the current planned end state (hundreds of years) and the RBES (potentially thousands of years). Schedule: Under the current planned end state, the construction and performance of the source actions would be implemented by 2010, with associated monitoring/attenuation potentially continuing for hundreds of years. A draft proposed plan for the C-400 DNAPL source action is currently scheduled for delivery to the regulatory agencies in January 2004. Under the RBES, no additional construction beyond installation of additional monitoring wells would be required; however, monitoring/ attenuation potentially could continue for thousands of years. Risk: The only variance in risk between the current planned end state and the RBES is the amount of time necessary to achieve MCLs. The PGDP Water Policy and/or enhanced institutional controls would eliminate risks to the public from off-site migration of DNAPL under both end states. However, the current planned end state could reduce the amount of time necessary to meet MCLs, thereby shortening the time period that the PGDP Water Policy or enhanced institutional controls would have to remain in effect. Implementation of *in situ* heating technology under the current planned end state could result in exposures of remediation workers to contaminated soil and groundwater and, potentially, gases, as well as physical hazards.	The regulators' position is that monitored natural attenuation would need to be supplemented by source actions to reduce contaminant concentrations to MCLs in a "reasonable" timeframe (e.g., = 100 years); however, even with source reduction, it would take hundreds of years to reach MCLs. (Without source reduction, the period potentially could be thousands of years.) Despite national performance data indicating that no technologies currently exist that can reduce DNAPLs in source areas to MCLs within a "reasonable" period, the regulators' position is that technical impractability (TI) waivers would be available only after a demonstrated, site-specific technology failure. The regulators' position is that the current fence	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Implementation of the source action could pose a risk of exposure to gases to general plant workers. Workers involved in disposal of materials contaminated during implementation of the source action could also be exposed. Finally, samplers involved in groundwater monitoring activities could be exposed. Except for risks to samplers, the magnitude of these risks has not been estimated at this time. Risks under the RBES are limited to samplers involved in groundwater monitoring activities. An assessment of these risks under current sampling protocols determined that risks to samplers are at *de minimis* levels[c].	line (located well inside the property boundary) should be used as the point of exposure.	
V-1.3	**Current Planned End State**: Excavation to remove suspected sources of groundwater contamination at burial grounds **RBES**: Capping and monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1.1)	Scope: The current planned end state assumes complete excavation of two burial grounds (C-749 Uranium Burial Ground and C-747 Contaminated Burial Yard) suspected to be sources of groundwater contamination, subsequent off-site disposal of excavated materials, and monitoring to determine the effectiveness of source removal. The RBES assumes capping and monitoring for these burial grounds. Cost: The variance between the combined cost of excavating the two burial grounds, off-site disposal of excavated material, and monitoring under the current planned end state and the combined cost for capping and monitoring under the RBES is estimated to range from $176,000,000 to $349,000,000. Schedule: The source action under the current planned end state would be completed by 2030. Capping under the RBES would be complete by 2019. Monitoring would follow both actions. Risk: The only potential risks posed by these burial grounds under current conditions are from possible migration of contaminants through groundwater to off-site residents and from direct contact at the burial ground by on-site industrial workers. However, the PGDP Water Policy and/or enhanced institutional controls would eliminate risks to the public from contaminant migration under both end states, and current access controls mitigate risk from direct contact by on-site industrial workers. Excavation of the burial grounds under the current planned end state would remove the suspected source term, thereby reducing the amount of	It is the regulators' position that capping, access controls, and/or enhanced institutional controls are inadequate to achieve long-term protectiveness for *in situ* management of contamination at burial grounds; therefore, their preference is to remove the burial grounds to prevent them from serving as long-term sources of groundwater contamination.	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		time taken to meet MCLs and shortening any monitoring period and the need for access controls. Capping of the burial grounds under the RBES would limit potential contact to the burial grounds and reduce possible migration of contamination to groundwater, but would require long-term monitoring and access controls. Off-site risks from contaminant migration would be controlled using enhanced institutional controls (see V-1.1). Excavation of the burial grounds would result in substantial risks to remediation workers through direct contact with wastes. (Note that one of the burial grounds to be excavated under the current planned end state contains pyrophoric uranium [i.e., uranium that spontaneously burns when exposed to air], which would pose significant inhalation risk and physical hazard to remediation workers.) Additionally, general site workers could be put at risk from exposure through inhalation of resuspended dust and vapors during excavation. Potential risks to the public and ecological receptors would also be increased during transportation of waste to the off-site disposal location. Finally, samplers involved in monitoring activities could be exposed. The magnitude of these risks has not been estimated at this time. Capping of the burial grounds under the RBES would result in potential risks to remediation workers through direct contact with surface soil at the burial grounds, but not through direct contact with waste. Samplers involved in monitoring activities could also be at risk of exposure. The magnitude of these risks has not been estimated at this time. Note that risks to remediation and general site workers would be smaller under the RBES than the current planned end state because, under the RBES, waste would not be dug up and moved, and the duration of the activity would be shorter.		
V-1.4	**Current Planned End State**: Treatment to reduce contaminant concentrations in the dissolved phase plume	Scope: The current planned end state assumes implementation of oxidation technologies (e.g., C-Sparge™) to remove TCE and other solvents from the dissolved phase plumes followed by monitored natural attenuation. The RBES does not assume plume actions and consists solely of monitored natural attenuation.	The regulators' position is that monitored natural attenuation would need to be supplemented by source actions to reduce contaminant concentrations to MCLs	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
	RBES: Monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1.1)	Cost: The cost for implementing oxidation technologies in the dissolved phase plumes has not been determined. The cost per year for monitored natural attenuation essentially would be the same under both the current planned end state and RBES; however, the duration of the monitoring/ attenuation period could differ between the current planned end state (hundreds of years) and the RBES (potentially thousands of years). Schedule: Under the current planned end state, the construction and performance of the plume actions would be implemented by 2019 with associated monitoring/attenuation potentially continuing for decades. Additionally, any actions to address the dissolved phase plumes under the current planned end state would need to follow source actions to be cost-effective. (See V-1.2 and V-1.3). Under the RBES, no additional construction beyond installation of additional monitoring wells would be required; however, monitoring/ attenuation potentially could continue for thousands of years. Risk: The only variance in risk between the current planned end state and the RBES is the amount of time necessary to achieve MCLs. The PGDP Water Policy and/or enhanced institutional controls would eliminate risks to the public from TCE and other solvents in the dissolved phase plumes under both end states. The current planned end state could reduce the length of time that the PGDP Water Policy or enhanced institutional controls would have to remain in effect depending on the extent and effectiveness of plume treatment. Note, however, that the oxidation technologies would not address other potential contaminants found in groundwater in on-site areas at PGDP (i.e., metals and radionuclides). Implementation of oxidation technologies would result in exposures of remediation workers to contaminated groundwater, as well as physical hazards. Workers involved in disposal of materials contaminated during implementation of the action could also be exposed. Finally, samplers involved in groundwater monitoring activities could also be exposed. Except for risks to samplers, the magnitude of these risks has not been estimated at this time.	in a "reasonable" timeframe (e.g., = 100 years); however, even with source reduction, it would take hundreds of years to reach MCLs. (Without source reduction, the period potentially could be thousands of years.) Despite national performance data indicating that no technologies currently exist that can reduce TCE and solvent concentrations in large plumes to MCLs within a reasonable time frame, the regulators' position is that TI waivers would only be available after a demonstrated, site-specific technology failure. The regulators' position is that the current fence line (located well inside the property boundary) should be used as the point of exposure.	

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Risks under the RBES are limited to samplers involved in groundwater monitoring activities. An assessment of these risks under current sampling protocols determined that risks to samplers are at *de minimis* levels[c].		
V-1.5	**Current Planned End State**: Actions to reduce solvent concentrations in groundwater discharged to surface water or control these discharges **RBES**: Continued monitoring of surface water concentrations at discharge point	Scope: The current planned end state assumes implementation of measures to reduce the solvent concentrations in the groundwater discharged to Little Bayou Creek and/or measures to control these discharges followed by monitoring. The RBES assumes continued monitoring. Cost: The cost of measures to reduce concentration in discharges and/or control discharges under the current planned end state has not been determined. Monitoring costs per year essentially would be the same under both the current planned end state and the RBES. Schedule: A schedule for implementation of the current planned end state actions is not available. However, the duration of monitoring under both the end states would be similar unless source and plume actions are taken. (See V-1.2, V-1.3, and V-1.4.) Risk: Screening human health and ecological risk assessments have determined that risks at the discharge point are at *de minimis* levels[c] for recreational user and ecological receptors. Modeling has indicated that contaminant concentrations could increase in the future, but these results and estimates of risks derived using them are uncertain. A baseline risk assessment has not been completed. Implementation of a technology to attenuate or control discharges would result in increased risks to remediation workers. Additionally, damage to the environment at the discharge point during implementation could lead to increased ecological risks. Finally, samplers involved in monitoring activities could be exposed. The magnitude of these risks has not been estimated at this time. Risks under the RBES are limited to samplers involved in monitoring activities. The magnitude of these risks has not been estimated at this time.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to either attain an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level.	Initiate further discussions with the public and regulators.
Hazard Area 2: Surface Water Operable Unit				
V-2.1	**Current Planned End State**:	Scope: The current planned end state assumes excavation of contaminated source sediments and soils to levels that achieve a target risk of 1E-06	Commonwealth of Kentucky regulators'	Initiate further discussions with the

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
	Excavation of source sediments and soils **RBES**: Excavation of sediments and soils "hot spots"	under a residential scenario and a PCB concentration of 1 ppm. The RBES assumes excavations of "hot spots" in sediment and soil using a target risk and PCB concentration consistent with the agreed future land use. (All parties have agreed that future land use of areas currently in the industrialized areas of PGDP is industrial and that the future use of areas currently outside of the industrialized areas but on DOE property is recreational.) Therefore, under the RBES, the action in industrial areas would achieve a target risk of 1E-04 to a worker and a PCB concentration of 25 ppm. The action in recreational areas would achieve a target risk of 1E-04 to a recreational user and a PCB concentration of 1 ppm. Cost: Based on existing PCB and ^{238}U sampling results, approximately 7 to 17 times as much soil and sediment would be required to be removed under the current planned end state cleanup target than under the RBES cleanup target, resulting in a cost variance of proportional size. Because many areas have not been fully characterized, there is a high degree of uncertainty in this estimate. Schedule: The investigation of the SWOU is ongoing. The completion dates under the current planned end state and RBES are 2021 and 2017, respectively. Risk: Under the current state, the only potential risks posed by sediment and soils to humans are from direct contact by industrial workers and recreational users with these media. However, these risks are currently mitigated through institutional and access controls that limit exposure. Ecological receptors could be at risk in some industrial and non-industrial areas; however, a baseline ecological risk assessment confirming this has not been completed. Potential risk in all areas under the current planned end state would be reduced to E-06 using a residential scenario in industrial and recreational areas. Additionally, protection of ecological receptors would be demonstrated by an ecological risk assessment. Potential risk under the RBES would be reduced to a value falling within EPA's acceptable risk range for site-related exposures (i.e., E-06 to E-04) using a worker scenario for industrial areas and a recreational user scenario in recreational	position is that Kentucky policy requires cleanup actions either to attain an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level. Commonwealth of Kentucky regulators' position is that Kentucky policy requires that cleanup of PCBs in soils and sediments located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		areas. Additionally, protection of ecological receptors would be demonstrated by an ecological risk assessment. Risks during excavation and disposal under both the current planned end state and RBES would affect remediation workers, general site workers, transportation workers (off-site disposal anticipated), landfill workers, the public, and ecological receptors. The magnitude of these risks under the current planned end state and RBES have not been assessed at this time; however, because a greater amount of material would be excavated under the current planned end state than under the RBES, risks to all receptors would be expected to be greater under the current planned end state than under the RBES.		
V-2.2	**Current Planned End State**: Construction of basins to control sediment migration **RBES**: No basins with "hot spot" removal (see V-2.1)	Scope: Under the current planned end state, construction of two basins to control sediment migration to areas outside the industrialized portions of the site is planned. Under the RBES, no basins are planned because "hot spot" removal would prevent migration of contaminated material. Cost: The variance between constructing and maintaining basins under the current planned end state and not constructing the basins under the RBES is estimated to range from $7,000,000 to $11,000,000. Schedule: The investigation to determine if sediment control basins for control of sediment migration are needed is ongoing. The decision for their construction will follow completion of that investigation. A completion date for construction would be selected as part of a decision to construct basins. Risk: An analysis of the potential impact of contaminant migration from on-site ditches to recreational use areas under current conditions determined that direct contact risks to recreational users and workers were at *de minimis* levels[c]. Under the current planned end state, remediation workers would be exposed to physical hazards during construction of the basins; however, risks from exposure to contamination would be at *de minimis* levels[c] because the basins would be constructed in clean areas. Additionally, ecological receptors would be at risk due to habitat disruption.	Lack of representative data to make the appropriate decision.	Complete investigation and risk assessment to determine if risks from migration of contaminants require action. Initiate further discussions with the public and regulators following completion of the investigation/ evaluation.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Under the RBES, construction would not occur, and no receptors would be at risk.		
Hazard Area 3: Burial Grounds Operable Unit (Group 1)				
V-3.1	**Current Planned End State**: Excavation of burial grounds **RBES**: Capping of burial grounds with access controls	Scope: Under the current planned end state, certain burial grounds are to be excavated and materials disposed of in an off-site location. Under the RBES, these burial grounds are capped to limit exposure, and the caps are maintained, including monitoring. For both end states, the goal of the action is to reduce risk to workers by eliminating or limiting exposure to contamination associated with the burial grounds. Cost: The variance between the cost of excavating the burial grounds and disposing of the materials off-site under the current planned end state versus capping and monitoring the burial grounds under the RBES is estimated to range from $185,000,000 to $298,000,000. Schedule: The source action under the current planned end state would be completed by 2030. Capping under the RBES would be complete by 2019. Monitoring under the RBES could continue for several decades. Risk: The only potential risks posed to humans are from direct contact at the burial ground by on-site industrial workers. Risks are driven by the presence of uranium isotopes, arsenic, PAHs, and PCBs in surface soils; however, current access controls mitigate risk from direct contact by on-site industrial workers. Screening ecological risk assessments determined that ecological risks for contact at the burial grounds were at *de minimis* levels[c] assuming future industrial use of the areas encompassing the burial grounds. Excavation of the burial grounds would result in substantial risks to remediation workers through direct contact with wastes. Additionally, general site workers could be put at risk from exposure through inhalation of resuspended dust and vapors during excavation. Potential risks to the public and ecological receptors would also be increased during transportation of waste to the off-site disposal location. Finally, samplers involved in monitoring activities could be exposed. The magnitude of these risks has not been estimated at this time.	It is the regulators' position that capping and access controls are inadequate to achieve long-term protectiveness for *in situ* management of contamination at burial grounds; therefore, their preference is to remove the burial grounds to achieve long-term protectiveness. It is the regulators' position that existing data are insufficient to characterize the contents and releases from the burial grounds.	Conduct investigation to better characterize the burial grounds. Initiate further discussions with the public and regulators following completion of the investigation/ evaluation.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Capping of the burial grounds under the RBES would result in potential risks to remediation workers through direct contact with surface soil at the burial grounds. Samplers involved in monitoring activities could also be at risk of exposure. The magnitude of these risks has not been estimated at this time. Note that risks to remediation and general site workers would be smaller under the RBES than under the current planned end state because, under the RBES, waste would not be dug up and moved, and the duration of the activity would be shorter.		
Hazard Area 4: Surface Soils Operable Unit				
V-4.1	**Current Planned End State**: Excavation of soil **RBES**: Excavation of soil "hot spots"	Scope: The current planned end state assumes excavation of contaminated soil to levels that achieve a target risk of 1E-06 under a residential scenario and a PCB concentration of 1 ppm. The RBES assumes excavations of "hot spots" in soil using a target risk of 1E-04 under a worker scenario, the most likely future use of the affected areas per past agreements with the regulators and the public. The PCB concentration target under the RBES would be 25 ppm. Cost: Based on existing PCB and ^{238}U sampling results, approximately 7 to 17 times as much soil would need to be removed under the current planned end state cleanup target than under the RBES cleanup target, resulting a cost variance of proportional size. Because many areas have not been fully characterized, there is a high degree of uncertainty in this estimate. Schedule: The investigation of the SSOU is not complete. For the current planned end state, the completion date is 2019. For the RBES, the completion date is 2015. Risk: Under the current state, the only potential risks posed by surface soils are from direct contact by on-site industrial workers. However, these risks are currently mitigated through institutional and access controls that limit exposure. The ecological risks were determined to be at *de minimis* levels[c] as long as the area remains industrial.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to either attain an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level. Commonwealth of Kentucky regulators' position is that Kentucky policy requires that cleanup of PCBs in soils and sediments located in industrial areas must attain 1 ppm (as opposed to federal	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Potential risk under the current planned end state would be reduced to E-06 using a residential scenario in an industrial area. Potential risk under the RBES would be reduced to a value falling within EPA's acceptable risk range for site-related exposures (i.e., E-06 to E-04) using a worker scenario for these industrial areas. Risks during excavation and disposal under both the current planned end state and RBES would affect remediation workers, general site workers, transportation workers (off-site disposal anticipated), landfill workers, and the public. The magnitude of these risks under the current planned end state and RBES have not been assessed at this time; however, because a greater amount of material would be excavated under the current planned end state than under the RBES, risks over the duration of the response action likely would be greater under the current planned end state than under the RBES.	TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	
Hazard Area 5: Permitted Landfills				
V-5.1	**Current Planned End State**: No construction of potential CERCLA Cell; continued off-site disposal of CERCLA-derived waste **RBES**: Potential construction of CERCLA Cell; on-site disposal of CERCLA-derived waste	Scope: The current planned end state does not include the potential construction of a CERCLA Cell for on-site disposal of CERCLA-derived wastes. The RBES includes the potential construction of such a facility. Cost: The cost estimates for on-site disposal of CERCLA-derived waste, which would include the construction, operation, maintenance, and monitoring of a potential CERCLA Cell under the RBES are not complete. It is uncertain if these costs would be less than those incurred under the current planned end state, which considers transporting and disposing of CERCLA-derived waste at an off-site location. Schedule: The schedule for completing the evaluation of the cost-effectiveness and construction of a potential CERCLA Cell has not been established. Risk: No risk assessments have been completed for a potential CERCLA Cell because this would be a newly constructed facility. However, off-site disposal of waste under the current planned end state potentially could expose transportation workers and the public to waste during transportation and landfill workers during disposal. On-site disposal of waste under the	Commonwealth of Kentucky's regulators' position is that site conditions (e.g., seismic conditions and climate) are not appropriate for construction of a potential CERCLA Cell. Commonwealth of Kentucky's regulators' position is that CERCLA-derived waste should not remain at PGDP. Regulators' position is that additional data is required to justify the on-site disposal of	Complete technical evaluation. Continue discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		RBES could expose remediation workers and landfill workers; exposure to the public would be minimized through access controls at a CERCLA Cell. Under the RBES, potential risks from exposure to CERCLA-derived waste could be greater because this waste would remain onsite; however, the potential risks to workers, recreational users, and the public from on-site disposal would be minimized by the engineered barriers (i.e., capping and leachate collection system) and access controls included in the potential CERCLA Cell design. Additionally, potential risks from environmental contamination across the site associated with soils, sediments, and GDP infrastructure could be lower because more of these materials may be removed and disposed of in a potential CERCLA Cell, where the chance of uncontrolled contact would be minimized.	CERCLA-derived waste in a potential CERCLA Cell.	
Hazard Area 6: Burial Grounds Operable Unit (Group 2)				
V-6.1	**Current Planned End State**: Continuation of PGDP Water Policy **RBES**: Enhanced institutional controls	Scope: The current planned end state includes continuation of the current PGDP Water Policy[a]. The RBES includes enhanced institutional controls[b], which would supercede the current PGDP Water Policy. Under both end states, the goal would be to reduce risks to residents from exposure to groundwater to *de minimis* levels[c]. Cost: The cost variance has not been determined to date. The current PGDP Water Policy costs range from $70,000 to $100,000 per year. Depending upon the specific enhanced institutional controls, the cost variance of the enhanced institutional controls could include some cost avoidance (if the PGDP Water Policy is terminated). However, the implementation of enhanced institutional controls would include costs for acquisition of rights to restrict groundwater use and continued monitoring to ensure continued long-term effectiveness of the enhanced institutional controls. Schedule: The PGDP Water Policy currently is in place. Implementation of the enhanced institutional controls would be a future planned CERCLA response action. Risk: The expected risk variance is zero under both the PGDP Water Policy and enhanced institutional controls because each would prevent exposure to contaminated groundwater, resulting in no risk. Enhanced	DOE policy may limit options available under the enhanced institutional controls.	Initiate further discussions with the public and regulators. Revisit DOE policy.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		institutional controls, however, would be more sustainable and, therefore, would result in greater long-term effectiveness because they would involve legally enforceable property restrictions and deed notices. (The agreements with landowners under the PGDP Water Policy do not restrict groundwater use, but only commit DOE to provide municipal water to replace the groundwater in return for the property owner's commitment not to use the groundwater. Thus, current or future property-owners could return to using groundwater in the home, completing this exposure pathway and potentially raising risk from *de minimis* levels[c].)		
Hazard Area 7: Legacy Waste and DOE Material Storage Areas				
V-7.1	**Current Planned End State**: Excavation of soil and/or decontamination of surface areas. **RBES**: Excavation of soil and/or decontamination of surface areas.	Scope: Upon completion of characterization and disposition of all wastes and debris contained in legacy waste storage areas and DMSAs, those areas that are discovered to contain hazardous waste will be subject to the closure requirements outlined in the Agreed Order and/or RCRA Permit. Under the current planned end state, the Agreed Order provides that "final clean closure" of any underlying soils and/or surface areas must achieve a 1E-06 and hazard index of 1 under a residential scenario without use of institutional controls or engineering barriers and a PCB target level of 1 ppm. Under the RBES, excavation of any contaminated soils and/or decontamination of surface areas would target a 1E-04 and hazard index of 1 under an industrial scenario in accordance with CERCLA and a PCB target level of 25 ppm, with the option of using institutional controls or engineering barriers. Cost: Because characterization of the DMSAs and legacy waste storage areas is not complete, any potential impacts to underlying soils and/or surfaces are not known at this time; therefore, estimated costs are not available. Schedule: The Agreed Order requires characterization to be complete for all DMSAs by 2009. The Agreed Order also defines timeframes for submittal of closure plans after completion of characterization for those DMSAs and waste storage areas determined to contain hazardous wastes.	The Agreed Order provides that "final clean closure" of any underlying soils and/or surface areas must achieve a 1E-06 and hazard index of 1 under a residential scenario without use of institutional controls or engineering barriers. It's the Commonwealth of Kentucky's position that cleanup of PCBs in soils located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for	Continue discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Risk: Under the current state, the only potential risks posed by surface soils and/or surface areas are from direct contact by on-site industrial workers. Characterization data collected to date indicates that these direct contact risks may approach *de minimis* levels[c]. Additionally, any risks are mitigated through institutional and access controls that limit exposure. No ecological risk assessment is available. Potential risk under the current planned end state would be reduced to E-06 using a residential scenario in industrial areas. Potential risk under the RBES would be reduced to a value falling between E-06 and E-04 using an industrial scenario. Excavation and/or decontamination activities under both the current planned end state and RBES would pose a potential risk to remediation workers, general site workers, transportation workers (off-site disposal anticipated), landfill workers, the public, and ecological receptors. The magnitude of these risks under the current planned end state and RBES have not been assessed at this time; however, because a greater amount of material potentially would be available for exposure under the current planned end state than under the RBES, risks over the duration of the response action likely would be greater under the current planned end state than under the RBES.	"high occupancy areas" if covered by a cap with institutional controls).	
Hazard Area 8: Cylinder Yards and DUF_6 Conversion Facility				
V-8.1	**Current Planned End State**: Excavation of soil **RBES**: Excavation of soil "hot spots"	Scope: The current planned end state assumes excavation of contaminated soils following completion of the DUF_6 conversion mission to levels that achieve a target risk of 1E-06 under a residential scenario and a PCB concentration of 1 ppm. The RBES assumes excavation of "hot spots" in soil using a target risk of 1E-04 under a worker scenario, the most likely future use of the affected areas per past agreements with the regulators and the public. The PCB concentration under the RBES would be 25 ppm. Cost: Based on existing PCB and ^{238}U sampling results, approximately 7 to 17 times as much soil would need to be removed under the current planned end state cleanup target than under the RBES cleanup target, resulting a cost variance of proportional size. Because many areas have not been fully characterized, there is a high degree of uncertainty in this estimate.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to attain either an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level.	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Schedule: No schedule is available because the conversion mission is expected to last for decades. Risk: Under the current state, the only potential risks posed by surface soils are from direct contact by on-site industrial workers. However, these risks are currently mitigated through institutional and access controls that limit exposure. The ecological risks are expected to be at *de minimis* levels[c] as long as the area remains industrial. Potential risk under the current planned end state would be reduced to E-06 using a residential scenario in an industrial area. Potential risk under the RBES would be reduced to a value falling within EPA's acceptable risk range for site-related exposures (i.e., E-06 to E-04) using a worker scenario for these industrial areas. Risks during excavation under both the current planned end state and RBES would affect remediation workers, general site workers, transportation workers (off-site disposal anticipated), landfill workers, and the public. The magnitude of these risks under the current planned end state and RBES have not been assessed at this time; however, because a greater amount of material would be excavated under the current planned end state than under the RBES, risks over the duration of the response action likely would be greater under the current planned end state than under the RBES.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires that cleanup of PCBs in soils and sediments located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	
Hazard Area 9: GDP Facilities				
V-9.1	**Current Planned End State**: Continuation of PGDP Water Policy **RBES**: Enhanced institutional controls	Scope: The current planned end state includes continuation of the current PGDP Water Policy[a]. The RBES includes enhanced institutional controls[b], which would supercede the current PGDP Water Policy. Under both end states, the goal would be to reduce risks to residents from exposure to groundwater to *de minimis* levels[c]. Cost: The cost variance has not been determined to date. The current PGDP Water Policy costs range from $70,000 to $100,000 per year. Depending upon the specific enhanced institutional controls, the cost variance of the enhanced institutional controls could include some cost avoidance (if the PGDP Water Policy is terminated). However, the implementation of enhanced institutional controls would include costs for	DOE policy may limit options available under the enhanced institutional controls.	Initiate further discussions with the public and regulators. Revisit DOE policy.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		acquisition of rights to restrict groundwater use and continued monitoring to ensure continued long-term effectiveness of the enhanced institutional controls. Schedule: The PGDP Water Policy is currently in place. Implementation of the enhanced institutional controls would be a future planned CERCLA response action. Risk: The expected risk variance is zero under both the PGDP Water Policy and enhanced institutional controls because each would prevent exposure to contaminated groundwater, resulting in no risk. Enhanced institutional controls, however, would be more sustainable and, therefore, would result in greater long-term effectiveness because they would involve legally enforceable property restrictions and deed notices. (The agreements with landowners under the PGDP Water Policy do not restrict groundwater use but only commit DOE to provide municipal water to replace the groundwater in return for the property owner's commitment not to use the groundwater. Thus, current or future property-owners could return to using groundwater in the home, completing this exposure pathway and potentially raising risk from *de minimis* levels[c].)		
V-9.2	**Current Planned End State**: Excavation of soil **RBES**: Excavation of soil "hot spots"	Scope: Excavation of contaminated soils is planned under both the current planned end state and RBES as part of D&D of the GDP. The current planned end state assumes excavation of contaminated soils to levels that achieve a target risk of 1E-06 under a residential scenario and a PCB concentration of 1 ppm. The RBES assumes excavation of "hot spots" in soil using a target risk of 1E-04 under a worker scenario, the most likely future use of the affected areas per past agreements with the regulators and the public. The PCB concentration under the RBES would be 25 ppm. Cost: Based on existing PCB and ^{238}U sampling results, approximately 7 to 17 times as much soil would need to be removed under the current planned end state cleanup target than under the RBES cleanup target, resulting in a cost variance of proportional size. However, because most areas associated with GDP D&D have not been fully characterized, there is a very high degree of uncertainty in this estimate.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to attain either an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level. Commonwealth of Kentucky regulators' position is that	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		Schedule: The schedule for GDP D&D and the subsequent Comprehensive Site Operable Unit (CSOU) will be determined 6 months before GDP shutdown. Risk: Under the current state, the only potential risks posed by surface soils are from direct contact by on-site industrial workers. However, these risks are currently mitigated through institutional and access controls that limit exposure. The ecological risks likely are at *de minimis* levels[c] because the GDP facilities are in industrialized areas of PGDP. Potential risk under the current planned end state would be reduced to E-06 using a residential scenario in industrial areas. Potential risk under the RBES would be reduced to a value falling within EPA's acceptable risk range for site-related exposures (i.e., E-06 to E-04) using a worker scenario for these industrial areas. Risks during excavation under both the current planned end state and RBES would affect remediation workers, general site workers, transportation workers (off-site disposal anticipated), landfill workers, the public, and ecological receptors. The magnitude of these risks under the current planned end state and RBES have not been assessed at this time; however, because a greater amount of material would be excavated under the current planned end state than under the RBES, risks over the duration of the response action would likely be greater under the current planned end state than under the RBES.	Kentucky policy requires that cleanup of PCBs in soils and sediments located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	
V-9.3	**Current Planned End State**: Treatment to attain source reduction **RBES**: Monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1.1)	Scope: The current planned end state assumes implementation of DNAPL source reduction actions using *in situ* heating technologies in combination with monitored natural attenuation as part of D&D of the GDP or as part of the CSOU. The RBES does not assume source actions and consists solely of monitored natural attenuation with a point of exposure established at the DOE property boundary or at a downgradient location in accordance with the requirements of CERCLA. Cost: The combined costs of implementing *in situ* heating technology at the DNAPL source areas associated with D&D of the GDP are unknown. The cost per year for monitored natural attenuation would be essentially the same under both the current planned end state and RBES; however, the	The regulators' position is that monitored natural attenuation would need to be supplemented by source actions to reduce contaminant concentrations to MCLs in a "reasonable" timeframe (e.g., = 100 years); however, even with source reduction, it would take hundreds of	Initiate further discussions with the public and regulators.

Table 5.1 (continued)

ID. No.	Description of Variance	Impacts	Barriers in Achieving RBES	Recommendations
		duration of the monitoring/ attenuation period could differ between the current planned end state (hundreds of years) and the RBES (potentially thousands of years). Schedule: The schedule for GDP D&D and the subsequent CSOU will be determined 6 months before GDP shutdown. Risk: The only variance in risk between the current planned end state and the RBES is the amount of time necessary to achieve MCLs. The PGDP Water Policy and/or enhanced institutional controls would eliminate risks to the public from off-site migration of DNAPL under both end states. However, the current planned end state could reduce the amount of time necessary to meet MCLs, thereby shortening the time period that the PGDP Water Policy or enhanced institutional controls would have to remain in effect. Implementation of *in situ* heating technology under the current planned end state could result in exposures of remediation workers to contaminated soil and groundwater and, potentially, gases, as well as physical hazards. Implementation of the source action could pose a risk of exposure to gases to general plant workers. Workers involved in disposal of materials contaminated during implementation of the source action could also be exposed. Finally, samplers involved in groundwater monitoring activities could be exposed. Except for risks to samplers, the magnitude of these risks has not been estimated at this time. Risks under the RBES are limited to samplers involved in groundwater monitoring activities. An assessment of these risks under current sampling protocols determined that risks to samplers are at *de minimis* levels[c].	years to reach MCLs. (Without source reduction, the period potentially could be thousands of years.) Despite national performance data indicating that no technologies currently exist that can reduce DNAPLs in source areas to MCLs within a "reasonable" period, the regulators' position is that TI waivers would only be available after a demonstrated, site-specific technology failure. The regulators' position is that the current fence line (located well inside the property boundary) should be used as the point of exposure.	

[a] The PGDP Water Policy is a removal action instituted to limit the use of potentially contaminated groundwater by off-site residences. This policy is discussed in *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1201&D2, United States Department of Energy, Paducah, KY, June 1994 (DOE 1994).

[b] Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.

[c] "*De minimis*" levels of risk, as used here, are defined as risks determined to be at or below the lower limit of EPA's acceptable risk range for site-related exposures (i.e., E-06) by the receptor(s) mentioned.

Table 5.2 Variance report over hazard areas[a]

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
V-1	**Current Planned End State:** Continuation of PGDP Water Policy **RBES:** Enhanced institutional controls **Hazard Areas Affected:** 1: Groundwater OU 6: Burial Grounds OU (Group 2) 9: GDP Facilities	Scope: The current planned end state includes continuation of the current PGDP Water Policy[b]. The RBES includes enhanced institutional controls[c], which would supercede the current PGDP Water Policy. Under both end states, the goal would be to reduce risks to residents from exposure to groundwater to *de minimis* levels[d].	DOE policy may limit options available under the enhanced institutional controls.	Initiate further discussions with the public and regulators. Revisit DOE policy.
V-2	**Current Planned End State:** Treatment to attain source reduction **RBES:** Monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1) **Hazard Areas Affected:** 1: Groundwater OU 9: GDP Facilities	Scope: The current planned end state assumes implementation of DNAPL source reduction actions using *in situ* heating technologies in combination with monitored natural attenuation. The RBES does not assume source actions and consists solely of monitored natural attenuation with a point of exposure established at the DOE property boundary or at a downgradient location in accordance with the requirements of CERCLA.	The regulators' position is that monitored natural attenuation would need to be supplemented by source actions to reduce contaminant concentrations to MCLs in a "reasonable" timeframe (e.g., = 100 years); however, even with source reduction, it would take hundreds of years to reach MCLs. (Without source reduction, the period potentially could be thousands of years.) Despite national performance data indicating that no technologies currently exist that can reduce DNAPLs in source areas to MCLs within a "reasonable" period, the regulators' position is that technical impractability (TI) waivers would only be available after a demonstrated, site-specific technology failure.	Initiate further discussions with the public and regulators.

Table 5.2 (continued)

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
			The regulators' position is that the current fence line (located well inside the property boundary) should be used as the point of exposure.	
V-3	**Current Planned End State:** Excavation to remove suspected sources of groundwater contamination at burial grounds **RBES:** Capping and monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1) **Hazard Areas Affected:** 1: Groundwater OU	Scope: The current planned end state assumes complete excavation of two burial grounds (C-749 Uranium Burial Ground and C-747 Contaminated Burial Yard) suspected to be sources of groundwater contamination, subsequent off-site disposal of excavated materials, and monitoring to determine the effectiveness of source removal. The RBES assumes capping and monitoring for these burial grounds.	It is the regulators' position that capping, access controls, and/or enhanced institutional controls are inadequate to achieve long-term protectiveness for *in situ* management of contamination at burial grounds; therefore, their preference is to remove the burial grounds to prevent them from serving as long-term sources of groundwater contamination.	Initiate further discussions with the public and regulators.
V-4	**Current Planned End State:** Treatment to reduce contaminant concentrations in the dissolved phase plume **RBES:** Monitored natural attenuation (with either PGDP Water Policy or enhanced institutional controls; see V-1)	Scope: The current planned end state assumes implementation of oxidation technologies (e.g., C-Sparge™) to remove TCE and other solvents from the dissolved phase plumes followed by monitored natural attenuation. The RBES does not assume plume actions and consists solely of monitored natural attenuation.	The regulators' position is that monitored natural attenuation would need to be supplemented by source actions to reduce contaminant concentrations to MCLs in a "reasonable" timeframe (e.g., = 100 years); however, even with source reduction, it would take hundreds of years to reach MCLs. (Without source reduction, the period potentially could be thousands of years.) Despite national performance data indicating that no technologies currently exist that can reduce TCE and solvent	Initiate further discussions with the public and regulators.

Table 5.2 (continued)

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
	Hazard Areas Affected: 1: Groundwater OU		concentrations in large plumes to MCLs within a reasonable time frame, the regulators' position is that TI waivers would only be available after a demonstrated, site-specific technology failure. The regulators' position is that the current fence line (located well inside the property boundary) should be used as the point of exposure.	
V-5	**Current Planned End State:** Actions to reduce solvent concentrations in groundwater discharged to surface water and/or control these discharges **RBES:** Continued monitoring of surface water concentrations at discharge point **Hazard Areas Affected:** 1: Groundwater OU	Scope: The current planned end state assumes implementation of measures to reduce the solvent concentrations in the groundwater discharged to Little Bayou Creek and/or measures to control these discharges followed by monitoring. The RBES assumes continued monitoring.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to either attain an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level.	Initiate further discussions with the public and regulators.
V-6	**Current Planned End State:** Excavation of source areas **RBES:** Excavation of soil or sediment "hot spots"	Scope: The current planned end state assumes excavation of contaminated source sediments and soils to levels that achieve a target risk of 1E-06 under a residential scenario and a PCB concentration of 1 ppm in all areas. The RBES assumes excavations of "hot spots" in sediment and soil using a	Commonwealth of Kentucky regulators' position is that Kentucky policy requires cleanup actions to either attain an E-06 risk assuming residential exposure or be supplemented with institutional controls and/or engineering barriers to attain that risk level.	Initiate further discussions with the public and regulators.

Table 5.2 (continued)

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
	Hazard Areas Affected: 2: Surface Water OU 4. Surface Soils OU 8: Cylinder Yards and DUF_6 Conversion Facility 9: GDP Facilities	target risk and PCB concentration consistent with the agreed future land use. (All parties have agreed that future land use of areas currently in the industrialized areas of PGDP is industrial and that the future use of areas currently outside of the industrialized areas, but on DOE property, is recreational.) Therefore, under the RBES, the action in industrial areas would achieve a target risk of 1E-04 to a worker and a PCB concentration of 25 ppm. The action in recreational areas would achieve a target risk of 1E-04 to a recreational user and a PCB concentration of 1 ppm.	Commonwealth of Kentucky regulators' position is that Kentucky policy requires that cleanup of PCBs in soils and sediments located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas] =1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	
V-7	**Current Planned End State**: Construction of basins to control sediment migration **RBES**: No basins, with "hot spot" removal (see V-2.1) **Hazard Areas Affected:** 2: Surface Water OU	Scope: Under the current planned end state, construction of two basins to control sediment migration to areas outside the industrialized portions of the site is planned. Under the RBES, no basins are planned because "hot spot" removal would prevent migration of contaminated material.	Lack of representative data to make the appropriate decision.	Complete investigation and risk assessment to determine if risks from migration of contaminants require action. Initiate further discussions with the public and regulators following completion of the investigation/ evaluation.
V-8	**Current Planned End State:** Excavation of burial grounds **RBES:** Capping of burial grounds, with access controls	Scope: Under the current planned end state, certain burial grounds are to be excavated and materials disposed of in an off-site location. Under the RBES, these burial grounds are capped to limit exposure, and the caps are maintained, including monitoring. For both end states, the goal of the action is to reduce	It is the regulators' position that capping and access controls are inadequate to achieve long-term protectiveness for *in situ* management of contamination at burial grounds; therefore, their preference is to remove the burial grounds to achieve long-term protectiveness.	Conduct investigation to better characterize the burial grounds. Initiate further discussions with the public and regulators following completion of the investigation/ evaluation.

Table 5.2 (continued)

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
	Hazard Areas Affected: 3: Burial Grounds OU (Group 1)	risk to workers by eliminating or limiting exposure to contamination associated with the burial grounds.	It is the regulators' position that existing data are insufficient to characterize the contents and releases from the burial grounds.	
V-9	**Current Planned End State:** No construction of potential CERCLA Cell; continued off-site disposal of CERCLA-derived waste **RBES:** Potential construction of CERCLA Cell; on-site disposal of CERCLA-derived waste **Hazard Areas Affected:** 5: Permitted Landfills	Scope: The current planned end state does not include the potential construction of a CERCLA Cell for on-site disposal of CERCLA-derived wastes. The RBES includes the potential construction of such a facility.	Commonwealth of Kentucky's regulators' position is that site conditions (e.g., seismic conditions and climate) are not appropriate for construction of a potential CERCLA Cell. Commonwealth of Kentucky;s regulators' position is that CERCLA-derived waste should not remain at PGDP. Regulators' position is that additional data is required to justify the on-site disposal of CERCLA-derived waste in a potential CERCLA Cell.	Complete technical evaluation. Continue discussions with the public and regulators.
V-10	**Current Planned End State**: Excavation of soil and/or decontamination of surface areas. **RBES**: Excavation of soil and/or decontamination of surface areas.	Scope: Upon completion of characterization and disposition of all wastes and debris contained in legacy waste storage areas and DMSAs, those areas that are discovered to contain hazardous waste will be subject to the closure requirements outlined in the Agreed Order and/or RCRA Permit. Under the current planned end state, the Agreed Order provides that "final clean closure" of any underlying soils and/or surface areas must achieve a 1E-06 and hazard index of 1 under a residential scenario without use of institutional controls or	The Agreed Order provides that "final clean closure" of any underlying soils and/or surface areas must achieve a 1E-06 and hazard index of 1 under a residential scenario without use of institutional controls or engineering barriers. It's the Commonwealth of Kentucky's position that cleanup of PCBs in soils located in industrial areas must attain 1 ppm (as opposed to federal TSCA regulations allowing =25 ppm for "low occupancy areas" [e.g., industrial areas]	Continue discussions with the public and regulators.

Table 5.2 (continued)

ID. No.	Description of Variance/Hazard Areas Affected	Impacts	Barriers in Achieving RBES	Recommendations
	Hazard Areas Affected: 7: Legacy Waste and DOE Material Storage Areas	engineering barriers and a PCB target level of 1 ppm. Under the RBES, excavation of any contaminated soils and/or decontamination of surface areas would target a 1E-04 and hazard index of 1 under an industrial scenario in accordance with CERCLA and a PCB target level of 25 ppm, with the option of using institutional controls or engineering barriers.	=1 ppm for "high occupancy areas" [e.g., residential areas], and >1 ppm to = 10 ppm for "high occupancy areas" if covered by a cap with institutional controls).	

[a] In this table, the "Impact" discussion is limited to the discussion of scope. Additional impact information (i.e., schedule, cost, and risk) is not discussed because these differ between hazard areas for some variances. Please see Table 5.1 for a discussion of the schedule, cost, and risk impacts of variances upon individual hazard areas.

[b] The PGDP Water Policy is a removal action instituted to limit the use of potentially contaminated groundwater by off-site residences. This policy is discussed in *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1201&D2, United States Department of Energy, Paducah, KY, June 1994 (DOE 1994).

[c] Enhanced institutional controls under the RBES would be implemented on both DOE- and non-DOE-owned property. These controls could range from implementation of legal agreements with surrounding landowners to place enforceable restrictions on groundwater use to DOE's acquiring rights from surrounding property owners and directly implementing restrictions on groundwater and property use.

[d] "*De minimis*" levels of risk, as used here, are defined as risks determined to be at or below the lower limit of EPA's acceptable risk range for site-related exposures (i.e., E-06) by the receptor(s) mentioned.

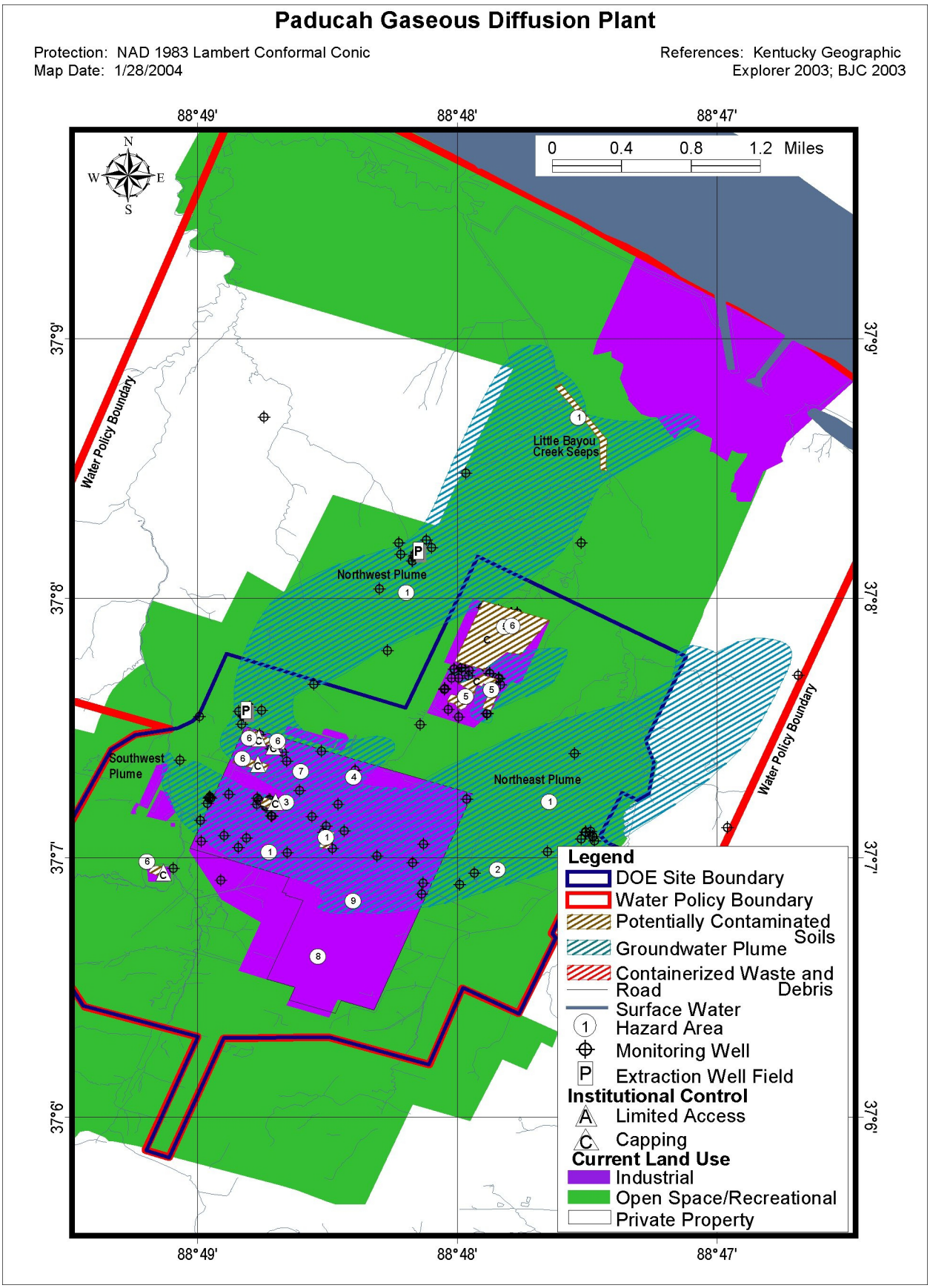


Fig. 5.0c1. Hazard areas – currently planned end state.

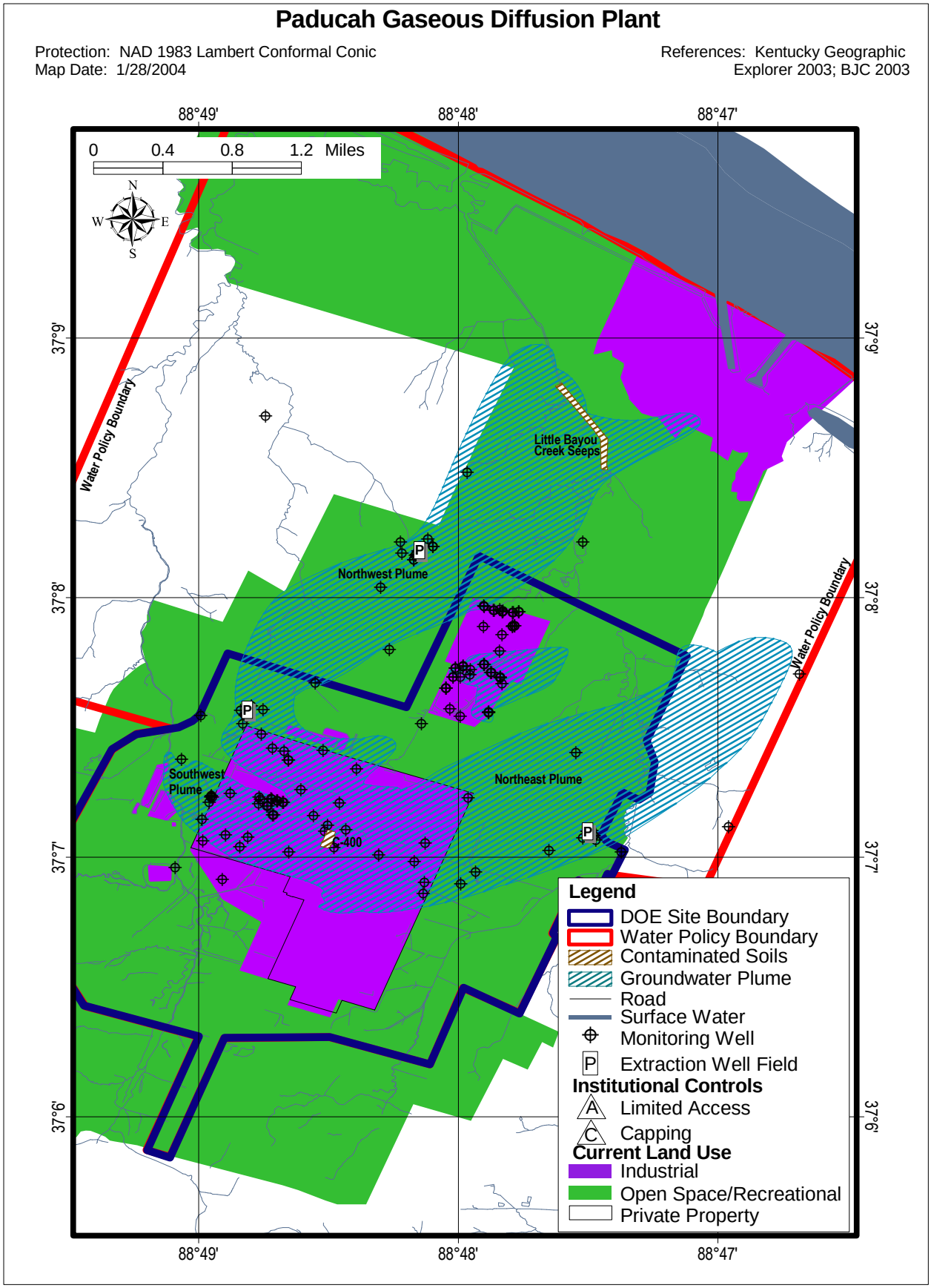
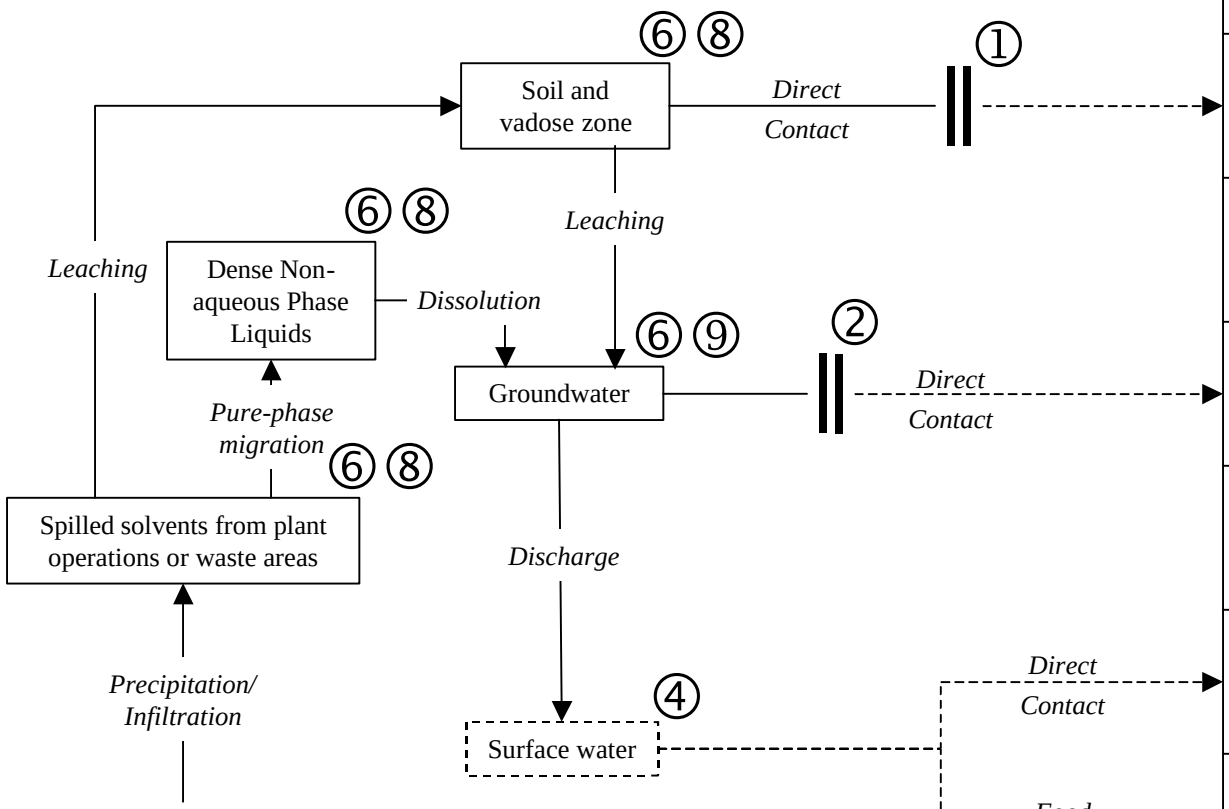


Fig. 5.1c1. Hazard Area 1: Groundwater OU – currently planned end state.

Hazard Area 1: Groundwater Operable Unit – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			
R/F/D/I	F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

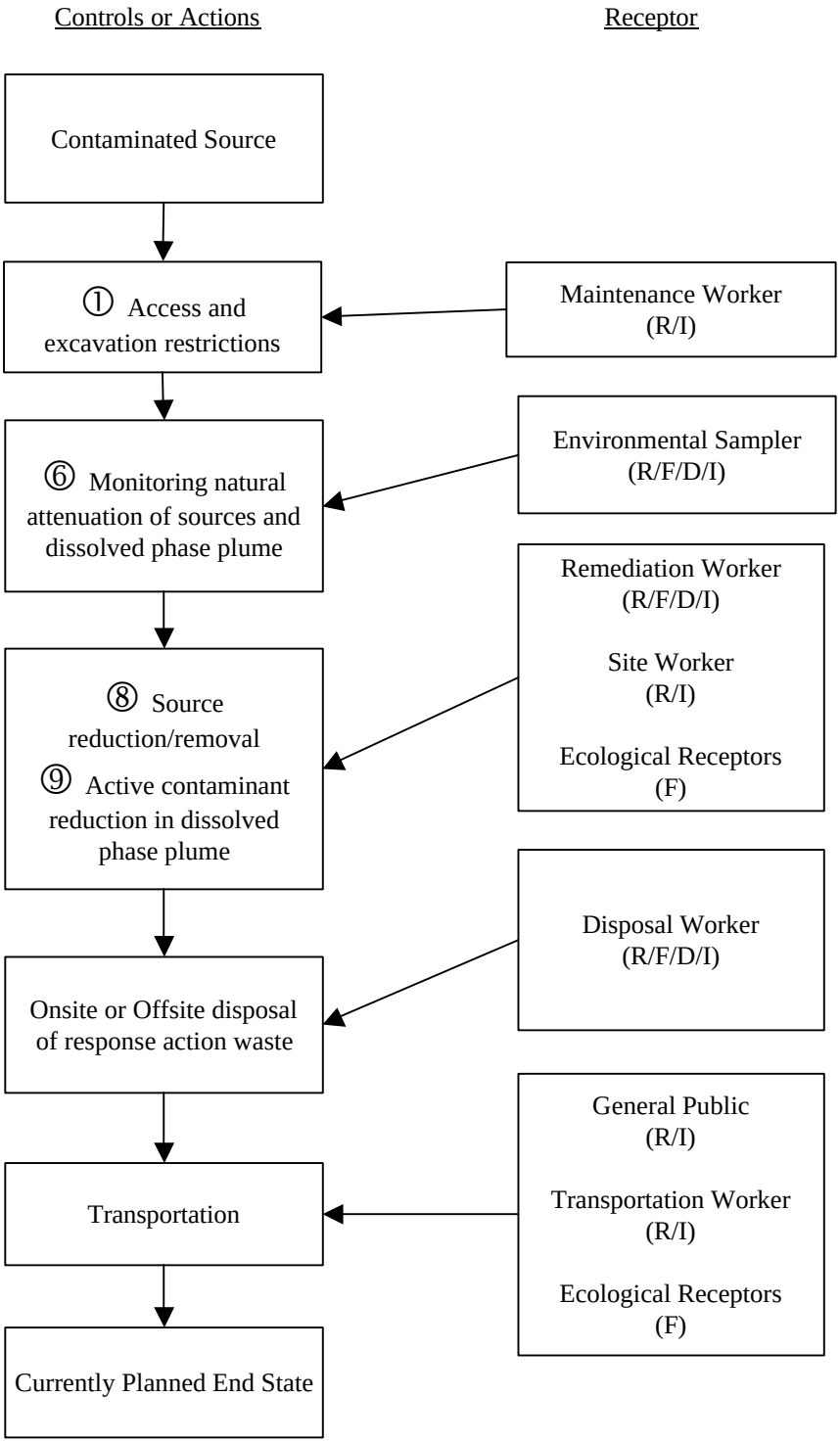
Current Planned Controls or Actions
① Access and excavation restrictions.
② PGDP Water Policy.
④ Natural attenuation.
⑥ Monitored natural attenuation of sources and dissolved phase plume.
⑧ Source reduction/removal.
⑨ Active contaminant reduction in dissolved phase plume

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.1c2. Hazard Area 1: Groundwater OU CSM – currently planned end state.

Hazard Area 1: Groundwater OU treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.1c3. Hazard Area 1: Groundwater OU treatment train – currently planned end state.

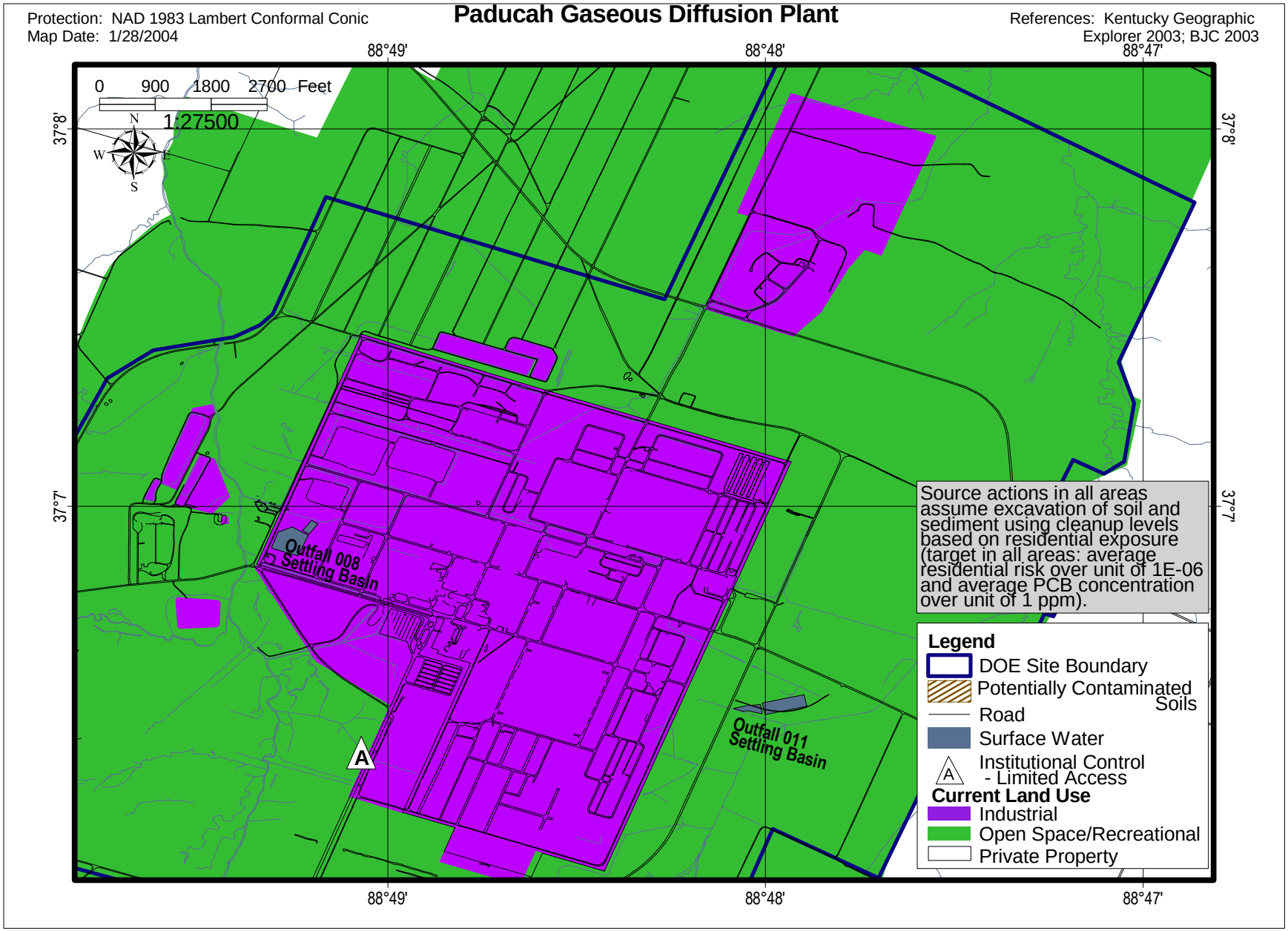
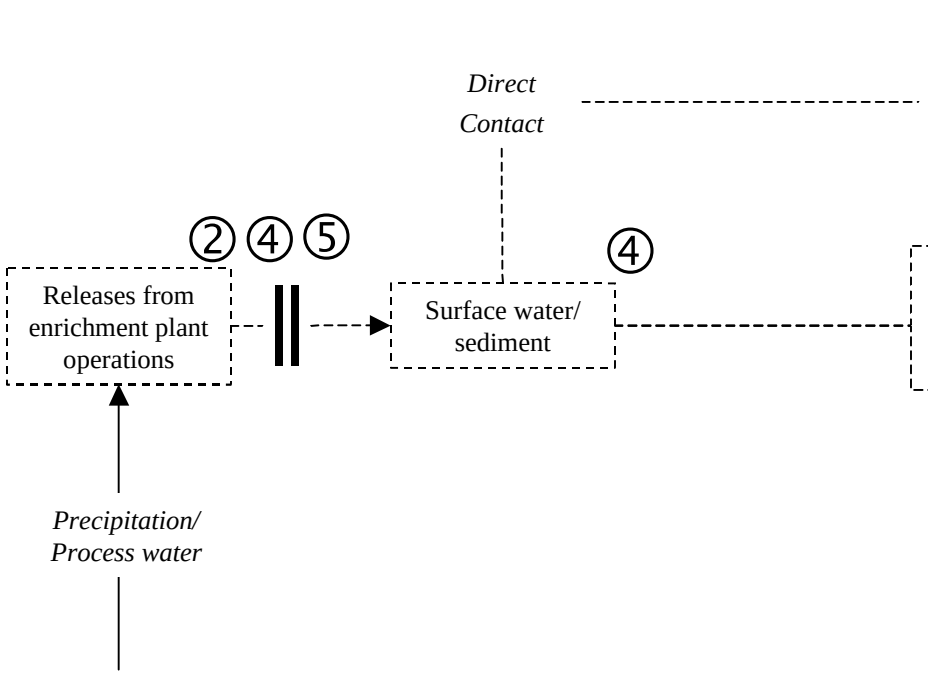


Fig. 5.2c1. Hazard Area 2: Surface water OU – currently planned end state.

Hazard Area 2: Surface Water Operable Unit – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
F/D/I		F/D/I	F/D/I
	F	F	F

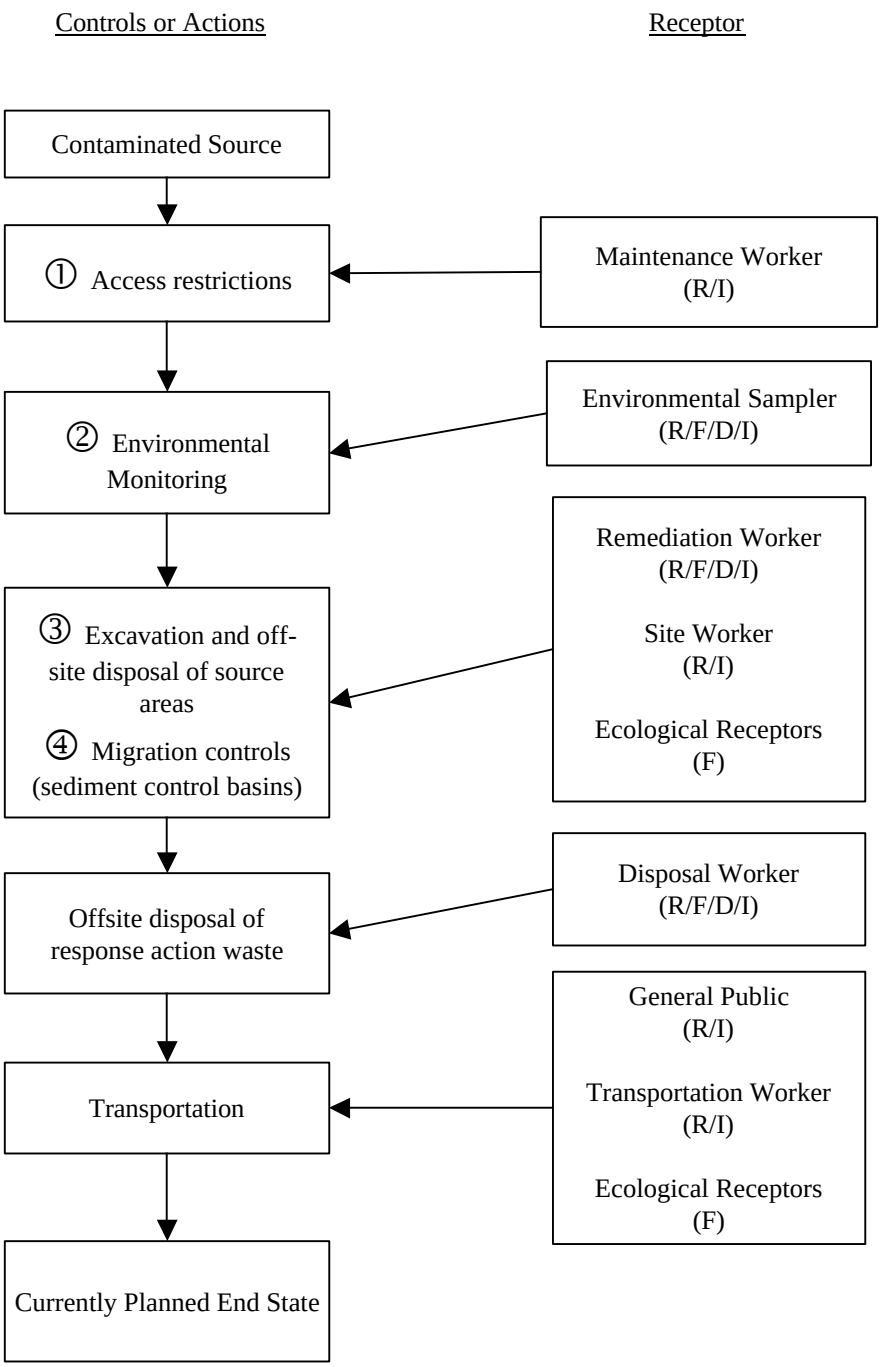
Current Planned Controls and Action
① Access restrictions.
② Environmental monitoring.
④ Scrap removal and excavation of source areas (target in all areas based on average exposure over entire unit:residential risk of 1E-06, PCBs at 1 ppm).
⑤ Migration controls (sediment control basins).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.2c2. Hazard Area 2: Surface water OU CSM – currently planned end state.

Hazard Area 2: Surface water OU treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.2c3. Hazard Area 2: Surface water OU treatment train – currently planned end state.

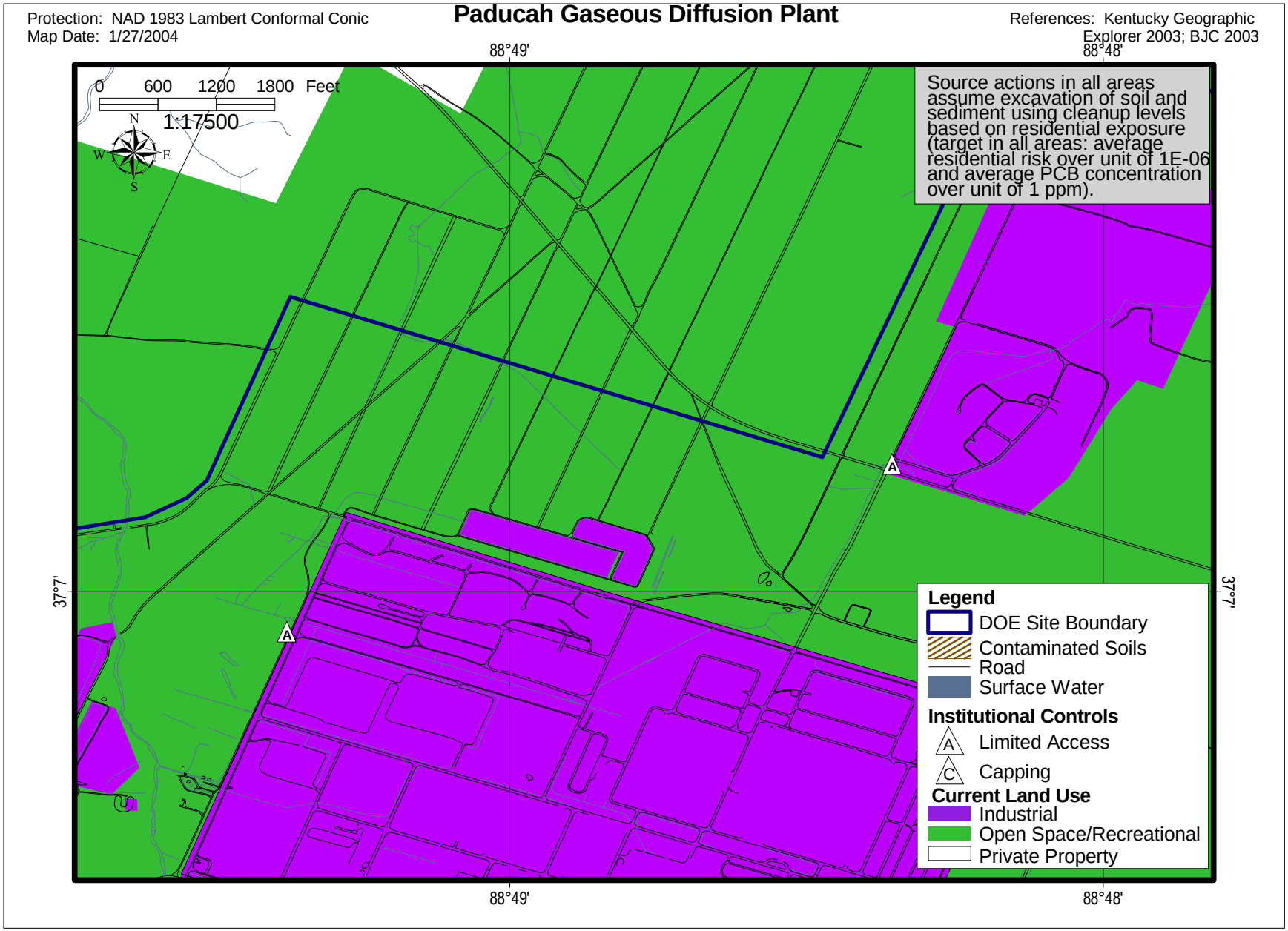
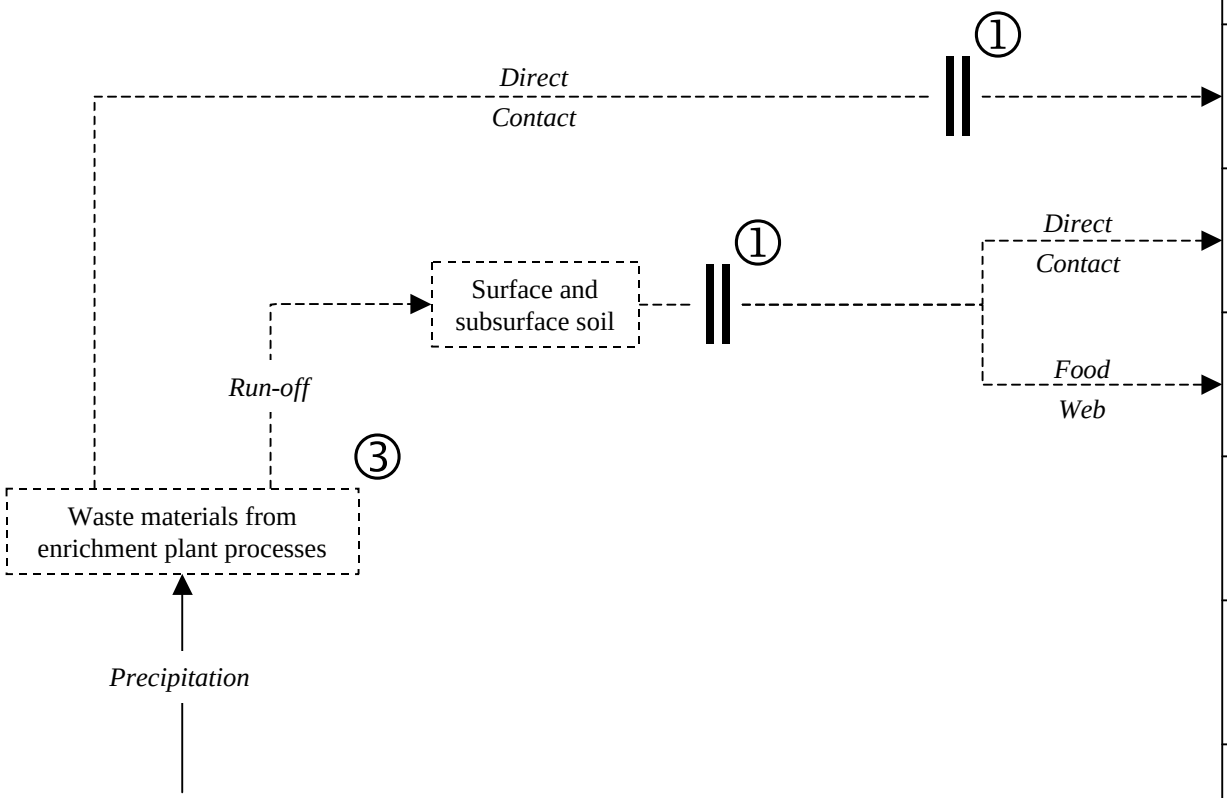


Fig. 5.3c1. Hazard Area 3. Burial grounds OU (Group 1) – currently planned end state.

Hazard Area 3: Burial Grounds Operable Unit (Group 1) – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
			F

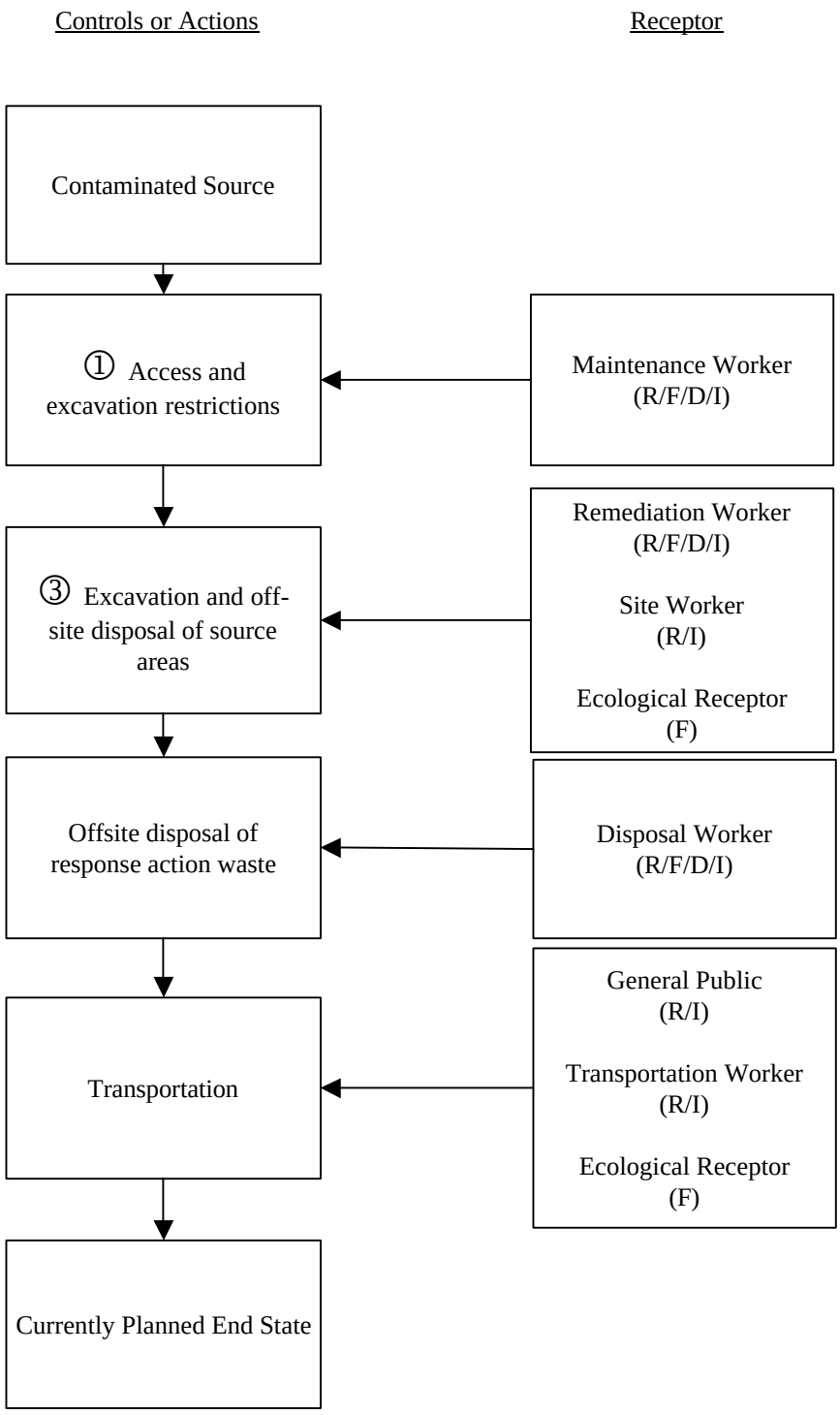
Current Planned Controls and Actions
① Access and excavation restrictions.
③ Excavation of burial grounds.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.3c2. Hazard Area 3: Burial grounds OU (Group 1) CSM – currently planned end state.

Hazard Area 3: Burial Grounds OU (Group 1) treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.3c3. Hazard Area 3: Burial grounds OU (Group 1) treatment train – currently planned end state.

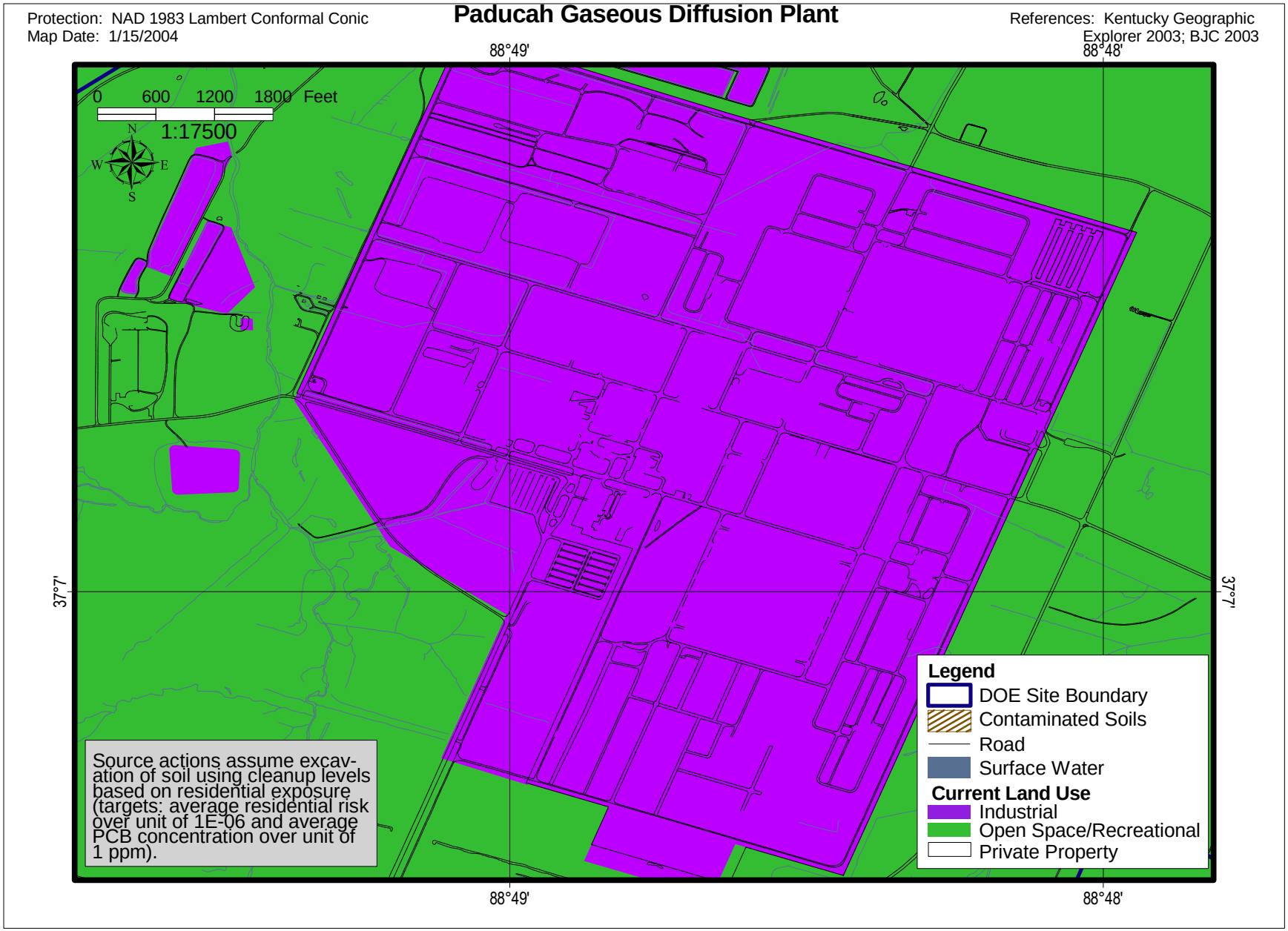
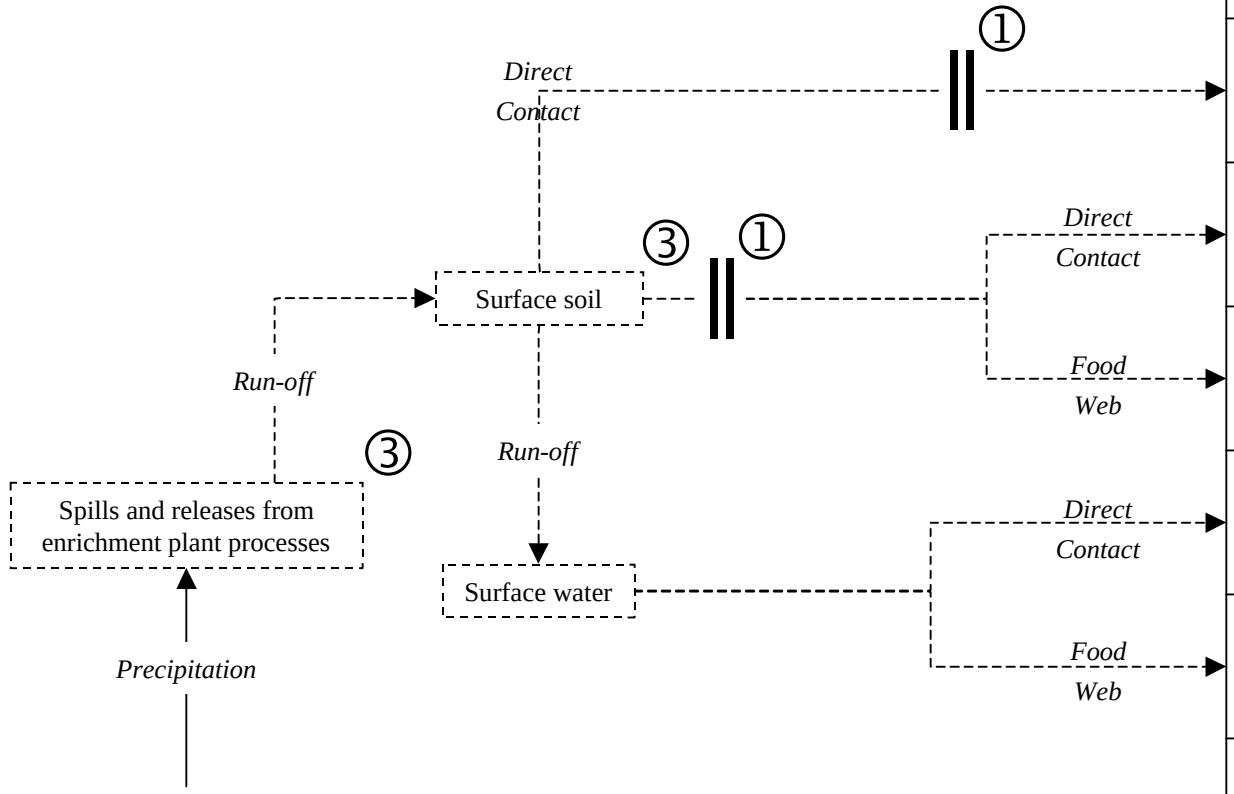


Fig. 5.4c1. Hazard Area 4: Surface soils OU – currently planned end state.

Hazard Area 4: Surface Soils Operable Unit – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
F/D/I		F/D/I	F/D/I
	F	F	F

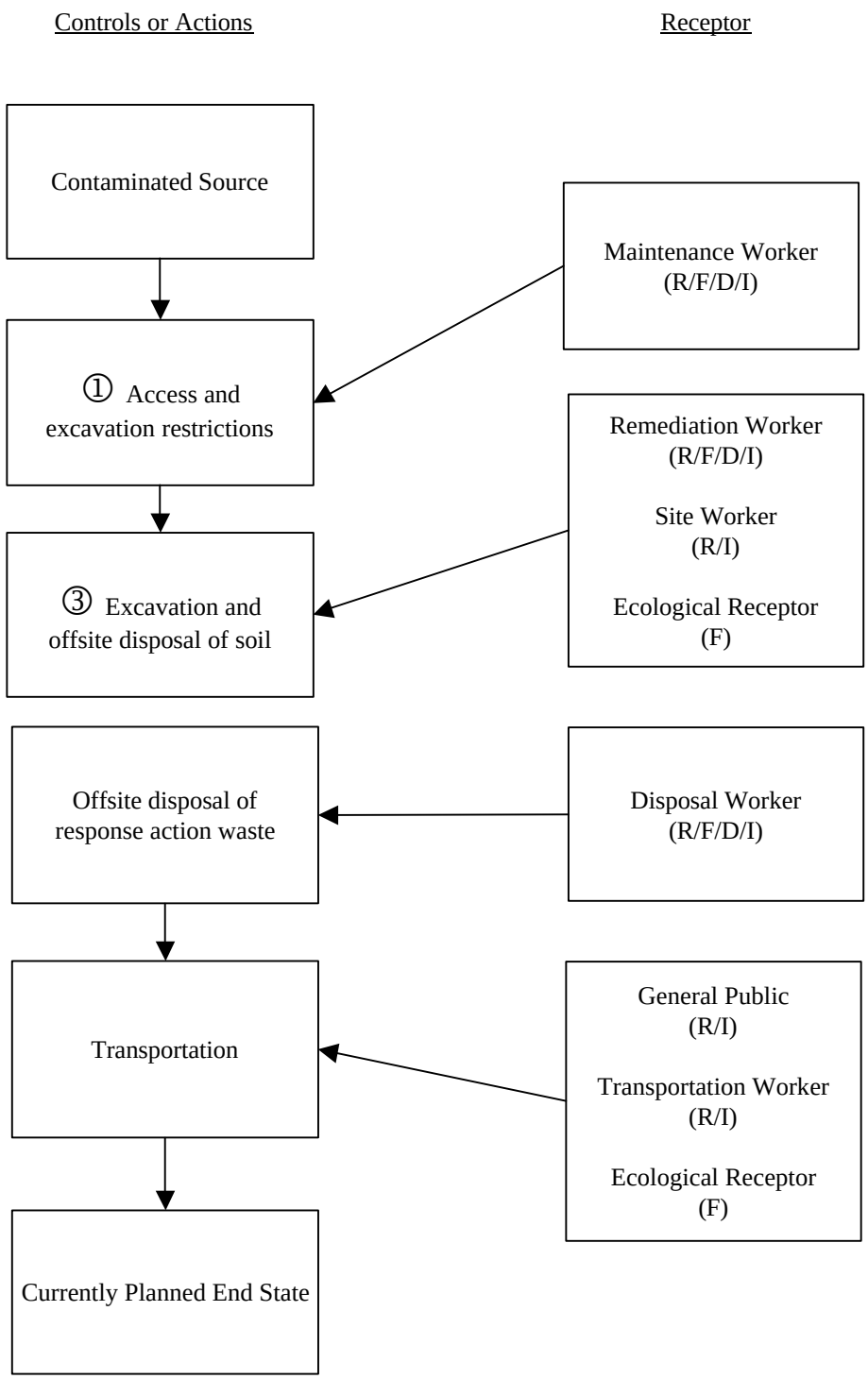
Current Planned Controls and Actions
① Access and excavation restrictions.
③ Excavation of soil (target based on average exposure over entire unit: residential risk of 1E-06, PCBs at 1 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.4c2. Hazard Area 4: Surface soils OU CSM – currently planned end state.

Hazard Area 4: Surface soils OU treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.4c3. Hazard Area 4: Surface soils OU treatment train – currently planned end state.

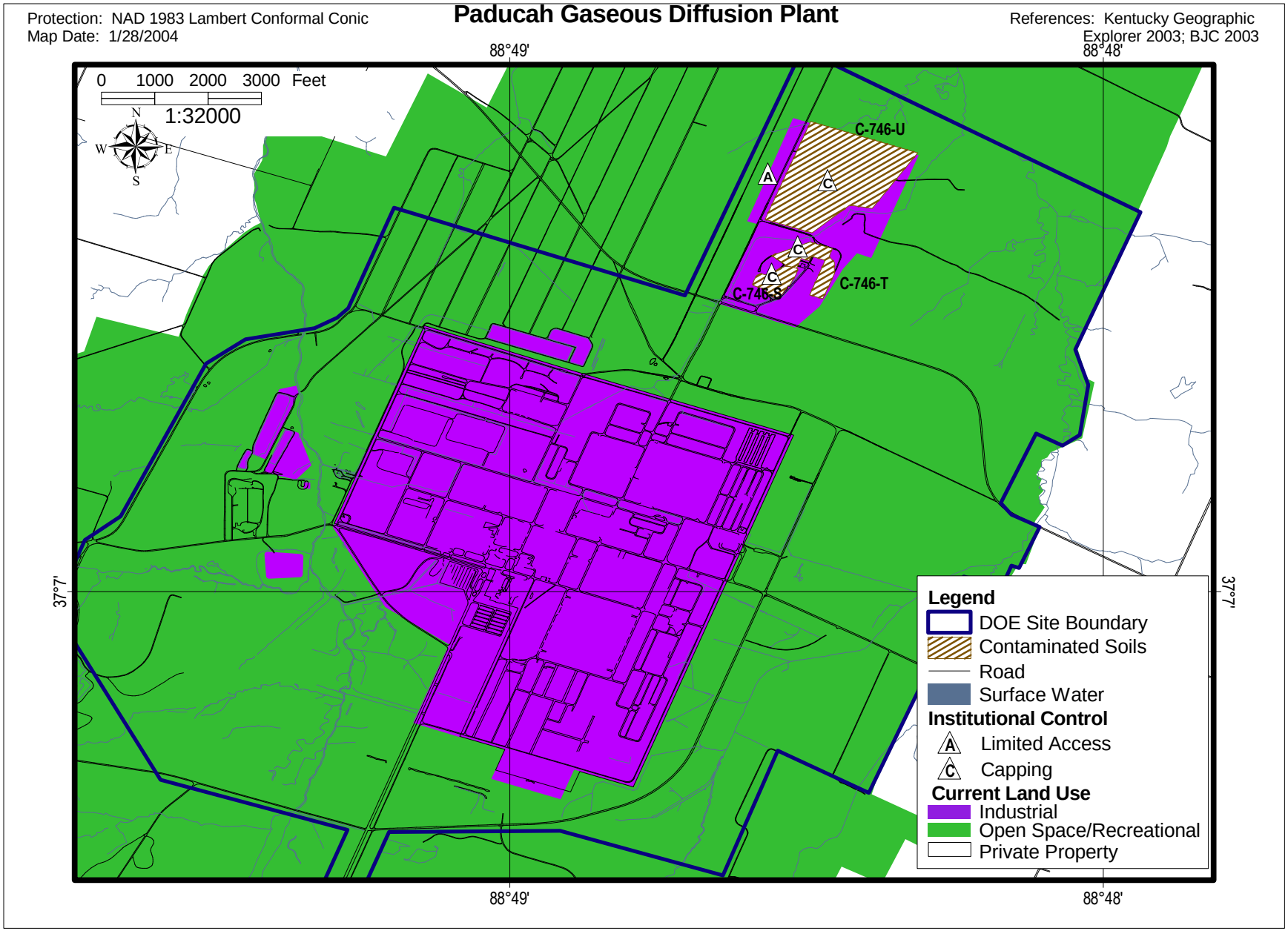
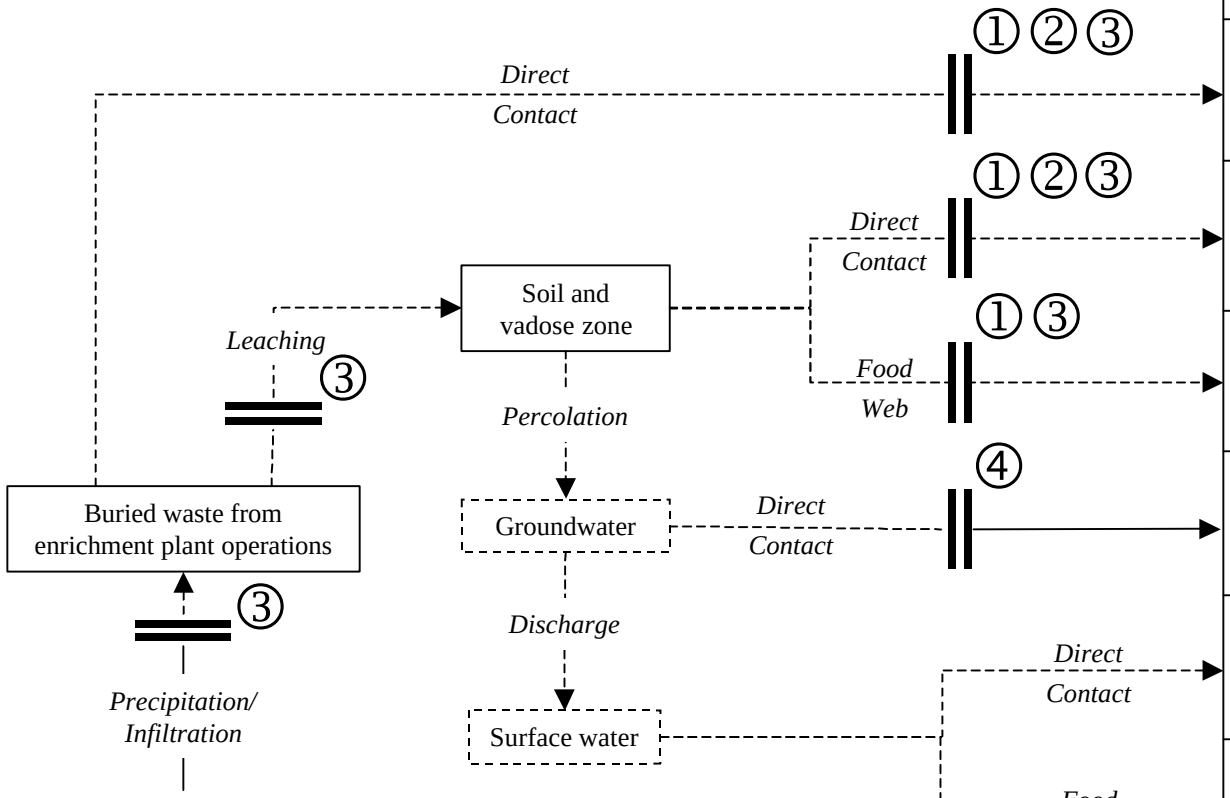


Fig. 5.5c1. Hazard Area 5: Permitted Landfills – currently planned end state.

Hazard Area 5 Permitted Landfills – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

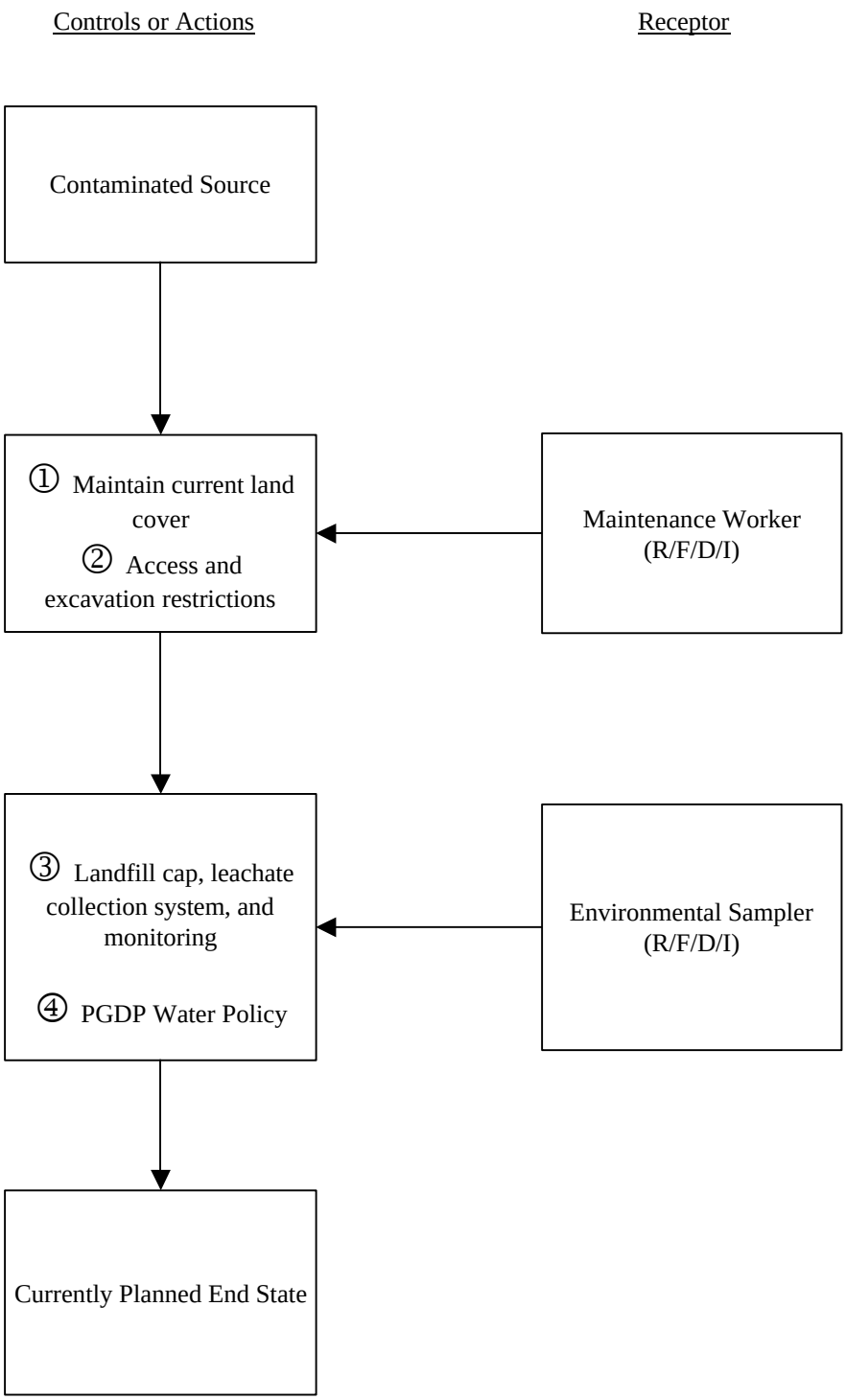
Current Planned Controls and Actions
① Current land cover.
② Access and excavation restrictions
③ Landfill cap, leachate collection system, and monitoring.
④ PGDP Water Policy.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.5c2. Hazard Area 5: Permitted Landfills CSM – currently planned end state.

Hazard Area 5: Permitted landfills treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.5c3. Hazard Area 5: Permitted Landfills treatment train – currently planned end state.

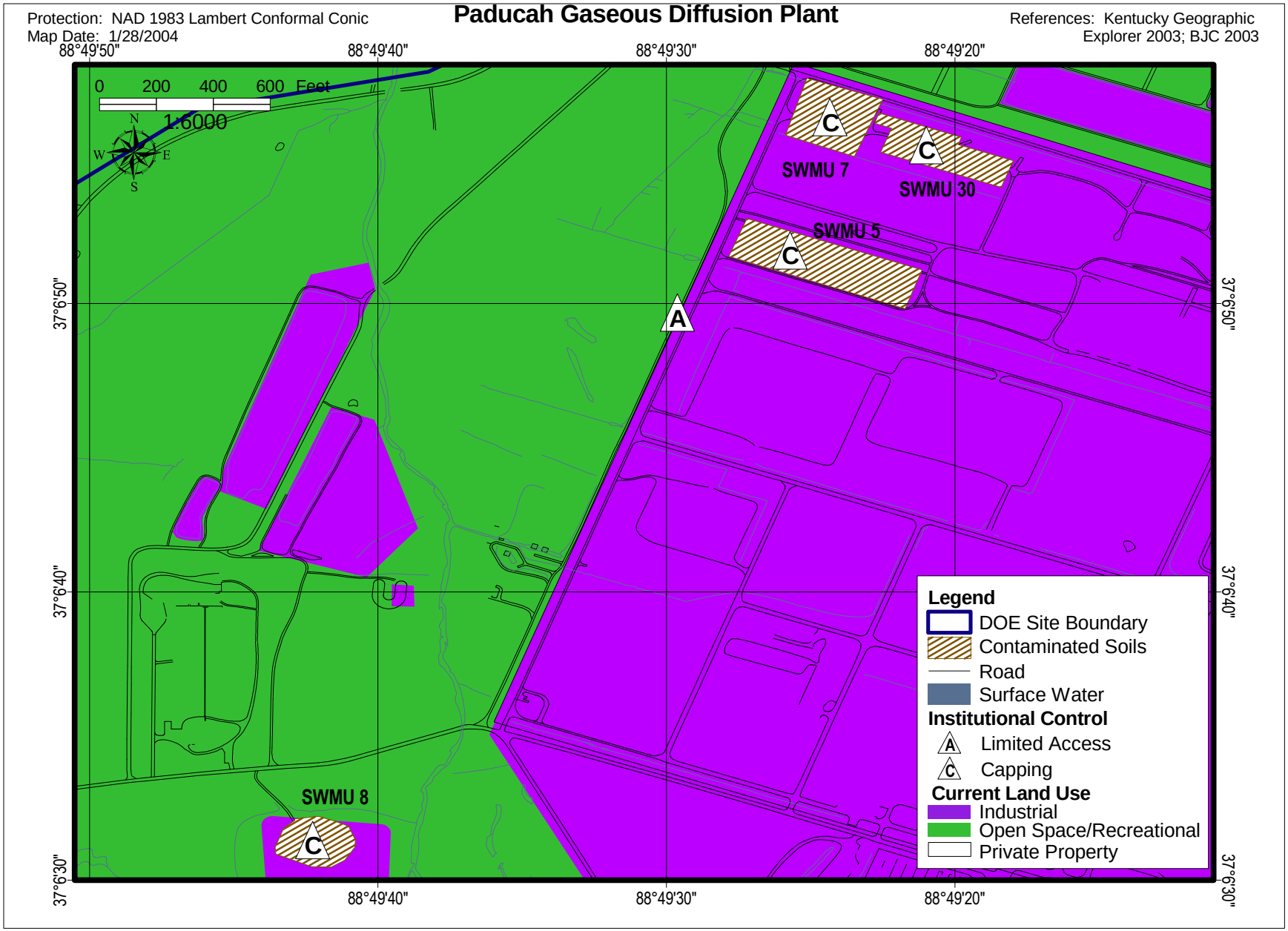
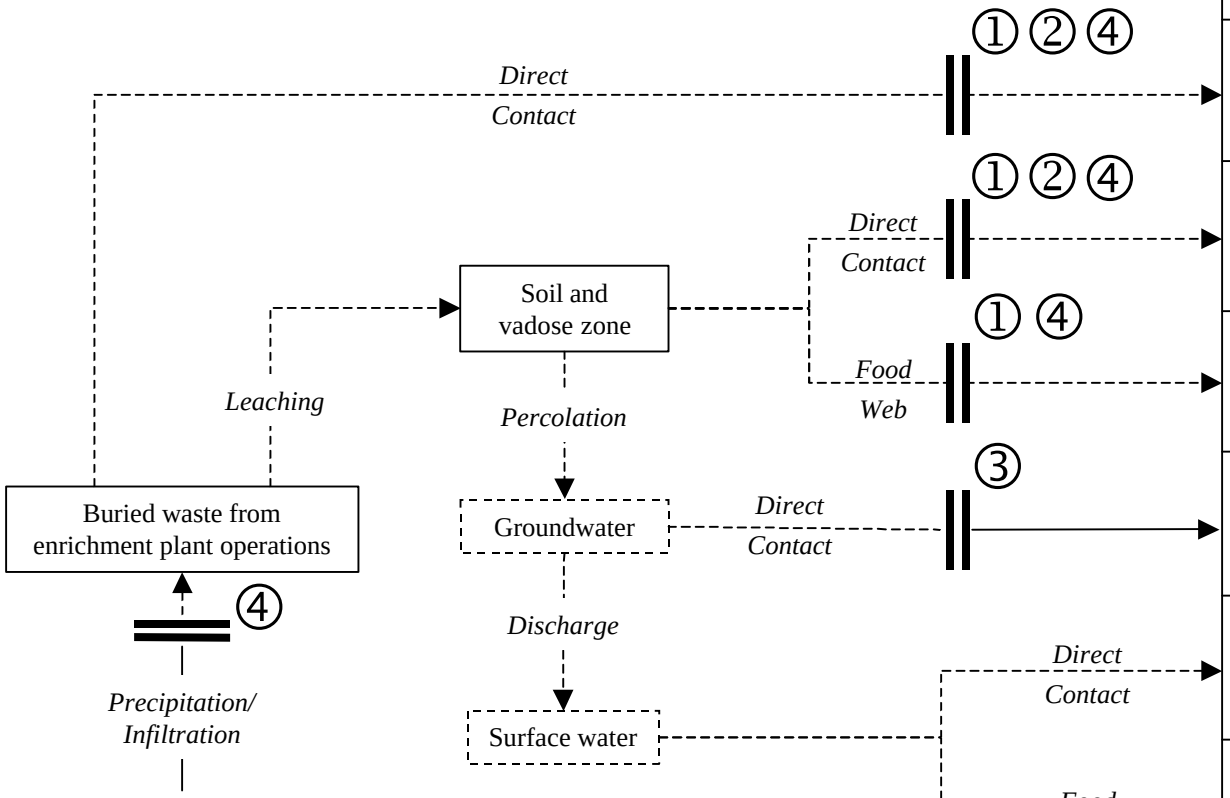


Fig. 5.6c1. Hazard Area 6. Burial grounds OU (Group 2) - currently planned end state.

Hazard Area 6 Burial Grounds Operable Unit (Group 2) – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
		F	F
R/F/D/I	R/F/D/I		
F/D/I		F/D/I	F/D/I
	F	F	F

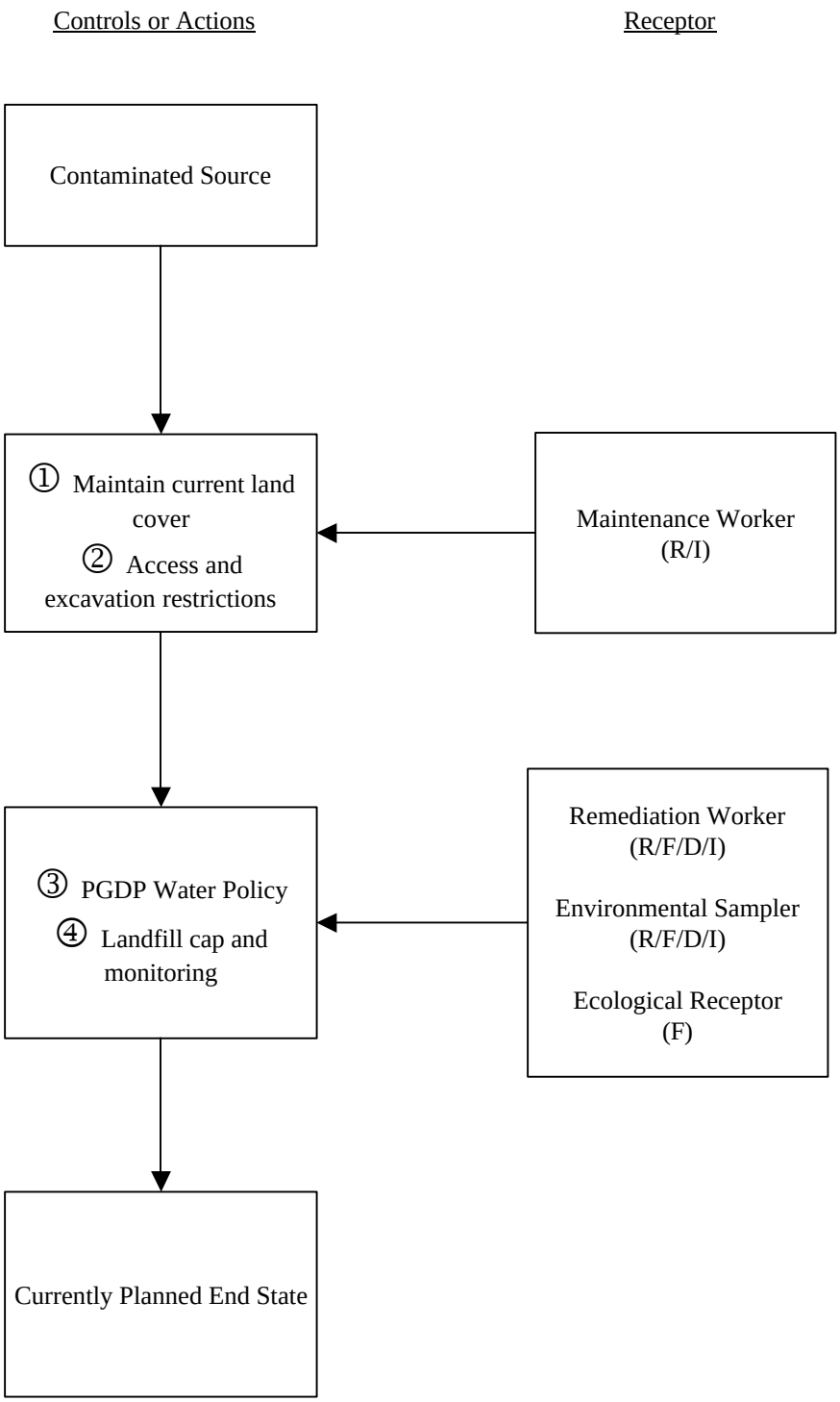
Current Planned Controls and Actions
① Current land cover.
② Access and excavation restrictions
③ PGDP Water Policy.
④ Landfill cap and monitoring.

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.6c2. Hazard Area 6: Burial grounds OU (Group 2) CSM – currently planned end state.

Hazard Area 6: Burial Grounds OU (Group 2) treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.6c3. Hazard Area 6: Burial grounds OU (Group 2) treatment train – currently planned end state.

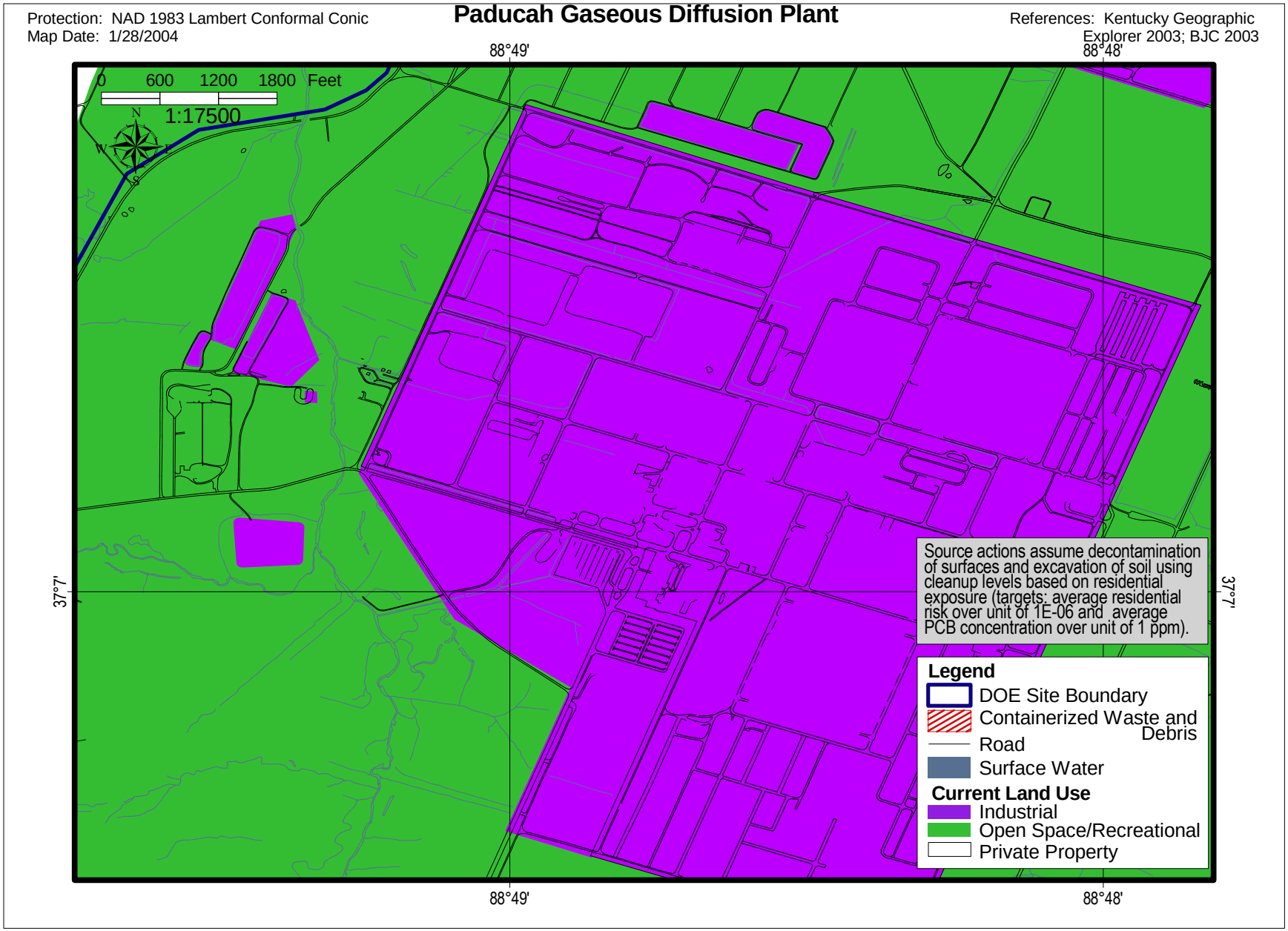
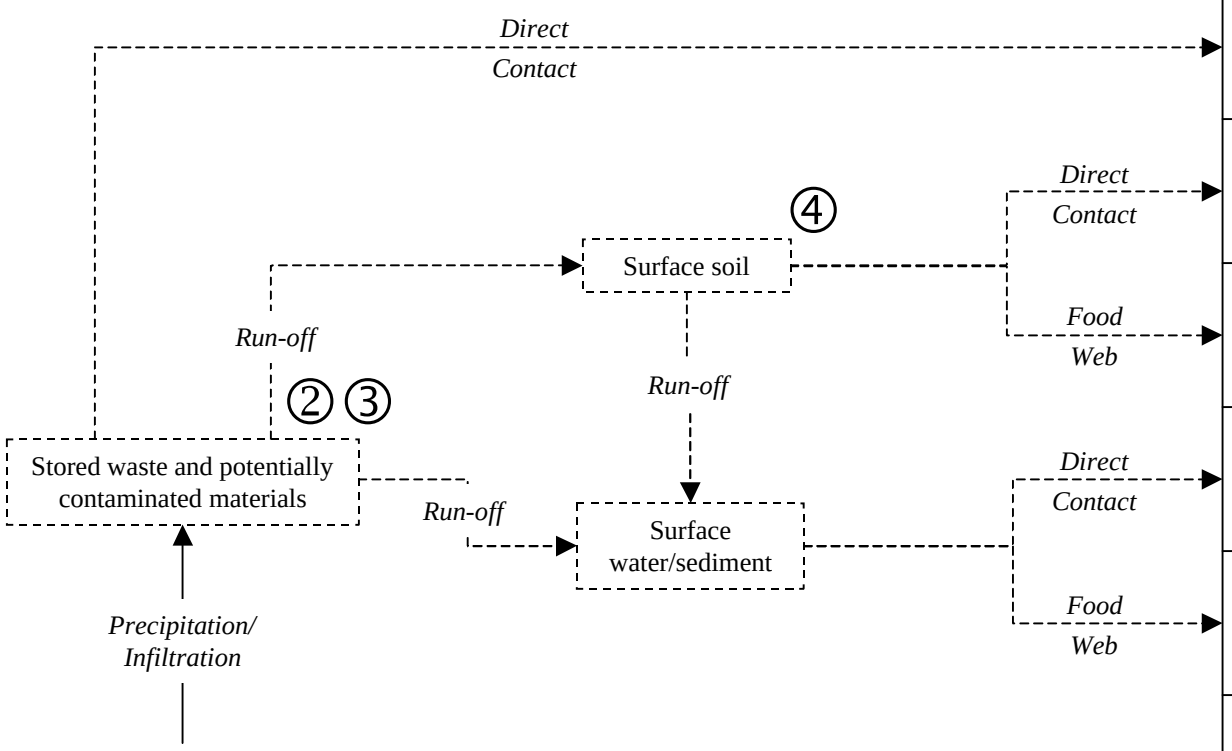


Fig. 5.7c1. Hazard Area 7: Legacy waste and DOE material storage areas – currently planned end state.

Hazard Area 7 Legacy Waste and DOE Material Storage Areas – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
			F
F/D/I		F/D/I	F/D/I
	F	F	F

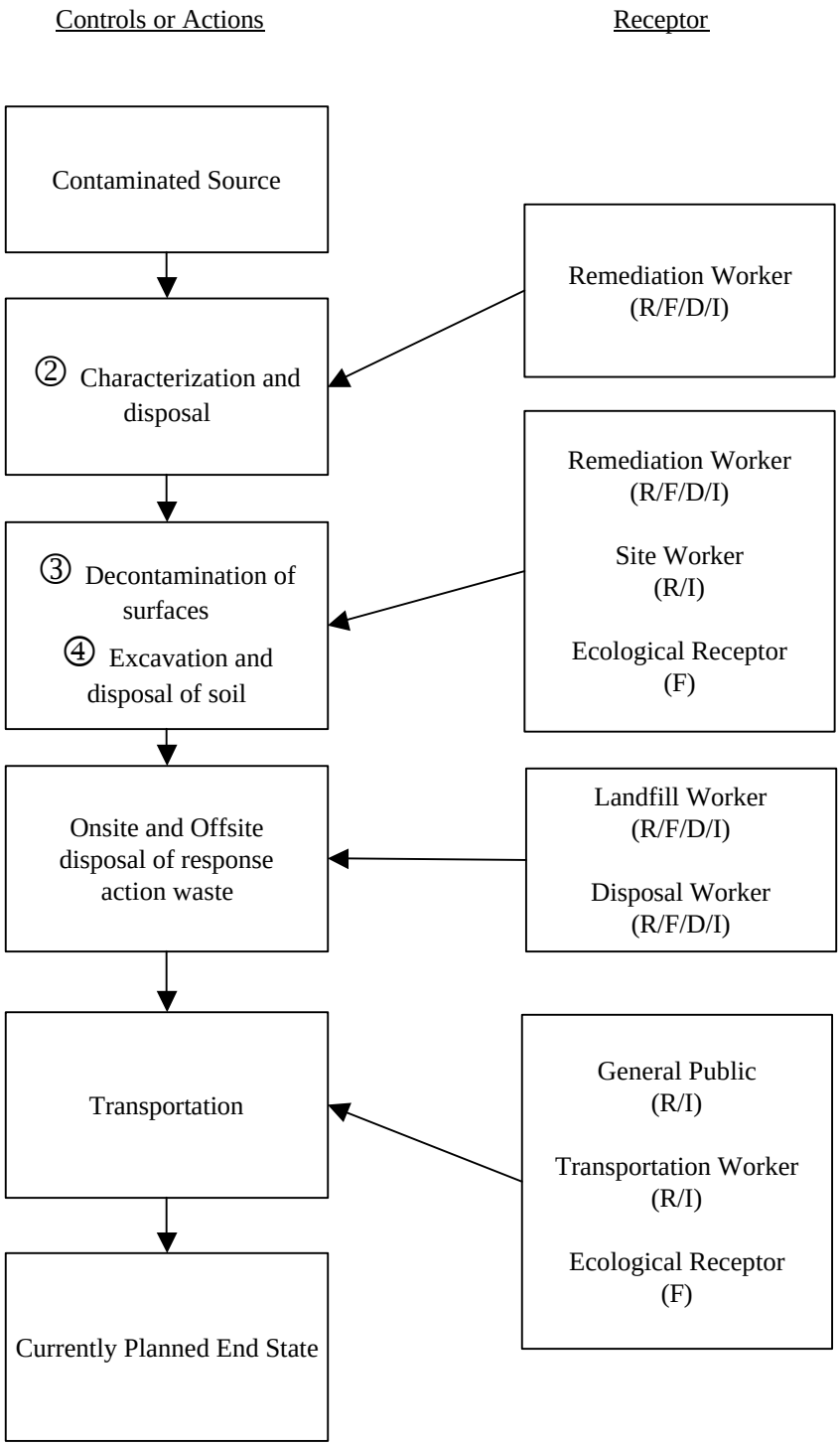
Current Planned Controls and Actions
② Characterization and disposal.
③ Decontamination of surfaces (target based on average exposure over entire unit: residential risk of 1E-06, PCBs at 1 ppm).
④ Excavation of soil (target based on average exposure over entire unit: residential risk of 1E-06, PCBs at 1 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.7c2. Hazard Area 7: Legacy waste and DOE material storage areas CSM – currently planned end state.

Hazard Area 7: Legacy waste and DOE material storage areas treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.7c3. Hazard Area 7: Legacy waste and DOE material storage areas treatment train – currently planned end state.

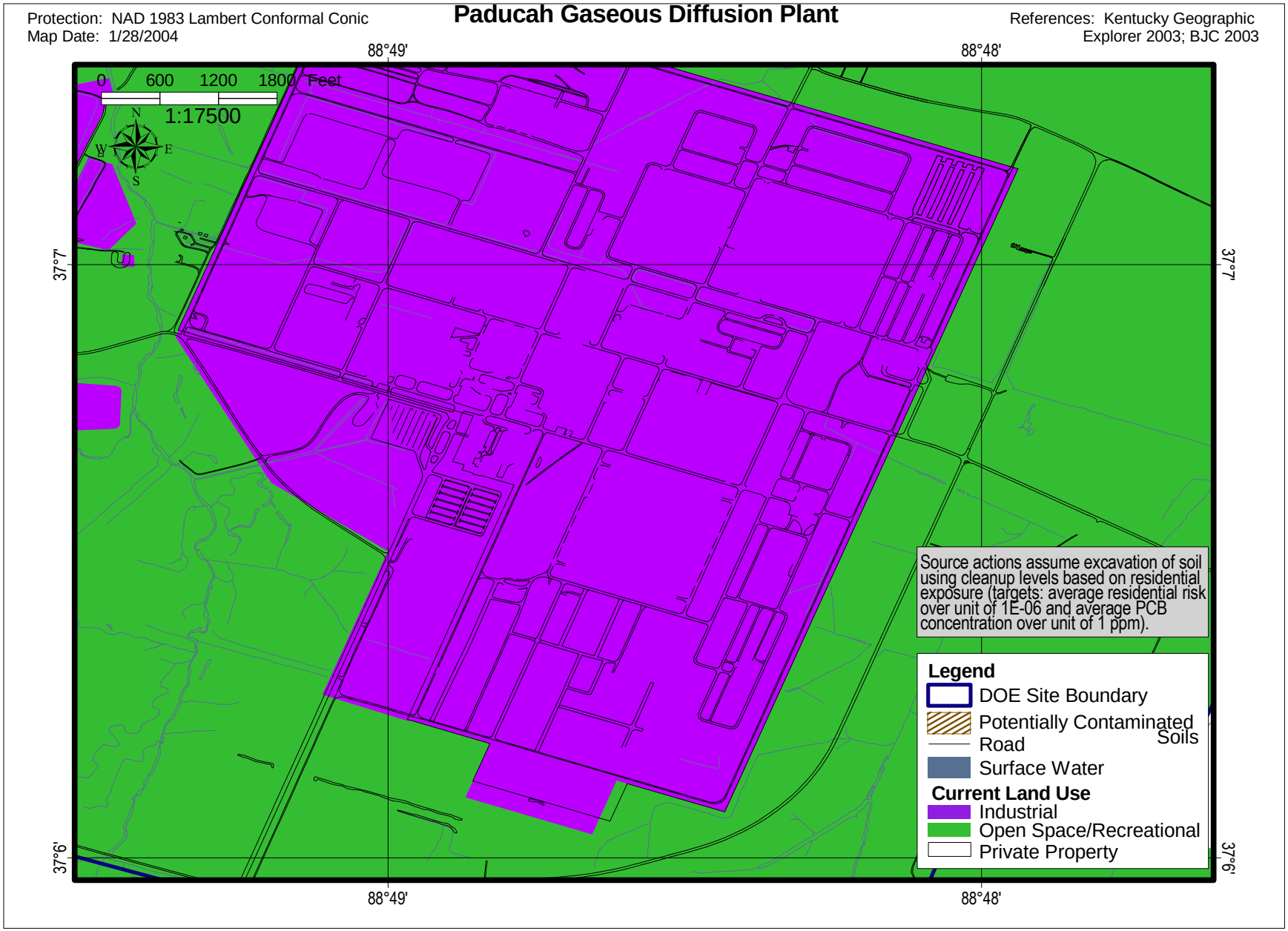
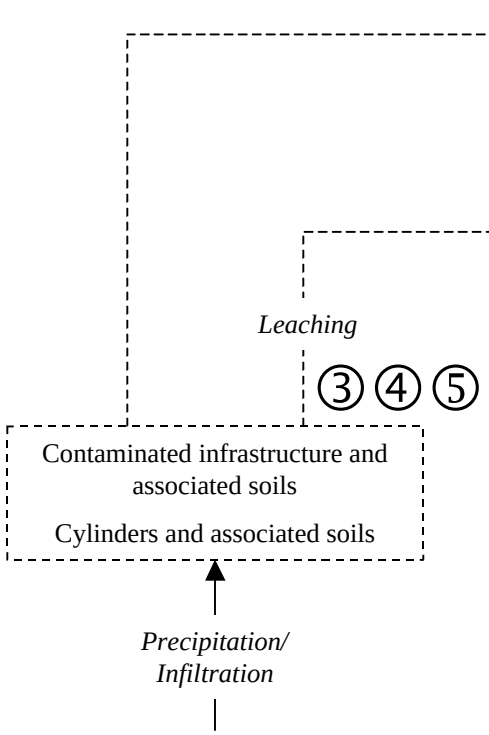


Fig. 5.8c1. Hazard Area 8: Cylinder yards and DUF_6 conversion facility – currently planned end state.

Hazard Area 8 Cylinder Yards and DUF_6 Conversion Facility – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I			R/F/D/I
R/F/D/I			R/F/D/I
		F	F
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

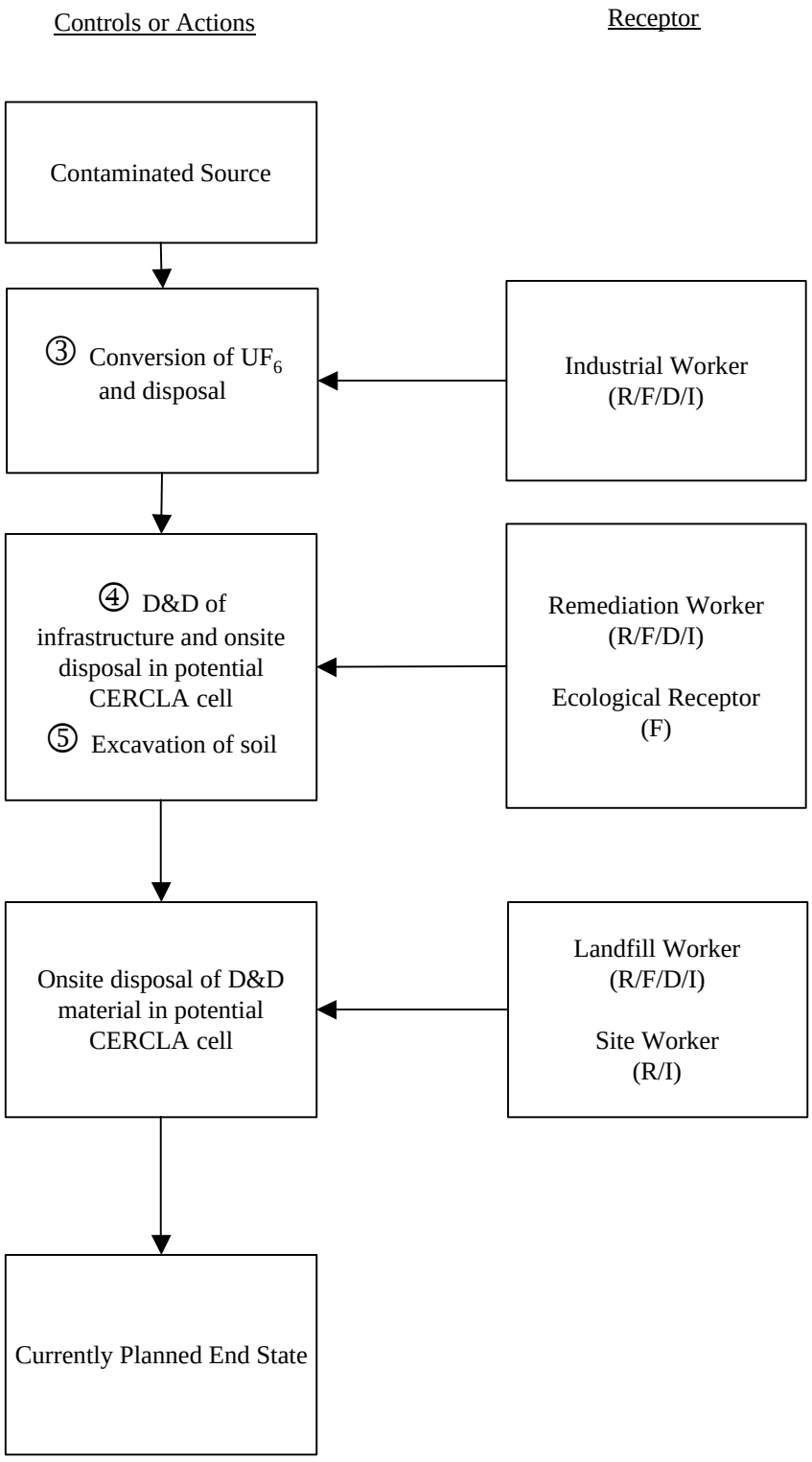
Current Planned Controls and Actions
② Attenuation
③ Conversion of depleted UF_6 and disposal.
④ D&D of infrastructure.
⑤ Excavation of surface soil (target based on average exposure over entire unit: residential risk of 1E-06, PCBs at 1 ppm).

Receptor Key
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key
R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.8c2. Hazard Area 8: Cylinder yards and DUF_6 conversion facility CSM – currently planned end state.

Hazard Area 8: Cylinder yards and DUF_6 conversion facility treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.8c3. Hazard Area 8: Cylinder yards and DUF_6 conversion facility treatment train – currently planned end state.

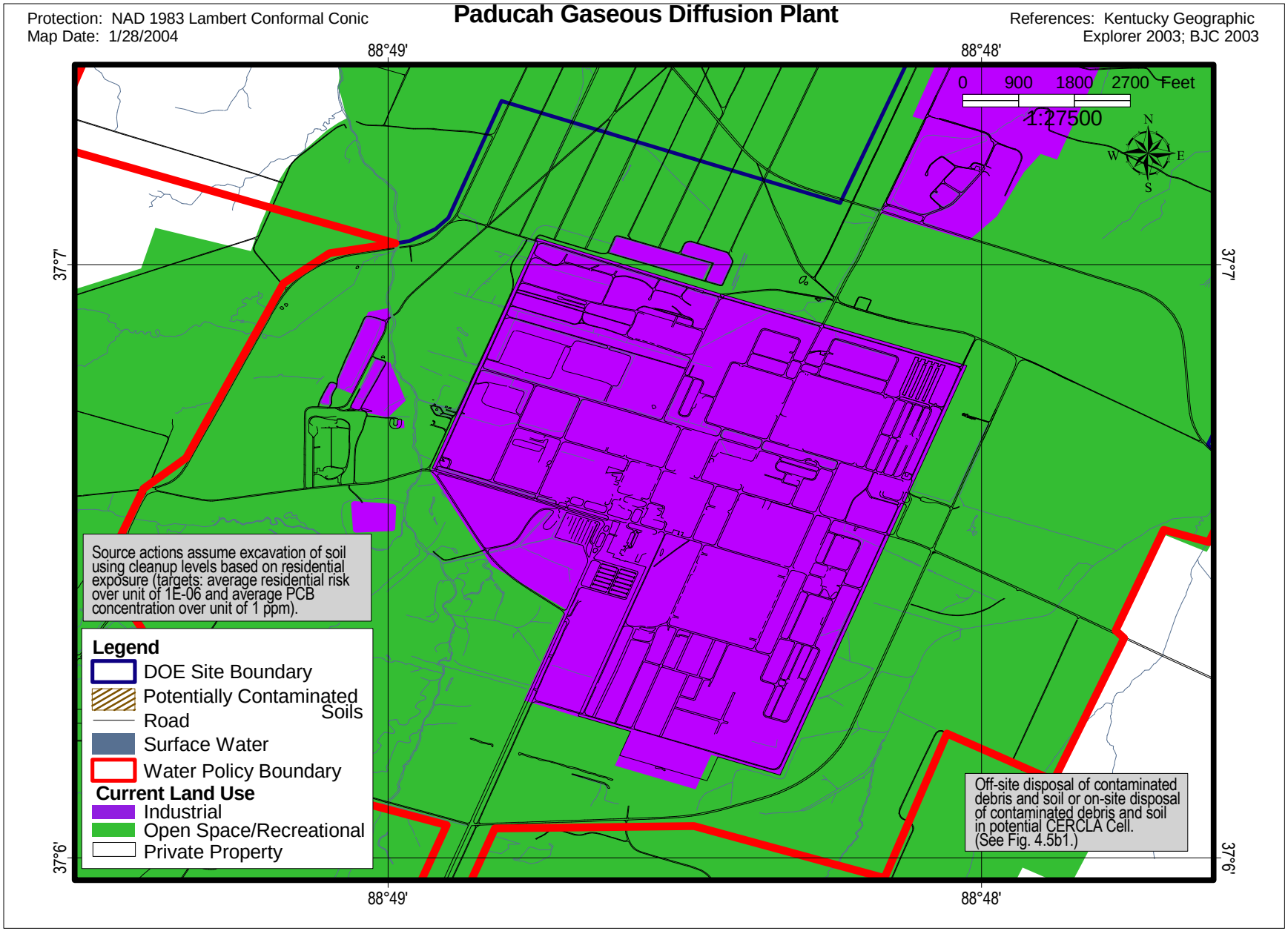
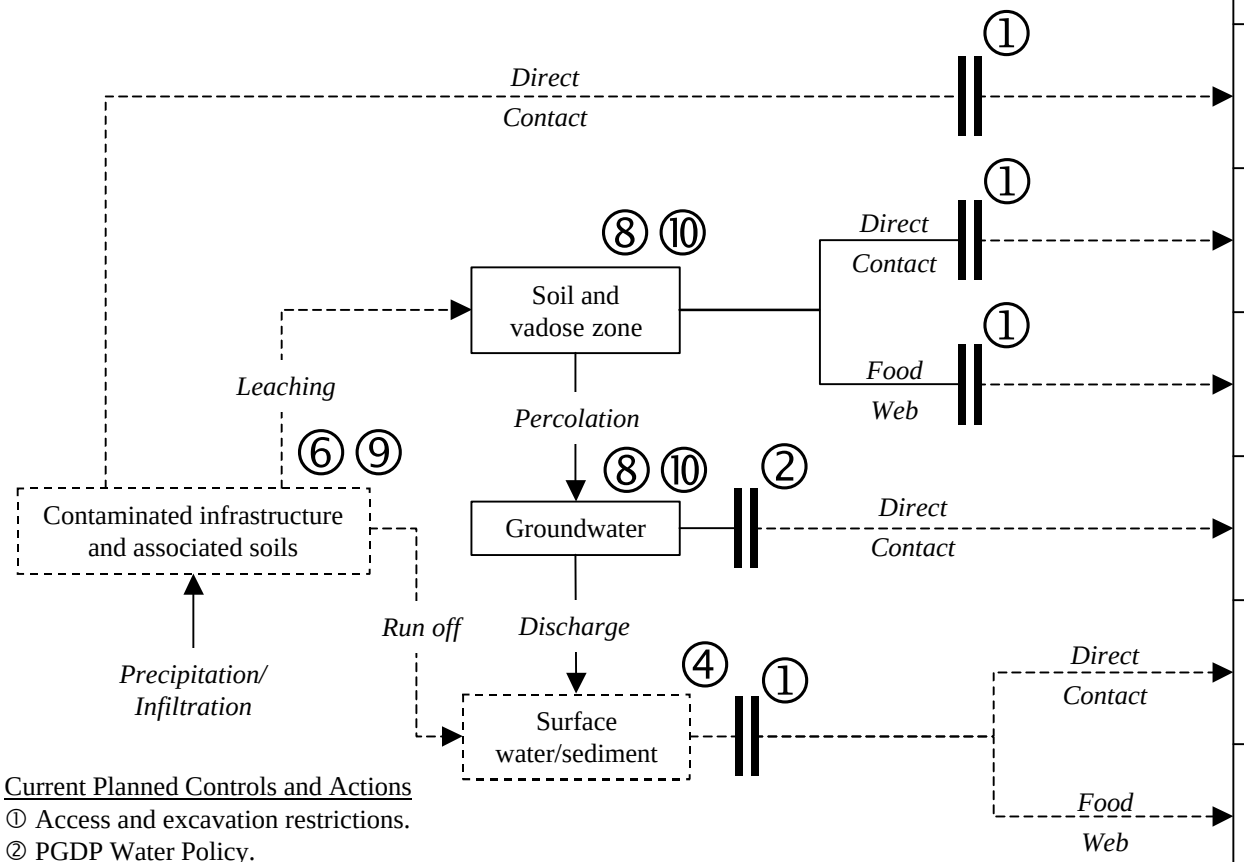


Fig. 5.9c1. Hazard Area 9: GDP facilities – currently planned end state.

Hazard Area 9 GDP Facilities – Current Planned End State



Potential Receptor Exposed			
Worker	Resident	Visitor	Ecological
R/F/D/I		R/F/D/I	R/F/D/I
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F
	R/F/D/I		
R/F/D/I		R/F/D/I	R/F/D/I
	F	F	F

Current Planned Controls and Actions

① Access and excavation restrictions.
② PGDP Water Policy.
④ Attenuation
⑥ D&D of infrastructure and disposal in potential CERCLA Cell.
⑧ Monitored natural attenuation of sources and plume.
⑨ Excavation of soil (target based on average exposure over entire unit: residential risk of 1E-06, PCBs at 1 ppm).
⑩ Source reduction/removal and active contaminant reduction in dissolved phase plume.

Receptor Key

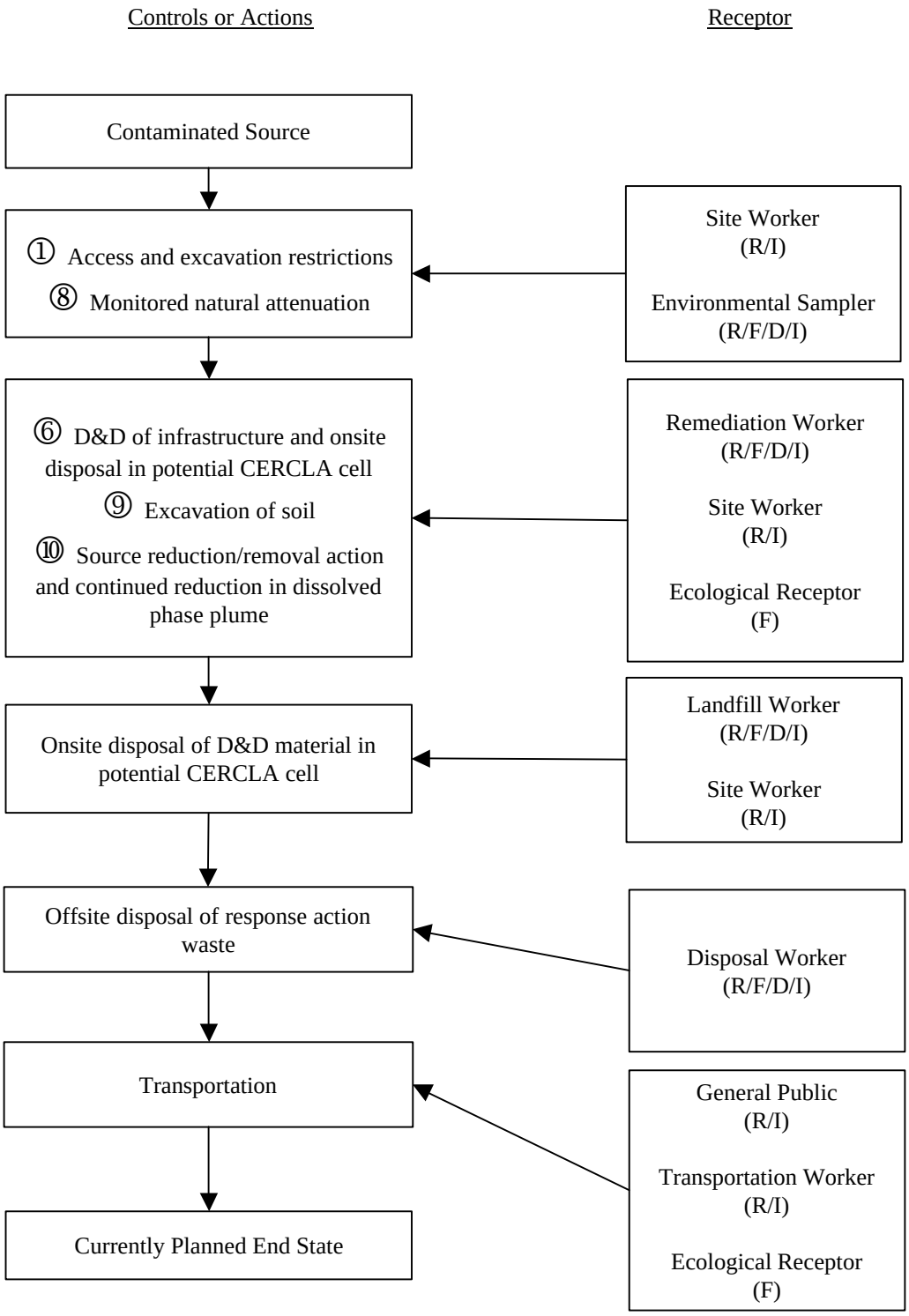
Worker – includes workers exposed during inside and outside activities, including the remediation worker.
Resident – includes residents engaged in all but recreation activities.
Visitor – includes recreational users, intruders, and trespassers.
Ecological – includes on- and offsite aquatic and terrestrial ecological receptors.

Exposure Route Key

R = External Exposure
F = Ingestion
D = Dermal
I = Inhalation

Fig. 5.9c2. Hazard Area 9: GDP facilities CSM – currently planned end state.

Hazard Area 9: GDP facilities treatment train – current planned end state



Exposure Route Key: R=External Exposure, F=Ingestion, D=Dermal, I=Inhalation

Fig. 5.9c3. Hazard Area 9: GDP facilities treatment train – currently planned end state.

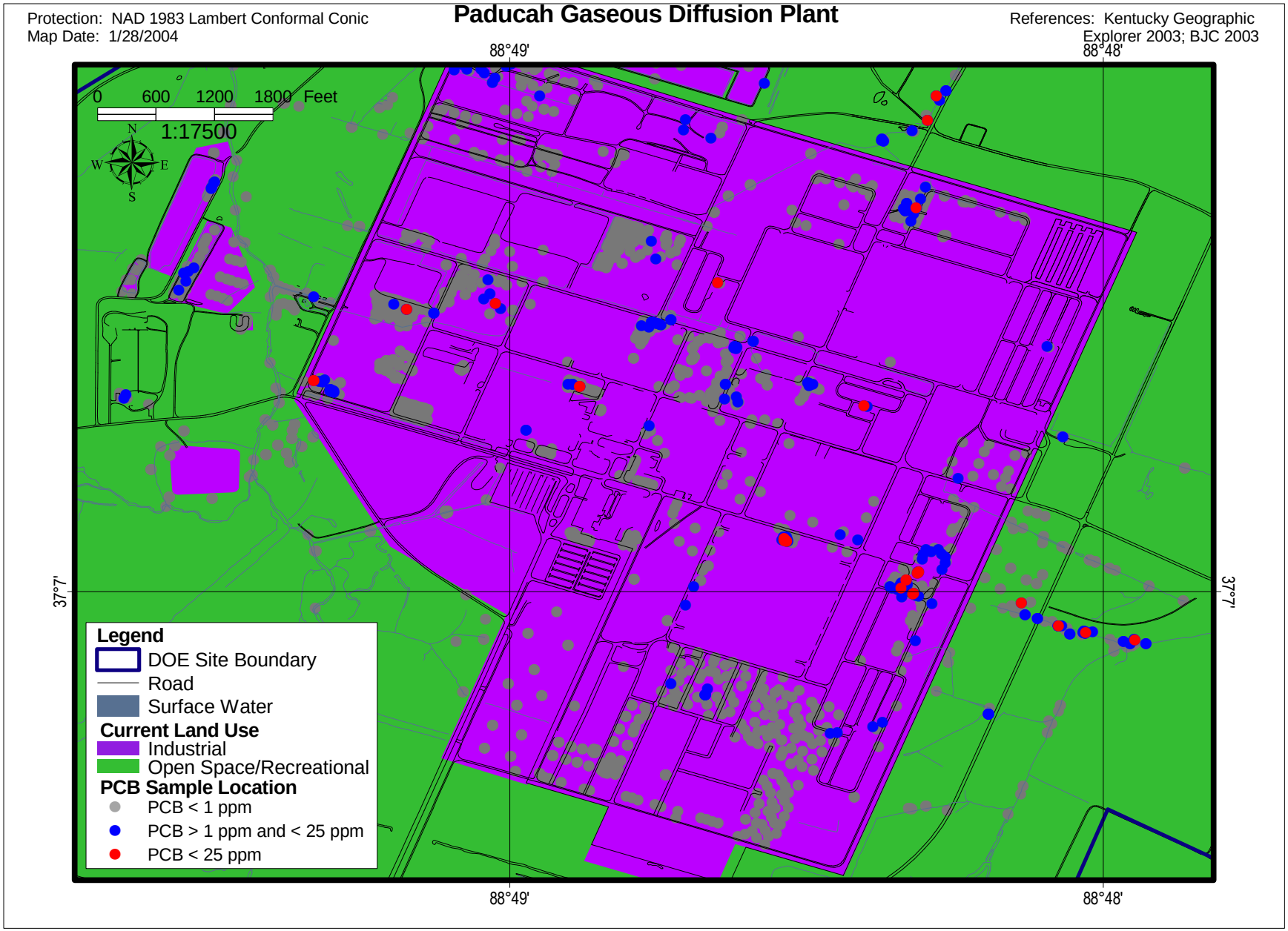


Fig. 5.10. Hazard Area 4: PCBs detected in shallow soil.

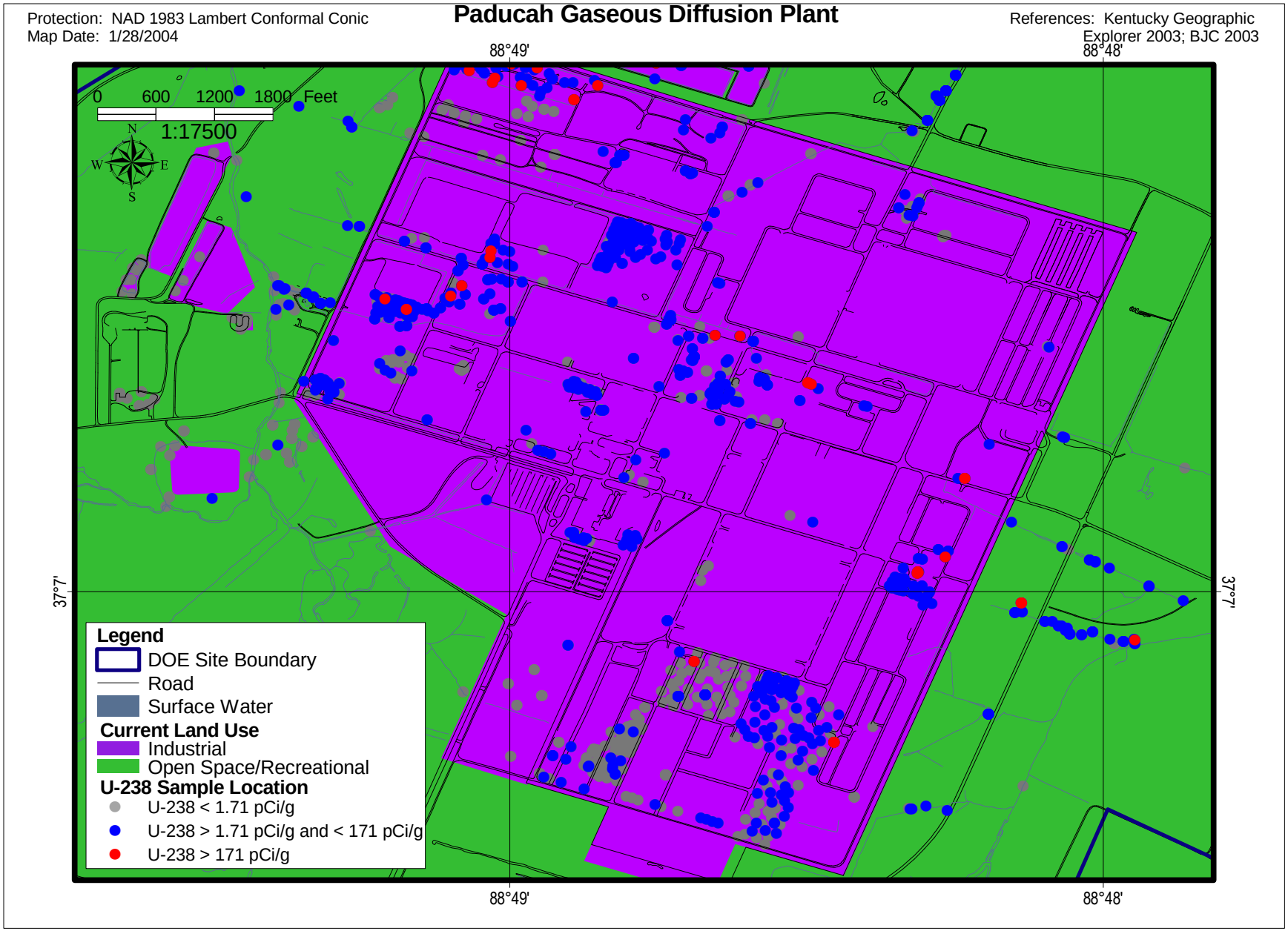


Fig. 5.11. Hazard Area 4: ^{238}U detected in shallow soil.