EXECUTIVE SUMMARY

In 2002, the Department of Energy's (DOE's) Office of Environmental Management (EM) established a set of corporate projects to lead EM's response to the *Top to Bottom Review*. One of these projects has resulted in the production of policy and guidance that directs DOE sites to submit a site-specific Risk-based End State (RBES) vision document. In accordance with that policy (DOE Policy 455.1, *Use of Risk-based End States*) and its implementing guidance (*Guidance for Developing a Site-specific Risk-based End State Vision*), as amended, the Paducah Gaseous Diffusion Plant (PGDP) has prepared this draft RBES vision and variance report for PGDP.

This draft report uses a standardized approach to meet the objectives for the RBES report contained in the guidance. This approach relies on the presentation of a series of maps and conceptual site models (CSMs) that depict the relationship between PGDP and its surroundings. The maps and CSMs are intended to present and allow comparisons between current and future land uses; depict hazards and risks to affected or potentially affected populations or receptors; serve as a planning tool for site management; facilitate communication of risks during discussions with stakeholders; allow tracking of expected and actual cleanup results; and serve as a communication tool for public meetings in regard to cleanup activities, current PGDP missions and requirements, and future land use. The maps follow a standardized hierarchical approach that depicts the PGDP RBES in regional-, site-, and hazard-specific contexts. The CSMs are produced only in a hazard-specific context. In the CSMs and their associated text, various responses to achieve site cleanup are presented. These presentations are not meant to be pre-decisional, but are meant to introduce examples of actions that may be completed to reach the RBES. The selection of specific actions will be made in accordance with applicable law and agreements.

> Note that stakeholders have not had an opportunity to provide input to this draft RBES report, including the variances identified. Once stakeholder input is received, this draft RBES report and the variance summary it contains will be modified as appropriate.
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> Additionally, this draft report presents potential actions to address hazards that could be used to reach the RBES. These presentations are not meant to be pre-decisional but are meant to introduce examples of actions the may be completed to reach the RBES. The selection of specific actions will be made in accordance with applicable law and agreements.

Once the final RBES vision is developed, DOE will further evaluate the cleanup activities and the strategic approaches at PGDP to determine if it is appropriate to pursue changes in the PGDP baseline. Any decision to pursue changes to the baseline will include factors beyond those presented in the RBES report, including input from involved parties. If DOE ultimately decides to seek changes to current compliance agreements, decisions, or statutory/regulatory requirements, then those changes will be made in accordance with applicable requirements and procedures.

Currently, PGDP, located in Paducah, Kentucky, is the nations only operating uranium enrichment facility. Missions performed at PGDP are the enrichment mission, a uranium conversion mission, and an environmental cleanup mission. The enrichment mission began in the early 1950s and involves producing enriched uranium for commercial uses through a gaseous diffusion process. At present, the facilities and infrastructure used to produce enriched uranium are leased to the United States Enrichment Corporation (USEC). The uranium conversion mission, which was recently initiated, involves the construction and operation of a facility that will convert depleted uranium hexafluoride (DUF_6) currently stored at PGDP less reactive uranium forms and the subsequent disposal of the converted uranium. Finally, the environmental cleanup mission involves work performed under a Federal Facility Agreement (FFA), as well as some work outside of the FFA. The current portion of the cleanup mission under the FFA is to investigate and address existing environmental contamination and to D&D those facilities currently leased to USEC once the GDP

ceases operation. The portion of the cleanup mission not included in the FFA includes the characterization and appropriate disposal of legacy waste and materials found in DOE Material Storage Areas (DMSAs) and continuation of waste management activities.

Consistent with the RBES guidance and the missions at PGDP, the following nine hazard areas were identified at PGDP:

- Hazard Area 1 – Groundwater Operable Unit (GWOU): This hazard area encompasses both the sources of contamination to groundwater and the three dissolved phase plumes that originate within the industrialized area of PGDP and extend off-site.

- Hazard Area 2 – Surface Water Operable Unit (SWOU): This hazard area encompasses the sources of surface water contamination found within the industrialized portion of PGDP, including plant ditches, and two creeks, Bayou and Little Bayou Creek, located outside of the industrialized portion of PGDP, which run both on and off DOE property.

- Hazard Area 3 – Burial Grounds Operable Unit (BGOU) (Group 1). This hazard area includes three burial grounds that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination but for which the current planned end state and RBES differ.

- Hazard Area 4 – Surface Soils Operable Unit (SSOU). This hazard area encompasses all areas containing contaminated soils that do not impact the GWOU or SWOU and that are not part of other hazard areas.

- Hazard Area 5 – Permitted Landfills. This hazard area includes two permitted, closed landfills, the currently operating permitted landfill, and, under future conditions, a potential "CERCLA Cell" that would be used to dispose of debris and other materials generated during GDP D&D.

- Hazard Area 6 - BGOU (Group 2). This hazard area includes of four areas that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination but for which the current planned end state and RBES do not differ.

- Hazard Area 7 - Legacy Waste and DMSAs. This hazard area encompasses legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DOE Material Storage Areas (DMSAs) located throughout PGDP.

- Hazard Area 8 – Cylinder Yards and DUF_6 Conversion Facility. This hazard area is composed of the cylinder yards that contain DUF_6 in cylinders and the conversion facility currently under construction.

- Hazard Area 9 – GDP Facilities. This hazard area is composed of the GDP facilities and infrastructure that will undergo decommissioning and decontamination (D&D) once the current uranium enrichment mission is ended. This hazard area also includes any sources to the GWOU and SWOU not addressed in the other hazard areas.

Each of these hazard areas, except for the portions of the dissolved phase groundwater plumes and Bayou and Little Bayou Creek located off DOE property, is in locations where current and future expected land uses are industrial or recreational. Some areas overlying the groundwater plumes or adjacent to the creeks are rural residential.

Under current conditions, risks at all hazard areas are at or below levels of risk that fall near the bottom of EPA's acceptable risk range for site-related exposures (E-06). This level of risk, which is called

a *de minimis* level of risk in this report, is attained under current conditions through access and institutional controls. However, unmitigated risks or risks that potentially could exist in the absence of these controls exceed the upper end of EPA's acceptable risk range for site-related exposures (E-04) at some locations. These risks are driven by the presence of chlorinated solvents (primarily trichloroethene [TCE] and its breakdown products) in groundwater and by the presence of polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), metals, and radionuclides (primarily the uranium isotopes) in soil and sediment.

Under the RBES, risk at all hazard areas will be at *de minimis* levels. These levels will be attained through the following actions:

- Continued access and institutional controls (e.g., capping, controls on groundwater use);
- Monitored natural attenuation of sources of groundwater contamination (TCE source areas) and the dissolved phase plumes with continued access and institutional controls;
- Excavation and on and off site disposal of contaminated surface soil and sediment to attain a target risk of 1E-04 to receptors consistent with current and future land use and an average PCB concentrations within exposure units of 25 ppm in industrial areas and 1 ppm in recreational areas;
- Characterization and off site disposal of legacy waste; and
- On- and off-site disposal of debris from D&D of facilities and infrastructure.

In order to identify variances between the RBES and the current PGDP baseline, a current planned end state also is presented for each of the hazard areas. Under the current planned end state, risk at all hazard areas also will be at *de miminis* levels. These levels will be attained through the following actions:

- Continued access and institutional controls (e.g., capping, controls on groundwater use);
- Response actions to reduce the concentration of TCE and other solvents in subsurface areas that act as sources of groundwater contamination;
- Response actions to reduce TCE concentrations in the dissolved phase plumes;
- Monitored natural attenuation of sources of groundwater contamination (TCE source areas) and the dissolved phase plumes following completion of response action to reduce TCE concentrations;
- Active measures to reduce TCE concentrations in groundwater discharged to surface water;
- Construction of sediment control basins;
- Excavation and off-site disposal of surface and subsurface soil and sediment to attain a target risk of 1E-06 for hypothetical residents and an average PCB concentration of 1 ppm within exposure units in industrial and recreational areas;
- Excavation and off-site disposal of wastes from burial grounds; and
- On- and off-site disposal of debris from D&D of facilities and infrastructure.

Using this information, the following ten variances were identified (RBES response action listed first):

1) Enhanced institutional controls to limit groundwater use versus continuation of PGDP Water Policy to limit groundwater use – affects Hazard Areas 1, 6, and 9;

2) Monitored natural attenuation for groundwater source areas, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment of groundwater source areas using heating technologies, with continuation of the PGDP Water Policy – affects Hazard Areas 1 and 9;

3) Monitored natural attenuation for groundwater source areas, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus excavation of groundwater source areas (burial grounds), with continuation of the PGDP Water Policy – affects Hazard Area 1;

4) Monitored natural attenuation for the dissolved phase groundwater plumes, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment for the dissolved phase plume using oxidation technologies, with continuation of the PGDP Water Policy – affects Hazard Area 1.

5) Continued monitoring of discharges of groundwater to surface water versus actions to reduce contaminant levels in groundwater discharged to surface water – affects Hazard Area 1;

6) Cleanup levels for soil and sediment in industrial areas set at targets of 1E-04 (under an industrial scenario) and PCBs of 25 ppm and cleanup levels for soil and sediment in recreational areas set at targets of 1E-04 (under a recreational scenario) and PCBs of 1 ppm versus cleanup levels for soil and sediment in industrial and recreational areas set at targets of 1E-06 (under a residential scenario) and PCBs of 1 ppm – affects Hazard Areas 2, 4, 8, and 9;

7) Continued monitoring of contaminant levels in surface water at outfalls versus construction of sediment control basins to reduce contaminant migration in surface water – affects Hazard Area 2;

8) Capping of certain burial grounds versus excavation of certain burial grounds – affects Hazard Area 3;

9) Construction of potential CERCLA Cell versus no construction – affects Hazard Area 5; and

10) Cleanup levels for soil and/or decontamination of surfaces in industrial areas set at targets of 1E-04 (industrial) and PCBs of 25 ppm versus targets of 1E-06 (residential) and PCBs of 1 ppm – affects Hazard Area 7.

Subsequent to the delineation of the variances between the RBES and the current planned end state, barriers in achieving the RBES and recommendations to address these barriers are discussed. In the discussion, the affected organizations that DOE needs to work with are identified, the affected organizations' views are noted, and a path forward for DOE is presented.