RBES Guiding Principles

- The Department will comply with the requirements of the nation’s environmental laws and regulations. However, the requirement to develop and achieve risk-based end states will drive the Department’s compliance strategy.
- End states, including the selected remedies, must be based on an integrated site-wide perspective (including the current and future use of surrounding land), rather than on isolated operable units or release sites.
- End states must be focused on protecting the relevant receptors based on the intended land use. Sites must document the final anticipated risk-based condition that drive a cleanup decision or activity.
- Sites must consider the interim risks to the public, workers, and the environment in the selection of actions required to achieve risk-based, end states. Ecosystem health should not be endangered nor should workers be put at risk by requiring them to take actions that result in little or no reduction in risk to the public or the environment.
- Where contaminants are expected to persist but can be isolated, risk concepts should include effective and transparent institutional controls to maintain isolation. Long term monitoring and surveillance methods must be designed to assure that the contaminants remain sequestered and human health and the environment are protected.
- Stakeholders and regulators must be consulted in the actions needed to develop and achieve risk-based, end-states
- End states must address how we are to manage the impacts of future risks and vulnerabilities, including the creation of contingency plans in the event that site conditions change after clean up is completed.
Phase I: Establish Framework
- Public and Intergovernmental Outreach
- Site Specific End State Vision Document

Phase II: Identify Changes
- Variance Analysis and Report
- Legislative Recommendations
- Public and Intergovernmental Outreach

Phase III: Implement Changes
- Renegotiate Agreements
- Modify Site Baselines
- Legislative Package and Actions
- Regulatory Actions
- Public Intergovernmental Outreach

The “Variance Report” (Chap. 5) is the primary product of these documents, 2nd only to the RBES Vision itself.

DOE P 455.1
“Once Sites develop their risk-based end state vision, they will re-evaluate their cleanup activities and strategic approaches to determine if it is appropriate to change site baseline documents and renegotiate agreements.”

Fig. 1.1 Conceptual product diagram for the RBES report
Site Characterization by Hazard Areas

• Groundwater Operable Unit (GWOU)
• Surface Water Operable Unit (SWOU)
• Burial Grounds Operable Unit (BGOU) (Group 1)
• Surface Soils Operable Unit (SSOU)
• Permitted Landfills
• Burial Grounds Operable Unit (BGOU) (Group 2)
• Legacy Waste and DMAs
• Cylinder Yards and DUF6 Conversion Facility
• GDP Facilities
Hazard Area Descriptions

- **Hazard Area 1:** This hazard area is composed of the GWOU. It encompasses both the sources of contamination to groundwater and the three dissolved phase plumes. Sources considered are those below the C-400 Cleaning Building located in the center of the industrialized area of PGDP, two burial grounds located in the west central portion of the industrialized area of PGDP, the C-720 Building located in the southern part of PGDP, and an oil landfarm.

- **Hazard Area 2:** This hazard area is composed of the SWOU. It encompasses the sources of surface water contamination found within the industrialized portion of PGDP, the plant ditches and outfalls found inside the industrialized portion of PGDP; the NSDD, a portion of which is located outside the industrialized portion of PGDP; and Bayou and Little Bayou Creeks, which are found outside the industrialized area and run both on and off DOE property.

- **Hazard Area 3:** This hazard area is composed of three areas included in the burial grounds OU 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. These burial grounds are located in the northwestern part of the industrialized area of PGDP.
Hazard Area Descriptions

- **Hazard Area 4:** This hazard area is composed of units that make up the SSOU. It encompasses all areas containing contamination that does not impact the GWOU or SWOU. As depicted later in this chapter, this hazard area includes all areas inside the industrialized portion of PGDP that are not part of other hazard areas, including those that are part of Hazard Area 9.

- **Hazard Area 5:** This hazard area is composed of 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. The two closed landfills and the operating landfills are located in the north-central portion of PGDP, outside the industrialized area. The site of the potential CERCLA Cell has not been determined at this time.

- **Hazard Area 6:** This hazard area is composed of four areas included in the BGOU 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. These include a landfill located to the southwest of the industrialized portion of PGDP, adjacent to Bayou Creek, and three burial grounds located in the northwestern part of the industrialized area of PGDP.
Hazard Area Descriptions

- Hazard Area 7: This hazard area is composed of legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DMSAs located throughout PGDP.

- Hazard Area 8: This hazard area is composed of the cylinder yards that contain DUF₆ and a facility currently being planned to convert the DUF₆ to more stable uranium oxides before off-site shipment. The cylinder yards are located throughout the site, and the largest yard is in the southeast corner of the industrialized area of PGDP. The planned conversion facility will be located adjacent to this yard.

- Hazard Area 9: This hazard area is composed of the GDP facilities and infrastructure that will undergo D&D as part of either the D&D OU strategic initiative (see Chap. 1) or the final GDP D&D. This hazard area also encompasses any sources to groundwater and surface water not addressed in other hazard areas.
Hazard Area 1 - GWOU

- 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
- SMWU 201: Northwest Groundwater Plume
- SWMU 202: Northeast Groundwater Plume
- SWMU 210: Southwest Groundwater Plume
- Little Bayou Creek Groundwater Plume Seeps
Hazard Area 2 – Surface Water Operable Unit

- 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 63: Bayou Creek
- SWMU 179: Storm sewer systems
- SWMUs 13, 14, 15, 16, and 520: Scrapyards
Hazard Area 3 – Burial Ground Operable Unit (Group 1)

- 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)
Hazard Area 5 – Permitted Landfills

- SWMU 9: C-746-S Residential Landfill
- SWMU 10: C-746-T Inert Landfill
- SWMU 208: C-746-U Landfill
Hazard Area 6 – C-746-K Landfill

• 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
## Hazard Area 7 – Legacy Waste DMSAs

<table>
<thead>
<tr>
<th>C-746-A</th>
<th>C-746-V</th>
<th>C-310</th>
<th>C-337</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-746-B</td>
<td>C-746-M</td>
<td>C-331</td>
<td>C-752-A</td>
</tr>
<tr>
<td>C-746-H3</td>
<td>C-752-C</td>
<td>C-333</td>
<td>C753-A</td>
</tr>
<tr>
<td>C-746-Q</td>
<td>C-733</td>
<td>C-335</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outside-Locations 1-18</th>
<th>C-333-Locations 1-43</th>
<th>C-409-Locations 1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-310-Locations 1-5</td>
<td>C-333-Locations 1-45</td>
<td>C-720-Locations 1-4</td>
</tr>
<tr>
<td>C-331-Locations 1-24</td>
<td>C-400-Locations 1-8</td>
<td></td>
</tr>
</tbody>
</table>
Hazard Area 9 – GDP Facilities

- 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
State Characterization

• Map

• Narrative Summary
  – Sources
  – Exposure pathways
  – Projected risk levels

• Conceptual Site Model
  – A description of the hazard area of concern
  – Primary and secondary sources of contamination
  – Current and potential future release, transport, and exposure mechanisms
  – Current and potential future receptors believed to be at risk
  – Current and planned barriers or mechanisms (e.g. removal) that will prevent or limit potential exposure to at-risk receptors

• Treatment Train
Table 4.1 Risk assessment summary for residential exposure to groundwater drawn from the RGA at a point within the off-site Northwest and Northeast Plumes and for recreational exposure to groundwater discharged to the surface at seeps along Little Bayou Creek

<table>
<thead>
<tr>
<th>Location</th>
<th>Land Use</th>
<th>Risk</th>
<th>Risk Scenario</th>
<th>Contaminant Description</th>
<th>Representative Concentration</th>
<th>Baseline Risk Level</th>
<th>PRG</th>
<th>Basis for PRG</th>
<th>Actual or Expected Post Cleanup Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW Plume Offsite</td>
<td>Residential</td>
<td>Y</td>
<td>Residential</td>
<td>TCE</td>
<td>1.39 mg/L</td>
<td>ELCR = 1E-03, HI=120</td>
<td>0.005 mg/L</td>
<td>MCL</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cadmium</td>
<td>0.0161 mg/L</td>
<td>ELCR = 6E-04, HI = 2</td>
<td>0.005 mg/L</td>
<td>MCL</td>
<td>NA</td>
</tr>
<tr>
<td>NE Plume Offsite</td>
<td>Residential</td>
<td>Y</td>
<td>Residential</td>
<td>TCE</td>
<td>0.754 mg/L</td>
<td>ELCR = 5E-04, HI = 64</td>
<td>0.005 mg/L</td>
<td>MCL</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,1-DCE</td>
<td>0.006 mg/L</td>
<td>ELCR = 6E-04, HI = NA</td>
<td>0.007 mg/L</td>
<td>MCL</td>
<td>NA</td>
</tr>
<tr>
<td>Seeps (1997 data)</td>
<td>Recreational</td>
<td>N</td>
<td>Recreational</td>
<td>TCE</td>
<td>0.051 mg/L (maximum)</td>
<td>18 of 88 results exceeded no action level</td>
<td>0.0218 mg/L</td>
<td>Risk-Based</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cadmium</td>
<td>0.026 mg/L (maximum)</td>
<td>1 of 39 results exceeded no action level</td>
<td>0.00457 mg/L</td>
<td>Risk-Based</td>
<td>NA</td>
</tr>
<tr>
<td>Seeps (2000 data)</td>
<td>Recreational</td>
<td>N</td>
<td>Recreational</td>
<td>TCE</td>
<td>0.44 mg/L (maximum)</td>
<td>49 of 71 results exceeded no action level</td>
<td>0.0127</td>
<td>Risk-Based</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Antimony</td>
<td>0.0035 mg/L (maximum)</td>
<td>1 of 13 results exceeded no action level</td>
<td>0.00312</td>
<td>Risk-Based</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Results for Northwest and Northeast Plumes are taken from DOE 2001a. Results for seeps are from an unnumbered information sheet entitled, Seeps Along Little Bayou Creek, Northwest Groundwater Plume, dated July 2001. Risks presented are "unmitigated" or baseline risks, which assume exposure with no barriers.
*Contaminant concentrations used for the assessment were the upper 95% confidence limit on the average concentrations of all groundwater results collected from wells in the off-site areas of the Northwest and Northeast Plumes.
*“Y” indicates the result came from a baseline risk assessment. “N” indicates the result came from a screening level risk assessment.
*Residential scenario considered lifetime (40 year) exposure by a resident to groundwater used in the home as drinking water, while showering, and for general household uses. Recreational scenario considered direct exposure to water while wading.
*“ELCR” is the excess lifetime cancer risk level. Values from E-06 to E-04 are within EPA’s acceptable risk range for site related exposures. “HI” is the hazard index, a measure for potential systemic toxicity. Values greater than 1 indicate that a deleterious health effect is possible.
*“PRG” is the preliminary remediation goal used when considering potential response actions.
*MCL = maximum contaminant level. “Risk-Based” = value derived using a scenario appropriate to the land use and a target risk of either 1E-06 (cancer) or 1 (hazard).
*Under RBES, the potential action is monitored natural attenuation; therefore, no values are available at this time.
Example Conceptual Site Model

Current Controls or Actions
① Access and excavation restrictions.
② PGDP Water Policy.
③ "Hot spot" pump and treat.
④ Attenuation

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.

Potential Receptor Exposed

<table>
<thead>
<tr>
<th>Worker</th>
<th>Resident</th>
<th>Visitor</th>
<th>Ecological</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/F/D/I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F/D/I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F/D/I</td>
<td>F/D/I</td>
<td>F/D/I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>

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

Fig. 4.1a2. Hazard Area 1: Groundwater OU CSM – current state.
Treatment Train

**Controls or Actions**

1. Access restrictions
2. Environmental Monitoring
3. Scrap removal and excavation and disposal of soil and sediment “hot spots”

**Receptor**

- Maintenance Worker (R/I)
- Environmental Sampler (R/F/D/I)
- Remediation Worker (R/F/D/I)
- Site Worker (R/I)
- Ecological Receptors (F)
- Disposal Worker (R/F/D/I)
- General Public (R/I)
- Transportation Worker (R/I)
- Ecological Receptors (F)

**RBES**
Current Planned 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 1ppm within exposure units in industrial and recreational areas
- Excavation and off-site disposal of wastes from burial grounds
- On- and off-site disposal of debris from D&D of facilities and infrastructure
Proposed RBES 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
• On-and off-site disposal of debris from D&D of facilities and infrastructure
<table>
<thead>
<tr>
<th>RBES Actions</th>
<th>Variance Analysis</th>
<th>Current Planned Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Enhanced institutional controls to limit groundwater VS</td>
<td>Contamination of PGDP Water Policy to limit groundwater use—affects Hazard areas</td>
<td>1, 6, and 9</td>
</tr>
<tr>
<td>2) Monitored natural attenuation for groundwater source areas, with either</td>
<td>Active treatment of groundwater source areas using heating technologies, with</td>
<td>continuation of the PGDP Water Policy—affects Hazard Areas 1 and 9</td>
</tr>
<tr>
<td>enhanced institutional controls or continuation of the PGDP Water Policy</td>
<td>continuation of the PGDP Water Policy—affects Hazard Areas 1 and 9</td>
<td></td>
</tr>
<tr>
<td>3) Monitored natural attenuation for groundwater source areas, with either</td>
<td>Excavation of groundwater source areas (burial grounds), with continuation of the</td>
<td>continuation of the PGDP Water Policy—affects Hazard Area 1</td>
</tr>
<tr>
<td>enhanced institutional controls or continuation of the PGDP Water Policy</td>
<td>PGDP Water Policy—affects Hazard Area 1</td>
<td></td>
</tr>
<tr>
<td>4) Monitored natural attenuation for the dissolved phase groundwater plumes,</td>
<td>Active treatment for the dissolved phase plume using oxidation technologies, with</td>
<td>continuation of the PGDP Water Policy—affects Hazard Area 1</td>
</tr>
<tr>
<td>with either enhanced institutional controls or continuation of the PGDP Water</td>
<td>continuation of the PGDP Water Policy—affects Hazard Area 1</td>
<td></td>
</tr>
<tr>
<td>Policy VS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Continued monitoring of discharges of groundwater to surface water VS</td>
<td>Actions to reduce contaminant levels in groundwater discharged to surface water—</td>
<td>affects Hazard Area 1</td>
</tr>
<tr>
<td>6) Cleanup levels for soil and sediment in industrial areas set at targets</td>
<td>Cleanup levels for soil and sediment in industrial and recreational areas set at</td>
<td>targets of 1E-06 (under a residential scenario) and PCBs of 1 ppm—affects Hazard Areas 2,4,8, and 9</td>
</tr>
<tr>
<td>of 1E-04 (under an industrial scenario) and PCBs of 25 ppm and cleanup levels</td>
<td>targets of 1E-04 (under a recreational scenario) and PCBs of 1 ppm—affects Hazard</td>
<td></td>
</tr>
<tr>
<td>for soil and sediment in recreational areas set at targets of 1E-04 (under a</td>
<td>Areas 2, 4, 8, and 9</td>
<td></td>
</tr>
<tr>
<td>recreational scenario) and PCBs of 1 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7) Continued monitoring of contaminant levels in surface water at outfalls</td>
<td>Construction of sediment control basins to reduce contaminant migration in surface</td>
<td>affects Hazard Area 2</td>
</tr>
<tr>
<td>8) Capping of certain burial grounds VS</td>
<td>water—affects Hazard Area 2</td>
<td></td>
</tr>
<tr>
<td>9) Construction of potential CERCLA Cell VS</td>
<td>Excavation of certain burial grounds—affects Hazard Area 3</td>
<td></td>
</tr>
<tr>
<td>10) Cleanup levels for soil and/or decontamination of surfaces in industrial</td>
<td>Targets of 1E-06 (residential) and PCBs of 1 ppm—affects Hazard Area 7</td>
<td></td>
</tr>
</tbody>
</table>
Transition Assessment
(for each hazard area)

Table 5.1 Variance report by hazard area

<table>
<thead>
<tr>
<th>ID. No.</th>
<th>Description of Variance</th>
<th>Impacts</th>
<th>Barriers in Achieving RBES</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard Area 1: Groundwater Operable Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-1.1 Current Planned End State: Continuation of PGDP Water Policy</td>
<td><strong>Scope:</strong> The current planned end state includes continuation of the current PGDP Water Policy. The RBES includes enhanced institutional controls, 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 <em>de minimis</em> levels.</td>
<td>DOE policy may limit options available under the enhanced institutional controls.</td>
<td>Initiate further discussions with the public and regulators. Revisit DOE policy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Cost:</strong> 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.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Schedule:</strong> The PGDP Water Policy is currently in place. Implementation of the enhanced institutional controls would be a future planned CERCLA response action.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Risk:</strong> 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 <em>de minimis</em> levels.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>