Principles of Environmental Restoration

Applying the Principles to Response Design and Implementation
Objectives

• Apply the four principles of environmental restoration to response design and implementation

• Provide framework and tools for conducting response design and implementation in light of inherent uncertainties
## Principles Translated through the Remediation Process

<table>
<thead>
<tr>
<th>Principle</th>
<th>Pre-Decision Document</th>
<th>Post-Decision Document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define objective and maintain focus on it (What needs to be done?)</td>
<td>Clear, concise statement of problem</td>
<td>Clear, concise definition of restoration objective</td>
</tr>
<tr>
<td></td>
<td>Clear, concise statement of restoration objective</td>
<td>Clear, concise definition of completion - performance measurement based on that definition</td>
</tr>
<tr>
<td>Early identification of probable means of achieving objective (How will it be done?)</td>
<td>Early identification of likely response actions</td>
<td>Early development of draft work plans</td>
</tr>
<tr>
<td></td>
<td>Early identification of likely design basis</td>
<td>Early development of draft work plans</td>
</tr>
<tr>
<td></td>
<td>Early development of draft work plans</td>
<td>Early identification of post-construction procedures for long term care</td>
</tr>
<tr>
<td>Uncertainties are inherent and must be managed (What are expected conditions and potential deviations?)</td>
<td>Evaluate effects uncertainty could have on response selection</td>
<td>Monitor indicators to provide early warning on which contingency will likely be needed, if any</td>
</tr>
<tr>
<td></td>
<td>Evaluate effects uncertainty could have on response design</td>
<td>Monitor indicators to provide early warning that response will fail to meet objective</td>
</tr>
<tr>
<td></td>
<td>Monitor indicators to provide early warning on which contingency will likely be needed, if any</td>
<td>Monitor indicators to provide early warning that response will fail to meet objective</td>
</tr>
<tr>
<td>Early open communication and consensual decision making by project team</td>
<td>Prepare problem statement, select response action and accept level of residual uncertainties</td>
<td>Develop consensus interpretation of decision document, approve designs, approve residual uncertainty management plan, and define/agree on objectives</td>
</tr>
<tr>
<td></td>
<td>Interpret performance measurement and contingency monitoring results, and approve implementation of contingencies</td>
<td>Review monitoring data, implementation of contingencies and be involved in 5 year reviews</td>
</tr>
</tbody>
</table>
Define Objective and Maintain Focus on It

- Translate the requirements of the decision document into description of:
  - Overall objectives
  - Performance criteria
  - Determination of when project reaches completion
Defining Objective during RDI

• Primary objective is achieved by working with the decision document to identify/clarify:
  – Performance objectives
  – Response action and its components
  – Criteria and standards
  – Other requirements and conditions
• Once "what" is required is identified, need to select performance metrics and criteria to define:
  – What we're measuring and how
  – Point for establishing objectives
Early Identification of Probable Means of Achieving Objective

- Identify areas of flexibility in decision documents that can be leveraged to optimize design and implementation
- Identify opportunities for continual improvement
- Identify opportunities to optimize projects and incentivize contractors
Means of Achieving Objective during RDI

- Select design basis for developing plans and specifications
- Capture optimization/innovation opportunities
- Manage uncertainty with project delivery strategies
- Look for ways to incentivize projects
Uncertainties are inherent and must be managed

- Once a response is selected, must evaluate implementation uncertainties including:
  - The range of values surrounding the selected design basis
  - The potential effects should project encounter conditions different than the estimate upon which the design is based
Managing Uncertainties during RDI

- Mitigate uncertainties arising from incomplete knowledge or changes in site conditions, technology performance, and regulatory requirements
- Evaluate impacts if estimates in design basis are different than what is encountered
- Ensure response is meeting all objectives
- Decide appropriate level of contingency development
## Example Uncertainty Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Design Basis</th>
<th>Range</th>
<th>Threshold</th>
<th>Impact</th>
<th>Probability</th>
<th>Monitoring</th>
<th>Contingency</th>
<th>Time to Implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation</td>
<td>No utilities</td>
<td>Water</td>
<td>Any one utility</td>
<td>Halt excavation</td>
<td>Low</td>
<td>Visual</td>
<td>Cocoon</td>
<td>1-2 day</td>
</tr>
<tr>
<td></td>
<td>Only Cr (III) present</td>
<td>Storm sewer Electrical</td>
<td>&gt; RCRA limits</td>
<td>Damage or disrupt service Remedy illegal w/o treatment Delay while new plan approved Revised H&amp;S plan Staging areas Delays in analytical services</td>
<td>Moderate</td>
<td>Field wet chemistry Visual</td>
<td>Hand dig</td>
<td>1-2 day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water</td>
<td>Storm sewer Electrical</td>
<td>Cr (VI) present</td>
<td>30-60 days if contingency not developed, including all permits and contracts, prior to implementing response</td>
<td>Contract to ship/treat off-site TSD Reduce to Cr (III)</td>
<td></td>
<td>30-60 days</td>
</tr>
</tbody>
</table>
Early Open Communication and Consensual Decision Making by Core Team

• Role of the core team evolves from the pre-decision stages through design and implementation
Consensus Decision Making during RDI

Investigation/Assessment Phase

- Core Team
  - Directs
  - Consensus on major decisions such as:
    - Site conceptual model
    - Project objectives
    - Selects response
    - Identifies uncertainties to be reduced and those for which contingencies will be developed to counteract impacts

- Project Team
  - Supports decisions by supplying inputs such as:
    - Work Plans
    - Results of investigation
    - Risk analysis

Action Phase (RDI)

- Core Team
  - Directs
  - Consensus on major decisions such as:
    - Interpretation of decision document
    - Contingency plans
    - Performance measures
    - Threshold values
    - Appropriate time to implement contingencies
    - Long-term options

- Project Team
  - Supports decisions by supplying inputs such as:
    - Alternate contingencies
    - Alternate performance measurement schemes
    - Conducts RDI
    - Collects performance measurement data
    - Develops long-term care alternatives, O&M, and other monitoring plans
Interrelationship among principles during RDI

Focus on Objective
- Defines Universe of Candidate Technologies
- Feedback on Achievability of Objective
- Determines Relevancy of Activities
- Determines Objective
- Determines Critical Thresholds
- Feedback on Probability of Meeting Objective

Core Team
- Provides Focus
- Selects Technologies
- Identifies Significant Uncertainties
- Assesses Impacts of Decisions
- Approves Management Plan

Uncertainty Evaluation
- Early Identification of Means of Achieving Objective

Core Team
- Provides Focus
- Selects Technologies
- Identifies Significant Uncertainties
- Assesses Impacts of Decisions
- Approves Management Plan