Module 2

Restoration Process Overview

Triad
- Systematic Planning
- Dynamic Work Strategies
- Real-Time Measurements
Life Cycle Site Decision-Making is Based on Data

- Are contaminants present in environmental media at levels above background at a site? (*Background and screening levels*)
- Does the site present ongoing and immediate health and safety issues? (*OSHA and other promulgated standards*)
- Do those contaminants pose unacceptable dose or risk concerns? (*Cleanup Levels*)
- Which portions of a site require remediation? (*Cleanup Levels*)
- Are remedial actions performing as expected? (*Various Performance Measures*)
- Where can we dispose of waste streams? (*Waste Acceptance Criteria and DOT Limits*)
- When can remediation stop, and are we confident that residual risks/doses are at acceptable levels? (*Cleanup Levels*)
Decision Criteria Depend on the Decision to be Made

- Different criteria come into play at different points in the cleanup process
- Example: uranium in soils at Fernald
  - Background in soils ~ 5 ppm
  - NRC soil screening level ~ 42 ppm
  - Cleanup level – 82 ppm
  - Waste Acceptance Criterion for OSDF – 1,000 ppm
For Every Step of the Process, Data Inputs are Key

**CERCLA** (Comprehensive Environmental Response, Compensation and Liability Act)
- Discovery; Preliminary Assessment (PA)
- Site Investigation (SI)
  - Extended Site Investigation (ESI)
  - Remedial Investigation/Feasibility Study (RI/FS)
- Remedial Action
  - Closure

**RCRA** (Resource Conservation and Recovery Act)
- Discovery
- RCRA Facility Assessment (RFA)
- RCRA Facility Investigation (RFI)
- Corrective Measures Study (CMS)
- Corrective Measures Implementation (CMI)
  - Closure

Discovery Cleanup

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Discovery Phase

Are contaminants present?

- Relatively limited judgmental/biased sampling/measurements
- Broad suite analyses
- Relatively high levels of analytical quality
- Individual sample results typically compared to some threshold
  - Soil screening levels
  - Background threshold values
Cleanup Phase

Are contaminants above cleanup levels?

- Relatively more, systematic sampling
- More limited set of target contaminants
- Opportunity for using lower quality analytical methods suitable for contaminants of concern/cleanup levels
- Sets of sample results compared to cleanup levels
Different Media Require Different Characterization Approaches

<table>
<thead>
<tr>
<th>Media</th>
<th>Strategies/Methods</th>
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<tbody>
<tr>
<td>Soils</td>
<td>• Systematic/biased soil samples with on site or off-site laboratory analysis for contaminants of concern</td>
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<tr>
<td></td>
<td>• Direct measurement of soils for some contaminants of concern</td>
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<tr>
<td></td>
<td>• Non-intrusive geophysics to look for buried wastes</td>
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<tr>
<td>Groundwater</td>
<td>• Monitoring wells with groundwater samples</td>
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<tr>
<td></td>
<td>• Direct push sample collection/measurements</td>
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<td></td>
<td>• Subsurface physical characteristics important (water table depth, groundwater flow direction, hydraulic conductivity, lithology, etc.)</td>
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<tr>
<td>Waste Streams</td>
<td>• Systematic sampling/screening of waste stream materials</td>
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<tr>
<td>Process Equipment</td>
<td>• Systematic sampling/screening of equipment</td>
</tr>
</tbody>
</table>
Insufficient Data Lead to Bad Consequences

- Missing contaminants of concern altogether
- Missing site-specific dose or health risks that should be addressed
- Spending resources on remedial actions that are not truly necessary from a risk or dose perspective
- Inefficient remedial actions that were based on misleading data
The Decision Unit for Criteria is Often **Not** Well-Defined

“Lead should not exceed 400 ppm in soils”

or

“TCE should not exceed 5 ppb in ground water”

Decisions are often ambiguous because cleanup criteria do not provide enough information to define the decision units.
For Soils, Three Cleanup Requirement Definitions are Most Common:

• **Never-to-Exceed Criteria**: “Lead concentrations cannot be > 400 ppm”

• **Hot-Spot Criteria**: “Lead concentrations cannot be > 400 ppm averaged over 100 m²”

• **Averaged Criteria**: “The average concentration of lead over an exposure unit cannot be > 400 ppm”
MARSSIM Requires DCGLs

• Rad sites are covered by MARSSIM (Multi-Agency Radiation Survey and Site Investigation Manual)

• MARSSIM poses cleanup requirements as DCGL (Derived Concentration Guideline Levels)

• $DCGL_w$ – wide area standard that must be achieved over an area the size of a survey unit

• $DCGL_{emc}$ – elevated measurement comparison, a higher level defined for smaller areas
DCGL Derivation

Site Specific Risk or Dose-Based Requirements

- Soil Ingestion
- Dust, Radon
- Drinking Water
- Fish
- Plant Foods
- Milk
- Meat

Radioactively Contaminated Material in Soil

Infiltration

Leaching

Groundwater

Elevated Area Size

FSS Unit Size

Cleanup Requirement (pCi/g)

Defined by Area Factor Analysis

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Any Questions?