Module 2

Restoration Process Overview
Life Cycle Site Decision-Making is Based on Data

• Are contaminants present in environmental media at levels above background at a site?
• Does the site present ongoing and immediate health and safety issues?
• Do those contaminants pose unacceptable dose or risk concerns?
• Which portions of a site require remediation?
• Are remedial actions performing as expected?
• When can remediation stop, and are we confident that residual risks/doses are at acceptable levels?
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

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Discovery Phase

Are contaminants present?

• Relatively limited judgmental/biased sampling
• 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
Bad Data Lead to Bad Consequences

- 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.
Complete Cleanup Criteria Definitions

• Cannot achieve data **representativeness** without a complete definition of cleanup criteria

• Incomplete criteria leads to confusion…example:
  – an *in situ* XRF Pb reading from a yard is 560 ppm,
  – while a homogenized sample from same is 200 ppm,
  – while the average for the yard is 50 ppm.

• Different **sample supports** → different concentration estimates that are all correct but lead to different conclusions

• **Must DEFINE population of interest to interpret data!!**
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
- MARSSIM poses cleanup requirements as DCGL (Derived Concentration Guideline Levels)
- DCGL\textsubscript{w} – wide area standard that must be achieved over an area the size of a survey unit
- DCGL\textsubscript{emc} – elevated measurement comparison, a higher level defined for smaller areas
DCGL Derivation

Site Specific Risk or Dose-Based Requirements

- Soil Ingestion
- Drinking Water
- Fish
- Soil Dust
- Radon
- Plant Foods
- Milk
- Meat
- Radioactively Contaminated Material in Soil
- Infiltration
- Leaching
- Groundwater

Cleanup Requirement (pCi/kg)

Defined by Area Factor Analysis

Elevated Area Size vs. FSS Unit Size

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Defensible Statistical Sampling Program Design and Data Analysis Requires:

• Clearly defined decision units and decision-making (e.g., action level) criteria
• Sample supports that are representative of the decision unit of interest
• Analytical method implementation consistent with required sample support
Any Questions?