

US EPA ARCHIVE DOCUMENT

SESSION 2

Addressing Data Gaps That Remain Before the Remedy Can Be Selected

WHAT ARE APPROPRIATE MEDIA CLEANUP
STANDARDS?



**Agenda:
Appropriate Media Cleanup Standards**

- ▶ Media cleanup standards defined
- ▶ Examples of media cleanup standards
- ▶ Factors to consider when selecting media cleanup standards
- ▶ How site-specific risk-based media cleanup standards are developed



Media Cleanup Standards Defined

- ▶ Risk-based concentrations of contaminants for specific media that must be achieved for a corrective measure to be protective of human and ecological receptors under current and future land use conditions

Carcinogens: Based on EPA's acceptable target risk range of 10^{-4} to 10^{-6} , with 10^{-6} typically used as point of departure

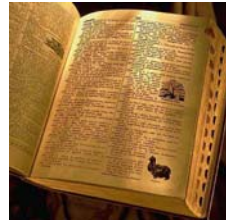
Non-carcinogens: Based on a hazard quotient less than or equal to 1.0

- ▶ Non-risk-based media cleanup standards are levels that have been set, for whatever reason, as benchmarks for cleanup
 - For example, background concentrations for metals like arsenic
- ▶ Also commonly known as remedial goals or corrective action goals



Media Cleanup Standards Defined (cont.)

- ▶ Media cleanup standards are selected as the goal of corrective measures implementation
 - For example, a remedy for lead contamination in soil might be to excavate all soil containing lead at concentrations greater than 400 mg/kg
- ▶ Used to determine the success of corrective measures
- ▶ Very dependent on land use, exposure assumptions, and level of protection required



Commonly Used Media Cleanup Standards

▶ Human Health Standards

- Maximum Contaminant Levels (MCLs)
- Federal and State Water Quality Standards
- EPA Region 9 Preliminary Remediation Goals (PRGs)
- Florida's Contaminant Cleanup Target Levels (F.A.C. 62-777)
- North Carolina Hazardous Waste Section Soil Screening Levels
- Site-Specific Concentrations
- Alternate Concentration Limits
- Site Background Concentrations

▶ Ecological Standards

- NOAA Screening Quick Reference Tables (SQuiRTs)
- ORNL Ecotoxicological Screening Benchmarks
- EPA Region 5 Ecological Screening Levels (ESLs)



Important Media Cleanup Standard Concepts

- ▶ Site-specific media cleanup standards (MCSs) must consider all complete exposure pathways
- ▶ Selected MCSs should consider presence of multiple contaminants
- ▶ Consideration of conditional remedies
 - Prevent further degradation of media
 - Monitoring is continued
 - Institutional or other controls utilized
 - Complies with waste management standards
- ▶ Consideration of current and future land use
 - Unrestricted versus restricted exposure scenarios



How Are Risk-Based Media Cleanup Standards Developed?

- ▶ Risk-based media cleanup standards are developed by performing a risk assessment in reverse
- ▶ Back-calculated from a specific target risk level (e.g., 1×10^{-6}) or a target hazard quotient (e.g., 1.0)
- ▶ Developed by evaluating potential risks posed by contaminants and media in question and considering:
 - Toxicity of constituents of concern
 - Human and ecological receptors
 - Receptor exposure assumptions
 - Exposure pathways
 - Fate and transport characteristics
 - Current and future land use



How Are Risk-Based Media Cleanup Standards Calculated?

Receptor	Off-Site Resident	On-Site Worker	Construction Worker
Exposure Frequency (d/yr)	350	225	Site-specific
Exposure Duration (yr)	30 (24 adult and 6 child)	25	Site-specific
Soil Ingestion Rate (mg/d)	200 (child) 100 (adult)	50–100	330
Drinking Water Ingestion Rate (L/d)	2	2	2
Inhalation Rate (m ³ /d)	20	20	20
Surface Area Exposed (cm ²)	2,800 (child) 5,700 (adult)	3,300	3,300
Adherence Factor (mg/cm ²)	0.02 (child) 0.07 (adult)	0.2	0.3
Body Weight (kg)	15 (child) 70 (adult)	70	70



Calculating Risk-Based Media Cleanup Standards

Ingestion of Benzene in Soil

On-Site Worker

$$\text{Media Cleanup Standard (mg/kg)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365\text{d/yr}}{\text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED} \times \text{SF}} = 464 \text{ mg/kg}$$

Parameter	Units	Value
Target Risk (TR)	unitless	1×10^{-6}
Body Weight (BW)	kg	70
Averaging Time (AT)	days	5,625 (EF x ED)
Soil Ingestion Rate (IR)	mg	100
Conversion Factor (CF)	kg/mg	1×10^{-6}
Fraction Ingested (FI)	unitless	1.0
Exposure Frequency (EF)	days	225
Exposure Duration (ED)	years	25
Slope Factor (SF)	mg/kg-day ⁻¹	5.5×10^{-2}



Calculating Risk-Based Media Cleanup Standards

Ingestion of Benzene in Soil

Construction Worker

$$\text{Media Cleanup Standard (mg/kg)} = \frac{\text{TR} \times \text{BW} \times \text{AT} \times 365\text{d/yr}}{\text{IR} \times \text{CF} \times \text{FI} \times \text{EF} \times \text{ED} \times \text{SF}} = 140 \text{ mg/kg}$$

Parameter	Units	Value
Target Risk (TR)	unitless	1×10^{-6}
Body Weight (BW)	kg	70
Averaging Time (AT)	days	5,625 (EF x ED)
Soil Ingestion Rate (IR)	mg	330
Conversion Factor (CF)	kg/mg	1×10^{-6}
Fraction Ingested (FI)	unitless	1.0
Exposure Frequency (EF)	days	250
Exposure Duration (ED)	years	1
Slope Factor (SF)	mg/kg-day ⁻¹	5.5×10^{-2}



Guidance/References

- ▶ U.S. Environmental Protection Agency. Risk-Based Clean Closure Memorandum. March 16, 1998.
- ▶ U.S. Environmental Protection Agency. RCRA Facility Investigation (RFI) Guidance. July 26, 1989. (OSWER Directive 9502.00-6D).
- ▶ U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals. December 1991. (OSWER Directive 9285.7-01B).
- ▶ <http://www.epa.gov/Region9/waste/sfund/prg/index.htm>

