

U.S. EPA CERCLA
(Superfund) Ecological
Radiation Risk Assessments
for Biota Receptors

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Environmental Risk from Radioactive
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EPA Addresses Site Cleanup Under
Several Laws, Programs

- ◆ Comprehensive Environmental Response, Compensation & Liability Act, CERCLA or “Superfund”
- ◆ National Contingency Plan (NCP) is regulation for CERCLA
- ◆ National Priorities List (NPL) guides EPA on which sites need further attention



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Purpose

- ◆ Provide overview of CERCLA ecological assessments for the protection of biota species
 - » Current approach
 - » Future guidance



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Part 1.
What does Superfund Address



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Superfund sites:
Number and Progress

- ◆ 1,279 NPL sites
 - » 56 are radiation sites
- ◆ 61 more sites proposed for NPL
 - » 1 is a radiation site
- ◆ 1,084 NPL sites have progressed to "construction completion"
 - » 37 are radiation sites



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What does a Superfund Site look like?

- ◆ There are many different types of Superfund sites.
 - » See following 4 pages for examples of radioactively contaminated sites.



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Nuclear Metals Inc. - Massachusetts



EPA

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Abandoned Uranium Mines Project - Navajo Nation



EPA

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Welsbach/General Gas Mantle - New Jersey



EPA

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Hanford – D Reactor / DR Reactor Remediation



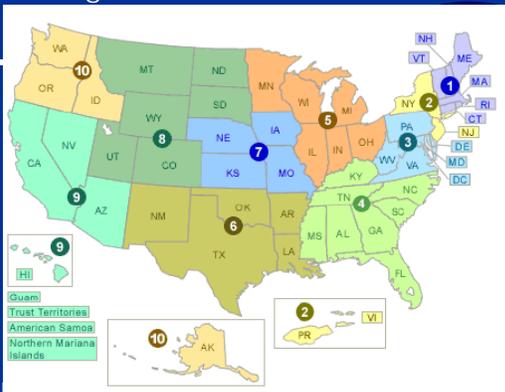
CERCLA Decision-making

- ◆ CERCLA cleanup decisions are made site-specifically
 - » Must comply with law (CERCLA) and regulations (NCP)
- ◆ EPA Regional site managers
 - » Removals – On Scene Coordinators (OSCs)
 - » Remedial (and NTC-removals) – Remedial Project Managers (RPMs)



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EPA Regions



2. Superfund Cleanup Process



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Nine CERCLA Remedy Selection Criteria

- ◆ Two threshold criteria (both must be met)
 1. Protect human health and the **environment**
 2. Comply (attain or waive) with other federal and state laws: Applicable or Relevant and Appropriate Requirements (ARARs)
 - Protect current or future sources of drinking water (e.g., attain MCLs or more stringent state standards)



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Nine CERCLA Remedy Selection Criteria (continued)

- ◆ Five balancing criteria (used to evaluate between potential remedies that meet threshold criteria)
 1. Long-term effectiveness and permanence
 2. Reduction of waste toxicity, mobility, or volume
 3. Short-term effectiveness
 4. Implementability
 5. Cost



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Nine CERCLA Remedy Selection Criteria (continued)

◆ Two modifying criteria (information from public comment period that may modify remedial action)

1. State acceptance
2. Community acceptance



CERCLA Cleanup Levels

- ◆ ARARs often determine cleanup levels
- ◆ Where ARARs are not available or protective, EPA sets site-specific cleanup levels that
 - » For carcinogens, represent an increased **cancer risk of 1×10^{-6} to 1×10^{-4}**
 - 10^{-6} used as “point of departure”
 - PRGs are established at 1×10^{-6}
 - » For non-carcinogens, will not result in adverse effects to human health (hazard index (HI) <1)

◆ **Address ecological concerns**

◆ To-be-considered (TBC) material may help determine cleanup level

3. Risk Assessment for Biota Receptors



Ecological Risk Assessment and Risk Management Principles for CERCLA Sites

◆OSWER Directive 9285.7-28 P, Signed 10/7/99

» www.epa.gov/superfund/programs/risk/tooleco.htm

◆Purpose: Help RPMs make ecological risk management decisions that are based on sound science, consistent across Regions, and present a characterization of site risks that is transparent to the public.

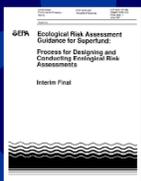
◆NCP says that we need to provide "adequate" protection from "unacceptable" risks.



Superfund Guidance for Ecological Risk Assessments

◆Superfund guidance recommends developing ecological benchmarks

» "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments"



Environmental Setting On and Off Site Land Uses

◆Use of human health protection to infer environmental protection.

"...if man is adequately protected then other living things are also likely to be sufficiently protected" (ICRP 1977)

- » Not protective at sites with limited human population
- » Doesn't account for sites with institutional controls
- » Doesn't consider differences in exposure pathways

Upcoming Radionuclide Ecological Benchmark (REB) Calculator

- ◆ Establish risk-based Biota Concentration guides (BCGs), or ecological benchmarks, for radioactively contaminated sites
- ◆ Expected finalization near end of 2012

Basis for Benchmarks

- ◆ Derived from DOE Graded Approach guidance
 - » Includes same dose levels for tissue death:
 - 1 rad per day for plants (aquatic and terrestrial), aquatic and riparian animals
 - 0.1 rad per day for terrestrial animals
- ◆ Graded Approach guidance often used at CERCLA sites



Evaluate Other Eco Effects

- ◆ Strong recommendation to look at eco effects other than tissue death, such as:
 - » Lethargy: may lead to death or young not fed
 - » Behavior: alteration in predator avoidance
- ◆ You should still consult chemical eco guidance



REB Exposure Scenarios

- ◆ Includes 12 animal or plant benchmark scenarios
 - » 6 generic composite only
 - » 6 species-specific/site-specific

Generic Composite Benchmarks

- ◆ Generic Composite Benchmarks use lumped factors (concentration factors) that predict tissue concentration based on the concentration of radionuclides in environmental media.
- ◆ Limited user inputs
 - » Target dose
 - » Area Correction Factor (site size)

Select Generic Composite Benchmarks.

- Sediment Aquatic Animals (generic only)
- Water Aquatic Animals (generic only)
- Sediment Aquatic Plants (generic only)
- Water Aquatic Plants (generic only)
- Sediment Riparian Animals
- Water Riparian Animals
- Soil Terrestrial Plants (generic only)
- Water Terrestrial Plants (generic only)
- Soil Terrestrial Animals
- Water Terrestrial Animals

Species-Specific/Site-Specific Benchmarks

- ◆ A more sophisticated method using kinetic/allometric equations is used in generating species-specific/site-specific benchmarks.
 - » User may input characteristics for specific species and their site

Select Species-Specific/Site-Specific Benchmarks.

- Sediment Riparian Animals
- Water Riparian Animals-carnivorous
- Water Riparian Animals-herbivorous
- Soil Terrestrial Animals-carnivorous
- Soil Terrestrial Animals-herbivorous
- Water Terrestrial Animals

Select Specific Endpoints

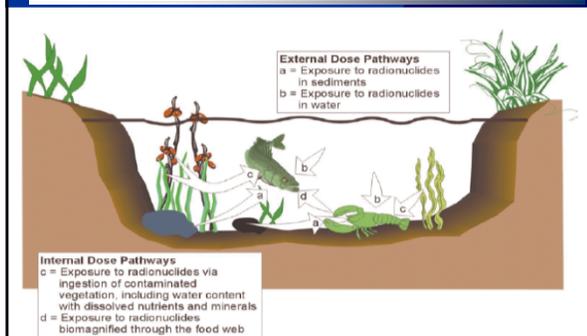
◆ When selecting representative species for species specific benchmarks the following should be considered.

- » Preference given to organisms with small home ranges.
- » Organism should be susceptible to ionizing radiation.
- » Organism should represent major exposure pathways
- » Organism should be indigenous to the area.
- » Organism should have a reasonable amount of data published and available.
- » Organism should be appropriate for the community being evaluated.

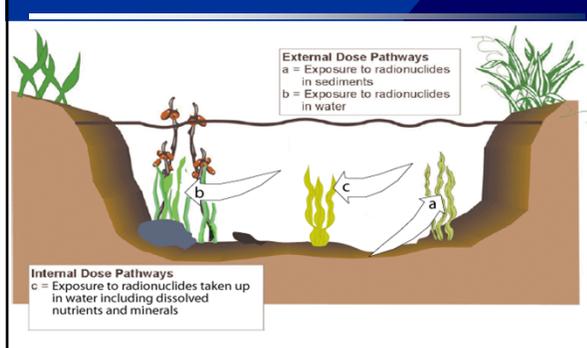


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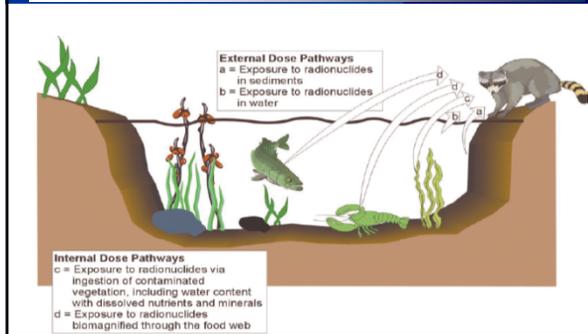
Exposure Pathways for Aquatic Animals (1 Rad per day)



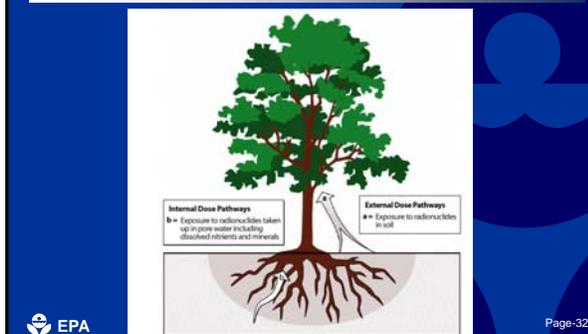
Exposure Pathways for Aquatic Plants (1 Rad per day)



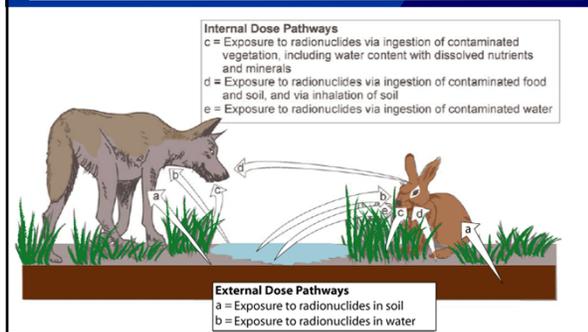
Exposure Pathways for Riparian Animals (1 Rad per day)



Exposure Pathways for Terrestrial Plants (1 Rad per day)



Exposure Pathway for Terrestrial Animals (0.1 Rad per day)



New Eco Dose Conversion Factors (DCFs)

- ◆ DOE Phased Guidelines contained DCFs for 42 radionuclides
- ◆ REB Calculator will include 800 DCFs using updated methodology

Animal sizes

- ◆ External DCFs will be adjusted based on size of the animal receptor
- ◆ Preset external DCF adjustment factors will be included that are based on:
 - » Each of 800 external DCFs
 - » Several animal sizes

Research Needs?

- ◆ Establish biota dose limits for more specific receptor groups
 - » Terrestrial animals (e.g., herbivores, omnivores, and carnivores)
 - » Aquatic animals (e.g., pelagic fish, bottom feeders and shellfish)
- ◆ Better data on factors affecting animal exposure (sediment chemistry and bioaccumulation)

For More Information

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Questions



Answers



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