Superfund Radiation Risk Assessment Approach for Ecological Protection

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CLU-IN Webinar
Overview of Radiation and Chemical Ecological Risk Assessment
Models and Guidance for Contaminated Sites and Selected Default Input Parameters
on July 25, 2024

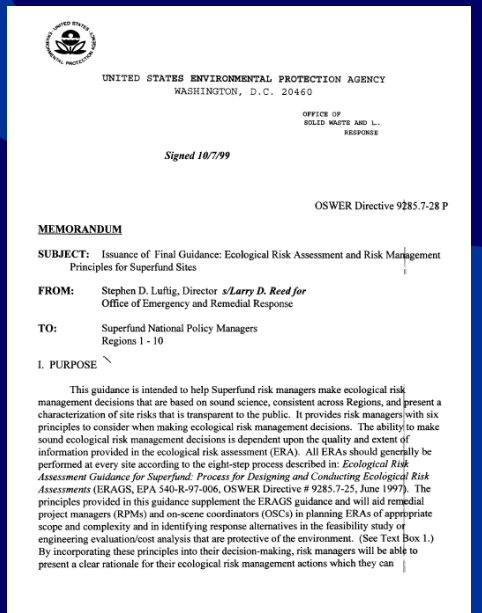
EPA

Purpose

- Provide brief overview of CERCLA (Superfund) tools for conducting risk assessing at radioactively contaminated sites to protect biota
- Need for this research project being discussed today

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.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND E.
RESPONSE

Signed 10/7/99

OSWER Directive 9285.7-28 P

MEMORANDUM

SUBJECT: Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites

FROM: Stephen D. Luftig, Director *s/Larry D. Reed for*
Office of Emergency and Remedial Response

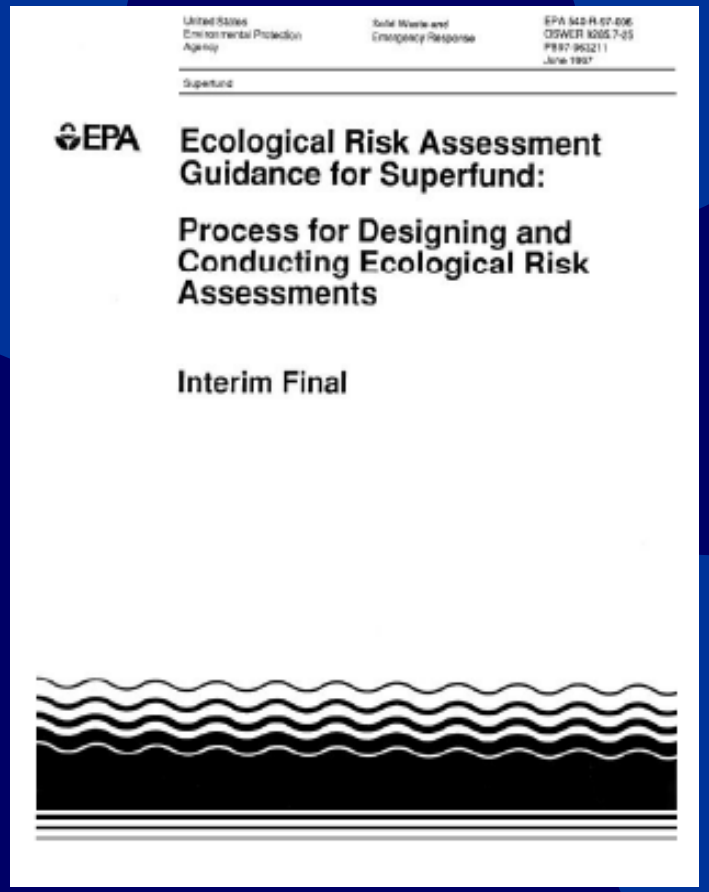
TO: Superfund National Policy Managers
Regions 1 - 10

I. PURPOSE

This guidance is intended to help Superfund risk managers 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. It provides risk managers with six principles to consider when making ecological risk management decisions. The ability to make sound ecological risk management decisions is dependent upon the quality and extent of information provided in the ecological risk assessment (ERA). All ERAs should generally be performed at every site according to the eight-step process described in: *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (ERAGS, EPA 540-R-97-006, OSWER Directive # 9285.7-25, June 1997). The principles provided in this guidance supplement the ERAGS guidance and will aid remedial project managers (RPMs) and on-scene coordinators (OSCs) in planning ERAs of appropriate scope and complexity and in identifying response alternatives in the feasibility study or engineering evaluation/cost analysis that are protective of the environment. (See Text Box 1.) By incorporating these principles into their decision-making, risk managers will be able to present a clear rationale for their ecological risk management actions which they can

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)

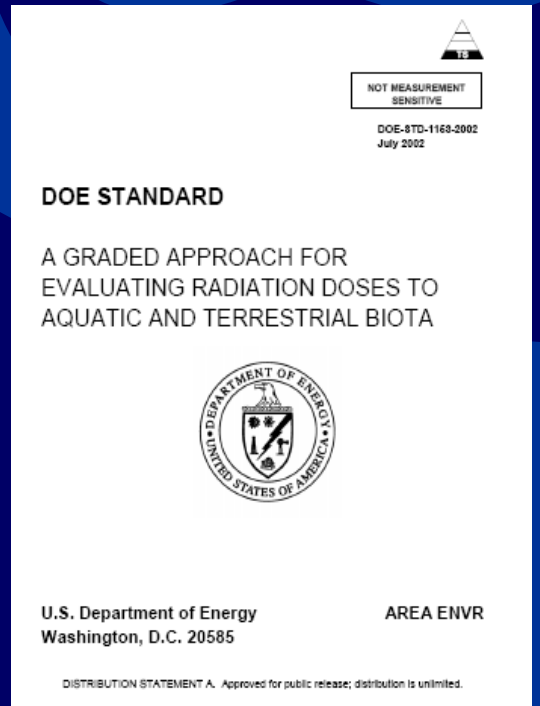
  - » Not protective at sites with limited human population
  - » Doesn't account for sites with institutional controls
  - » Doesn't consider differences in exposure pathways

Upcoming Radionuclide Ecological Benchmark (REB) Calculator

- Establish risk-based Biota Concentration guides (BCGs), or ecological benchmarks, for radioactively contaminated sites
- Expected finalization (maybe 2025?)
  - » Project has been delayed due to working on higher priority Human Health risk tools

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



NOT MEASUREMENT SENSITIVE

DOE-STD-1153-2002
July 2002

DOE STANDARD

A GRADED APPROACH FOR EVALUATING RADIATION DOSES TO AQUATIC AND TERRESTRIAL BIOTA

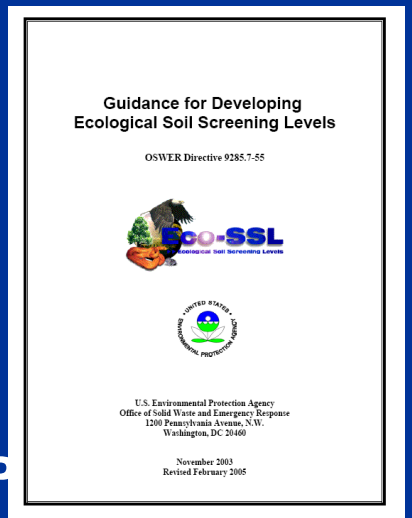
U.S. Department of Energy
Washington, D.C. 20585

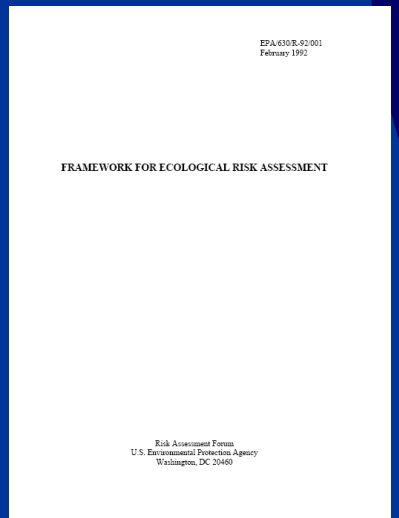
AREA ENVR

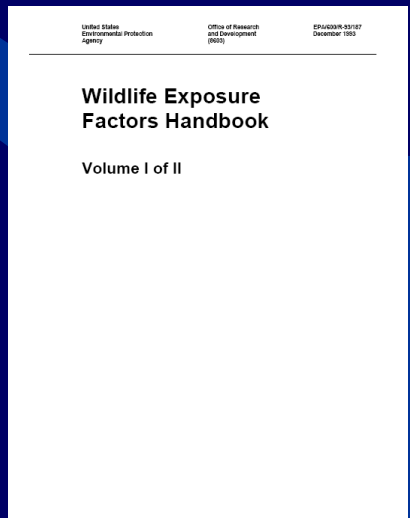
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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





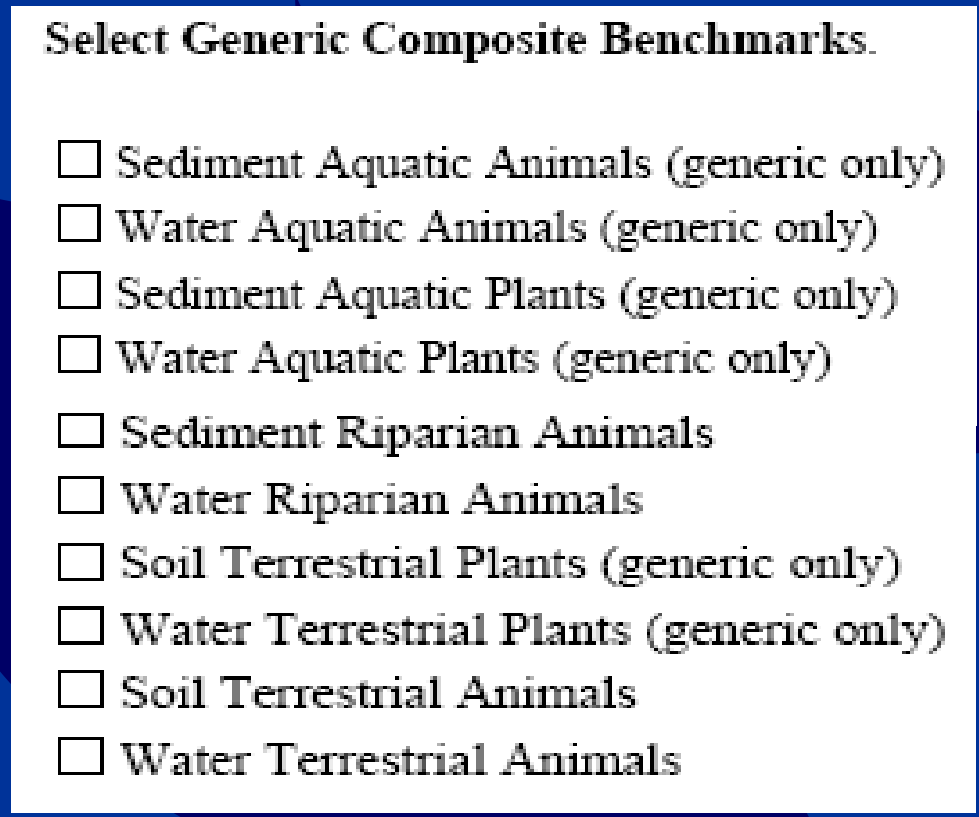


REB Exposure Scenarios

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

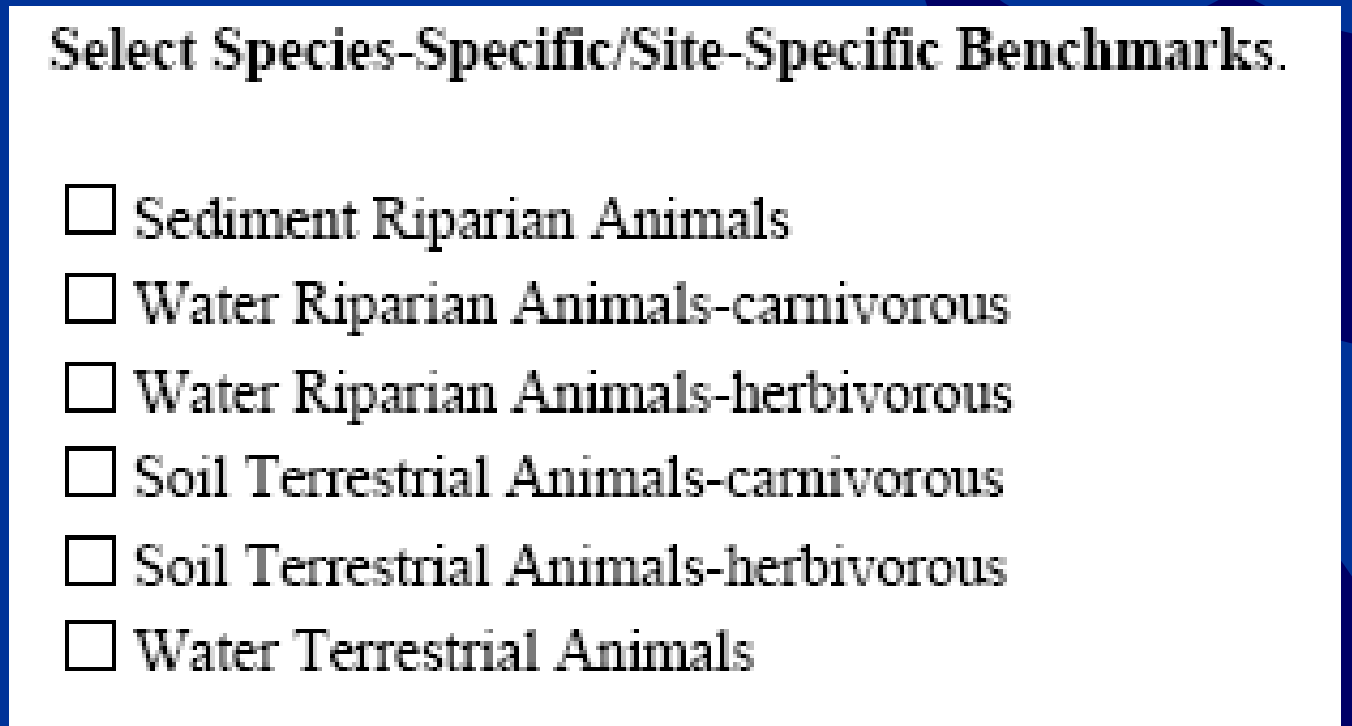
Generic Composite Benchmarks

- 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)



Species-Specific/Site-Specific Benchmarks

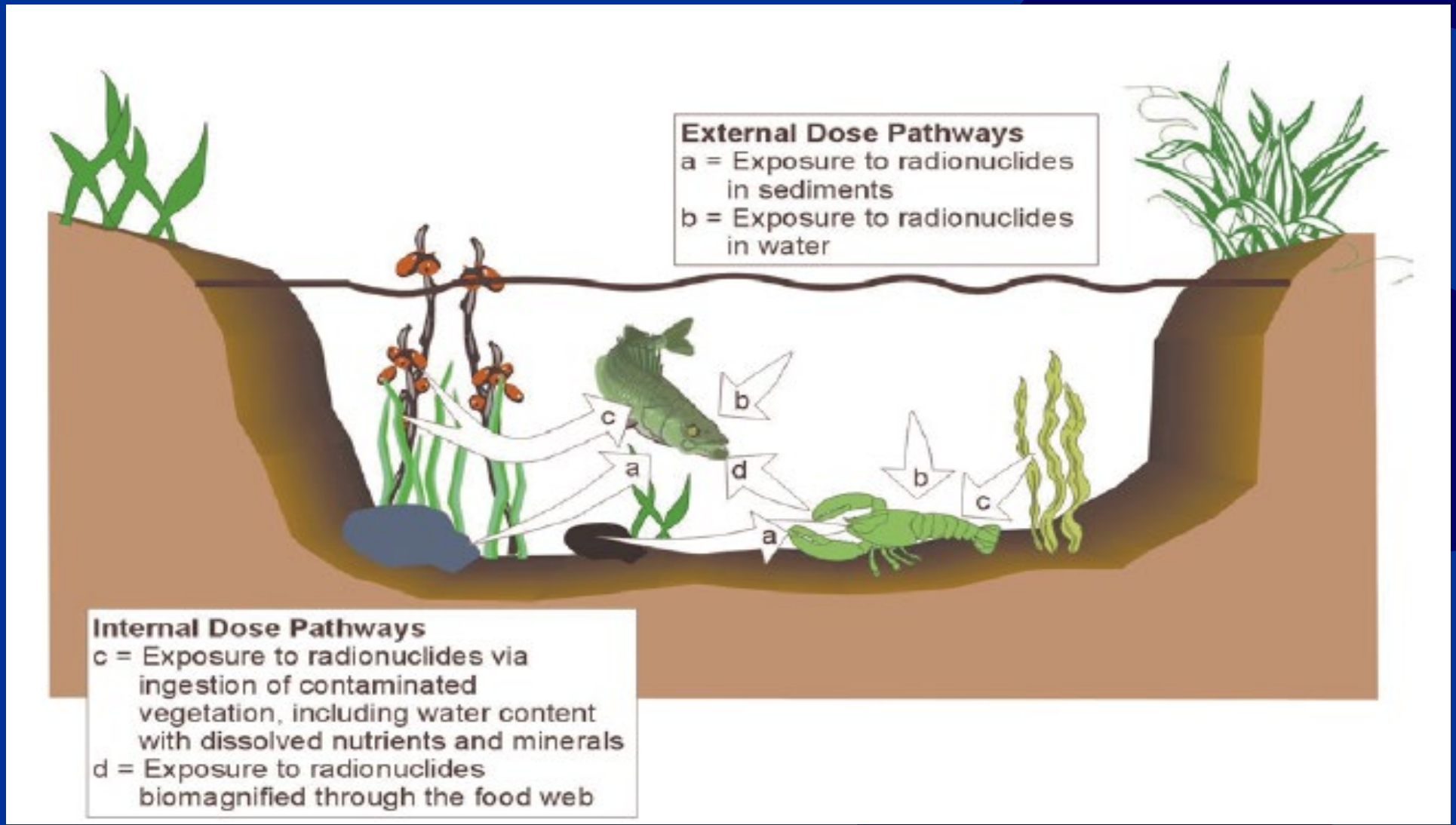
- A more sophisticated method using kinetic/allometric equations is used in generating species-specific/site-specific benchmarks.
  - User may input characteristics for specific species and their site



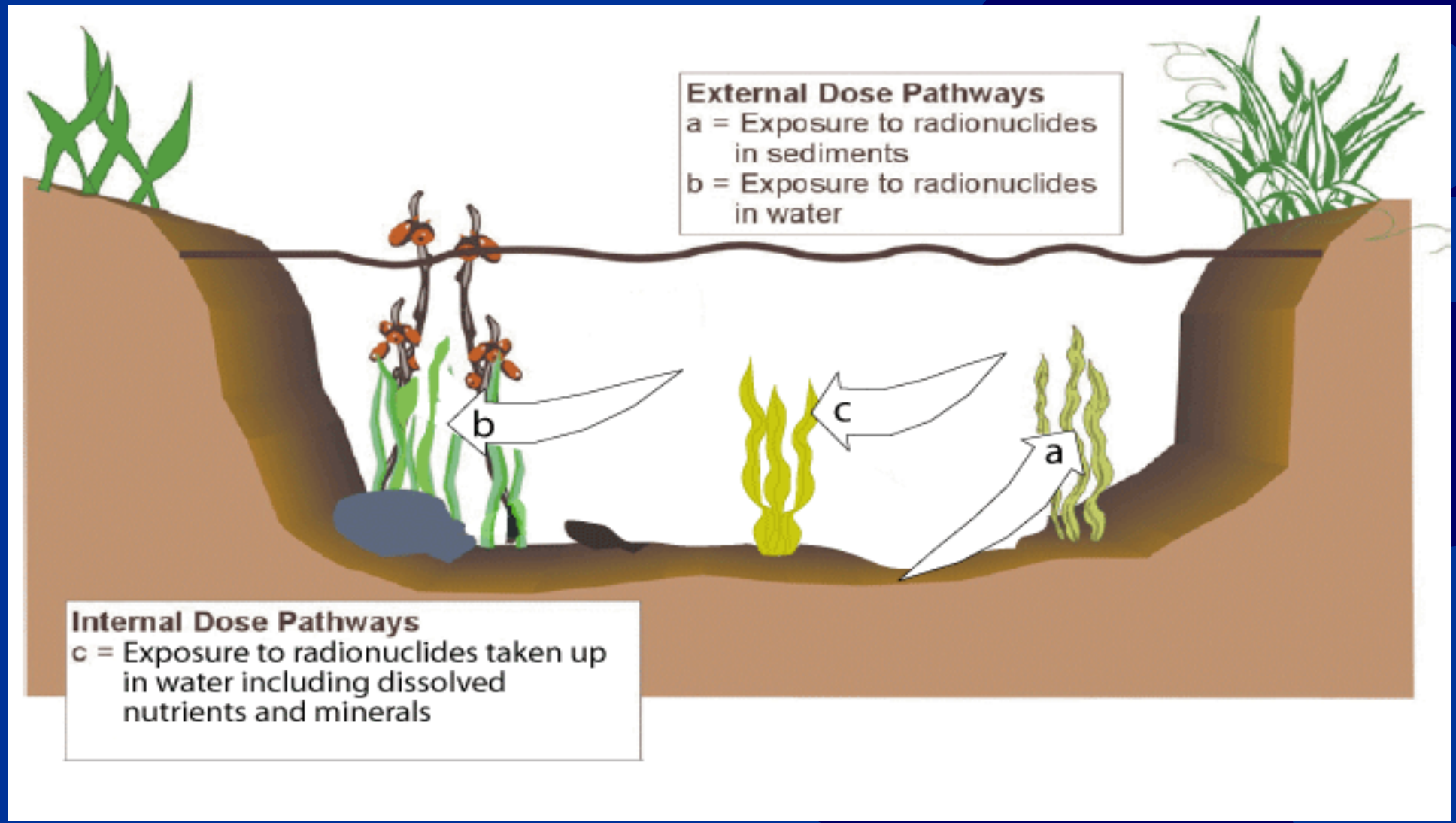
Select Specific Endpoints

- 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.

Exposure Pathways for Aquatic Animals (1 Rad per day)



Exposure Pathways for Aquatic Plants (1 Rad per day)



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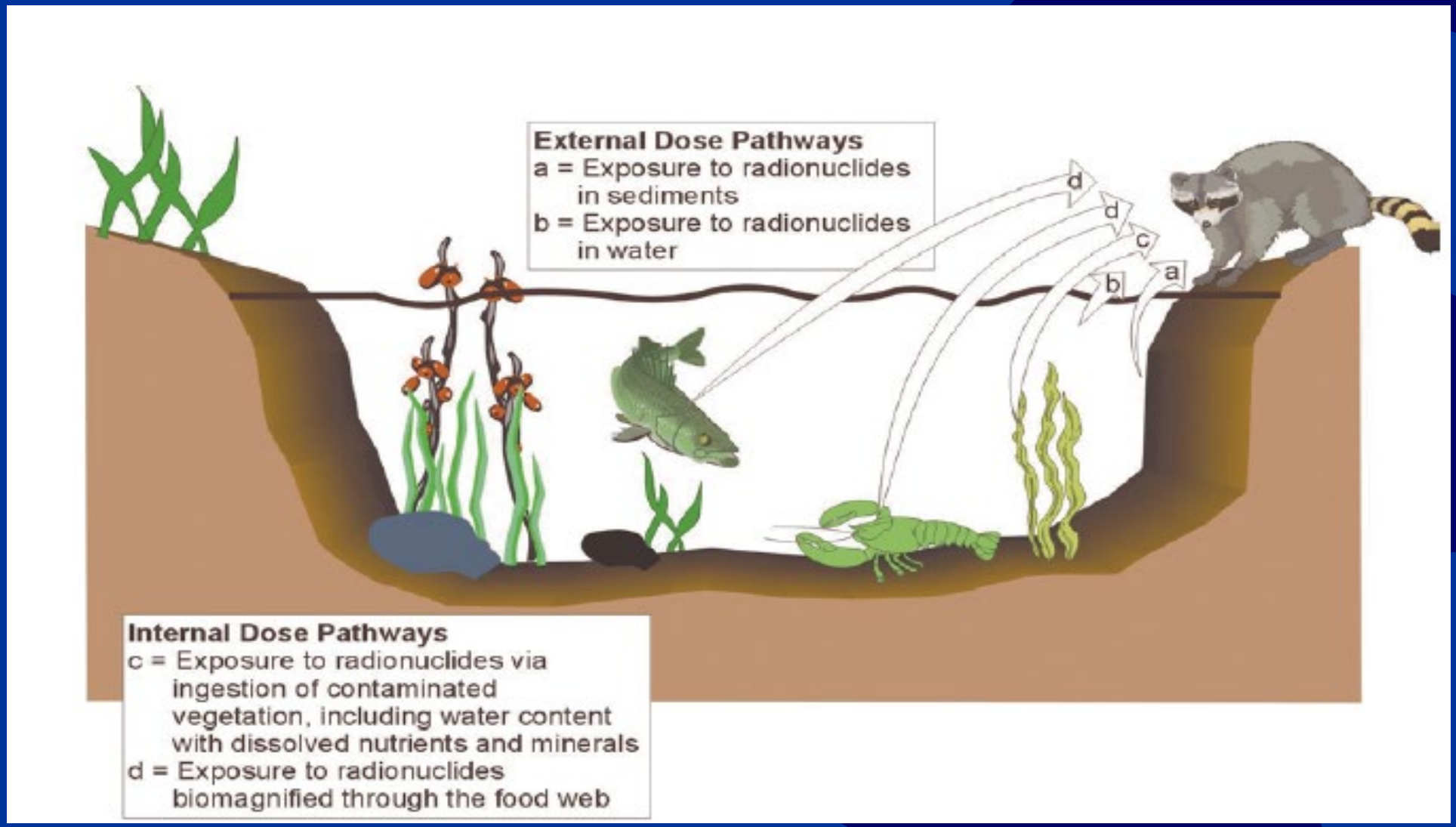
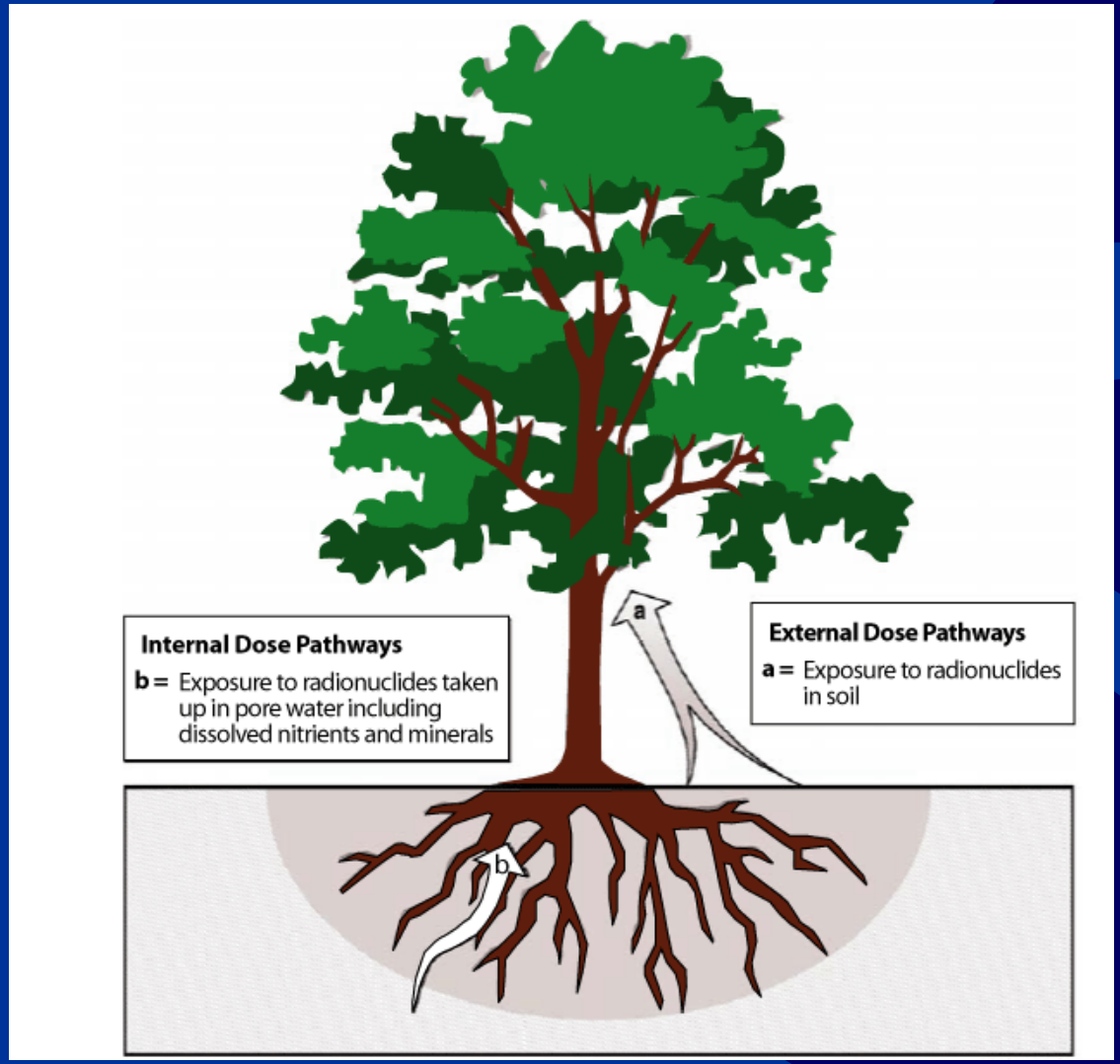
Exposure Pathways for Riparian Animals (1 Rad per day)



Exposure Pathways for Terrestrial Plants (1 Rad per day)



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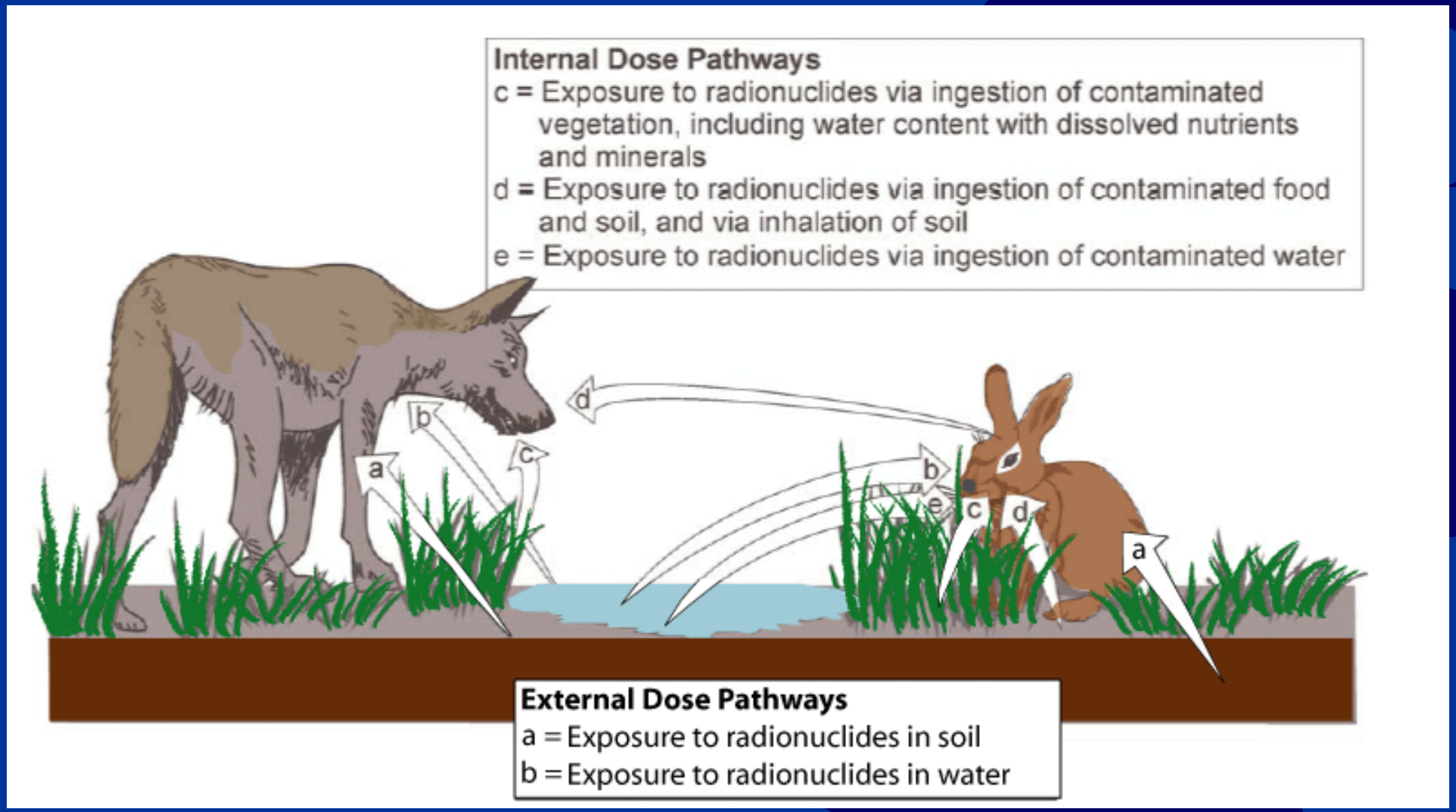
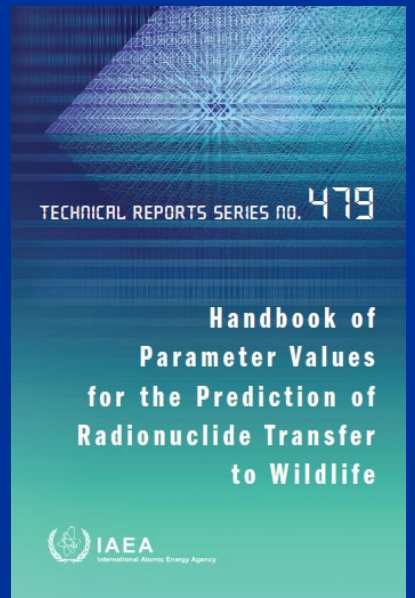
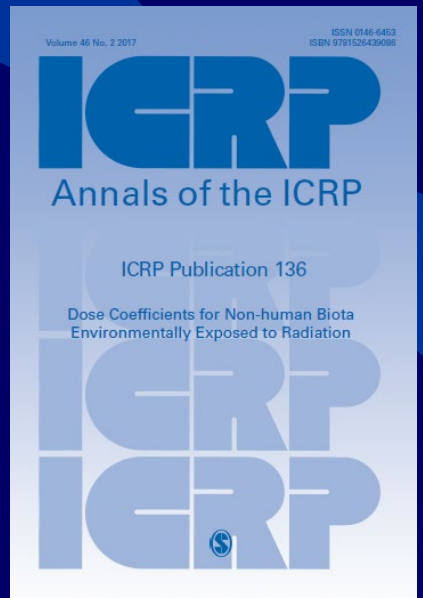
Exposure Pathway for Terrestrial Animals (0.1 Rad per day)



New Radiological Ecological Information for Potential REB calculator revision

- IAEA TRS 479 “Handbook of Parameter Values for the Prediction of Radionuclide Transfer to Wildlife”
- ICRP 136 “Dose Coefficients for Non-human Biota Environmentally Exposed to Radiation”





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Need for Intern Study

- The REB calculator project has been delayed while EPA worked on several human health risk assessment projects
- As those project near completion and REB calculator work will recommence, EPA wanted a study of available tools being used for ecological risk assessment.
  - » This will help inform subsequent REB calculator revisions.