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Overview of Environmental Impact Techniques for Non-Human Biota

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Objectives:

- Summarize three most commonly used techniques
 - Ecological indicators
 - Bioassays
 - Models
- Summarize the strengths and limitations of each
- Identify most widely used technique


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Use Ecological Indicators to Assess Impacts

- Compare indicators in contaminated area with control area
- Measure indicators such as:
 - Numbers of species; Numbers of individuals; Species diversity index; Fecundity; Population age distribution; Population density or productivity
- Advantages
 - Directly assesses affected populations and communities
 - Not likely to yield false negative results
 - Commonly used ecological method
- Disadvantages
 - Not a predictive technique
 - No cause and effect linkage to contamination
 - Differs from conventional dose assessment approach

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Use Bioassays to Assess Impacts

- Expose (in lab) representative organisms to contamination or effluents
- Measure parameters such as
 - Survival; Growth rates; Reproductive capacity at various exposures
- Compare lab results at various levels of contamination to controls
- Typically protocols use standardized species and tests
- Advantages
 - Directly assesses the effects of actual contamination
 - Standardization eliminates some sources of variability
 - Can be a predictive technique
- Disadvantages
 - May not truly represent population response in actual environment

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Use Model Simulations to Assess Impacts

- Impact modeling has 4 basic steps
 1. Estimate contaminant media concentrations
 2. Estimate contaminant uptake into representative organisms
 3. Estimate dose to various organisms
 4. Compare dose to reference level for environmental protection
- Advantages
 - Predictive capabilities
 - Can be used for screening and identifying important issues
- Disadvantages
 - Does not assess actual population or community response
 - Simulation results are artifact of limited knowledge of processes with potentially large uncertainties

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Model Simulations Most-Widely-Used by Radioecologists

- International Commission for Radiological Protection (ICRP)
 - Modeling framework described in Publications 108 and 114
 - Based on human assessment framework
- International Atomic Energy Agency (IAEA)
 - Biota Working Group – assessed various models
 - Ongoing development of Wildlife Transfer Coefficients Database
- European Commission
 - ERICA - dose modeling tool
 - FREDERICA – database for biological effects
- U.S. Department of Energy (DOE)
 - Only U.S. Agency with formalized approach
 - RESRAD-Biota, implements DOE technical standard

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