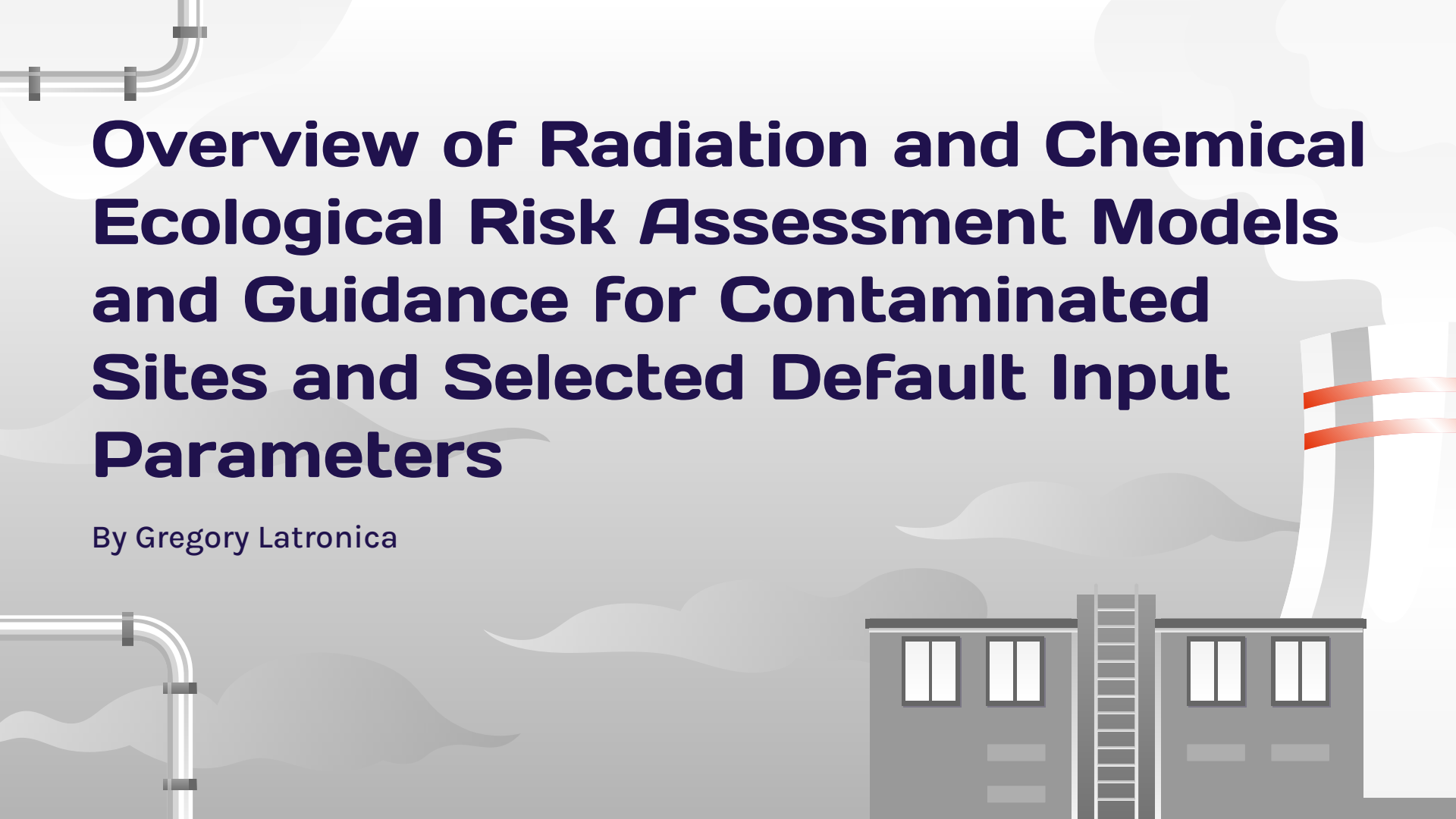
Overview of Radiation and Chemical Ecological Risk Assessment Models and Guidance for Contaminated Sites and Selected Default Input Parameters

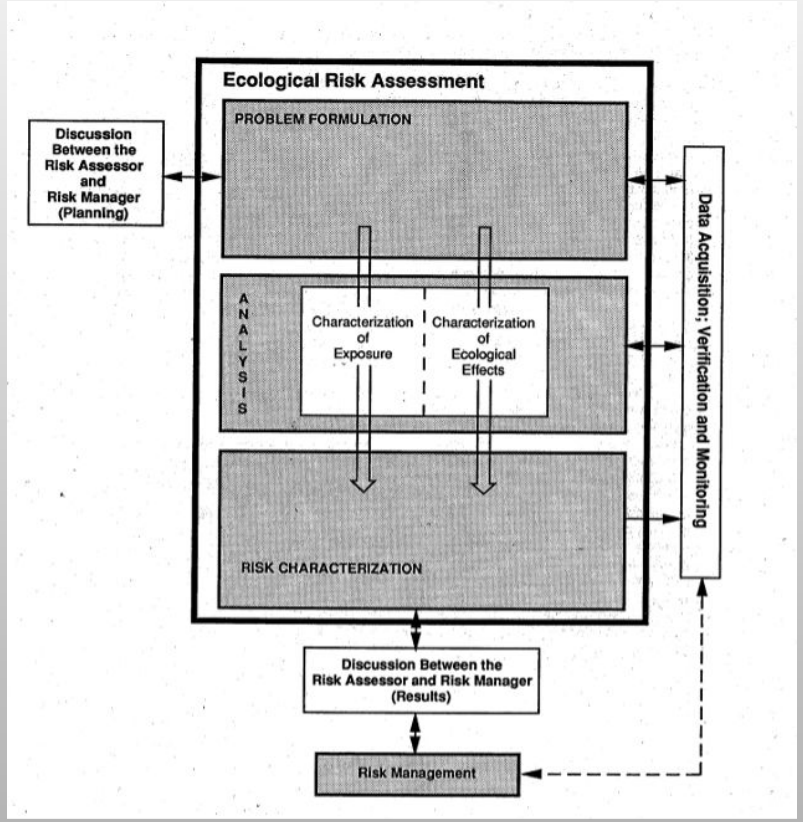
By Gregory Latronica



Superfund

- Comprehensive Environmental Response Compensation and Liability Act (CERCLA)
- Superfund Program → Contaminated Site Cleanup
- Lack of Consensus on detection and modeling for biota
- EPA → “Ecological Benchmarks for Radionuclides” calculator for Superfund site assessments

Ecological Risk Assessment Framework

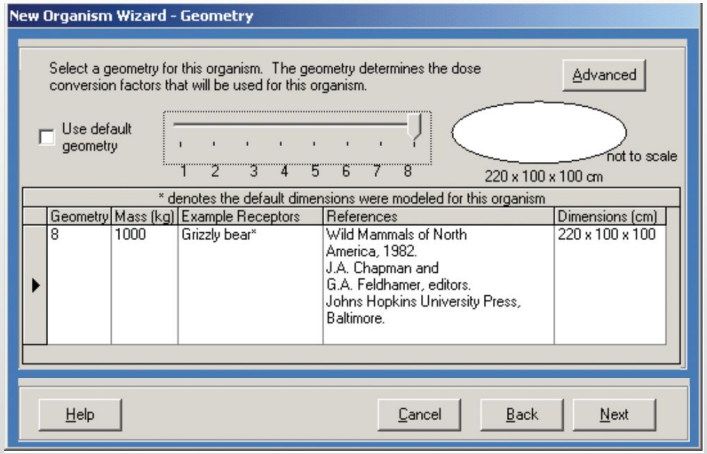


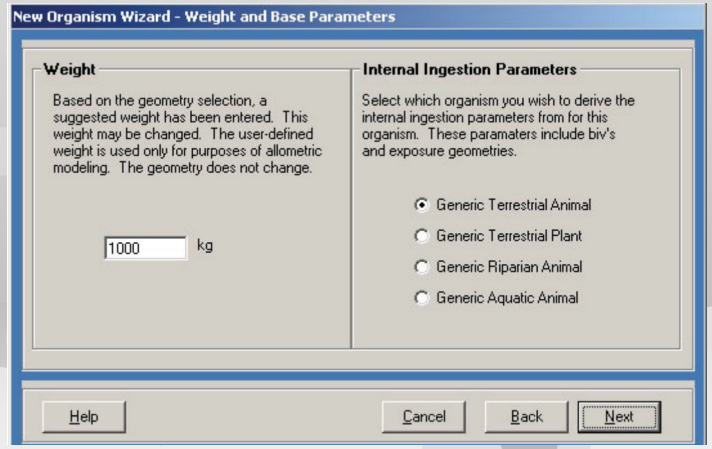
Biota Dosimetry Overview

- International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP)
- Internal vs. External Exposures
- Dose Conversion Coefficients (DCC)
- Absorbed Fraction

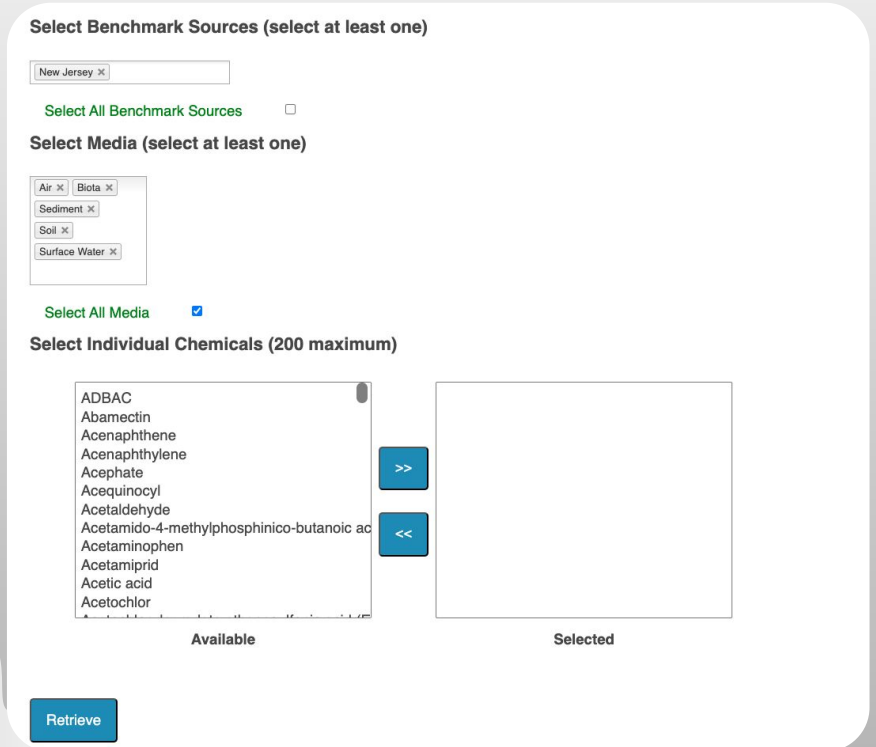
Model References for Biota

- ICRP's Reference Animals and Plants
  - Deer, Rat, Duck, Frog, Trout, Flatfish, Bee, Crab, Earthworm, Pine Tree, Wild Grass, Brown Seaweed
- DOE's Organism Wizard



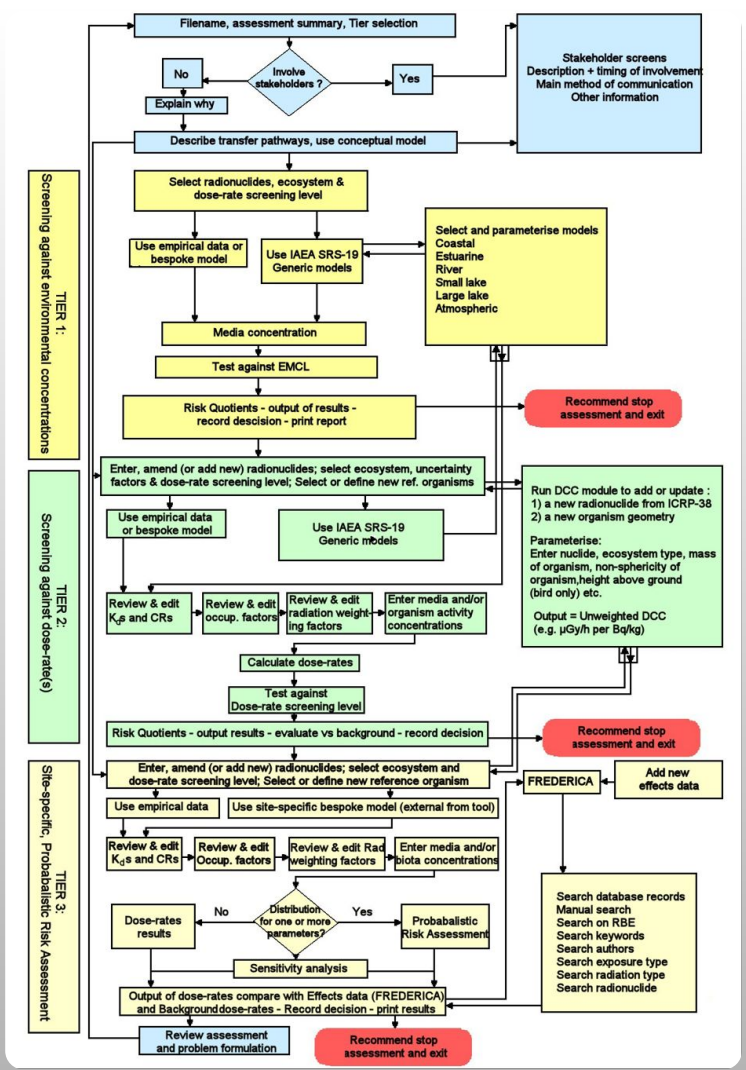


Risk Assessment Information System (RAIS) for Chemical and Radionuclide Models



Primary Radionuclide Models

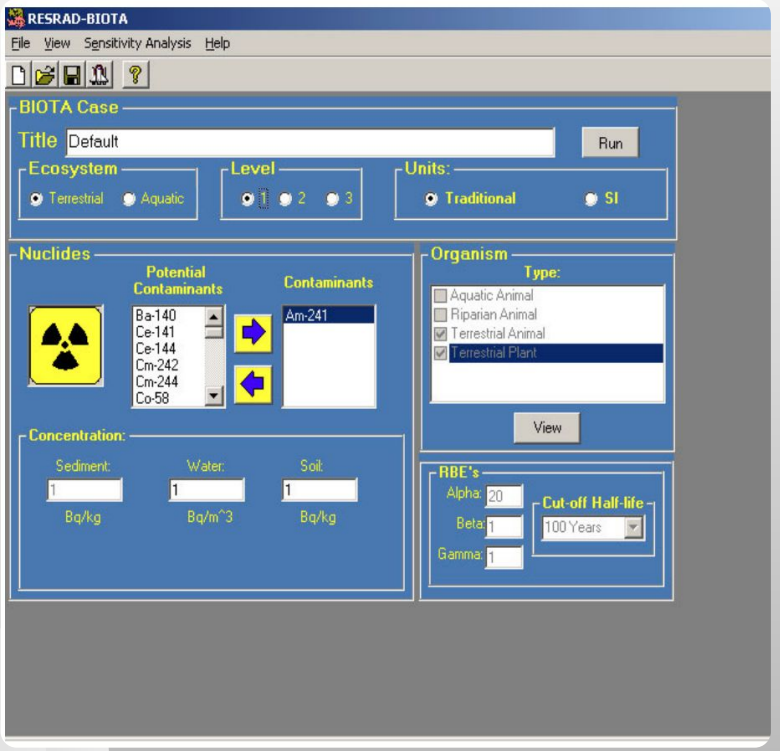
The ERICA Tool

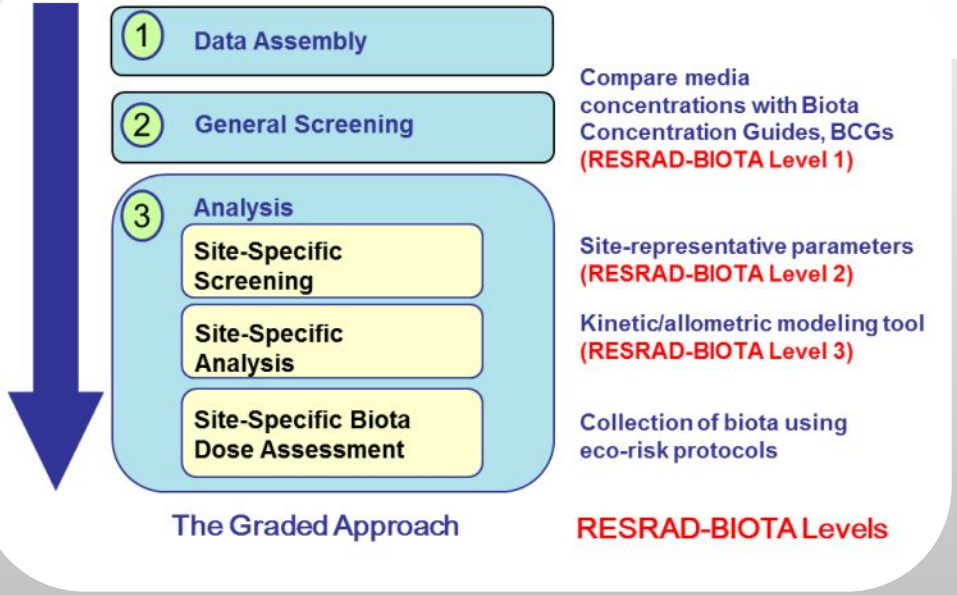


Google Scholar ERICA tool

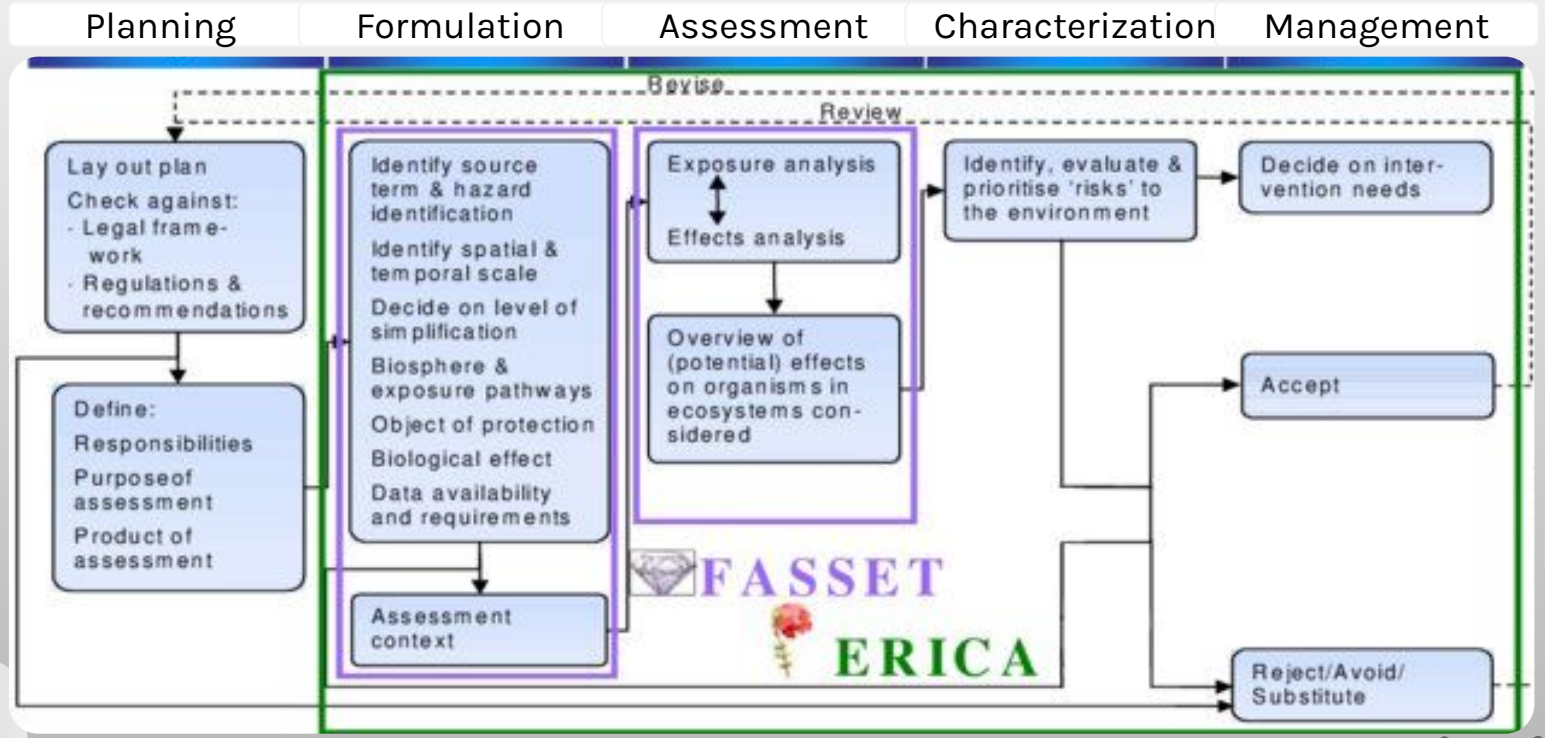
Articles About 448,000 results (0.08 sec)

RESRAD-BIOTA

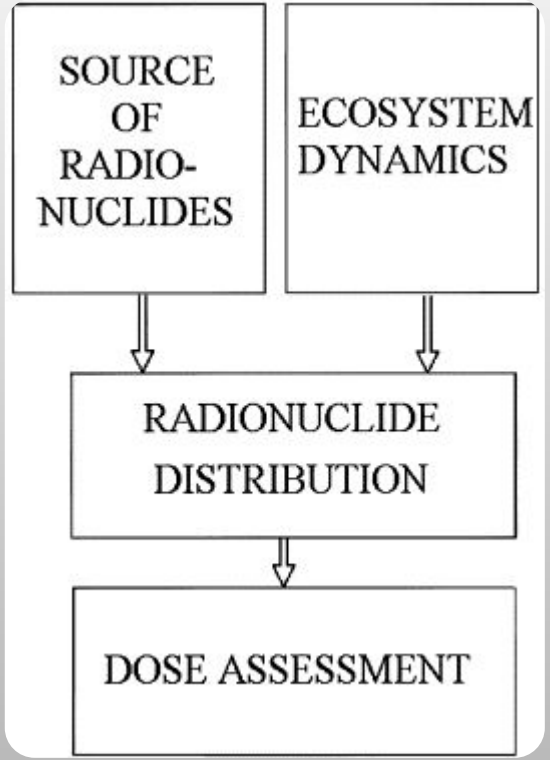


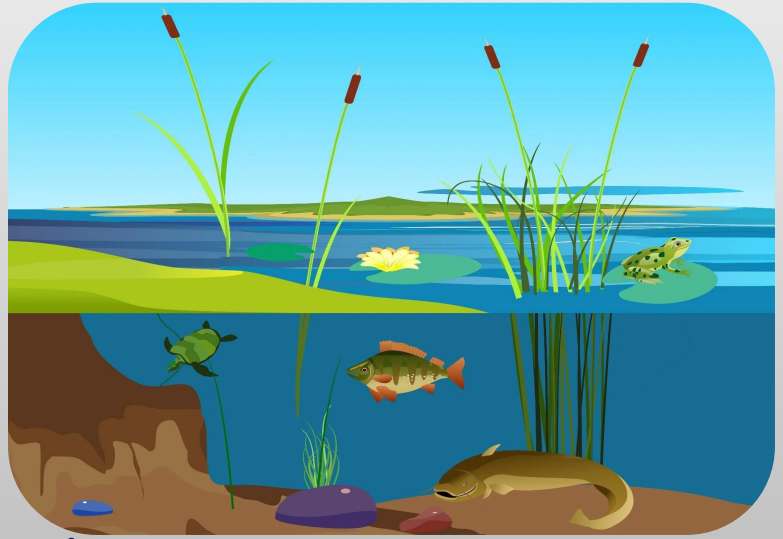


The FASSET Project



ECOMOD





Source

Other Radionuclide Models

England and Wales EA

More limited, adapted by ERICA and FASSET

EDEN

Small French model for ionizing radiation

CASTEAUR

Specific to river radionuclide concentrations from nuclear installations

DosDiMEco

Calculates energy absorption of reference organisms

LAKECO-B

Dutch model to estimate radionuclide concentrations in lakes and reservoirs

FASTer

Considers food chain transfer parameters to improve FASSET

In the Field

- ERICA effective in predicting dose rates on marine organisms exposed by a decommissioned offshore oil and gas pipeline in Australia

- Success in radioactive biota detection in areas including Fukushima and Chernobyl
- However, field conditions add a level of uncertainty which prevents a full mechanistic understanding from field strategies

Grand Summary Table

Rad Model	User Information	Biota Covered
RESRAD-BIOTA	RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation. User's Guide, Version 1. (DOE Report No. DOE/EH-0676; ISCORS Technical Report 2004-02, January 2004)	Organisms classified by: terrestrial animal, terrestrial plant, aquatic animal, riparian animal. Organism parameters can then be inputed, new organisms can be added using the Organism Wizard.
ERICA	ERICA Assessment Tool Help Function Document	Default Reference Organisms (page 14): **Freshwater**: amphibian, benthic fish, bird, crustacean, insect larvae, mammal, mollusc-bivalve, mollusc – gastropod, pelagic fish, phytoplankton, reptile, vascular plant, zooplankton **Marine**: benthic fish, bird, crustacean, macroalgae, mammal, mollusc- bivalve, pelagic fish, phytoplankton, polychaete worm, reptile, sea anemones & true coral, vascular plant, zooplankton **Terrestrial**: amphibian, annelid, arthropod – detritivorous, bird, flying insect, grasses & herbs, lichen & bryophytes, mammal – large, mammal- small-burrowing, mollusc – gastropod, reptile, shrub, tree Screen dose-rates found on page 15.

Grand Summary Table (cont.)

FASSET	Handbook for Assessment of the Exposure of Biota to Ionising Radiation from Radionuclides in the Environment	Reference organisms defined by their habitat: forest, semi-natural pasture and healthland, agriculture, freshwater, marine, brackish waters, and rivers Transfer Factors and DCCs for organisms in these ecosystems can be found on **pages 57- 80**
ECOMOD	ECOMOD — An ecological approach to radioecological modelling	Used in aquatic ecosystems: main organisms include phytoplankton, macroalgae, zooplankton, and fish of different feeding and living habits
EDEN	E.D.E.N.: A tool for the estimation of dose coefficients for non-human biota	Study system is defined within the tool. Shape of organisms (ellipses) and media, their composition, and radioactive sources (page S923).
CASTEAUR	CASTEAUR: A tool for operational assessments of radioactive nuclides transfers in river ecosystems	Considers main biotic components of river ecosystems: phytoplankton, zooplankton, macrobenthos and fish (planktivorous and omnivorous)

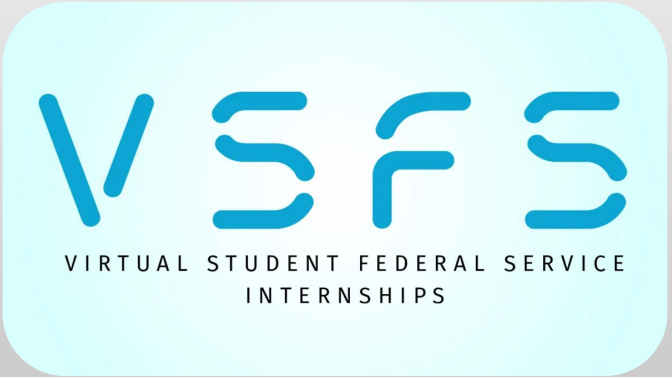
Help us out!

Do you know of any other ecological risk assessment models for radioactive or chemical contaminants that are not mentioned in this presentation?

If it is publicly available, please provide information on it (e.g., name of government agency, university, company, etc) and how to obtain it (e.g., website, contact name and phone number)

Any other questions?

Acknowledgements



Sources available upon request.