ERICA Demonstration & Practical

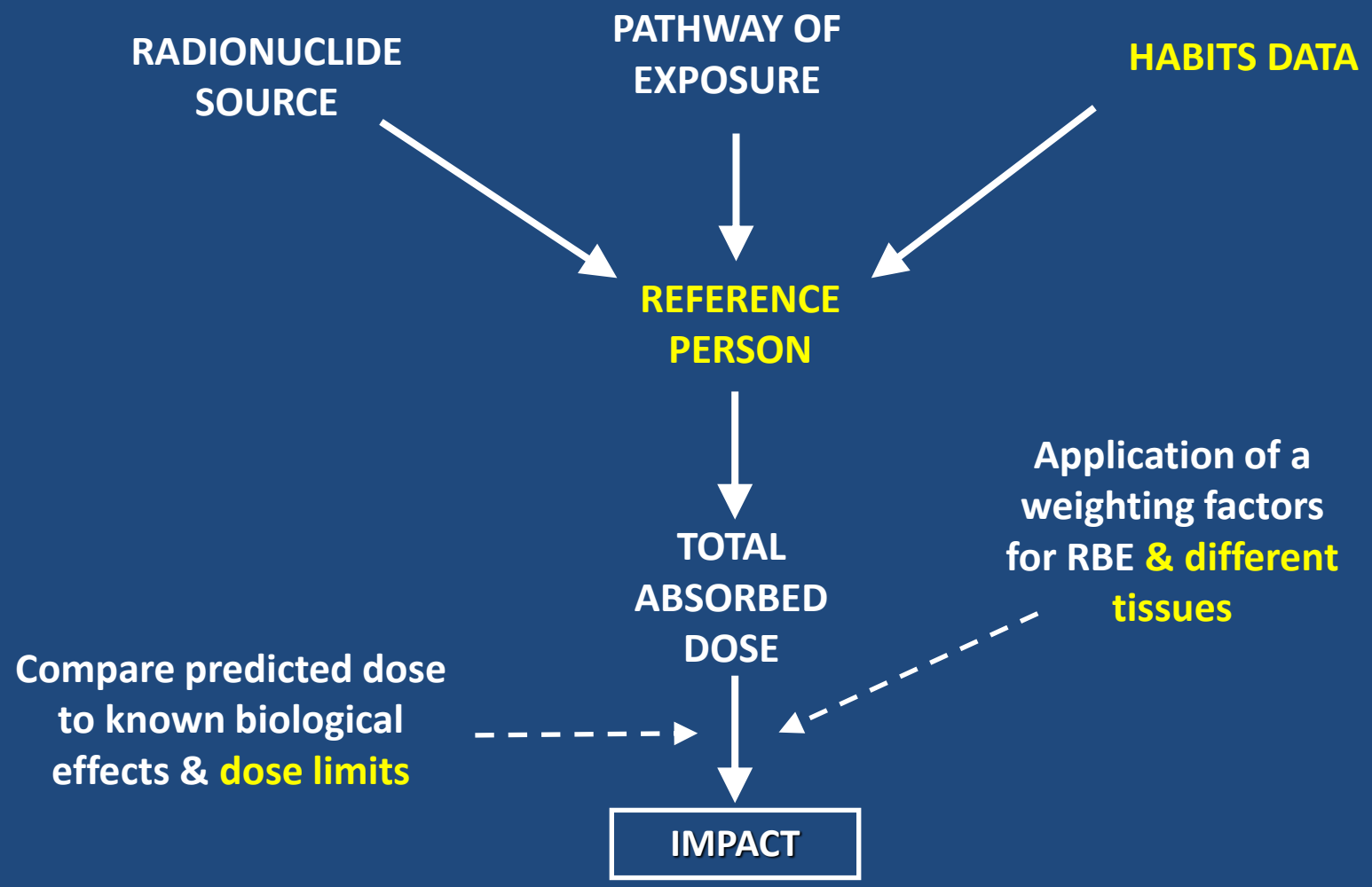
Purpose of today's session

- Overview of how non-human biota assessments work using
  - the ERICA tool (v2) as a demonstration
  - Tier 1 and Tier 2 assessment only

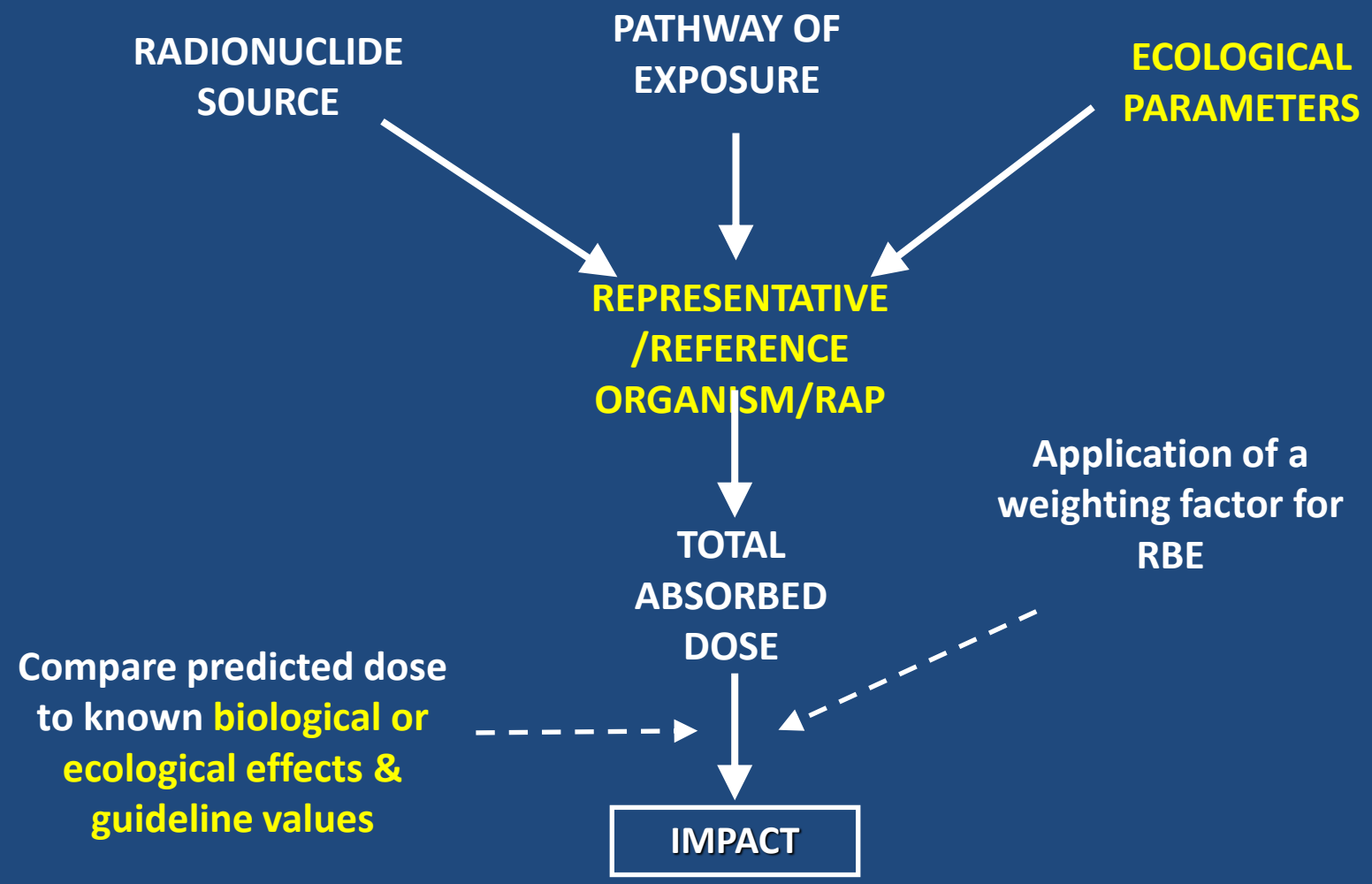
- Discussion of the functionality in the ERICA tool
- Examples of what to think about in a non-human biota assessment
- Other tools are available whether bespoke, freely available, etc

Assessments

Human assessment (overview)

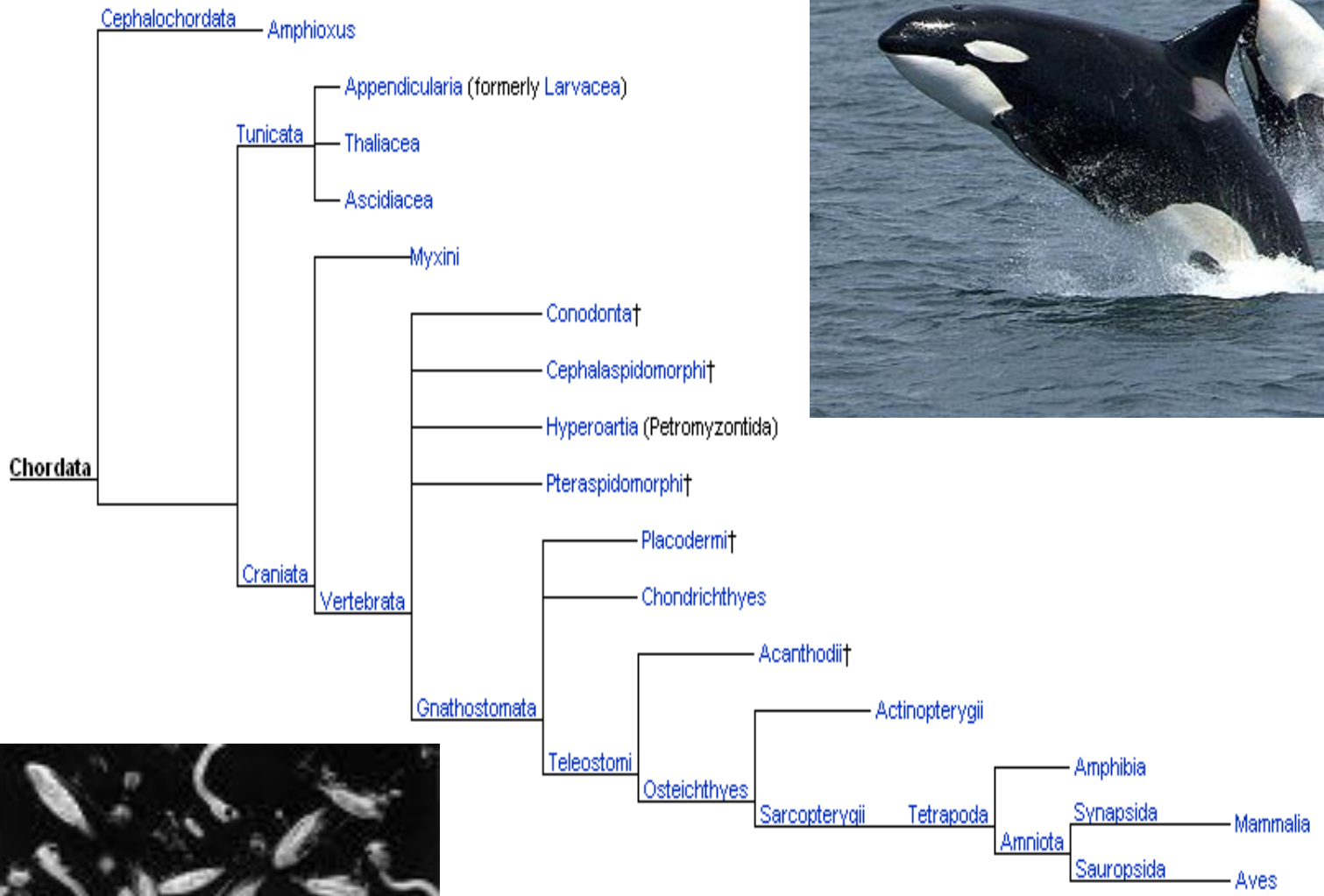


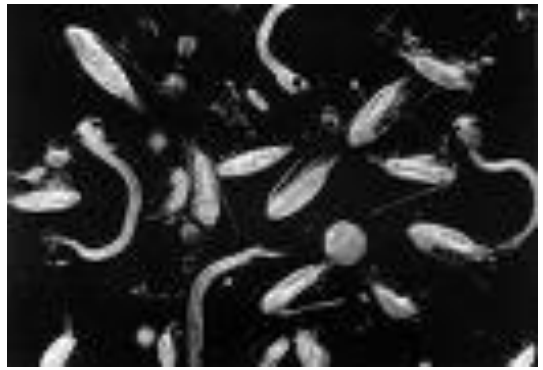
Non-human species assessment (overview)



Complexity of the environment

Phylogeny


Cephalochordata
Amphioxus
Appendicularia (formerly Larvacea)
Tunicata
Thaliacea
Ascidiacea
Myxini
Conodonta†
Cephalaspidomorphi†
Hyperoartia (Petromyzontida)
Chordata
Pteraspidomorphi†
Placodermi†
Craniata
Vertebrata
Chondrichthyes
Acanthodii†
Gnathostomata
Actinopterygii
Teleostomi
Amphibia
Osteichthyes
Synapsida
Mammalia
Sarcopterygii
Tetrapoda
Amniota
Sauropsida
Aves



Dealing with the range of species out there...

Reference organisms have been defined as:

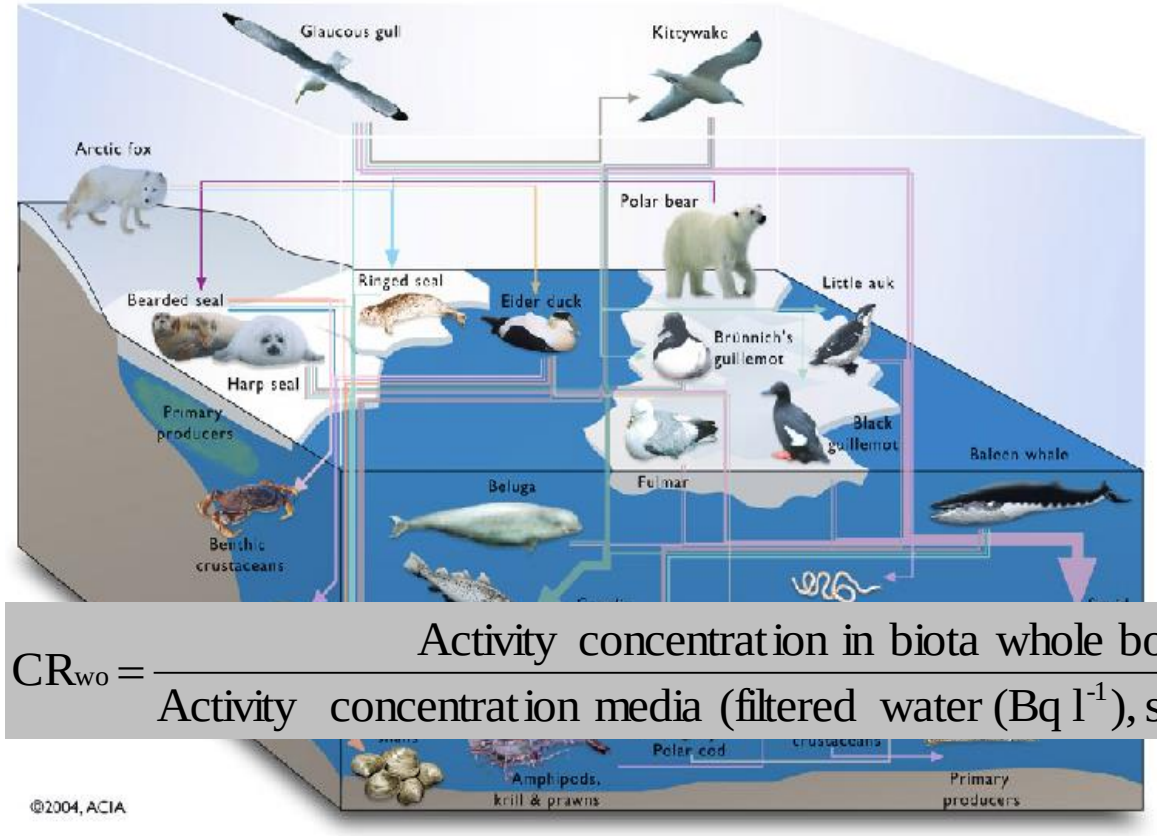
> *"a series of entities that provide a basis for the estimation of radiation dose rate to a range of organisms which are typical, or representative, of a contaminated environment. These estimates, in turn, would provide a basis for assessing the likelihood and degree of radiation effects."*
>
> Strand and Larsson, 2001

Reference organism concept

Key points:

- Selected to represent different trophic levels (to enable transfer of radionuclides to be determined/estimated)
- Selected to represent different exposure pathways - e.g. immersed in soil or water, surrounded by air etc.
- Doses calculated to whole organism
- Direct and indirect (through predator/prey interactions) impacts can be assessed

Parameters



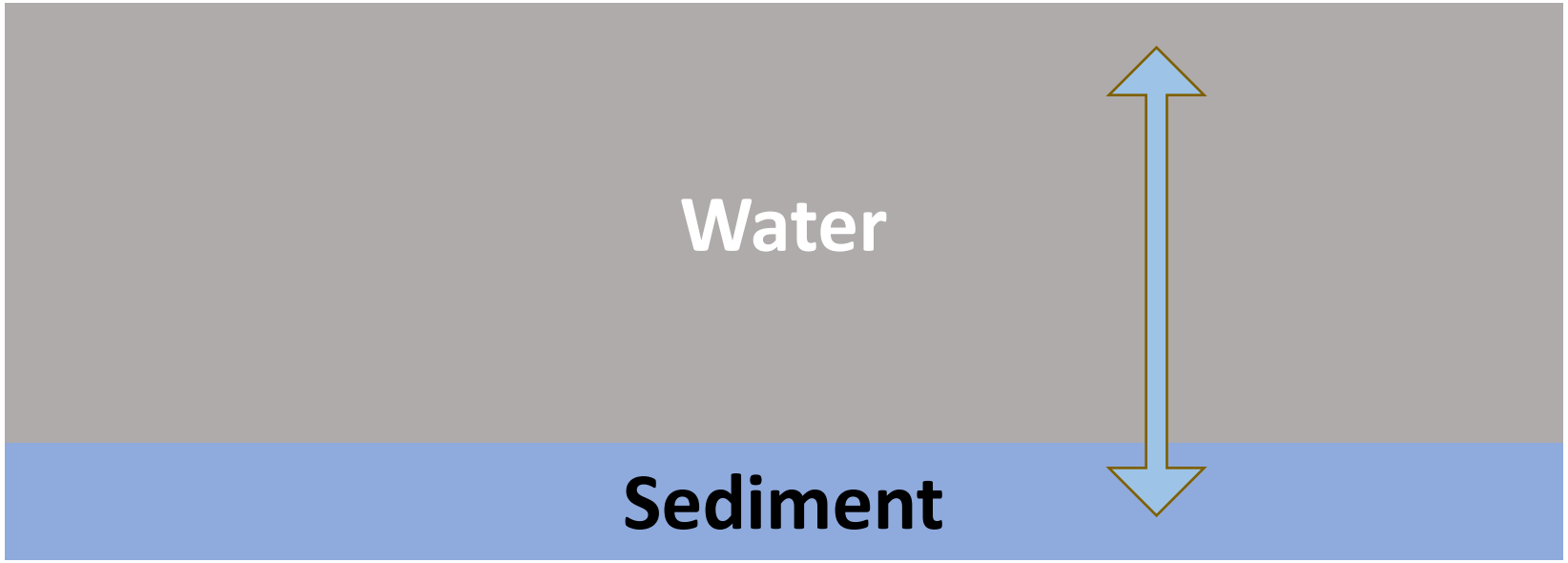
Need to simplify!

... to the Concentration Ratio

$$CR_{wo} = \frac{\text{Activity concentration in biota whole body (Bq kg}^{-1}\text{ fresh weight)}}{\text{Activity concentration media (filtered water (Bq l}^{-1}\text{), soil (Bq kg}^{-1}\text{ dry weight) or air (Bq m}^{-3}\text{))}}$$

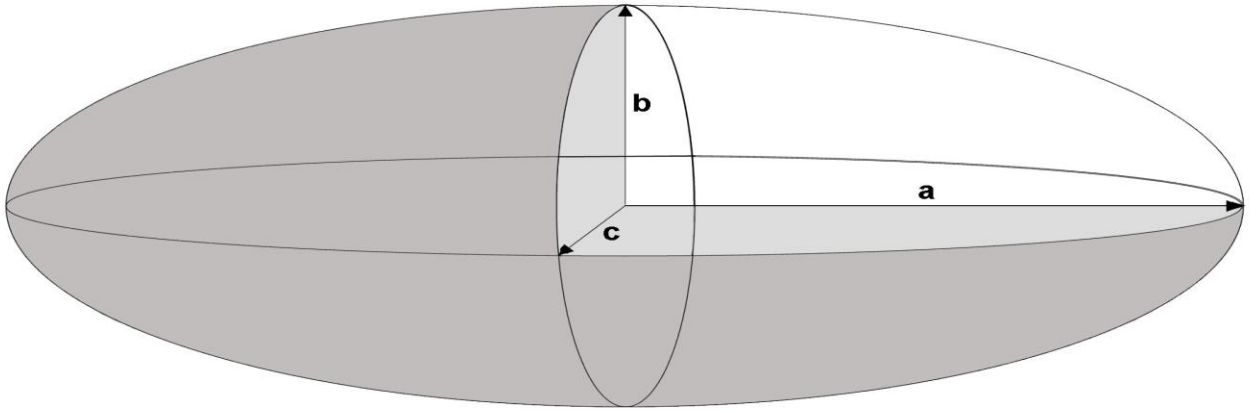
& the distribution coefficient (K_d):

$$K_d\ (l\ kg^{-1}) = \frac{Activity\ concentration\ in\ sediment\ (Bq\ kg^{-1}\ dry\ weight)}{Activity\ concentration\ in\ \ filtered\ water\ (Bq\ l^{-1})}$$



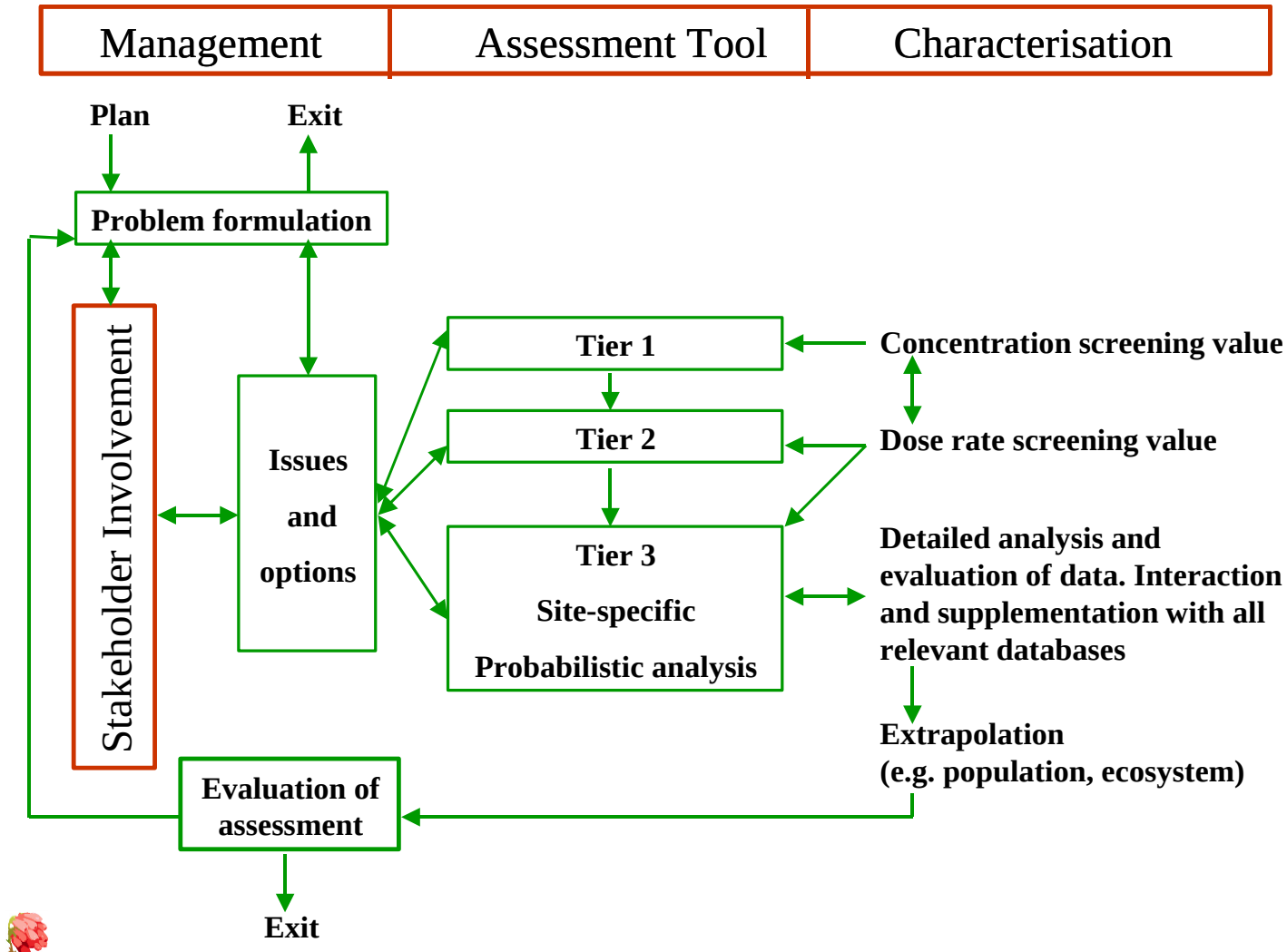
Dosimetry

- Assumed homogeneous radionuclide distribution, i.e. no organs considered
- Endpoint is the average dose rate for the whole body per unit activity concentration in the organisms or surrounding media



ERICA Tool

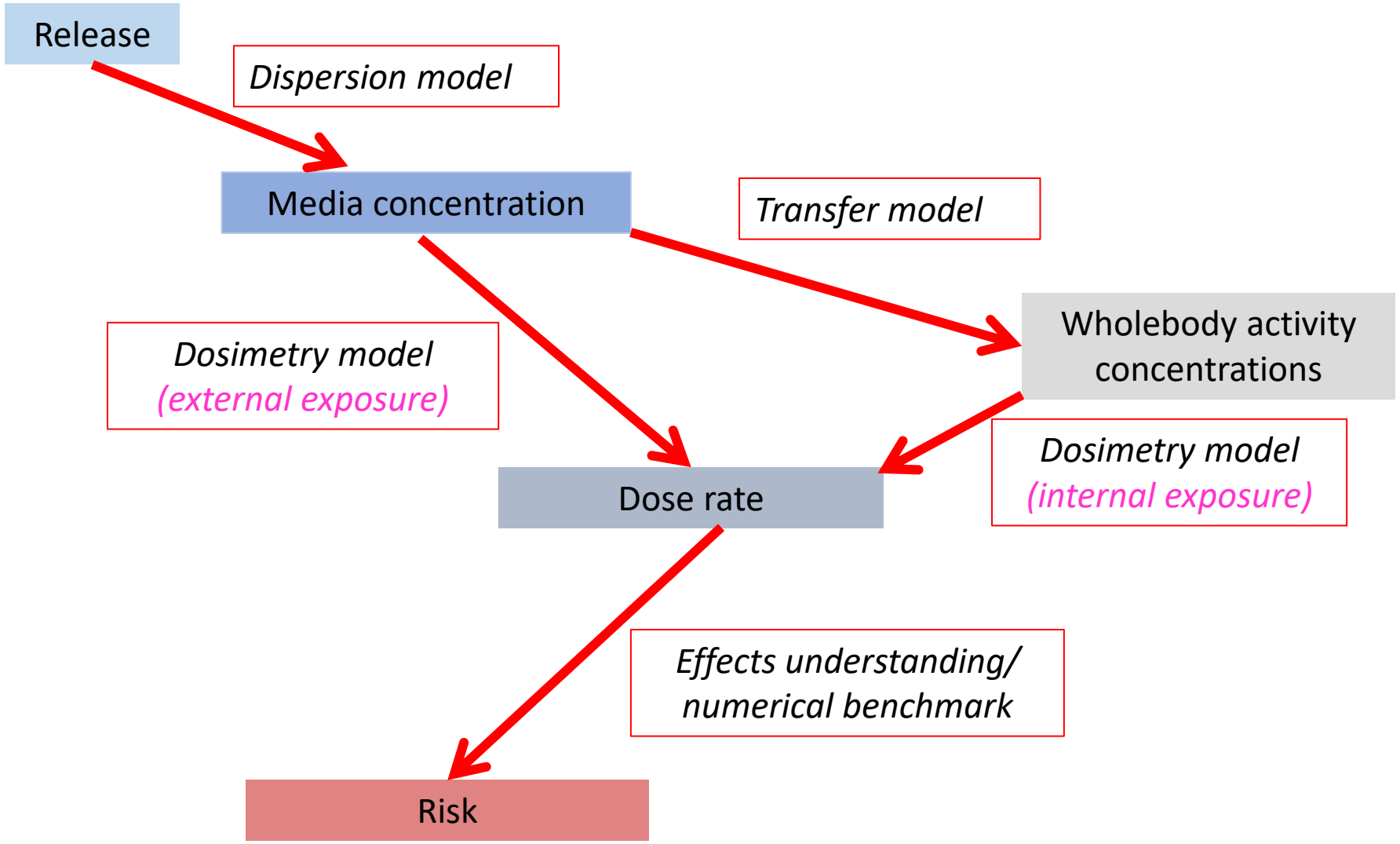
ERICA flow chart



ERICA Integrated Approach

April 2006

Elements of assessment



Demonstration/Practical

- Imagine you are an environmental officer or advisor working for
  - A Regulatory organisation
  - Industry
  - Environmental consultant

- We are going to:
  - Tier 1 prospective assessment of gaseous discharges of a planned Nuclear Power Plant (showing SRS19 functionality)
  - Tier 2 retrospective assessment of liquid discharges from a NPP

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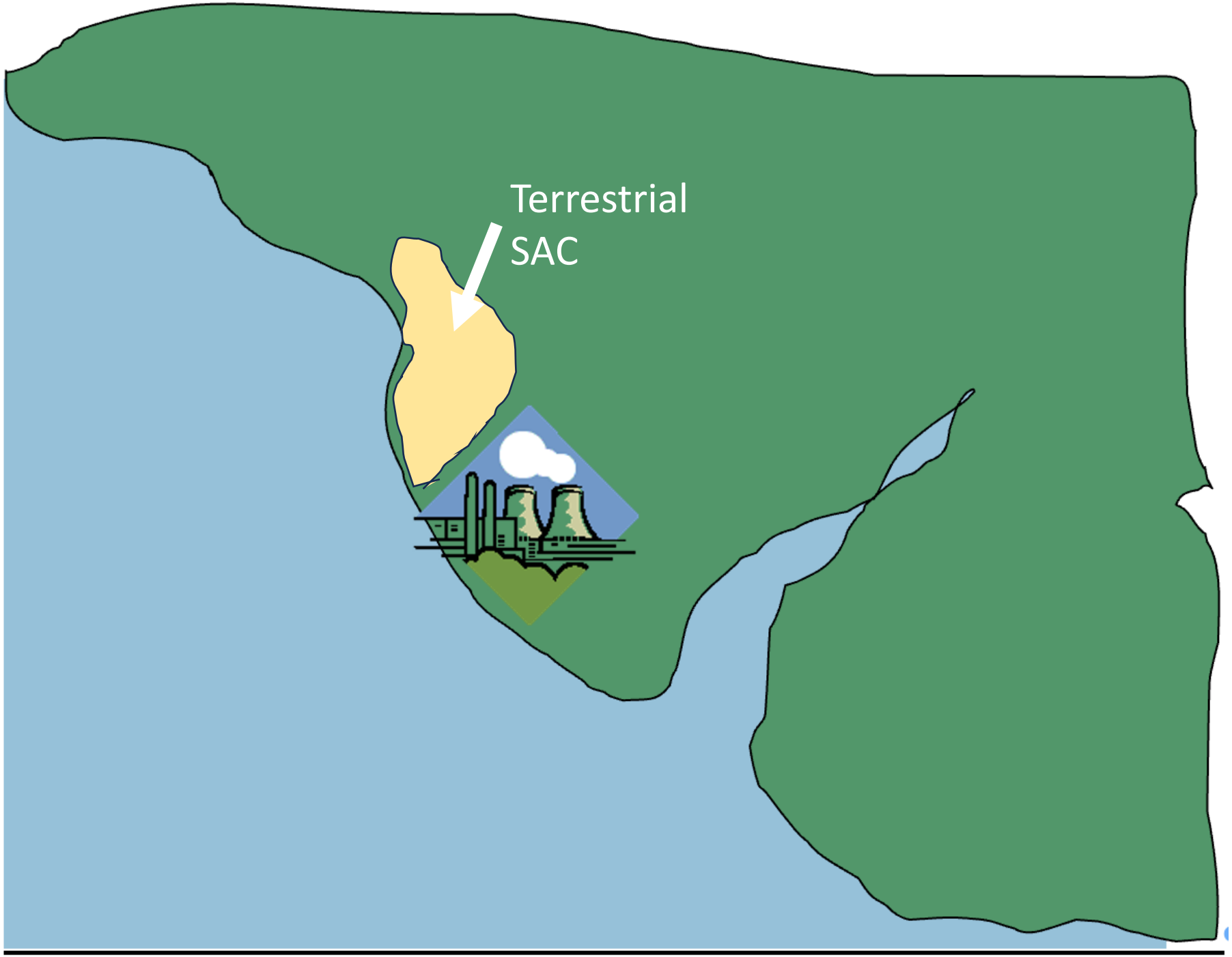
- This is a simplified assessment based loosely on real discharges modified to help demonstrate the functionality of the ERICA Tool

Tier 1 Gaseous Release


Terrestrial
SAC

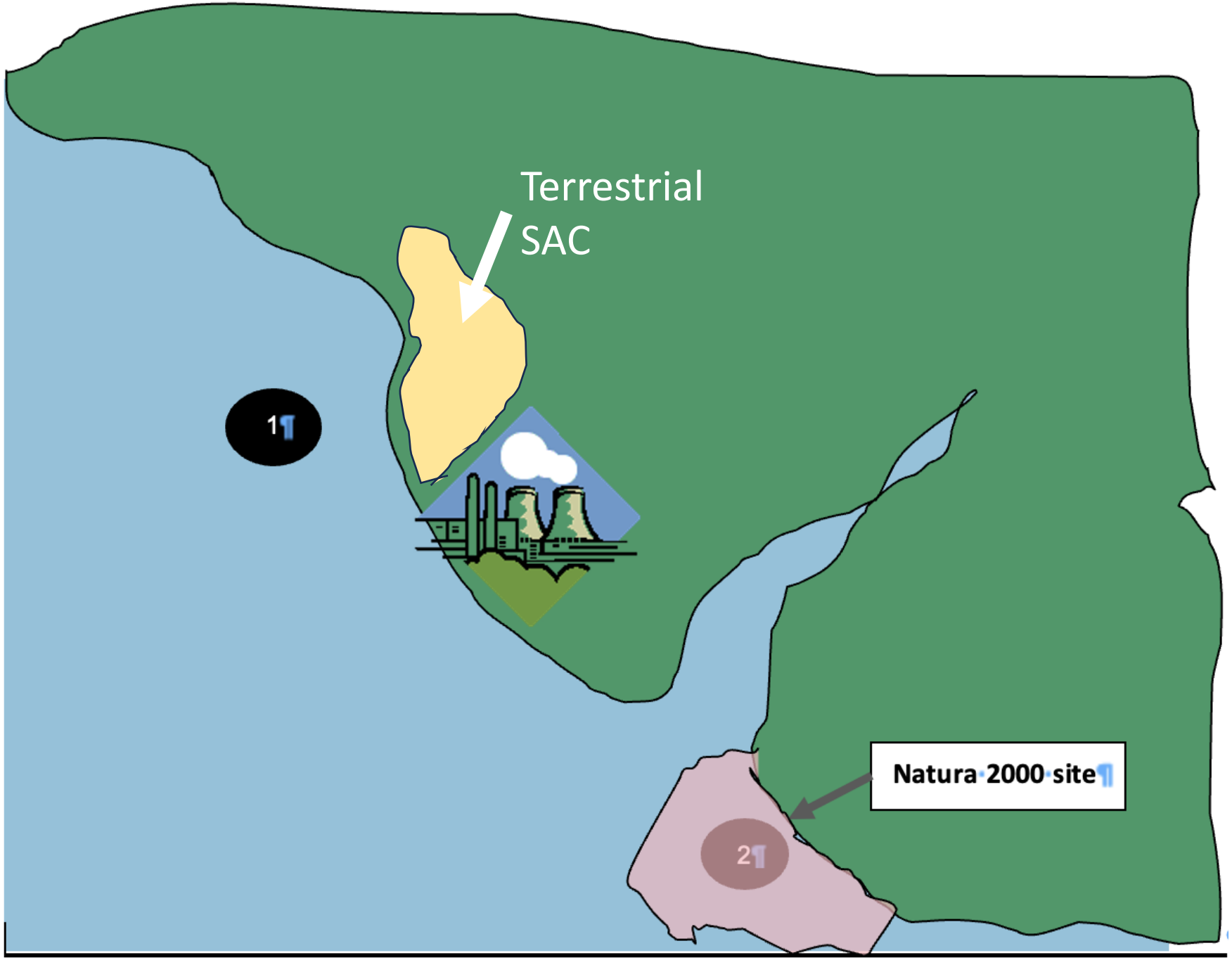
Gaseous Discharges

- Tier 1
- Going to look at two stack heights (10 and 30m)
- Screen against 10 microGy/h

Gaseous radioactive discharge limits		
Radionuclide	GBq/y	Bq/s
C-14	8.00E+03	2.54E+05
H-3	2.00E+05	6.34E+06
I-131	7.50E+01	2.38E+03
Sr-90	3.50E+02	1.11E+04

Parameter	Value
Release height (m)	10 or 30
Distance to receptor (m)	250
Wind speed (m/s)	2
Fraction of time	0.25
Dry deposition coefficient (m/d)	500
Wet deposition coefficient (m/d)	500
Surface soil density (kg/m^2)	260
Duration of discharge (y)	50
Buildings nearby?	No

Tier 2 Liquid Release


Terrestrial
SAC
1
Natura 2000 site
2

Water (Bq/l) and sediment (Bq/kg dw) activity concentrations at two sampling sites

	Site 1		Site 2	
	Water	Sediment	Water	Sediment
H-3	5.3E-1	5.3E-1	2.0E+0	2.0E+0
Co-60	2.7E-4	8.0E+1	9.9E-3	3.0E+3
Cs-134	1.3E-1	5.3E+2	5.0E+0	2.0E+4
Cs-137	1.3E+0	5.3E+3	8.0E+0	2.0E+4
Pu-239	1.3E-2	1.3E+1	5.0E-1	5.0E+1

CR data – Pelagic fish for Pu we have site specific values – 5E1