

**Initial Review Phase for SKB's safety  
assessment SR-Site: Radiological effects  
on non-human biota  
-preliminary review findings**

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# Regulations

- The Environmental Code
- The Nuclear Activity Act
- **SSM FS 2008:37**
  - **Section 6** “The final management of spent nuclear fuel and nuclear waste shall be implemented so that biodiversity and the sustainable use of biological resources are protected against the harmful effects of ionising radiation.”
  - **Section 7** “Biological effects of ionising radiation in the habitats and ecosystems concerned shall be described. The report shall be based on available knowledge on the ecosystems concerned and shall take particular account of the existence of genetically distinctive populations such as isolated populations, endemic species and species threatened with extinction and in general any organisms worth protecting.”

# Method

- SKB use the ERICA tool for the assessment of radiation doses to non-human biota, starting at tier 2.
- Modelled activity concentrations in media from the central corrosion case are used as input.
- Doses were calculated to Representative Species/  
Average Organisms and Reference Organisms (to cover red-listed species).
- Results are compared to screening value  $10 \mu\text{Gy/h}$

# Preliminary findings

## Completeness of the safety assessment

- Radionuclides considered. The radionuclide isotopes Ac-227, Am-242m, Cd-113m, Eu-152, H-3, Mo-93, Nb-93m, Pa-231, Pd-107, Pu-238, Sn-121m were not included in the dose assessment for biota but included for humans. (SKB TR-10-09 Table 9-2 and Table 11-1) Only Ac-227, Pa-231, and Pd-107 are explained because of a lack of data (SKB TR-10-08).

SKB could consult sources of CR data such as the new IAEA TRS or ICRP tables (at least Ac is included). [www.wildlifetransferdatabase.org](http://www.wildlifetransferdatabase.org)

# Preliminary findings

## Completeness of the safety assessment

- Ecosystems considered. Activity concentrations in water and sediment in Freshwater and Marine ecosystems, and in peat and air in Wetland ecosystem are included in the calculations.
  - What about activity concentrations in soil and water in other terrestrial ecosystems such as forest?
  - Why are not ecosystems such as a river and floodplain included? (SKB R-06-82)
  - How large area has a biosphere/landscape object in the radionuclide model? (Apply to a Pool frog habitat?)

# Preliminary findings

## Scientific soundness and quality of the SR-Site

- Questionable concerning use of site data:
  - Site data are missing for major dose contributing radionuclides (Ra-226, Np-237, Po-210). SR-Can and BIOPROTA (2010) also pointed out these radionuclides as key radionuclides. Data gaps has not been filled.
  - A lack of consistency over time in sampling and measurements from Forsmark (SKB TR-10-08).

# Preliminary findings

-Too few samples were collected from the site to perform a comparison with the ERICA tool CR database (SKB TR 10-08).

-The calculated CRs from collected samples show a tendency to be lower than in the ERICA tool for terrestrial and freshwater biota. What characteristics at the Forsmark site can influence this?

-For CRs where ERICA has few data the difference from site data was higher.

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# Preliminary findings

## Scientific soundness and quality of the SR-Site

- Questionable concerning integration human/non-human:
  - SKB TR-10-07 presents Best Estimate (BE) values and Probability Distribution Functions (PDFs) of CRs for different types of terrestrial and aquatic biota used in the derivation of Landscape Dose Factors (LDFs) applied in dose assessments for humans. The report also describes a kinetic-allometric model that was applied for deriving values of CR for terrestrial herbivores in cases when data for an element were missing. Are these values also used in the dose assessment for non-human biota? If not, why not?

# Preliminary findings

- The CRs for humans are normalized to the carbon content. What are the advantages of this approach? Why was this approach not applied for CRs for biota?
- What is the reasoning behind developing a new dose assessment model (LDFs) for humans but not for biota dose assessment?

# Preliminary findings

Other questions regarding the assessment

- In SR-Can dose calculations for biota in the advection/corrosion case resulted in risk quotients above 1 for Po-210 and Ra-226. What has changed in SR-Sites dose calculations to result in no risk quotients above 1 for biota?
- In SR-Site the activity concentrations used for biota are from the central corrosion case. Is this the same case as used in SR-Can or has something changed?

# Preliminary findings

- It is assumed that the ERICA marine ecosystem and CRs is adequate for the Baltic Sea/brackish biota (SKB TR-10-08). Is this correct? There are separate CRs for marine and estuarine/brackish water biota in the new IAEA TRS.
- Because peat was used as input in the ERICA tool, how was the soil density and water content considered in the calculations? How many percent dry weight was assumed? How did this affect the dose results?
- Internal exposure by intake of water by terrestrial biota was not considered. Does RESRAD-BIOTA consider this? Would the dose results be different if RESRAD-BIOTA was used instead of ERICA?

# Preliminary findings

- SKB TR-11-01. Page 842. Section 15.7.5. It is stated that “The methodology used to evaluate dose to non-human biota needs further development to fully utilize site data”. Is this referring to using the ERICA-tool to assess doses? What developments would be necessary and what has SKB done to develop/implement them?
- Lifetime doses may differ for organisms compared to dose rates. Which organisms would be the most exposed in such calculations?
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