MODARIA WG4

Analysis of radioecological data in IAEA TRS to identify key radionuclides and associated parameter values for human and wildlife assessment
IAEA Parameter value compilations
Objectives

Using the recent data compilations:

- To identify the most important radionuclides, pathways and parameter values
  - For different source terms
  - For different exposure situations
- Identify data gaps which matter
- Provide guidance on need for further data for different source terms
- Explore ways to make TRS 472 data more usable by modelling community

Consider both human and wildlife
Approach

• Develop a set of criteria to evaluate importance of parameter values
  • Source terms
  • Magnitude and importance of total, external and internal dose
  • Variability in environmental parameter values

• Analyse data quantity and quality
  • TRS data characteristics (n, variation, max, env. variability)

Builds on, and compliments:

➢ Model based Sensitivity analysis
➢ Sensitivity EMRAS II WG
Using TRS publications – identify which parameter values...

• may be assumed to be generically representative

• are not generically representative as they vary significantly due to
  • Ecosystems, agricultural practices, climate
  • Physico – chemical form, soil characteristics
  • Life cycle stages

• Are based on data or are derived (and how)

• need further consideration
Current Focus of WG4

- Source terms, contaminated areas
- WILDLIFE $CR_{WO-media}$ values
- TRS 472 soil-plant and plant to animal transfer values – SRS update
- Kd values
  - Soil
  - Sediment
Progress - Wildlife

Terrestrial ICRP RAPs approach using conservative CR or actual highest value if this is exceeded, using dose criteria

<table>
<thead>
<tr>
<th>Deer</th>
<th>Rat</th>
<th>Duck</th>
<th>Pine Tree</th>
<th>Frog</th>
<th>Wild Grass</th>
<th>Bee</th>
<th>Earth-worm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ag</td>
<td>Ag</td>
</tr>
<tr>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
<td>Ca</td>
</tr>
<tr>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
<td>Cd</td>
</tr>
<tr>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
<td>Cr</td>
</tr>
<tr>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
<td>Mn</td>
</tr>
<tr>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
<td>Ni</td>
</tr>
<tr>
<td>Se</td>
<td>Se</td>
<td>Se</td>
<td>Se</td>
<td>Se</td>
<td>Se</td>
<td>Se</td>
<td>Se</td>
</tr>
<tr>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
<td>Tc</td>
</tr>
<tr>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
<td>Zn</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LOW Priority
## High priority

<table>
<thead>
<tr>
<th>Deer</th>
<th>Rat</th>
<th>Duck</th>
<th>Pine Tree</th>
<th>Frog</th>
<th>Wild Grass</th>
<th>Bee</th>
<th>Earth-worm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Am</td>
<td>Am</td>
<td>Am</td>
<td>Am</td>
<td>Am</td>
<td>Ag</td>
<td>Am</td>
<td>Am</td>
</tr>
<tr>
<td>*Ba</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cd</td>
<td></td>
</tr>
<tr>
<td>Cf</td>
<td>Cf</td>
<td>Cf</td>
<td>Cf</td>
<td>Cf</td>
<td>Cf</td>
<td>Cf</td>
<td></td>
</tr>
<tr>
<td>Cd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
<td>Cm</td>
</tr>
<tr>
<td>Cs</td>
<td>Cs</td>
<td>Cs</td>
<td>Cs</td>
<td>Cs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*La</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
<td>Pa</td>
</tr>
<tr>
<td>Po</td>
<td>Po</td>
<td>Po</td>
<td>Po</td>
<td>Po</td>
<td>Po</td>
<td>Po</td>
<td>Po</td>
</tr>
<tr>
<td>Pu</td>
<td>*Pu</td>
<td>Pu</td>
<td>Pu</td>
<td>Pu</td>
<td>Pu</td>
<td>Pu</td>
<td>Pu</td>
</tr>
<tr>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
<td>Ra</td>
</tr>
<tr>
<td>Sr</td>
<td>Sr</td>
<td>Sr</td>
<td>Sr</td>
<td>Sr</td>
<td>Sr</td>
<td>Sr</td>
<td>Tc</td>
</tr>
<tr>
<td>Te</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Th</td>
<td>Th</td>
<td>Th</td>
<td>Th</td>
<td>Th</td>
<td>Th</td>
<td>Th</td>
<td>Th</td>
</tr>
<tr>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
<td>U</td>
</tr>
</tbody>
</table>

*Elements marked with * are considered high priority.*
SRS 19 update – human foodchain

• Considering comparison of draft aggregated screening dose rates and underlying transfer values
  – How important is the parameter value to the dose
  – How “uncertain” are the transfer values used? Which are based on data, which not
  – what methods are used when there are no data – is there a consistent approach, is it tested, can we improve it - how?
  – Are there relevant source terms?

• More than 700 isotopes – need to focus
BUT – are there sources?

• To what extent are priority radioisotopes in source terms /contaminated areas

So, WG4 is:

• Collating key radioisotopes for different sources
  – Criteria, which sources, contaminated areas, naturals and anthropogenic

• Maximum activity concentrations in ecosystems

• Identify those isotopes which do not need to be well characterised CR values or to use process modelling
Revision and application of Kd values

Aim
To harmonise the approach used to develop and extend the range of PDFs available
To provide PDFs in a format applicable for modelling for soils and freshwater

Collate new data and integrate into current databases
Select appropriate statistics to analyse data to develop the PDFs
Update of soil $K_d$ database

Starting point: soil $K_d$ database created for TRS 472

- More than 50 documents critically reviewed: other relevant data sources not yet available/identified.
- Significant increase in the number of records (especially for Am, Eu, Ni, Cs, Sr and Co).
- Identification of significant gaps (comparison with ERICA and ICRP lists).
- Reconsideration of criteria to accept data: use of analogues.
Update of freshwater $K_d$ database

Starting point: the freshwater $K_d$ database created in the frame of TRS 472

Four radionuclides groups:

1) with large databases (Ag, Am, Co, Cs, I, Mn, Pu and Sr)
2) with moderate databases (Be, Ba, Ce, Ra, Ru, Sb, and Th)
3) with only a single value (Cr, Fe, Zn, Zr, Tc, Pm, Eu, U, Np, Cm)
4) with only expert estimates

- including $K_d$ values for particulate matter and/or superficial sediments (top 0-5 cm) in rivers and lakes.
- giving log-normal distributions for the $K_d$ values of the radionuclides of the two first groups.
Objectives

- Update the database with the new Kd data published since 2007:
  - To build a common tool.
  - To extend the list of radionuclides described with probabilistic distribution.
  - To test conditional probabilistic distributions.
  - To distinguish the Kd values between suspended matter and superficial sediments by taking into account sedimentation rates, particles sizes...

- Consider conservative probabilistic approaches for radionuclides with small data set.
Method

- Determine criteria, scores and the structure of the common database.
- Update the Kd database as a function of these criteria and new Kd data published since 2007.
- Operate the data base:
  - To refine the adjustment of probabilistic parameters.
  - To test conditional probabilistic distributions as a function of relevant and available parameters (*suspended matter, superficial bottom sediment, pH, sorption/desorption...*).
• Monday
  – Source terms
  – $\text{Cr}_{\text{wo-media}}$ methodology
  – SRS 19 update
    • Consider comparison of draft aggregated screening dose rates and underlying transfer values
      – How important is the parameter value to the dose
      – How “uncertain” are the transfer values used? Which are based on data, which not - should we use Kd approach for soil-plant-anima in human foodchain?
      – Are there relevant source terms?

• Tuesday
  • Kd