Development of a Canadian database of parameter values for modelling doses to non human biota and accompanying recommendations

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INTRODUCTION

Objectives: (1) Develop a Canadian database of parameter values (for environmental media, species and radionuclides) for modeling doses to non-human biota and (2) Develop a national strategy for assessing doses to non-human biota, as well as associated risks.

Government priorities: (1) Providing S&T to support the understanding of the effects of radiation on the environment and (2) To help make future ERAs consistent in Canada, thus making the process easier for the licensees and the regulator.

Federal stakeholder: CNSC, Health Canada and Environment & Climate Change Canada.

Fig 1: Canadian locations for parameter values database.

PROJECT STATUS

- **Tasks performed**: Technical Meeting held via teleconference with CNSC and Health Canada, June 17, 2019.
- Collections of literature has begun based on: CNSC guidance, discussions with Canadian experts including FSNT's other project experts, and with CRL ERA performers.
- First collection of 21 **full papers/reports;** review started.
- Library's literature search provided 204 **abstracts;** paper selection started.
- Data extraction started.
- Tentative meeting is scheduled for 2019 Sep 20 with experts form CNSC.
- Collected Australian papers and data on parameter values for radionuclides associated with mining.
- Environmental Data Management System (EDMS) demo taken (Figure 2).
- Review of available literature and various environmental assessment documents - ongoing.
- Dissemination of unpublished data – ongoing.

- **Final Output:** A list of datasets with sufficient details.

- **Status:** slightly behind schedule.
- Establishing links with CNSC's experts, and getting their help in collecting Mining and NPP ERAs data in electronic form.
- Waiting for OPG ERA report.

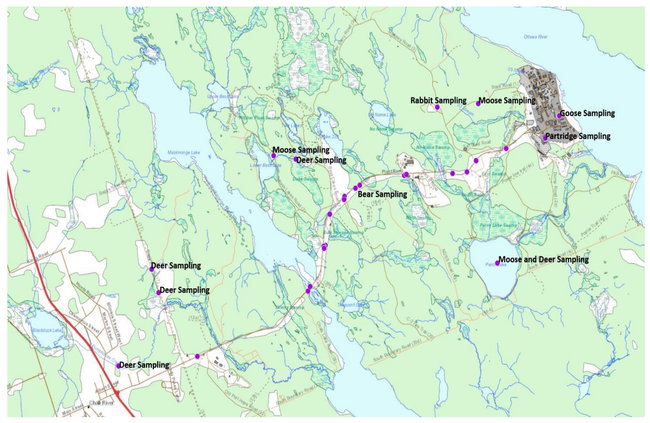

Fig 2: Game sampling locations map produced by CRL's EDMS.

RESULTS

- **Highlights:** Methodology for the whole project is almost finalized.
- US DOE Standard received and discussion started.
- ERICA tool V 1.3 received and discussion started.
- CRL ERA electronic data received and discussion started.
- Various meetings held.
- Out of 21 full papers, 15 selected.
- Out of 204 abstracts, 153 were reviewed, 72 abstracts selected.
- Data and summary extracted from 2 papers.

- **Issues and Risks:** It is an open-ended project; amount of data available is currently unknown – this will be determined more definitively by this fiscal year end.
- Decisions around whether to keep the database in the text files or use SQL Server are to be made.

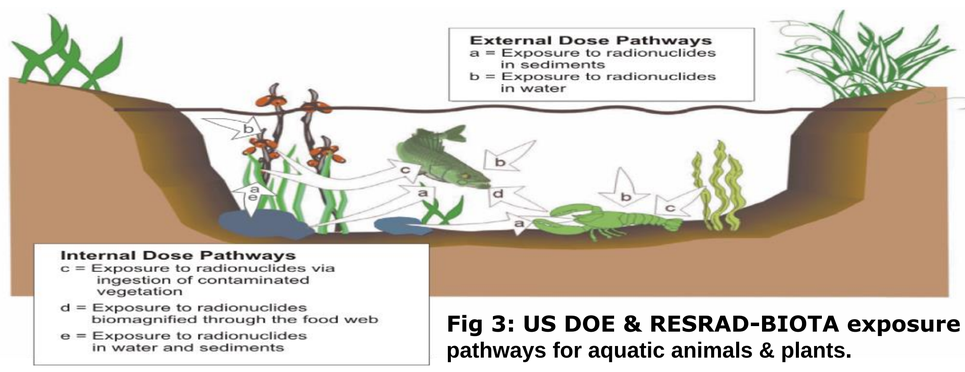

Fig 3: US DOE & RESRAD-BIOTA exposure pathways for aquatic animals & plants.

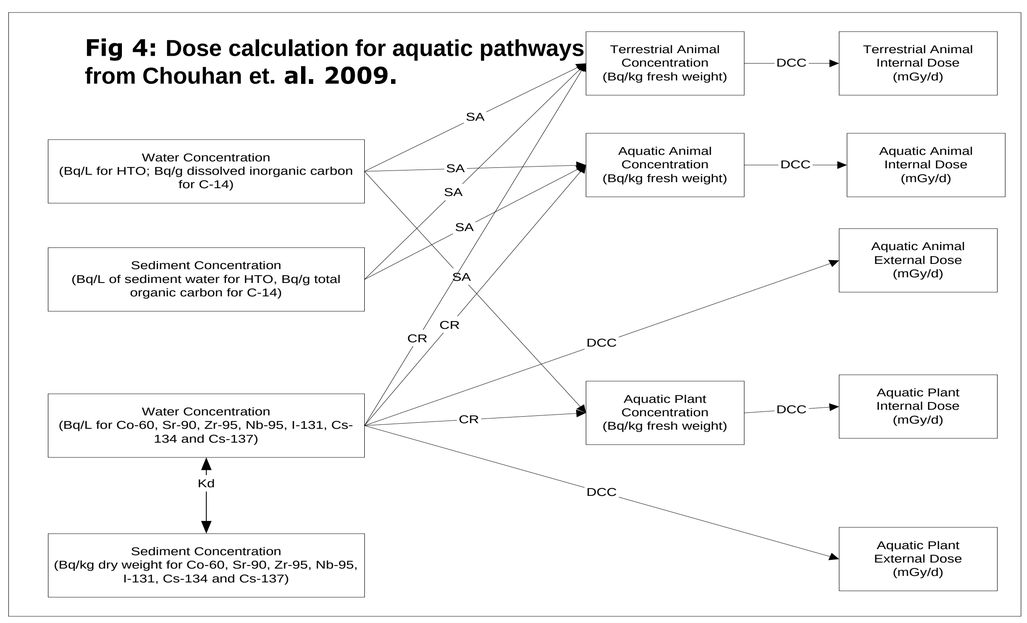

Fig 4: Dose calculation for aquatic pathways from Chouhan et. al. 2009.

Fig 5: Example concentration ratios for freshwater ecosystem shown from European ERICA tool.

Radioecology Parameters

Distribution Coefficient (Kd) [L kg-1] | Concentration Ratio (CR) [Bq kg-1(f.w.) per Bq L-1]

Nuclide	Amphibian	Benthic fish	Bird	Crustacean	Insect larvae	Mammal	Mollusc - bivalve	Mollusc - gastropod	Pelagic fish	Phytoplankton	Reptile	Vascular plant	Zooplankton
Ag													
Am		7.60E2					1.04E4	1.04E4	7.60E2			1.35E3	
Ba		1.72E2		1.20E3					1.72E2	5.02E1	1.41E2	4.50E2	
C		1.80E5							1.80E5	4.00E3		8.80E3	
Ca	1.23E3	1.43E3			4.29E1	3.93E2	7.40E2	7.40E2	1.43E3	2.41E2	5.01E2	2.50E2	
Cd		2.07E3		2.77E4			1.70E5	1.70E5	2.07E3	1.83E3	1.69E3	3.59E3	
Ce		1.71E2					1.03E3	1.03E3	1.71E2	8.77E3	6.26E2	8.81E2	
Cf													
Cl		1.25E3							1.25E3			2.58E2	
Cm					2.50E2		1.70E1	1.70E1			7.70E1	2.30E0	
Co		2.31E2		1.85E3			1.05E3	1.05E3	2.31E2	6.46E2	1.22E1	9.28E2	
Cr		1.97E2					1.32E3	1.32E3	1.97E2		1.31E3	3.67E2	
Cs		3.37E3	2.27E3	1.81E3	1.99E3		1.29E2	1.29E2	3.37E3	1.42E2	3.95E3	3.59E2	8.9
Eu		6.56E1							6.56E1			2.32E2	
H													
I		3.19E2					8.31E1	8.31E1	3.19E2			5.41E1	
Ir													
La		1.31E2							1.31E2		2.39E2	8.64E2	
Mn		2.90E3		3.76E3		3.41E2			2.90E3		1.88E2	7.40E2	5.10E3

Select ERICA default CR values

Method used to derive ERICA default CR value when no empirical data:

1 Similar reference organism
2 From published review
3 Modelling approaches
4 Element of similar biogeochemistry for reference organism
5 Element of similar biogeochemistry for similar reference organism
6 Highest available value
7 Estuarine data
8 Highest animal value
9 Highest plant/algae value
10 Combined methods*

Select/Unselect all check boxes

NEXT STEPS

- Output, **year-2**: sensitivity analyses using models. Write a section on calculating dose to non-human biota for future version of CSA N288.6.
- Output, **year-3**: quality assurance, removing duplications from data and linking to original sources, and putting final Database in the text files.

- Future **follow-up output**: database likely to be hosted in MS-SQL Server, and made available to contributors and users.

Team member's acknowledgements: S. Chester, D. Beaton and C. Vu.