

Biota Modelling Group (WG4)

Objectives

To improve Member State's capabilities for protection of the environment by comparing and validating models being used, or developed, for biota dose assessment (that may be used) as part of regulatory process of licensing and compliance monitoring of authorised releases of radionuclides

- Consider ICRP C5 output(s) & IAEA transfer handbook



Agreed activities

- Scenarios/exercises:
 - Beaverlodge U mine, Canada (freshwater assessment)
 - Little Forest Burial Ground waste trenches, Australia (terrestrial assessment)
 - Wetlands (mixed ecosystem assessment)
 - DCC benchmarking exercise
- Overview of dynamic modelling – requirements & capabilities (chapter for final report)
- Consideration of screening level assessments
- Assessment of heterogeneous distribution of radionuclides in media



‘Exercise 3’

Purpose:

Compare unweighted internal and external absorbed dose rates assuming 1 Bq kg⁻¹ in organism & 1 Bq unit⁻¹ media respectively

Radionuclides considered – those from ICRP ‘RAP’ report (+⁵⁵Fe)

³H, ¹⁴C, ³²P, ³³P, ³⁵S, ³⁶Cl, ⁴⁰K, ⁴⁵Ca, ⁵¹Cr, ⁵⁴Mn, ⁵⁵Fe, ⁵⁷Co, ⁵⁸Co, ⁶⁰Co, ⁵⁹Ni, ⁶³Ni, ⁶⁵Zn, ⁷⁵Se, ⁷⁹Se, ⁸⁹Sr, ⁹⁰Sr, ⁹⁵Zr, ⁹⁴Nb, ⁹⁵Nb, ⁹⁹Tc, ¹⁰³Ru, ¹⁰⁶Ru, ^{110m}Ag, ¹⁰⁹Cd, ¹²⁴Sb, ¹²⁵Sb, ^{129m}Te, ¹³²Te, ¹²⁵I, ¹²⁹I, ¹³¹I, ¹³⁴Cs, ¹³⁵Cs, ¹³⁶Cs, ¹³⁷Cs, ¹⁴⁰Ba, ¹⁴⁰La, ¹⁴¹Ce, ¹⁴⁴Ce, ¹⁵²Eu, ¹⁵⁴Eu, ¹⁵⁵Eu, ¹⁹²Ir, ²¹⁰Pb, ²¹⁰Po, ²²⁶Ra, ²²⁸Ra, ²²⁷Th, ²²⁸Th, ²²⁹Th, ²³⁰Th, ²³¹Th, ²³²Th, ²³⁴Th, ²³¹Pa, ²³³U, ²³⁴U, ²³⁵U, ²³⁸U, ²³⁷Np, ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, ²⁴¹Pu, ²⁴¹Am, ²⁴²Cm, ²⁴³Cm, ²⁴⁴Cm, ²⁵²Cf

Did not include noble gases (Ar, Kr Rn) which had been requested by some group members



Purpose:

Compare unweighted internal dose rates assuming 1 unit⁻¹ media respectively

Radionuclides considered in report (+⁵⁵Fe)

³H, ¹⁴C, ³²P, ³³P, ³⁵S, ³⁶Cl, ⁴⁰K, ⁴⁵Ca, ⁵¹Cr, ⁵⁴Mn, ⁹⁰Sr, ⁹⁵Zr, ⁹⁴Nb, ⁹⁵Nb, ⁹⁹Tc, ¹⁰³Ru, ¹⁰⁶Ru, ^{110m}Ag, ¹³⁵Cs, ¹³⁶Cs, ¹³⁷Cs, ¹⁴⁰Ba, ¹⁴⁰La, ¹⁴¹Ce, ¹⁴⁴Ce, ²²⁸Th, ²²⁹Th, ²³⁰Th, ²³¹Th, ²³²Th, ²³⁴Th, ²³¹Pa, ²⁴¹Am, ²⁴²Cm, ²⁴³Cm, ²⁴⁴Cm, ²⁵²Cf

Did not include noble gases, which have not been requested by some



Fulltext Preview

Radiat Environ Biophys
DOI 10.1007/s00411-010-0346-5

ORIGINAL PAPER

The estimation of absorbed dose rates for non-human biota: an extended intercomparison

J. Vives i Batlle · K. Beaugelin-Seiller · N. A. Beresford · D. Coplestone · J. Horyna · A. Hosseini · M. Johansen · S. Kamboj · D.-K. Keum · N. Kurosawa · L. Newsome · G. Olyslaegers · H. Vandenhove · S. Ryufuku · S. Vives Lynch · M. D. Wood · C. Yu

Received: 28 June 2010 / Accepted: 14 November 2010
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Abstract An exercise to compare 10 approaches for the calculation of unweighted whole-body absorbed dose rates was conducted for 74 radionuclides and five of the ICRP's Reference Animals and Plants, or RAPs (duck, frog, flatfish egg, rat and elongated earthworm), selected for this exercise to cover a range of body sizes, dimensions and exposure scenarios. Results were analysed using a non-parametric method requiring no specific hypotheses about the statistical distribution of data. The obtained unweighted absorbed dose rates for internal exposure compare well between the different approaches, with 70% of the results falling within a range of variation of ±20%. The variation is greater for external exposure, although 90% of the

estimates are within an order of magnitude of one another. There are some discernible patterns where specific models over- or under-predicted. These are explained based on the methodological differences including number of daughter products included in the calculation of dose rate for a parent nuclide; source-target geometry; databases for discrete energy and yield of radionuclides; rounding errors in integration algorithms; and intrinsic differences in calculation methods. For certain radionuclides, these factors combine to generate systematic variations between approaches. Overall, the technique chosen to interpret the data enabled methodological differences in dosimetry calculations to be quantified and compared, allowing the

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Published online: 27 November 2010

Springer

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d

,

⁸⁹Sr,

Cs,

Th,



Little Forest Burial Ground (ANSTO)

- Waste trenches (1960's)
- Radionuclides include: U, ^3H , Pu Am, Cs, Sr, Co



LFBG - progress

- Initial discussion of results Sept. workshop
- Participants checked results & provided description of approach
- Data analysed
- Abstract accepted for Hamilton Radioecology conference June 2011



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Participants

SCK·CEN, Belgium

CEH, UK

ANL, USA

KAERI, Korea

Jozef Stefan Institute, Slovenia

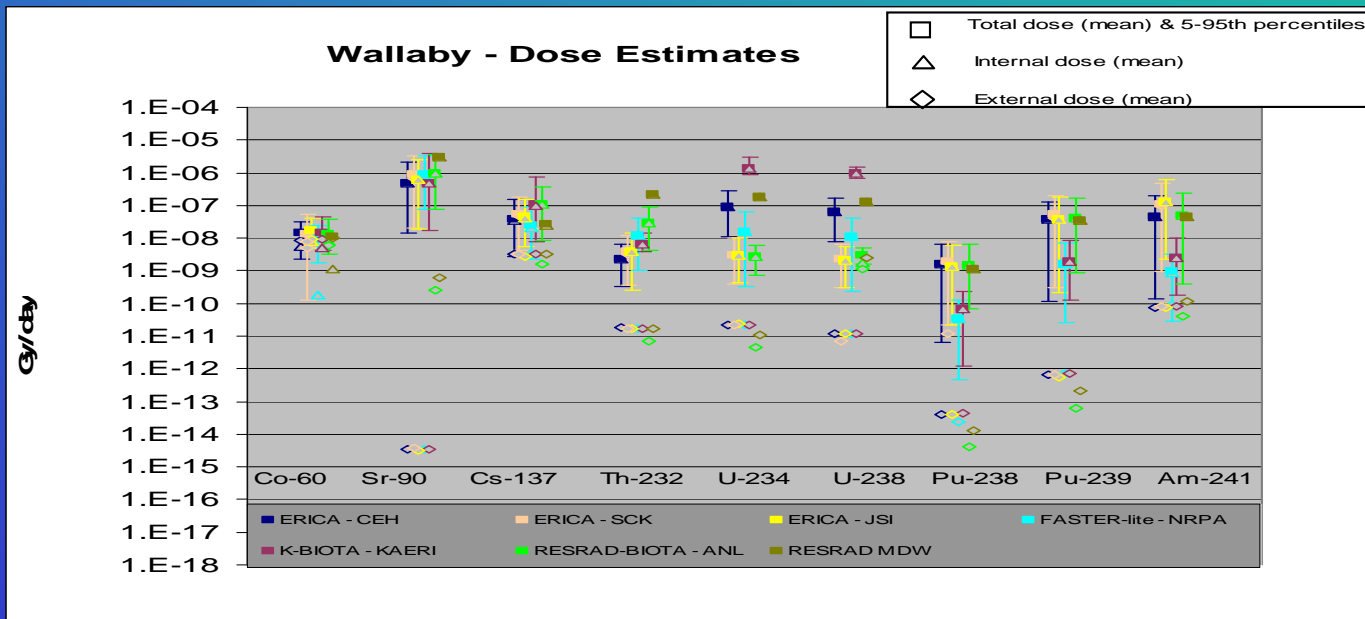
NRPA, Norway

Manchester Univ., UK



LFBG – objectives this meeting

- Discuss (understand) results
- Agree schedule for submission of paper



Beaverlodge uranium mine (CNSC)

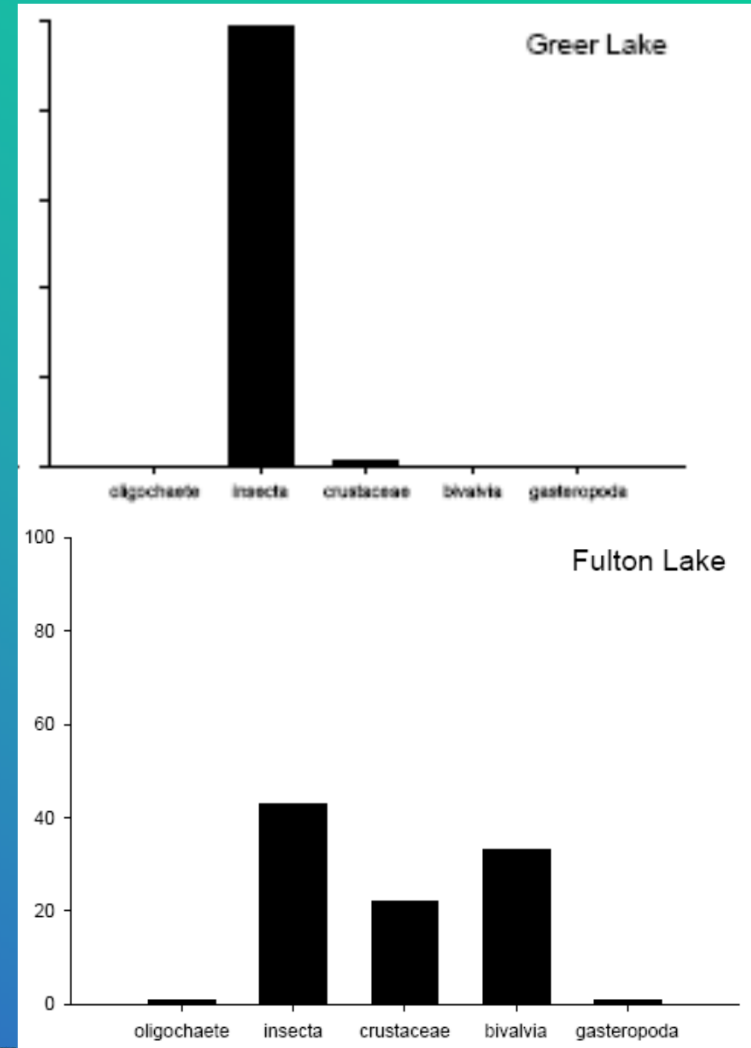


To
Crackingstone
River, and then
into Lake
Athabasca



Beaverlodge

- Sediment, water & fish data available over a number of years [enables model-data comparison] – for U-238 series radionuclides
- Reduced invertebrate populations/effects in fish/multi-contaminants (interaction with WG6)
- Provide informed opinion on real issue



Progress to date

- Initial results submitted for discussion in September 2010
 - Revised and resubmitted this workshop
- Activities this workshop
 - Joint session with WG6 to assess appropriate benchmarks
 - Assessment of submitted results
 - Plan next 6 months
 - U-235?



Progress to date

- Initial results submitted 16 September 2010
 - Revised and resubmitted 16 September 2010
- Activities this workshopt
 - Joint session with WRO on 16 September 2010
 - benchmarks
 - Assessment of submitted data
 - Plan next 6 months
 - U-235?

Participants

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BARC, India

IRSN, France

SUJB, Czech Republic

CNSC, Canada

KAERI, Korea

Jozef Stefan Institute, Slovenia



Dynamic modelling (SCK·CEN)

- Assess the need and demand for dynamic models
- Review available (adaptable) models
- Achieved via questionnaire
 - To date 13 responses from regulators, industry, model developers/users
 - More responses requested by end Feb. 2011
(jvibat11@SCKCEN.BE or nab@ceh.ac.uk)
- Initial results will be discussed at this workshop



EMRAS I new BWG outputs

IOP PUBLISHING

JOURNAL OF RADIOLOGICAL PROTECTION

J. Radiol. Prot. **30** (2010) 299–340

doi:10.1088/0952-4746/30/2/S06

An international model validation exercise on radionuclide transfer and doses to freshwater biota

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IOP PUBLISHING

JOURNAL OF RADIOLOGICAL PROTECTION

J. Radiol. Prot. **30** (2010) 341–373

doi:10.1088/0952-4746/30/2/S07

Predicting the radiation exposure of terrestrial wildlife in the Chernobyl exclusion zone: an international comparison of approaches

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Agenda overview

- Tuesday

- Morning meeting with WG6 (relevant Beaverlodge scenario)
- Afternoon – Beaverlodge scenario

- Wednesday

- Little Forest Burial Ground
- Wetlands scenario
- Heterogeneous sediment profile – dose rate modelling
- Dynamic model – requirements and status

