Minutes of the
2nd Meeting of the EMRAS Biota Working Group

IAEA Headquarters, Vienna
1–3 June 2005

PARTICIPANTS

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Apologies			
Karine Beaugelin-Seiller	IRSN, France		
Tatjana Nedveckaite	Inst. of Physics, Lithuania		

Note – participants are identified by initials throughout minutes and action lists.

ACTIONS ARISING

Action	Responsible member	Due date
General		
Liaise with other WG Leaders and MB to set timetable for November EMRAS meeting	BH/NB	1/08/05
Agree minutes of WG Meeting	All	22/06/05
Confirm that (i) NB has top copy of your presentation; (ii) you are happy for presentation to go on BWG website	All making a presentation	24/06/05
Amend BWG objective	BH	1/07/05
Exercises 1		
Check results and send revised spreadsheet (or confirm no changes needed) to NB	All exercise participants	1/07/05
Supply template for recording Exercise 1 assumptions	NB	12/07/05
Complete Exercise 1 assumption template	All exercise participants	1/08/05
Supply sediment surface DCCs	JVB	1/07/05
Extend comparison of confirmed results and send to attending participants for comment.	NB	30/08/05
Prepare short text on external β-exposure to be included in these minutes	MB	20/06/05
Invite G. Pröhl to Nov. 2005 WG Meeting to present ERICA / ICRP methodology	BH	30/06/05
Exercise 2		
Check results and send revised spreadsheet (or confirmation of no changes) to NB	All exercise participants	1/07/05
Conduct freshwater component of Exercise 1 using RESRAD-BIOTA	CY	1/08/05
Code R&D128 spreadsheet so that the assumption made can be easily seen	DC	1/07/05
Establish dialogue between TY and ERICA participants conducting freshwater data review	NB	17/06/05
Conduct ECOMOD estimations using Perch Lake scenario water parameters	TS	1/08/05
Extend comparison of confirmed results and send to attending participants for comment.	NB	30/08/05
Ask if ICRP will recommend transfer values for RAPs	DC	1/08/05
Reference organisms		
Produce short report for discussion	DC	30/08/05
Scenarios		
Generate scenario instruction text for Chernobyl	NB/BH	30/08/05
Let NB know any soil parameters are required to run model	All participating	30/08/05
Edit Perch Lake results sheets and send to TY	NB/BH	1/07/05
Prepare Perch Lake scenario text for comment	TY	15/07/05
Agree Perch Lake scenario text	All participating	30/07/05
Distribute Perch Lake scenario	TY	30/08/05
Report Perch Lake results to NB	All participating	01/11/05
Investigate potential use of FASTer model in terrestrial scenarios	JB	01/11/05
Nice extended abstract		
Ask Torun for delay in submission	JB	6/06/05
Prepare draft and circulate for comment	NB	8/06/05
Comment on draft	All	14/06/05
Submit abstract	NB	17/06/05
Prepare poster and oral presentation and circulate for comment	NB/BH	16/09/05

MINUTES
(see below for Agenda)

Introductions

MB reminded the Working Group that the current EMRAS programme ran until 2007. EMRAS aims to enable improved models for Member States, the final results are reports of each Working Groups. The EMRAS web site is in full operation and documents can be accessed in the Working Group sections. Anybody wanting to put materials or links onto the BWG web pages should first send them to NB. The next full EMRAS meeting is in 21-25 November 2005, within which the Working Groups take 3.5-4 of the 5 days (to be decided by the Working Groups).

Members were informed that it has been agreed that NB and BH will co-lead the Working Group.

As the group included a number of new participants, members introduced themselves and described their interest in the BWG.

Exercises 1 & 2

Members were reminded that the primary aim of these exercises, agreed at the Nov. 2004 WG Meeting, was to compare the methodologies and assumptions used in the dosimetry and transfer component of each participating model before moving on to scenario testing against observed data. As such, any new model entering the group would be expected to participate in these exercises. NB informed participants that of the models offered for participation in Nov. 2004 - two had not been able to complete the exercises. OURSON because of lack of time and ERICA as the project was not yet developed enough. It is still the intention of the ERICA project to participate within the BWG (hopefully having completed the exercises by the November meeting). However, three additional organisations had participated within the exercises (see below).

The exercise descriptions can be found on the BWG website.

Exercise 1

Aim: To present unweighted internal and external dose conversion coefficients (DCCs) for six of the ICRPs suggested reference animals and plants using the geometry information presented by the ICRP. The radionuclides selected were ^{137}Cs, ^{241}Am, ^{60}Co, ^{238}U, ^{14}C, ^{90}Sr and ^{3}H. A range of simple external exposure scenarios was specified. Participants presented a brief overview of the approach they had used and any problems they had encountered. The presentation of each participant can be found on this website (http://www-ns.iaea.org/projects/emras/emras-biota-wg.htm) and will not be repeated in full here.

England & Wales Environment Agency R&D128

The methodology as used in R&D128 (and published in Vives i Batle *et al*. 2004 *J. Radiol. Prot*., **24**, A13-A34) was applied to calculate DCCs for the specified geometries. No result was reported for the sediment interface, although this would be half the DCC for an assumption of residence in sediment. DCCs were presented relative to fresh weight soil concentrations and not dry weight as specified. However, this was generally felt not to present a problem for intercomparison at this stage.

FASSET

The FASSET framework presents tabulated DCC values for example geometries of different reference organisms. For the purposes of this exercise, the geometry nearest to that as specified by the ICRP was assumed. It was not possible to report values for all the geometry-radionuclide-media combinations. The methodology used to derive DCCs for aquatic organisms was identical to that of R&D128, however, terrestrial values were estimated using a Monte-Carlo approach. Daughter radionuclides with half-lives <10d are included within estimation of DCCs of the parent.

EDEN

Bespoke package capable of calculating DCCs for most radionuclides for user-defined ellipsoidal geometries. Hence could complete exercise fully. The (i) external gamma doses to small organisms (fish egg in this case) may be underestimated by the Monte-Carlo approach used; (ii) electrons were not accounted for in β-dose calculations.

ECOMOD

Used published (nuclear medicine) literature values for absorbed fractions across a range of ellipsoids to generate DCCs for a limited number of the reference organism-radionuclide-media combinations.

EPIC-DOSES3D

Bespoke software developed by SGo and here applied by NRPA. A description of the calculation approach (EPIC deliverable 4) can now be downloaded from the EPIC page of the ERICA website (http://www.erica-project.org/). Can estimate internal and external dose to any convex user defined shape, currently for 43 radionuclides. Consequently could estimate most of the exercise DCCs with the exception of situation when air is contaminated media and those for ^{60}Co. The approach includes daughter radionuclides with half-lives <1d within estimation of DCCs. Default for external exposure of terrestrial organisms to anthropogenic radionuclides is to consider external exposure from planar source at 0.5 g cm^{-2} depth. This differs to exercise scenario and it was agreed estimates would be recalculated. The approach includes daughter radionuclides with half-lives <1d within estimation of DCCs of the parent.

RESRAD-BIOTA

DCCs estimated for all organism-radionuclide-media combinations using a Monte-Carlo transport code. Calculations for ^{238}U included no daughter radionuclides, whilst those for ^{90}Sr included ^{90}Y.

LIETDOS-BIO

Recently developed by Institute of Physics Lithuania, DCCs are estimated using Monte-Carlo transport code.

SCK-CEN

Recently developed model for estimating absorbed doses based on the Point-Kernel (corrected with a build-up factor) and the Bethe-Bloch methodology. All geometries were assumed to be ellipsoids. Densities of soil and animal tissues were assumed to be concrete and water respectively; values for concrete and water were also used for the Taylor development and attenuation coefficients when those for soil and tissue respectively, were not available.

SÚJB

Used integration of point sources to estimated absorbed doses based on 'standard handbook formula'. No daughter products were included in the estimation of ^{238}U DCC.

AECL

For screening purposes, hyperconservative internal and external DCCs, which are not corrected for organism size, are usually used (Amiro, 1997). For more realistic assessments, and this exercise, DCCs from Blaylock *et al*. (1993) or FASSET are used as appropriate. Where default DCCs were not provided, the most conservative value was used. NB and TY had used different FASSET DCCs to provide some of the exercise results. Internal dose to fish eggs was assumed to be negligible, as organism is so small.

Comparison and discussion

Results of the exercises were not obtained from some participants until the start of the WG Meeting. Therefore, only limited analyses had been made for presentation – in the case of Exercise 1, results were presented as a ratio of the result of RESRAD-BIOTA (RESRAD-BIOTA was selected as being one of the models with a complete set of results and not because it was thought to be any better than any other of the models/approaches).

The provisional results indicate that DCCs for internal exposure compare well between the different models; typically coefficients of variation are <20% of the mean. Where variation is greater it is as a consequence of different daughter products being included (e.g. for ^{238}U [two approaches including ^{234}U] and ^{90}Sr [some approaches not including ^{90}Y]) within the estimation of DCC. Variation is greater for external exposure DCCs and this may partially be a consequence of differing media geometries being assumed. It was recognised that the exercise did not well define all aspects of media geometries for many of the external exposure DCCs.

Whilst external doses from β-emitters are low, there is considerable variation between the different approaches. However, it is highly questionable whether external β-doses should be considered for some radionuclides. MB agreed to produce a short text on this.

As a few outlying results were identified participants decided that they would check all their results and resubmit for a more rigorous statistical analyses. To more fully understand the variation in external exposure, CY suggested that a table of assumptions/methods should be prepared by each participant.

In the course of discussions, it was noted that ICRP-38 (data source for energy, yield etc. used by all participants) would be revised. However, it was felt that the revised document would not contain many changes of significance for the BWG.

It was noted that the ICRP should have estimated DCCs for their RAPs by November 2005. BH thought that G. Pröhl (GP) is producing these, although BH/NB were unsure as to if these would differ in approach to those G. Pröhl is generating for the ERICA project. It was agreed that BH would ask G. Pröhl to attend the November BWG to present the ICRP (and ERICA) approach to estimating DCCs.

Exercise 2

Aim: To estimate the fresh weight whole body activity concentration of 18 radionuclides in a range of reference organisms assuming 1 Bq kg^{-1} (dry weight) in soil for terrestrial organisms (for ^{14}C and ^{3}H 1 Bq m^{-3} air was to be assumed) and 1 Bq l^{-1} for freshwater organisms.

England & Wales Environment Agency R&D128

Conservative screening approach using equilibrium biota-soil or biota-water activity concentration ratios supplemented with advice (see Copplestone *et al*. 2003 R&D report SP1a) on how to estimate transfer when a required CR vale is missing. Nature of assumption can vary from use of a value for the same radionuclide for a similar organism to use of a K_d value for aquatic systems or values for different radionuclides. In the exercise the advice was followed when required biota-radionuclide parameters were missing and consequently a complete set of predicted activity concentrations were reported.

FASSET

Similar to R&D128, although a larger number of ecosystems are considered and some CR values were generated using a compartment model (FASTer). For this exercise, semi-natural pasture and freshwater CR values were used; where both data review and FASTer derived CR values are recommended, data review values were selected by preference. The paucity of data and the multiple recommended values for some ecosystems were demonstrated. The FASSET approach uses an adaptation of the R&D128 guidance for application when no CR value is available (although the guidance is not as extreme with regard to selecting CR values for different radionuclides). The

guidance was used and hence, a complete set of results reported with the exception of ^{60}Co, which is not considered within FASSET.

FASSET predictions for plants were on a dry weight basis in contrast to the exercise requirements for fresh weight predictions. The three organisations using FASSET look-up tables need to correct their results accordingly.

AECL

Activity concentrations in receptor biota were predominantly estimated using CRs in aquatic systems. Combination of allometric approaches from RESRAD-BIOTA were used together with CR values from FASSET, the Canadian literature or international reviews.

SCK-CEN

CR values are used from literature reviews (predominantly IUR Radioecology book and IAEA TRS364) to estimate transfer for a restricted number of organism-radionuclide combinations.

RESRAD-BIOTA

Multi-compartment foodchain model using allometric relationships for higher animals run to derive activity concentrations in biota.

ECOMOD

ECOMOD requires various water chemistry parameters, which were not supplied in the exercise. For the purposes of this meeting, TS had conducted a literature review. TS agreed to run ECOMOD using water chemistry parameters as specified, and now available, in the draft Perch Lake scenario.

LIETDOS-BIO

Used a combination of FASSET CR values, international reviews and Russian language publications. NB noted that where the FASSET approach offered multiple CR values for a given organism-radionuclide combination the *LIETDOS-BIO* and *FASSET* results were not always the same; reflecting the lack of guidance within FASSET on which value to use.

Comparison and discussion

As for Exercise 1, time constraints meant that only limited comparisons could be made at the WG Meeting. For this comparison, results were normalised to values predicted by the R&D128 approach, as this was the only one to report a complete set of results. All approaches which consider transfer of ^{3}H and ^{14}C use a specific activity approach relating biota activity concentrations to those in air for terrestrial organisms. Results of the different models predicting these two radionuclides varied by no more than *circa* a factor of 3. Predictions for some other radionuclides varied widely, by up to seven orders of magnitude. However, the comparison at the meeting was made difficult because values were assumed by two of the approaches when specific values for organism-radionuclide combinations were missing. Once the nature of the assumptions used have been tabulated a more rigorous analyses will be conducted. A positive aspect of the exercise was that different groups were identifying source materials, which will be of value to those models which currently have missing data. Following on from this, TY stated that she was conducting the TRS review of freshwater transfer parameters. NB offered to initiate a dialogue between TY and the ERICA participants responsible for collating freshwater CR values.

The group were unsure as to if the ICRP was going to suggest transfer parameters, for its suggest RAPs. DC will discuss with Jan Pentreath and communicate answer to the BWG.

Reference organisms

DC presented a summary of a comparison of how the reference organism/receptor organisms (etc.) were selected by the different approaches including the ICRP RAPs. All groups providing information used examples of the following criteria:

— Ecological relevance
— Radioecological sensitivity
— Monitoring/sampling
— Radiobiological sensitivity
— Representative of protected species

A need for consistency in terminology was highlighted. DC will prepare a short report on the comparison, which will include proposals on definitions.

Use of Medaka as a bioindicator

MD presented an overview on the potential use of Medaka fish as a bioinidicator based on work conducted in Japan.

Scenarios

The group had selected two scenarios for development between the November 2004 and June 2005 WG Meetings: Chernobyl exclusion zone terrestrial ecosystems and Perch Lake. In November 2004, the decision was that the scenarios would not be overly prescriptive to provide a comparison of how people use their models in assessments.

Chernobyl

A database for the Chernobyl exclusion zone has been put together by NB in collaboration with AA and SGa. It currently consists of ^{90}Sr and radiocaesium soil activity concentrations for sampling sites at which a range of mammals, invertebrate, amphibians, reptiles, birds and plants have been sampled. Data are available for the biota. There are currently 47 data entries. NB noted that soil activity concentrations could be given for Co-60, Ru-106, Am-241, Ce-144 and Pu-239. Biota concentrations are not available for these nuclides and hence, they could only be used for model intercomparisons. The group decided that the intercomparison of prediction for these radionuclides would be useful. NB described studies which would be conducted this summer by the ERICA in collaboration with SGa, to determine actinide activity concentrations in small mammals and amphibians and doses to small mammals estimated by TLD measurements. The decision was made to delay this scenario until these data were available. In the meantime, a scenario description and text will be written and circulated for comment. A number of soil parameters could be collated but participating groups were requested to state what they need, if anything (e.g. loss on ignition, K^+ concentration, etc.).

Models which agreed to participate in the scenario were:

FASSET/ERICA
RESRAD-BIOTA
AECL
SCK-CEN
R&D128
EPIC 3D combined with the FASSET FASTer model (to be run by NRPA)
EDEN (dosimetry only)

Perch Lake

TY had prepared an extensive document on the availability of data for Perch Lake (Canada). Data for activity concentration of ^{3}H, ^{137}Cs, ^{90}Sr and ^{60}Co in water, sediments and biota are available over the period late 1950's to 1990's. The most data are available for two periods, 1968-71 and 1990's, and the group decided to concentrate on these two periods.

Suggested changes to the results table were made and it was agreed that the scenario data would contain both sediment and water activity concentrations. TS stated that the water chemistry data as presented by TY was sufficient to run ECOMOD. The scenario description will include websites from which ecological data concerning the species present at Perch Lake can be obtained.

Models which agreed to participate in the scenario were:

FASSET/ERICA
RESRAD-BIOTA
AECL
SCK-CEN
R&D128
EPIC 3D (dosimetry only)
EDEN (dosimetry only)
ECOMOD

IUR Task Group Network

DC explained the goals of the Network as:

— to identify the players worldwide and their research potential,
— to open up new opportunities for wider collaboration,
— to strengthen radioecology as a reknown scientific discipline dealing with the environment,
— to ensure ultimate coordination of the scientific actions and programmes at an international scale.

Web questionnaire is available until end of June see - http://www.iur-uir.org/taskgroups/

Review of BWG objects

BH led a discussion of BWG objects as originally agreed in November 2004 – a few suggested changes were made.

AGENDA

Agenda item	Presenter
Wednesday pm	
Welcome & introductions	M. Balonov/B. Howard
Overview of progress and aims of the WG Meeting	N. Beresford
Presentation of Exercise 1	
RESRAD-BIOTA	C. Yu
England & Wales Environment Agency	J Vives Batelle
EDEN	F. Jasserand
FASSET	N. Beresford
ECOMOD	T. Sazykina
EPIC DOSES3D	A. Hosseini
LIETDOS-BIO	N. Beresford (for T. Nedveckaite)
SCK-CEN	G. Olyslaegers
SUJB	J. Horyna
AECL	T. Yankovich
Comparison of results	N. Beresford
Discussion	All
Thursday pm	
Continuation of Exercise 1 discussions	All
Presentations of Exercise 2	
RESRAD-BIOTA	C. Yu
England & Wales Environment Agency	D. Copplestone
FASSET	N. Beresford
ECOMOD	T. Sazykina
LIETDOS-BIO	N. Beresford (for T. Nedveckaite)
SCK-CEN	G. Olyslaegers
AECL	T. Yankovich
Comparison of results	N. Beresford
Discussion	All
Comparison of criteria used to select reference organisms	D. Copplestone
Presentation of case study scenarios (1)	
Chernobyl zone - terrestrial	N. Beresford
"Medaka"as a possible index of environmental impacts	M. Doi
Presentation of case study scenarios (2)	
Perch Lake	T. Yankovich
Discussion & agree scenario workplan for next 6 months	All
Review Exercises 1&2 – way forward	All
Nice conference abstract	All
IUR task group network	D. Copplestone
Review of BWG objectives	B. Howard