

**The IAEA's Programme on
Environmental Modelling for Radiation Safety
(EMRAS II)**

**EMRAS II
Reference Approaches for Human Doses Assessment
Working Group 3
Reference Models for "Waste Disposal"
WORK PLAN**

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1. Introduction and Objectives

The IAEA EMRAS II Working Group 3 (WG3) entitled Reference Models for "Waste Disposal" met for the first time during the First EMRAS II Technical Meeting, held at IAEA Headquarters in Vienna, from 19 to 23 January 2009. During the meeting it was decided that the objectives of WG3 are as follows:

- To agree on approaches for developing reference biosphere models appropriate for assessments of exposures to humans in performance assessment studies of radioactive waste repositories for radioactive waste.
- The models should take into account changes of the exposure conditions as e.g. due to changes of the climate, the use of land, agricultural practices and changes in living habits.
- To derive a set of models that cover a wide range of environmental situations.

The January meeting identified some important and difficult areas which need to be addressed, notably:

- Environmental change, which can be climate driven but also includes related factors such as changes in landscape, and groundwater and sea levels, as well as changed land use by humans.
- Processes at the transition zone between the geosphere and the biosphere. A variety of potentially relevant geosphere-biosphere interfaces was identified, though it was recognised that the details will be site specific.
- Important migration and accumulation processes within the biosphere itself, which in many cases are radionuclide and/or site specific.

2. Progress in Biosphere Modelling Since Publication of the IAEA's Reference Biosphere Methodology

The IAEA's BIOMASS Programme completed extensive guidance on the development of reference biospheres in 2001 (IAEA, 2003). This included examples of how to develop reference biospheres in different assessment contexts. Since 2001, significant international projects have addressed some of the critical issues identified in IAEA (2003), notably the European projects:

- BIOCLIM (2004) which considered how to address climate change; and
- BIOMOSA (Olyslaegers et al, 2005) which considered the application of the BIOMASS methodology at specific sites, as compared to a generic methodology application.

Significant model intercomparison exercises have been carried out under the BIOPROTA international collaboration, allowing peer review among operators and regulators of the science behind the biosphere modelling assumptions, as well as investigation of improved models for specific radionuclides, such as Cl-36 (Limer, 2008). More information on this work programme and its publications is available at <http://www.bioprota.com/>.

A further important international development is the setting up of a topical group on Radioactive Waste Management within the Asian Nuclear Safety Network, <http://www.ansn.org>. This group has developed a database for biosphere parameters relevant to climates in that region.

Yet another important development has been the update of IAEA's TRS-364 data advice.

Finally, it is worth noting that the IAEA-BIOMASS-6 (IAEA, 2003) methodology has been taken into account in many major repository assessment projects, some of which have been site generic, e.g., ONDRAF/NIRAS (2001) and NWMO (Gierzewski P et al, 2004), and some of which are site specific, e.g., SR-CAN (SKB, 2006; KBS-3H Posiva Working report 2007-109 (Broed, et al., 2007) and US DOE, (2008). These applications and variant approaches adopted in a wide variety of assessment contexts, as well as the international work referred to above, provide a substantial basis for review and updating of the usefulness of the IAEA-BIOMASS-6 (IAEA, 2003) methodology. This would be very timely given the 8 years since the methodology was developed.

3. Proposed Working Group Outputs and Activities

Noting the above, it is proposed that WG3 works towards producing updated IAEA guidance on biosphere modelling for assessment of post-closure safety of radioactive waste repositories. It can be anticipated that the update will be able to consider how the biosphere assessment needs to evolve, as a repository development programme goes from being at the proof of concept and site generic stages, towards site specific investigation. In addition, IAEA-BIOMASS-6 (IAEA, 2003) only gave limited consideration to the assessment of environmental change. These aspects are therefore now worth further consideration.

The activities proposed to produce the updated guidance naturally take account of the ideas from January 2009 as well as explicit consideration of the assessment related applications and research referred to above, i.e.:

Step 1. Process orientated consideration of critical factors that may have a major influence on dose to man

Here the idea is to think about the processes using our radioecological and assessment experience but not in any specific site or regulatory context to identify important processes, based on existing work in BIOMASS, BIOMOSA, BIOPROTA, BIOMOSA and the national assessment projects which have been on-going, notably concerning:

- climatic factors and climate change processes,
- geosphere-biosphere interface processes,
- geomorphological processes, and
- land use processes;

and then:

- determine whether these factors are of more universal nature or are they specific to a site, and
- consider whether models developed for one climate (e.g., temperate) are adequate to address the specific conditions of a changed climate.

Step 2. Learning from Recent Assessments and Research

A study of how recent assessments and related research have addressed critical issues will provide practical examples of how issues have been addressed. Those assessments will have had specific contexts attached to them (as discussed in IAEA-BIOMASS-6, etc.), so it will be instructive to identify the assessment approaches used and to consider how they needed to be different in those different contexts, or whether in fact common solutions can be effective.

Participants may wish to propose particular assessments and research work for consideration.

Step 3. Quantitative analysis of alternative approaches

It is anticipated that the work in Steps 1 and 2 will throw up potentially important questions which can be examined though applying alternative modelling approaches. Scenarios related to these questions can be constructed and different methods for their analysis applied or developed. Participants may already have such questions and proposals for their examination, as discussed in January 2009 in relation to the geosphere-biosphere interface, and these are certainly invited for consideration.

Step 4. Development of Updated Guide

The results from Steps 1–3 can be used to address questions such as:

- Are the basic steps in the IAEA-BIOMASS-6 (IAEA, 2003) methodology still relevant?
- What detailed improvements may be made in each step to support future biosphere assessments for repositories, relevant to:
 - specific ecosystems and their site specific data,
 - specific climate systems and climate changes,
 - specific geosphere-biosphere interfaces, in constant conditions and under environmental changes/transitions,
 - the selection and justification of model discretisation,
 - the assumptions for reference groups and food habits,
 - specific land use assumptions, and
 - specific regulatory requirements?

4. Conclusions

Participants are invited to consider the above proposals and it is hoped that feedback can be provided to the Working Group Leader (contact details above) as soon as possible so that the necessary preparations can be made in good time for the next (2nd) Working Group Meeting which will take place during the Second EMRAS II Technical Meeting, being held at IAEA Headquarters in Vienna, from 25 to 29 January 2010.

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