

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

**EMRAS II
Reference Approaches for Human Dose Assessment
Working Group 3
Reference Models for Waste Disposal**

MINUTES

**of the First Meeting held at IAEA Headquarters, Vienna
19–23 January 2009**

IAEA Scientific Secretary	Working Group Leader
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Background

Working Group 3 “Reference Models for Waste Disposal” (WG 3) met for the first time on 20 January 2009 at the IAEA’s Headquarters in Vienna during the First EMRAS II Technical Meeting, which was held 19–23 January 2009. WG 3 met 20–22 January 2009. Details of the WG 3 members are listed above. During the first session of WG 3, Gerhard Proehl was proposed as Working Group Leader; which he accepted.

Objectives of the Working Group

The objectives of the WG 3 are:

- 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 high level radioactive waste.
- The models should take into account changes of the exposure conditions such as e.g., due to changes of the climate, the use of land, agricultural practices and changes in living habits.
- The aim is to derive a set of models that cover a wide range of environmental situations.

General Discussion of Biosphere Modelling

Initially, the WG 3 discussed general aspects that need to be taken into consideration for biosphere modelling, if environmental changes need to be taken into account. It was agreed that biosphere modelling should be considered as one component within performance assessment that covers the radionuclide behavior in the repository, the geosphere and the biosphere. For biosphere modelling, the transition zone between geosphere and biosphere is of special importance because they represent the point of entrance into the biosphere. The relevant geosphere-biosphere-transition-zones are site-specific. However, a general simplification of the processes occurring in this zone should be avoided. Furthermore, there was agreement which processes within the biosphere may have a feedback to processes in the geosphere. Those interactions should be adequately taken into account. It was concluded that for the purpose of this comparison the following geosphere-biosphere-transition-zones should be taken into account:

- soils in areas with a low ground water table;
- sediments of freshwater bodies or the sea;
- freshwater bodies or the sea; and
- withdrawal of contaminated water from a well.

Relevant Transfer Processes

A general discussion followed on the processes that need to be taken into account for modelling the radionuclide transfer in the biosphere. The following processes were mentioned:

- contamination of soils:
 - uptake by plants,
 - accumulation / speciation / migration / sorption / desorption,
 - erosion / resuspension / bioturbation;
- foliar contamination:
 - Interception, weathering, translocation;
- transfer to meat and milk;
- processes in sediments:
 - sorption / desorption / speciation / bioturbation / resuspension column;

- processes in water:
 - speciation, uptake by fish etc.;
- ingestion, inhalation, external Exposure;
- drinking water (human, cattle).

These processes might change or be altered under the influence of environmental change.

Addressing Environmental Change

A number of developments were identified, which may cause environmental changes. The following reasons for environmental change were considered to be taken into account in detail:

- climate change;
- change of land use management; and
- change of landscape.

There was consensus that these factors should not be considered in isolation, but that all these factors are in more or less close interaction, e.g., climate changes caused by modifications of temperature and precipitation have a direct impact on land use and, changes in the landscape as an uplift impact on the use of land.

An example for an analysis of environmental conditions was presented by Tobias Lindborg. In the Swedish performance assessment study, climate changes are an important factor in considering long-term safety. Several climate stages were identified, one of those climates is permafrost. For an analysis of those climates, an analogue permafrost site in Greenland was studied. The peculiarities of land use, hydrology and pathways were discussed.

Further work

Finally, the future work for integrating environmental changes into biosphere modeling was discussed. Two fields were identified: firstly, it should be identified, in how far transfer processes are influenced by environmental changes. Secondly, model calculations will be performed that take into account environmental changes.

Process analysis

The following work should be done to analyse the different processes:

- WG 3 members are asked to identify impact of climatic factors on processes that may have a major influence on the resulting exposure to man, subsequent to a discharge of radionuclides:
 - soils;
 - lakes;
 - landscape.
- One should identify if these processes/features are of universal nature or if they specific to a site?
- In how far should models for temperate climate be modified/further developed in order to address the specific conditions of the changed climate?

This work should be done by all participants.

Model calculation (3–5 WG 3 members)

The model calculations of 3–5 WG 3 members will be performed:

- assessment of exposures to adult reference persons for discharges of radionuclides assuming different for GBI-ecosystem combinations:
 - apply present day temperate climate conditions,
 - document and justify assumptions, conceptual model, processes, parameters;
- modification and application of model for other climates:
 - to give modifications for assumptions, conceptual model, processes, parameters,
 - justify modification;
- compare results:
 - exposure, concentration in media,
 - first conclusion.

Radionuclides to be considered

If possible, the following radionuclides should be considered:

Cl-36, Ni-59, Se-79, Tc-99, I-129, Ra-226, Np-237, Pu-239

Ecosystems and Geosphere-Biosphere-Interfaces

Receiving ecosystem	GBI	Participant
Agriculture Grassland, Wetland	Well, soil, soil	Gerhard Proehl
Agriculture Semi-natural Agriculture	Well, soil Soil River, sediment	Geert Olyslaegers
To be specified		Shulan Xu
To be specified		Tobias Lindborg

Climates

Initially one should start with a temperate climate. To account for the climate change, one should consider several possibilities within a spectrum of climates: An example could be:

- boreal (Df according to the Köppen classification);
- temperate (Cf according to the Köppen classification);
- subtropical (Cs according to the Köppen classification);
- dry climate (BS according to the Köppen classification).

Please note: There are several climate classification schemes around.

Next Meeting

During the meeting, it was discussed to hold the next meeting in Madrid in the week 4–8 May 2009 (Remark: Due to schedule difficulties, a meeting in this week is unlikely. A new date is envisaged for late August/September).