PROPOSALS FOR A FOLLOW-UP TO THE IAEA'S EMRAS PROGRAMME

Material for consideration during the Technical Meeting on EMRAS II
IAEA Headquarters, Vienna, 19–23 January 2009
(754-J9-TM-37508)

1. INTRODUCTION

The IAEA's programme on Environmental Modelling for Radiation Safety (EMRAS) ran from 2002 to 2007. In common with the former VAMP and BIOMASS programmes EMRAS had the following general objectives:

(i) to improve models and modelling methods by model testing, comparison and other approaches;
(ii) to develop international consensus, where appropriate, on environmental modelling philosophies, approaches, and parameter values;
(iii) to develop methods for the assessment of radionuclide transfer in the biosphere in areas where they did not already exist;
(iv) to provide an international focal point in the area of environmental assessment modelling for the exchange of information; and
(v) to respond to environmental assessment modelling needs expressed by other international groups.

It is noted that a special feature of the IAEA's modelling programmes in this area is the possibility of testing models using 'real environmental data'. In many other contexts, models cannot be tested in this way and can only be partly tested or compared. For this reason some priority has been given to model testing with real environmental data during previous programmes.

The Themes and Working Groups within the EMRAS programme were as follows:

Theme 1: Radioactive Release Assessment

(i) The revision of the IAEA Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments (TRS-364);
(ii) model testing related to countermeasures applied to the intake of iodine-131from the Chernobyl accident;
(iii) testing of models for tritium and carbon-14 from routine and accidental releases; and
(iv) testing of models for predicting the behaviour of radionuclides in fresh water systems and coastal areas.

Theme 2: Remediation Assessment

(i) Testing of models for the remediation of the urban environment; and
(ii) modelling the transfer of radionuclides from naturally occurring radioactive material (NORM).

Theme 3: Assessment Related to Protection of the Environment

(i) The review of data and testing of models for predicting the transfer of radionuclides to non-human biological species.

The IAEA has decided to continue with the same type of programme as EMRAS, and so consideration has been given to the possible contents of a follow-up programme. This document outlines and summarizes the suggestions received on the nature and topics to be contained in the new programme, and some proposals are made for the contents of the programme.

2. INPUT FROM THE IAEA CONFERENCE ON ENVIRONMENTAL RADIOACTIVITY (APRIL 2007)

During the discussions which were part of the Conference, a number of general conclusions were drawn regarding possible future IAEA programmes in the environmental area. In relation to environmental modelling assessment the following conclusions were drawn:

(i) The value of international exercises to develop and improve environmental assessment models was demonstrated in one of the sessions of the Conference (Session 6) and the continuation of suitably focused model testing programmes was recommended.

(ii) Concern was expressed in several sessions over the potential loss of knowledge and competence in the radioecology and environmental assessment areas. To address this problem, the international organizations should organize and support appropriate training programmes.

In addition, some ideas were drawn from the Conference by the IAEA Secretariat on future topics for the EMRAS follow-up programme.

2.1. Suggested new topics

The new programme should reflect current developments in the fields related to environmental radiological assessment modelling. Some of these are:

The new ICRP Recommendations and, in particular, the shift from 'critical group' to 'representative individual'.

A group could be established to investigate the implications of ICRP 101 for assessment modelling.

The development of a framework for the protection of non-human species.

This remains a developing area and one on which ICRP has yet to make firm proposals. EMRAS had a working group on assessment of radiation doses to biota and it could be asked to propose any obvious next steps that are needed.

Climate change and the implications for the future of nuclear installations.

There is concern about this subject and a working group could be tasked with examining the implications for nuclear installations of various kinds regarding types of hypothetical climate change scenarios, e.g. sea level change, desertification.

2.2. Existing topics

Some topics already studied during EMRAS have not yet been explored to the desired degree, for example, NORM and urban modelling. These represent radiologically important topics but, for various reasons, the existing working groups were not able to fully develop them under EMRAS.

2.3. Long-standing EMRAS topics

Some EMRAS working groups have existed since VAMP and/or BIOMASS, e.g. on tritium and carbon-14 modelling, post-Chernobyl scenario modelling and aquatic modelling. The value of continuing with them needs to be examined. On the other hand, until now they have continued to be viable in terms of numbers of modellers and the quality of work produced. It can be argued that programmes like EMRAS have important training functions as well as providing a forum for modellers with the same interests to meet and exchange views.

3. INPUT FROM THE FINAL EMRAS COMBINED MEETING (NOVEMBER 2007)

3.1. IAEA views

The new ICRP 103 exposure scenarios should provide the basis for the programme structure, i.e. planned, existing and emergency. Possible topics that would fit within the framework are:

Planned

(ii) emphasise integrated assessment modelling — multiple nuclides, multiple environments — as an international methodology; and
(iii) biota dose assessment.

Existing — assessment of environments affected by NORM.

Emergency — consideration of 'environmental sensitivity' in assessment modelling.

3.2. Participants views

Continue some existing working groups, i.e.:

Biota

— Still more work to be done;
— model testing and comparison;
— international reference transfer data; and
— interact with other international projects and programmes, e.g. ICRP and EC.

H-3/C-14

— An international working group on tritium environmental assessment is a political need in some countries; and
— develop a reference approach to accident assessment for tritium.

Urban

— Currently an important topic — threat of urban explosions; and
— dispersion and transfer modelling not yet reliable.

NORM

— Almost all countries have NORM issues;
— environmental assessment only moderately explored as yet; and
— must be coherent with other related IAEA activities in this area.

Additionally:

New model testing scenarios

— Integrated testing — several nuclides, aquatic and terrestrial environments;
— human and biota impacts;
— countermeasure effectiveness; and
— at least one such scenario has already been proposed.

Transfer of knowledge and training

A new recognition of the importance of the types of programmes like EMRAS, for facilitating the transfer of knowledge to younger generations and for providing training for new generations of assessors.

4. INPUT FROM THE IAEA QUESTIONNAIRE TO EMRAS PARTICIPANTS (DECEMBER 2007)

The IAEA decided to distribute a questionnaire to the participants in the EMRAS programme. The following is a summary of the most frequently expressed interests for the future programme:

(i) NORM;
(ii) operational releases;
(iii) emergencies — by combining accident response planning, countermeasures and urban post accident;
(iv) tritium;
(v) biota; and
(vi) marine and aquatic.

5. ADDITIONAL CONSIDERATIONS

The IAEA, while recognizing the views of the EMRAS participants, has to take into account some other factors related to its international role and mandate in determining the format and content of the follow-up programme to EMRAS.

5.1. Needs of developing countries

Many countries with only a few sources of ionizing radiation nevertheless have requirements in relation to environmental assessment and wish to improve their capabilities in environmental assessment. The modelling needed by them is related to small scale discharges to the environment, e.g. atmospheric and aquatic dispersion modelling and radionuclide transfer. The IAEA has provided guidance on modelling of such applications in Safety Reports Series No.19 (2000) but it would be helpful for such countries to be able to apply the models and to improve in their use by comparison and discussion with others. Furthermore, it will be useful for all Member States to review and update this report.

5.2. New nuclear facilities

Recent nuclear developments suggest that, in the near future, new siting and licensing proposals will be made in several countries. A factor to consider in siting a new nuclear facility is its potential environmental impact. The IAEA’s guidance in this area is limited and a document is currently under preparation in this regard. At present, countries must develop their own approaches to demonstrating that planned facilities will comply with basic radiation protection standards. It may therefore be appropriate to consider whether more international guidance should be prepared.

At the same time the ICRP has recommended the use of the representative individual concept in place of the critical group concept and several other considerations related to demonstrating that discharges comply with radiation protection standards.

The follow-up programme to EMRAS may be an appropriate platform to explore these aspects with a possible view to providing input to new IAEA safety standards guidance in the area.

5.3. A harmonized approach to the protection of humans and biota

International proposals for an approach to demonstrating that both humans and biota will be adequately protected from discharges to the environment, and existing radiation in the environment, have not yet been made. Methodologies for assessing radiation dose to biota have been developed and are in the process of being tested and compared in the EMRAS programme (this working group is still in existence). As a way of making progress in the development of a harmonized approach, the follow-up programme to EMRAS could address the issue, possibly through scenario development, model comparison and testing. It is noted that some suggestions for a harmonized approach to the protection of humans and biota have been made at the national level.

6. PROPOSAL FOR AN EMRAS FOLLOW-UP PROGRAMME

The IAEA has decided to continue its series of programmes on the improvement and testing of environmental assessment models (BIOMOVS, BIOMOVS II, VAMP, BIOMASS and EMRAS) with a new programme starting in January 2009.

In this document, proposals are made for the themes and contents of a new programme. The proposals have been developed following discussions during the IAEA Conference on Environmental Radioactivity in April 2007, the final EMRAS Combined Meeting in November 2007, the results of a Questionnaire sent out in December 2007 and a Consultants Meeting held in May 2008.

These proposals will be widely circulated in advance of the first Technical Meeting of the new programme (EMRAS II), which will take place 19–23 January 2009.

A common theme to the proposed programme will be the development of reference approaches:

Working Group 1: Reference and Graded Approaches for Assessing the Impact of Radioactive Discharges

Analysis of available assessment schemes for regulatory purposes; development, validation and testing of the graded approach to the prospective assessments of public exposure and environmental impact at the design stage of nuclear facilities. Testing of the graded approach for demonstrating compliance at the operational stage of a facility. Formulation of the reference assessment schemes for common types of nuclear facilities and installations (e.g. laboratories, hospitals, uranium industry facilities, nuclear power plants, waste management facilities, waste disposal facilities, etc).

Prospective assessments of radioactive discharges

At a time when there is the prospect of new nuclear facilities being built in several countries, it may be appropriate to establish reference principles and procedures for the prospective assessment of radioactive releases. Such principles and procedures have already been developed in some Member States, but to differing degrees.

The programme would include consideration of appropriate models suitable for particular discharge conditions (e.g. nuclear industry, NORM facilities, small enterprises, etc.), defining standard values for some of the key assumptions and parameters governing the control of discharges, e.g. critical group or representative person, reference habitat data, reference dosimetry. The new guidance given in ICRP 101 should be considered in this context.

Prospective assessments of the long term impact of radioactive waste repositories

This group will extend the work of the BIOMASS programme on developing reference modelling approaches and reference cases for the biosphere in the far future, relevant to assessing releases from

radioactive waste repositories by considering the influence of the different environmental changes, including climate change.

As necessary, the group will interact with the BIOPROTA project.

Prospective assessments of the impact of NORM releases to the environment

To carry on the work of the EMRAS NORM working group, i.e. model improvement and testing in relation to NORM releases and sites contaminated by NORM.

The utility and feasibility of developing reference regulatory approaches to assessments of NORM will be explored.

Assessments for demonstrating compliance

Reference and graded assessment schemes for demonstrating compliance at the operational stage of a facility (based on the source and environmental monitoring data) will be elaborated upon.

The monitoring of radionuclides in the environment is an important element of discharge control. It provides the ultimate means of demonstrating compliance with regulatory limits. However, the extent, nature and location of environmental monitoring are not always easy to define. To examine how a strategy for environmental monitoring in relation to discharge control should be developed.

International intercomparison exercise: Testing of models for discharge assessment

Model predictions based on harmonized principles and procedures for assessment of impact of radioactive releases (see above) will be compared for the range of scenarios. The exercises are intended, amongst other things, to contribute to national capability building and training in assessment.

Applicability of modelling and assessment in the regulatory approach to the protection of humans and biota

The goal is to work towards developing an assessment scheme for protecting humans and biota against the effects of ionizing radiation. To this effect, it will consider how assessments for human and non-human species can be taken into account to provide a coherent, single overview of the likely exposure, and its consequences, to ionizing radiation in the environment. Issues that may need to be considered here could include the impact of the effects of ionizing radiation over different spatial scales, how the variability in natural background might need to be considered, and other issues of key interest for non-human species.

Existing international and national proposals/suggestions for an integrated approach will be reviewed and evaluated. Exercises to test the scheme using hypothetical discharge situations will be carried out.

The work will be carried out through interactions with ICRP Committees 4 and 5.

Working Group 2: Reference Approaches for Assessing the Radiation Doses to Biota

The work of the EMRAS working group on biota model testing and data acquisition will be completed. It will include:

New model comparison/testing scenarios.

Development of a handbook of transfer parameter values for application to biota.

Development of methods for determining protection quantities and levels for biota based on the existing data available on radiobiological effects.

As necessary, the working group will interact with other working groups and with international activities related to this subject, i.e. ICRP and EC.

Working Group 3: Assessment after Emergency Situations

Urban situations

The potential for emergency situations in urban environments continues to exist. The uncertainties in predicting the dispersion and retention of radionuclides in these environments are significant. The EMRAS urban working group did not complete its work and has made proposals for further model comparison and testing, mainly in the context of evaluating the effectiveness of countermeasures.

Rural situations — environmental sensitivity

It is well known that the agricultural, and especially semi-natural, environments vary in their radioecological sensitivity to contamination in terms of the potential transfer of radionuclides to the human food chain. That effect is significant in the Arctic, forest and alpine environments, some freshwater bodies and potentially in some other environments. The countermeasures that have to be applied therefore also vary depending on soil, climate and freshwater conditions, land use, etc. both in the short and long term, following radioactive fallout. The influence of environmental sensitivity on establishing countermeasure strategies in existing and emergency situations will be explored by means of modelling.

As necessary, this subgroup will interact with the International Union of Radioecology (IUR) task group focusing on a similar subject.

Tritium accidents

For many countries tritium continues to be an issue, especially with regard of potential emergency releases, and for them maintaining a national radiological assessment competence is essential. The tasks of the working group would include:

— developing a standard conceptual dynamic model for tritium dose assessment for accidental releases to atmosphere and water bodies; and
— carrying out model comparison and testing for tritium releases in various circumstances.

As necessary, this subgroup will interact with the IUR task group focusing on a similar subject.

Working Group 4: Integrated Assessment

One of the special features offered by international model testing programmes is to obtain access to unusual and unique environmental data sets and to test and compare assessment model predictions of transfer in real environments.

A particular challenge would be to perform assessments of situations in which several radionuclides have been released into the environment, possibly involving radionuclide transfer in air, water and on land with an assessment endpoint of the radiation dose to both humans and biota.

For this purpose, suitable scenarios would be sought, e.g. past releases from a nuclear reprocessing plants. Proposals for a potential scenario have already been made.