

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

**EMRAS II
Approaches for Assessing Emergency Situations
Working Group 8
"Environmental Sensitivity"**

MINUTES

**of the Fourth WG8 Meeting held at IAEA Headquarters, Vienna
24–28 January 2011
(during the Third EMRAS II Technical Meeting)**

IAEA Scientific Secretary	Working Group Leader
<p>Mr Volodymyr Berkovskyy (<i>VB</i>) Assessment & Management of Environmental Releases Unit Waste & Environmental Safety Section (Room B0764) Division of Radiation, Transport & Waste Safety International Atomic Energy Agency (IAEA) Vienna International Centre PO Box 100 1400 VIENNA AUSTRIA Tel: +43 (1) 2600-21263 Fax: +43 (1) 2600-7 Email: V.Berkovskyy@iaea.org</p>	<p>Mr Bliss L. Tracy (<i>BLT</i>) Retired, formerly with: Radiation Protection Bureau Health Canada Ottawa, CANADA Tel: +1 (613) 526-1229 Email: neutracy@rogers.com</p>

Attending	
Name / Initials* / Email	Organization / Country
Ms Sarah Barabash (<i>SB</i>) Email: sbarabash@ecometrix.ca	Ecometrix Incorporated, CANADA
Mr John E. Brittain (<i>JEB</i>) Email: j.e.brittain@nhm.uio.no	Freshwater Ecology & Inland Fisheries Laboratory (LFI), University of Oslo, NORWAY
Ms Franca Carini (<i>FC</i>) Email: franca.carini@unicatt.it	Università Cattolica del Sacro Cuore, ITALY
Mr Sohan Chouhan (<i>SC</i>) Email: chouhans@aecl.ca	Atomic Energy of Canada Limited (AECL), CANADA
Mr Georgos Eleftheriou (<i>GE</i>) Email: gelefthe@central.ntua.gr	National Technical University of Athens, GREECE
Ms Eleni Florou (<i>EF</i>) Email: eflorou@ipta.demokritos.gr	National Center for Scientific Research "Demokritos", GREECE
Ms Aniko Földi (<i>AF</i>) Email: foldia@aeki,kfki.hu	KFKI Atomic Energy Research Institute (AEKI), Hungarian Academy of Sciences, HUNGARY
Mr Mikhail Iosjpe (<i>MI</i>) Email: mikhail.iosjpe@nrpa.no	Norwegian Radiation Protection Authority (NRPA), NORWAY
Mr Luigi Monte (<i>LM</i>) Email: luigi.monte@casaccia.enea.it	ENEA, CR Casaccia, ITALY
Ms Lisa Outola (<i>LO</i>) Email: lisa.outola@stuk.fi	Radiation & Nuclear Safety Authority (STUK), FINLAND
Ms Maria Psaltaki (<i>MP</i>) Email: ramps11@hotmail.com / n.markatos@ntua.gr	National Technical University of Athens (NTUA), GREECE

*Initials used to refer to participants within minutes and actions as appropriate.

Attending	
Name / Initials* / Email	Organization / Country
Mr Jochen Tschiersch (<i>JT</i>) Email: tschiersch@helmholtz-muenchen.de	Helmholtz-Zentrum München GmbH, German Research Center for Environmental Health, GERMANY
Ms Catrinel O. Turcanu (<i>COT</i>) Email: cturcanu@sckcen.be	Studiezentrum für Kernenergie (SCK/CEN), BELGIUM
Ms Beata Varga (<i>BV</i>) Email: varga.beata@t-online.hu	Central Agricultural Office, HUNGARY

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Working Group Attendance

Sixteen participants from eight countries took part in discussions of the Environmental Sensitivity Working Group (WG8) during the 3rd EMRAS II Technical Meeting (TM).

Objectives and tasks

The objective of WG8 is to explore the concept of environmental sensitivity in rural and semi-natural environments within the framework of assessments after an emergency situation. The main tasks of the WG8 are to:

- formulate the concept of environmental sensitivity;
- compile a list of sensitivity factors;
- design scenarios; and
- carryout modelling exercises.

Modellers were instructed to complete the following exercises:

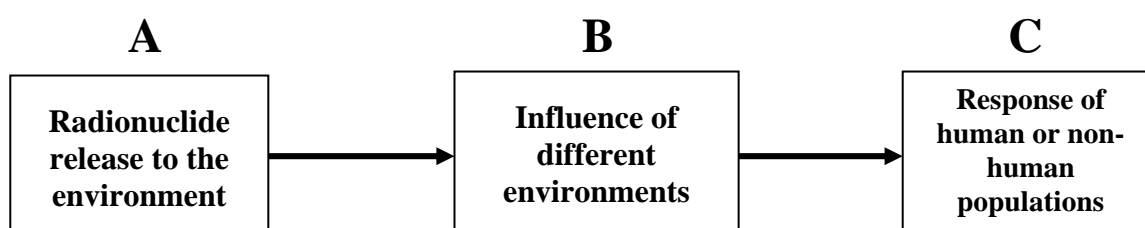
Assume a deposition of 1000 Bq/m² for ¹³⁷Cs, ⁹⁰Sr, and ¹³¹I in each of the following non-urban environments:

- Agricultural;
- Alpine;
- Temperate forest;
- Arctic;
- Freshwater aquatic; and
- Coastal marine.

Calculate concentrations in environmental media and food chain products leading to humans. Also calculate the radiation dose to the most-affected human population during first, second, and 10th year following the deposition.

Discussion of the concept of environmental sensitivity

There is a need to clarify what we mean by “environmental sensitivity” and whether indeed this is the best term to use. Some people interpret it to mean the sensitivity of the environment to the effects of radiation. For the purposes of WG8, we have taken environmental sensitivity to refer to the role played by environmental factors in the human response to an accidental release of radionuclides. This is best illustrated by a simple A → B → C model.



For a given radionuclide release **A**, *environmental sensitivity* can be defined as the response of **C**, subject to the influence of **B**. The question then arises as to what is the best indicator of this response. WG8 decided that for this exercise the best single index of sensitivity would be the dose to an adult member of the human critical group, i.e., an identifiable group whose lifestyle and dietary habits make it maximally susceptible to the radiation exposure. The response of non-human biota would also be important, but this consideration lies outside the scope of what WG8 can accomplish within the given timeframe.

As noted above, the response of the critical group depends not only on the characteristics of the particular environment, but also on the dietary habits of the group. In order to separate these two factors, it is valuable to use secondary indices, such as the radionuclide concentrations in abiotic media (soil, water, etc.) and in certain plants and animals that are significant components of food chains leading to humans.

A third measure of impact on the human population would be the collective dose arising from the food production or harvest per unit area in the region affected by the radionuclide deposition. Please note that this approach does not require knowledge regarding the number or distribution of the people affected by the release. It merely assumes that all of the food produced or harvested in a given region is consumed by somebody, somewhere. The collective dose can then be calculated using the simple formula:

$$\text{Collective dose (person-Sieverts/unit area of production)} = \sum C_i(\text{Bq/kg}) \times P_i(\text{kg/unit area}) \times \text{DCF}(\text{Sv/Bq})$$

where:

C_i is the concentration of a radionuclide in food item i ;

P_i is the production of food item i per unit area; and

DCF is the ingestion dose conversion factor for the radionuclide.

The following four indices of environmental sensitivity are being calculated, with the emphasis being placed upon #3 for the comparison of different environments:

- (1) Radionuclide concentrations in the abiotic environment,
- (2) Radionuclide concentrations in the biotic environment,
- (3) Dose to an adult member of the critical group from one year of exposure,**
- (4) Collective dose to human population per unit area of production from one year of exposure.

Results of the modelling exercises

Results are now available for the first three indices in the different environments. The following work still needs to be completed on these scenarios:

- (1) reconcile or explain differences between Canadian and Belgian agricultural scenario results;
- (2) obtain results for the Alpine scenario;
- (3) refine the calculations for Canadian Arctic and forest scenarios;
- (4) carry out a calculation for Scandinavian Arctic scenario;
- (5) carry out modeling for a Mediterranean coastal marine scenario; and
- (6) add collective dose estimates per unit area of production for all scenarios.

Preparation of the Final Report

A draft table of contents and writing assignments were drawn up for the final report. The exact format for the Working Group Report will be provided by the IAEA Secretariat, so some details of the following outline may require modification:

- (1) Introduction to the problem of environmental sensitivity (*BLT*)
- (2) General discussion of what we mean by “environmental sensitivity in the context of radiological emergencies” (*LM, SC, BLT*)
- (3) Overview of the modelling exercises (*COT*)
- (4) Sensitivity factors for different environments (*FC*)
- (5) Presentation and discussion of results of each exercise:
 - (a) Agricultural (*COT, SC*)

- (b) Alpine (*JT*)
- (c) Temperate forest (*BLT, SB*)
- (d) Arctic (*BLT, JEB*)
- (e) Freshwater aquatic (*LM, JEB*)
- (f) Coastal marine (*MI, GE*)
- (6) Comparison and discussion of different environments (*All*)
- (7) Conclusions and recommendations
- (8) References and bibliography.

Work Plan for 2011 with deadlines

- Finalization of exercises (1 June 2011);
- preparation of WG8 report (first draft by 1 September 2011);
- presentations at the ICRER Conference in Hamilton (19–24 June 2011):
 - an overview presentation from WG8,
 - 6 presentations from individual members;
- interim Working Group meeting in the fall (September or October 2011); and
- expected completion of report (January 2012).

Interim Working Group Meeting during 2011

An interim meeting of WG8 will be held sometime in 2011, with the exact dates and location still to be decided. The meeting will likely take place in either Brussels or Munich in September or October.

Suggestions for further work

The following exercises were beyond the scope of WG8 during the EMRAS-II Programme, but should be considered in a future EMRAS programme:

- broaden the concept of environmental sensitivity to include impacts on non-human biota;
- consider direct releases to aquatic environments.

WG8 MEETING AGENDA

Monday, 24 January 2011

09:30–13:00	Opening Plenary Session	
13:00–14:00	<i>LUNCH BREAK</i>	
14:00–15:30	Introductions, information sharing and plans for the week	Bliss Tracy, WGL (RPB, Canada) All WG participants
15:30–16:00	<i>COFFEE BREAK</i>	
16:00–17:30	Presentation on *CHERPAC Results for the Agricultural Scenario with discussions	Sohan Chouhan (AECL, Canada)

Tuesday, 25 January 2011

09:30–12:30	Presentation on *JRODOS Calculations for the Agricultural Scenario with discussions	Catrinel Turcanu (SCK-CEN Belgium)
12:30–14:00	<i>LUNCH BREAK</i>	
14:00–15:30	Presentation on *Coastal Marine Regions : Preliminary Results with discussions	Mikhail Iosjpe (NRPA, Norway)
15:30–16:00	<i>COFFEE BREAK</i>	
16:00–17:30	Presentation on *Arctic and Forest Scenarios with discussions	Bliss Tracy

Wednesday, 26 January 2011

09:00–11:00	Plenary Session	
11:00–12:30	Presentation on *MOIRA PLUS : Assessment of Environmental Sensitivity	Luigi Monte (ENEA, Italy)
12:30–14:00	<i>LUNCH BREAK</i>	
14:00–15:30	Considerations on the *Definition of the Concept of Environmental Sensitivity Discussion of what we mean by “sensitivity”	Luigi Monte All WG participants
15:30–16:00	<i>COFFEE BREAK</i>	
16:00–17:00	Presentation on *Thoughts on Radioecological Sensitivity Concept (RSC) Document Development of a sensitivity concept document	Sohan Chouhan All WG participants

Thursday, 27 January 2011

09:00–12:30	Presentation on *Sustainable Management of Food Production: Guidance Levels with discussions	Beata Varga (AEKI, Hungary)
12:30–14:00	<i>LUNCH BREAK</i>	
14:00–17:00	Further modelling exercises and plans for 2011	All WG participants

Friday, 28 January 2011

09:00–13:00	Closing Plenary Session	
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* Indicates the name of the presentation given on the WG8 web page
(<http://www-ns.iaea.org/projects/emras/emras2/working-groups/working-group-eight.asp?s=8>).