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

EMRAS II
Approaches for Assessing Emergency Situations
Working Group 9
"Urban" Areas

M I N U T E S

of the Sixth WG9 Meeting (Part 1)
McMaster University, Hamilton, Ontario, CANADA
15–18 June 2011

IAEA Scientific Secretary	Working Group Leader
Mr Volodymyr Berkovskyy ***(VB)*** 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	Ms Kathleen M. Thiessen ***(KMT)*** Senior Scientist SENES Oak Ridge Inc., Center for Risk Analysis 102 Donner Drive 37830 OAK RIDGE, TENNESSEE UNITED STATES OF AMERICA Tel: +1 (865) 483-6111 Fax: +1 (865) 481-0060 Email: kmt@senes.com

Attending	
Name / Initials* / Email	**Organization / Country**
Mr Kasper G. Andersson ***(KGA)*** (kasper.andersson@risoe.dk)	Technical University of Denmark (DTU), DENMARK
Mr Sohan Chouhan ***(SC)*** (chouhans@aecl.ca)	Atomic Energy of Canada Limited (AECL), CANADA
Mr David Rowan ***(DR)*** (rowand@aecl.ca)	Atomic Energy of Canada Limited (AECL), CANADA
Mr Gert Sdouz ***(GS)*** (gert.sdouz@ait.ac.at)	Austrian Institute of Technology (AIT), AUSTRIA
Mr Dejan Trifunovic ***(DT)*** (dejan.trifunovic@dzns.hr)	State Office for Radiological and Nuclear Safety, CROATIA
Mr Hartmut Walter ***(HW)*** (hwalter@bfs.de)	Bundesamt für Strahlenschutz (BfS), GERMANY

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

Background

The EMRAS II Theme entitled "Approaches for Assessing Emergency Situations", includes three areas of interest in connection with emergencies or accidental releases of radionuclides. These areas include urban situations (dispersion and retention of radionuclides in urban environments), environmental sensitivity of various non-urban or rural situations, and tritium accidents. The Urban Areas Working Group (WG9) is continuing with, and building on, the work done by the Urban Remediation Working Group of the first phase of the EMRAS Programme. In particular, WG9's goal is to test and improve the capabilities of models used in the assessment of radioactive contamination in urban settings, including dispersion and deposition events, short- and long-term contaminant

redistribution following deposition events, and potential countermeasures or remediation efforts for reducing human exposures and doses.

At its initial meeting in January 2009, the Working Group identified three modelling exercises to be developed and carried out by the group:

(a) Atmospheric dispersion, short-range;
(b) Atmospheric dispersion, mid-range; and
(c) Contaminant transport and countermeasures.

At this meeting, WG9 discussed two of the three modelling exercises, including modelling results, progress to date, and plans for continuing work.

Working Group attendance

The sixth meeting of WG9 (part 1) took place at McMaster University, in Hamilton, Ontario, Canada, the week prior to the International Conference on Radioecology and Environmental Radioactivity (ICRER), which was also held in Hamilton. The meeting was hosted by participants from Atomic Energy of Canada Limited (AECL). Eight participants from 7 countries attended the sixth meeting (part 1) of WG9. The sessions were moderated by ***KMT*** and ***VB*** served as the IAEA's Scientific Secretary. A list of the attending participants is provided above.

Scope and objectives of the meeting

The main objectives of the meeting were to:

(1) present and discuss modelling approaches and calculations for two of the three modelling exercises;
(2) develop schedules for completing the modelling exercises; and
(3) discuss future plans, including completion of the draft Working Group report.

A copy of the WG9 Agenda for this meeting is provided at the end of these Minutes.

Work performed

Most of the meeting time was spent discussing modelling results for two of the three modelling exercises, together with plans for their completion. Specifically, the "short-range" and "NPP" scenarios were discussed. Five participants provided presentations about their modelling results for one or both scenarios. Some participants who were not able to attend this meeting sent materials that were also included in the discussions. Copies of the available presentations can be downloaded from the WG9 web page (http://www-ns.iaea.org/projects/emras/emras2/working-groups/working-group-nine.asp?s=8). Some time was also spent discussing possible areas for further work in a successor programme following the end of EMRAS II.

Outcomes of the Meeting

Short-range atmospheric dispersion exercise

The short-range atmospheric dispersion exercise is based on data from experimental explosions contributed by Jiří Hůlka and colleagues at SÚRO, Czech Republic. This exercise permits comparison of model predictions with measurements for several endpoints, including surface contamination, time-integrated air concentrations, and dose rates, up to 50 m downwind. Intercomparisons of model predictions are possible for additional endpoints, including surface contamination, time-integrated air concentrations, and dose rates at distances greater than 50 m; estimates of a 95% contamination zone; the effects of structures on the predicted dose rates; and validation of location factors.

Following the first few meetings of WG9, the plans for this exercise called for using two explosion events for model calibration purposes and carrying out blind testing of models for two subsequent explosion events (May 2009 and July 2009). The modelling domain extends beyond the range for which measurements are available (50 m downwind), out to 2000 m downwind and 100 m upwind. Following the June 2010 Interim WG Meeting, several parameters (e.g., plume height and position, distribution of activity within the plume, stability class, aerosol characterization) were specified in order to more nearly standardize the input information across participants.

The January 2011 WG Meeting included presentations of modelling results for the short-range exercise from eight participants. Two participants (HW and DT) provided some updated predictions at the June 2011 meeting. In addition, at the June 2011 meeting, the WG was able to improve a table comparing important model features and selected parameter values (Table 1). Figure 1 shows some updated comparisons of model predictions for downwind deposition for two of the explosion events. Jan Helebrant provided some initial comparisons of model predictions in terms of contour maps (Figure 2) and multi-point comparisons of predictions with measurements.

Plans for the short-range exercise call for completion of all calculations in August 2011, before the second interim meeting. Model documentation, including values for key parameters, is also to be completed at that time.

Table 1. Comparison of models and selected parameters used in the short-range atmospheric dispersion exercise.

Model (Participant)	Type of model	Stability classes	Wind speed (m/s)	Dry deposition velocity (m/s)
ADDAM/CSA-ERM (Chouhan)	Gaussian	Test 3: Class C Test 4: Class A	Test 3: 2.7 Test 4: 0.726	1E-1
Hotspot 2.07.1 (Charnock)	Gaussian	Test 3: Class D Test 4: Class C	Test 3: 1.5 Test 4: 0.4	Respirable fraction, 1E-4; nonrespirable fraction, 4E-1
Hotspot (Trifunović)	Gaussian	Test 2: Class B Test 3: Class D Test 4: Class C	Test 2: 0.6 Test 3: 1.3 Test : 0.1	Respirable fraction, 8E-4
RDD_MMC (Ďúran)	Lagrangian	Test 1: Class C Test 2: Class A Test 3: Class B Test 4: Class A	Test 1: 4.00 Test 2: 0.59 Test 3: 1.30 Test 4: 0.20	0.2 µm, 5.0E-3 1.0 µm, 1.5E-4 8.0 µm, 1.0E-3 20.0 µm, 8.0E-3
University of Seville (Periáñez)	Lagrangian	Not applicable	Time-dependent measurements	Not applicable
LASAIR (Walter)	Lagrangian	Test 1: Class D Test 2: Class B-C Test 3: Class D Test 4: Class C	Test 1: 0-6.3 Test 2: 0.28-1.85 Test 3: 0.9-7.2 Test : 0-4.9	< 0.39 µm, 5E-5 0.39-1.3 µm, 1.5E-5 1.3-10.2 µm, 1E-3 > 10.2 µm, 8E-3
CFD (de With)	Computational fluid dynamics	Not applicable	Steady-state conditions (mean values)	0.2 µm, 5.0E-5 1.0 µm, 1.5E-4 8.0 µm, 1.0E-3 20.0 µm, 8.0E-3
CLMM (Fuka)	Atmospheric computational fluid dynamics	Not applicable	Test 1: 3.8 Test 2: 0.77 Test 3: 2.3 Test : 0.4	Not applicable

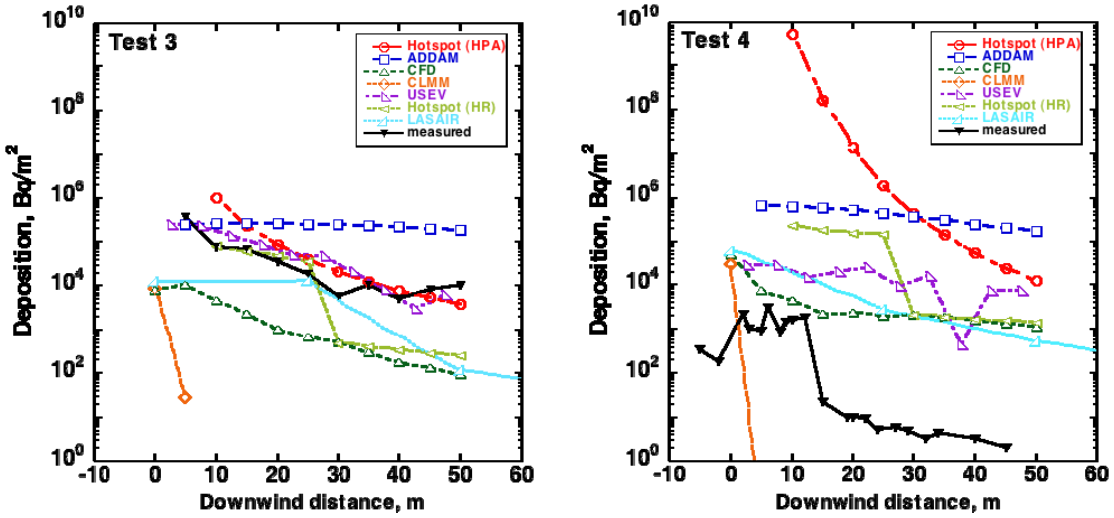

Figure 1. Examples of model predictions and measured deposition down the center line of the grid (x = 0; ADDAM, CFD, CLMM,USEV, LASAIR, measurements) or the plume center line (Hotspot).

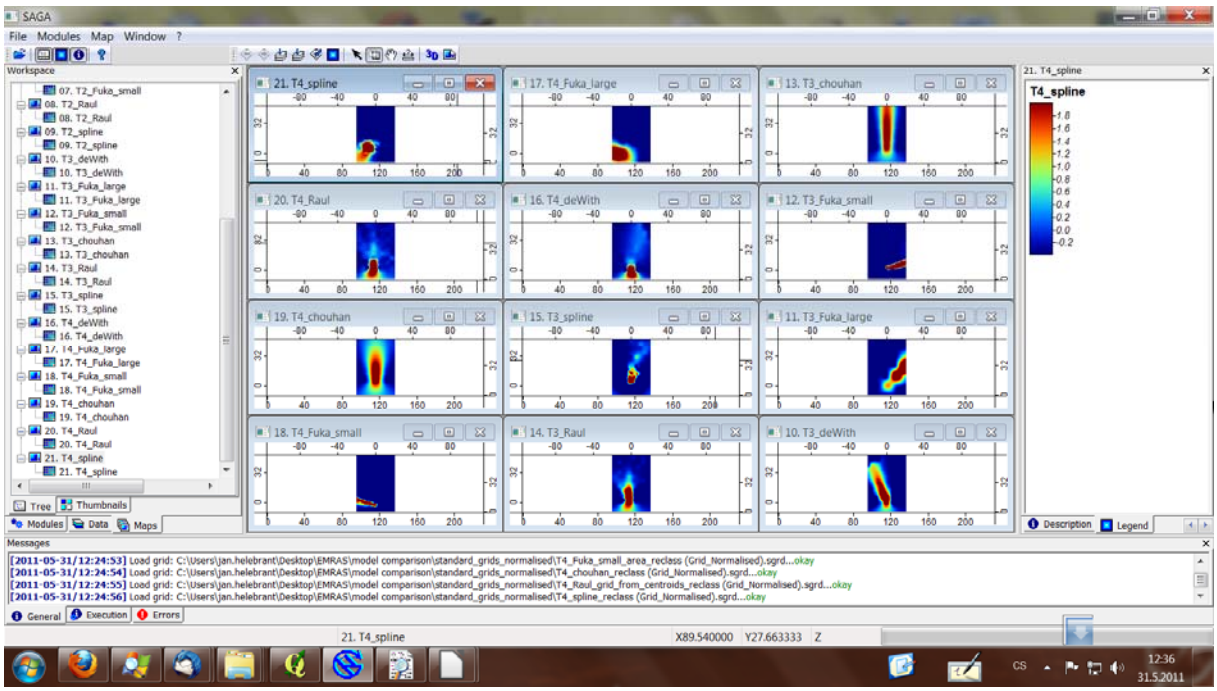

Figure 2. Example comparison of contour plots of model predictions from several participants for Tests 3 and 4.

Mid-range atmospheric dispersion exercise

The mid-range atmospheric dispersion exercise is based on a hypothetical NPP accident and the resulting predicted deposition in an urban environment. Emilie Navarro (France) provided an accident scenario previously developed in France for use as source term information, and Raúl Periañez (Spain) provided relevant geographic data for the Trillo NPP in Spain, including nearby urban areas. This is a model intercomparison exercise for all endpoints, including deposition on a reference lawn surface at selected locations and time-integrated air contamination. The scenario is based on a 1 hour release of I-131 and Cs-137 from a hypothetical rupture of a steam generator tube.

Four sets of modelling results were presented at the June 2010 and January 2011 meetings. A fifth set of predictions was presented at the June 2011 meeting (DT). Table 2 provides a comparison of model features and important parameter values.

Plans for the mid-range exercise call for completion of all calculations in August 2011, before the second interim meeting. Model documentation, including values for key parameters, is also to be completed at that time.

Table 2. Comparison of models and parameters used in the mid-range atmospheric dispersion exercise.

Model (Participant)	Type of model	Release time step	Wind speed	Dry deposition velocity (m/s)
ADDAM (Chouhan)	Gaussian	1 h	wind vectors summed outside the code	Cs-137, 0.01 I-131, 0.008
Hotspot (Trifunović)	Gaussian	1 h	Class E: 3.0 m/s Class D: 6.0 m/s	Cs-137, 0.0004 I-131, 0.0022
JRODOS (Sdouz)	Gaussian + simplified puff	30 min	wind fields as provided	calculated internally
RASCAL 3.0.3 (Mancini)	Gaussian plume & Lagrangian puff	1 h	limited number of wind vectors used	Cs-137, 0.003 I-131, 0.003
University of Seville (Periáñez)	Lagrangian	1 min	wind fields as provided	not applicable

Additional activities

The WG had the privilege of touring McMaster University's research reactor and hearing about the projects carried out with the reactor.

DR gave a presentation on the subject of modelling radionuclide bioaccumulation in aquatic foodwebs, in particular, the differences between steady-state and biokinetic approaches to modelling episodic contamination events.

Future plans and next meetings

WG9 plans a second interim meetings at IAEA Headquarters in Vienna, in September 2011. This meeting will include additional discussion of model predictions, including predictions from participants who have not previously submitted predictions for this Working Group. The meeting will also include discussion of the draft Working Group report.

UPDATE: Since this meeting was held it was announced that the follow-up programme to EMRAS II – "MODARIA" **MO**delling and **DA**ta for **R**adiological **I**mpact **A**ssessments) – will run for 4 years (2012–2015) and the first Technical Meeting will take place at IAEA headquarters in Vienna, 19–22 November 2012.

6th Meeting of the EMRAS II Urban Areas Working Group (WG9)

McMaster University, Hamilton, Ontario, Canada
15-18 June 2011

DRAFT AGENDA

Wednesday, 15th June 2011

09:30–12:00	1. Welcome	David Rowan and Sohan Chouhan, AECL hosts (Canada) Kathy Thiessen, WG Leader (USA) Volodymyr Berkovskyy, WG Scientific Secretary (IAEA)
	2. Overview of meeting Scope, objectives and expected outcomes	Kathy Thiessen
	3. "Short-range" scenario	
	3.1. Modeling results	Hartmut Walter (Germany), Dejan Trifunovic (Croatia), Sohan Chouhan (Canada), other WG participants
12:00-13:00	*Lunch break*	
13:00–17:00	3.2. Analysis of modeling results	All WG Participants
	3.3. Plans and schedule for "short-range" modelling exercise	All WG Participants
	3.4. Material for draft WG report	All WG Participants
17:00	*Close*	

Thursday, 16th June 2011

09:00–12:00	4. "NPP" scenario	
	4.1. Modeling results	Gerd Sdouz (Austria), Sohan Chouhan, Dejan Trifunovic (Croatia), other WG participants
12:00–13:00	*Lunch break*	
13:00–17:00	4.2. Analysis of modeling results	All WG Participants
	4.3. Plans and schedule for "NPP" modelling exercise	All WG Participants
	4.4. Material for draft WG report	All WG Participants
17:00	*Close*	

Friday, 17th June 2011

09:00–10:00	5. Other topics	
10:00-11:00	Tour of McMaster Nuclear Reactor	
11:00-12:30	5.1 Remaining business	
12:30	*Close of Meeting*	Kathy Thiessen, WG Leader (USA) Volodymyr Berkovskyy, WG Scientific Secretary (IAEA)

Saturday, 18th June 2011

to be determined	Trip to downtown Toronto