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 2)
IAEA Headquarters, Vienna
17–19 October 2011

IAEA Scientific Secretary	Working Group Leader
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Attending	
Name / Initials* / Email	**Organization / Country**
Mr Govert de With ***(GDW)*** (g.dewith@nrg.eu / dewithgovert@yahoo.co.uk)	Nuclear Research & Consultancy Group (NRG), NETHERLANDS
Mr Juraj Duran ***(JD)*** (duran@vuje.sk / juraj.duran@ttonline.sk)	VÚJE Inc. - Engineering, Design & Research Organization, SLOVAK REPUBLIC
Mr Jan Helebrant ***(JH)*** (jan.helebrant@suro.cz)	National Radiation Protection Institute (SÚRO), CZECH REPUBLIC
Mr Won Tae Hwang ***(WTH)*** (wthwang@kaeri.re.kr)	Korea Atomic Energy Research Institute (KAERI), REPUBLIC OF KOREA
Ms Katerina Kouts ***(KK)*** (kate.kouts@mail.ru / kouts.kate@gmail.com)	Republican Scientific-Practical Centre of Hygiene (RSPCH), BELARUS
Mr Petr Kuca ***(PK)*** (petr.kuca@suro.cz)	National Radiation Protection Institute (SÚRO), CZECH REPUBLIC
Mr Raúl Periáñez ***(RP)*** (rperianez@us.es)	University of Seville, SPAIN
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 Charley Yu ***(CY)*** (cyu@anl.gov)	Argonne National Laboratory (ANL), UNITED STATES OF AMERICA

*Initials used to refer to participants within minutes and actions as appropriate.
♠ Unable to attend due to other commitments.

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 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 2) took place at IAEA Headquarters, in Vienna. Eleven participants from 9 countries attended the sixth meeting (part 2) of WG9. The sessions were moderated by ***KMT***. 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 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 the three modelling exercises, together with plans for their completion. Seven participants provided presentations about their modelling results for at least one scenario. 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).

Outcomes of the Meeting

Contaminant transport and countermeasures exercise

The contaminant transport and countermeasures exercise starts with a defined (hypothetical) radionuclide concentration in air, in parts of a city (Seoul) for which detailed geographic and building information is available. The scenario (developed by ***WTH***) starts with a radionuclide concentration in air (Co-60 or Pu-239), with deposition for each site to be predicted based on weather conditions (i.e., dry, light rain, heavy rain). This is a model intercomparison exercise for all endpoints, including dose rates, countermeasure effectiveness, and doses for specified reference individuals.

The January 2011 meeting was the first opportunity for discussion of model predictions for the countermeasures exercise. Three sets of modelling approaches and initial predictions were presented at that time. At the October 2011 meeting, two participants presented (WTH) or sent (TC) revised predictions, and a new set of predictions was presented by an additional participant (CY).

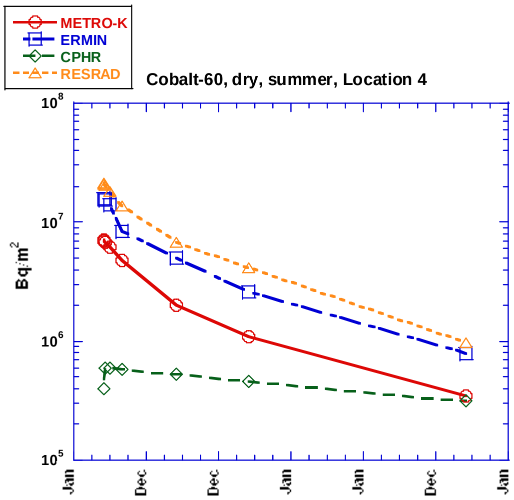
Table 1 compares some of the main features of the four models. For example, ERMIN and RESRAD include indoor surfaces, while METRO-K and CPHR do not; CPHR does consider contamination of indoor air. RESRAD does not include trees, while the other three models do.

Figure 1 shows examples of the predicted contamination densities for an outdoor location in a business area during the summer, for dry conditions, for Co-60 (left) and Pu-239 (right). Figure 2 shows the predicted % contributions to external dose rate from Co-60 for the same outdoor location, for the most important surfaces. Figure 3 compares the predicted cumulative external doses from Co-60 at 1, 2, and 5 years, in the business area, together with the corresponding doses expected for specified countermeasures. Figure 4 compares the predicted cumulative internal doses from Pu-239 at 1, 2, and 5 years, in the business area, together with the corresponding doses expected for specified countermeasures.

Plans for the countermeasures exercise call for completion of all calculations (new or revised) by the end of 2011. Model documentation, including values for key parameters, is also to be completed at that time.

Table 1. Comparison of models and parameters used in the contaminant transport and countermeasures exercise.

Model (Participant)	Deposition	Weathering	Indoor contamination	Trees
METRO-K (Hwang)	dry deposition by surface; wet deposition from daily rainfall and washout ratio, with retained fraction	short-term and long-term removal rates by surface	not included	deciduous; date for leaf fall not specified; deposition on trees in winter 10% of deposition in summer
ERMIN (Charnock)	deposition on lawn from METRO-K; other surfaces relative to lawn, wet or dry	surface-specific empirical weathering functions; movement down soil column	included, from penetration of building; simple empirical retention function for generic indoor surfaces	deciduous and coniferous; specified date for leaf fall
CPHR (Tomás)	dry deposition velocity; washout coefficient for wet deposition	half-lives depending on surface	indoor air but not surfaces; filtration factor	deciduous, no contamination after first leaf fall
RESRAD (Yu)	deposition, then partitioning factors	short-term and long-term weathering half-lives, mobile and fixed fractions	indoor floors and walls, direct and indirect penetration	not considered



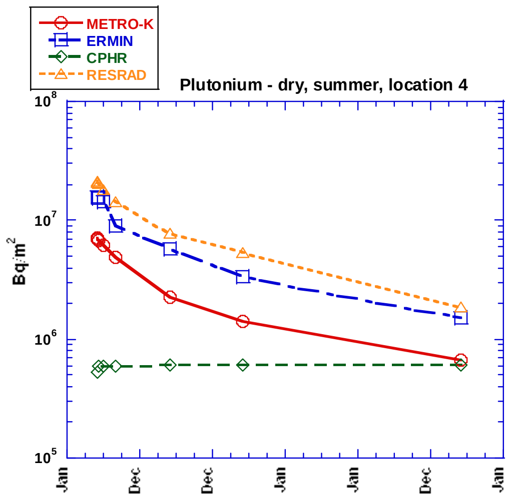


Figure 1. Comparisons of predicted contamination densities at an outdoor location in a business area, for dry conditions in summer, for Co-60 (left) and Pu-239 (right).

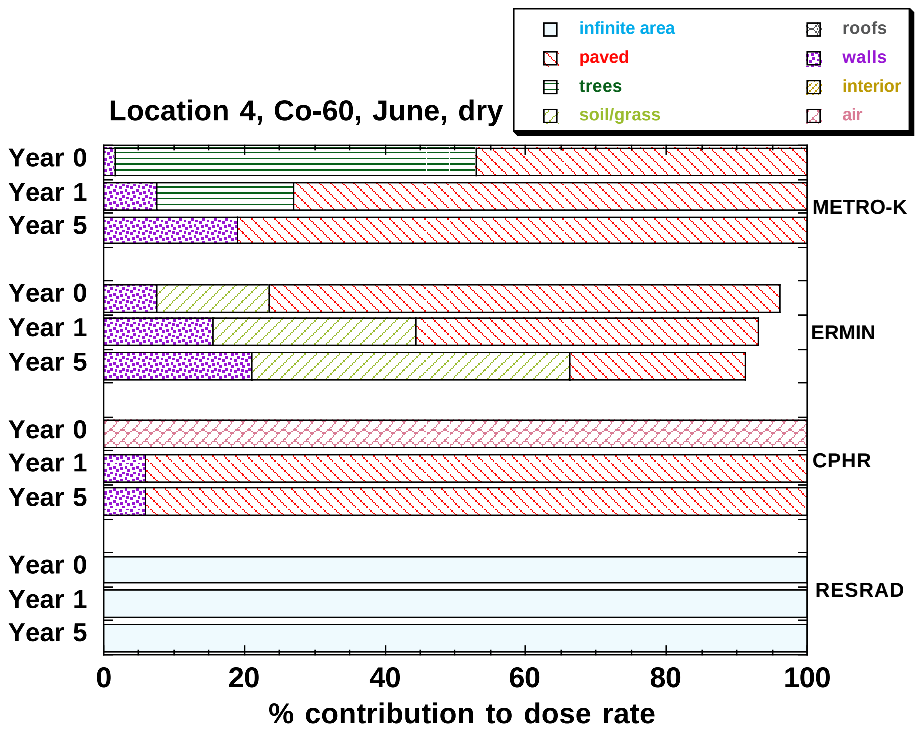


Figure 2. Comparisons of the % contributions to external dose rate for the most important surfaces, for an outdoor location in a business area, for dry conditions in summer, for Co-60.

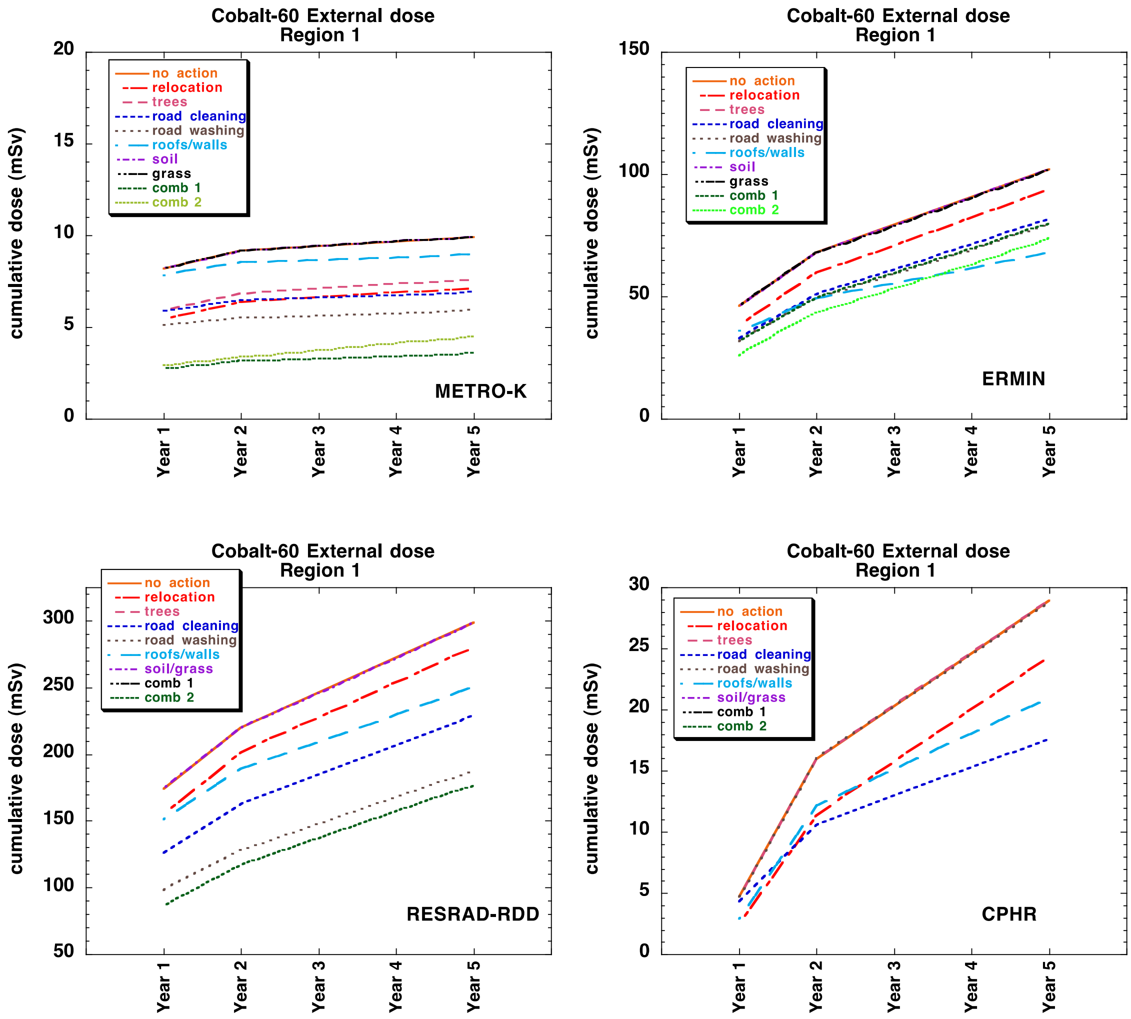


Figure 3. Predicted cumulative external dose (1 y, 2 y, 5 y) from Co-60 in a business area, with the predicted cumulative doses assuming specified countermeasures.

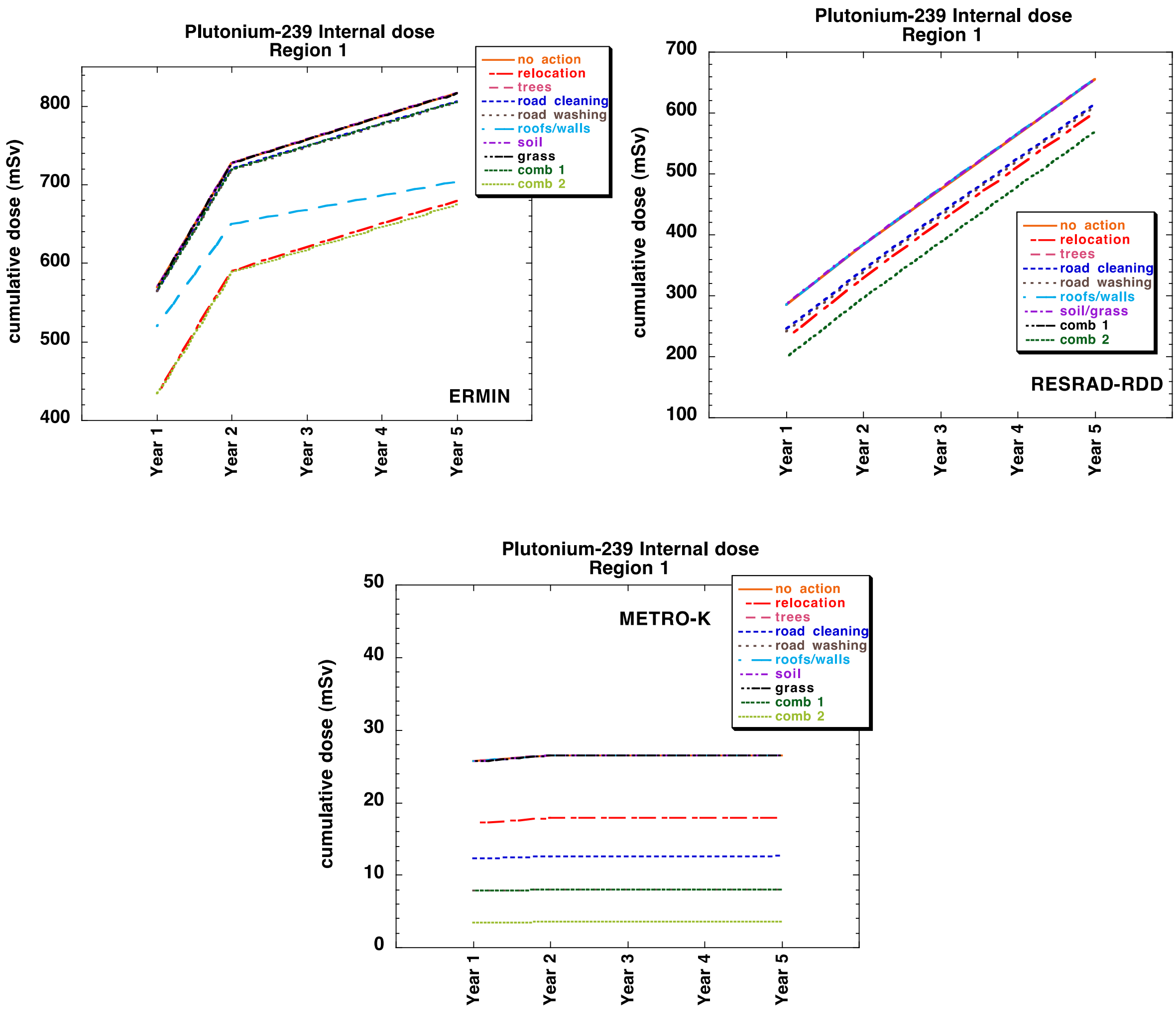


Figure 4. Predicted cumulative internal dose (1 y, 2 y, 5 y) from Pu-239 in a business area, with the predicted cumulative doses assuming specified countermeasures.

Short-range atmospheric dispersion exercise

The short-range atmospheric dispersion exercise is based on data from experimental explosions contributed by Jiří Hůlka and colleagues (including ***PK*** and ***JH***) 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.

The January 2011 and June 2011 WG Meetings included presentations of modelling results for the short-range exercise from eight participants. The October 2011 meeting included additional material from some participants and considerable discussion about the various sets of model predictions. Figure 5 shows the predicted and measured deposition down the grid or plume center line for two of the explosion events. Note that for Test 3, some predictions are low and some are high, while for Test 4, most predictions were overestimates in comparison with the measurements. A number of possible explanations for differences between model predictions and measurements have been suggested, including the presence of the obstacle in Test 4 but not Test 3, reversed wind direction for part of the time during Test 4, differences between the plume centerline (Hotspot) and the grid centerline (other models) due to differences in wind direction. Major sources of uncertainty for the modellers include the particle size distribution, initial source volumes, vertical profiles of the source volumes, and deposition velocity.

Plans for the short-range exercise call for completion of all calculations by the end of 2011. Model documentation, including values for key parameters, is also to be completed at that time.

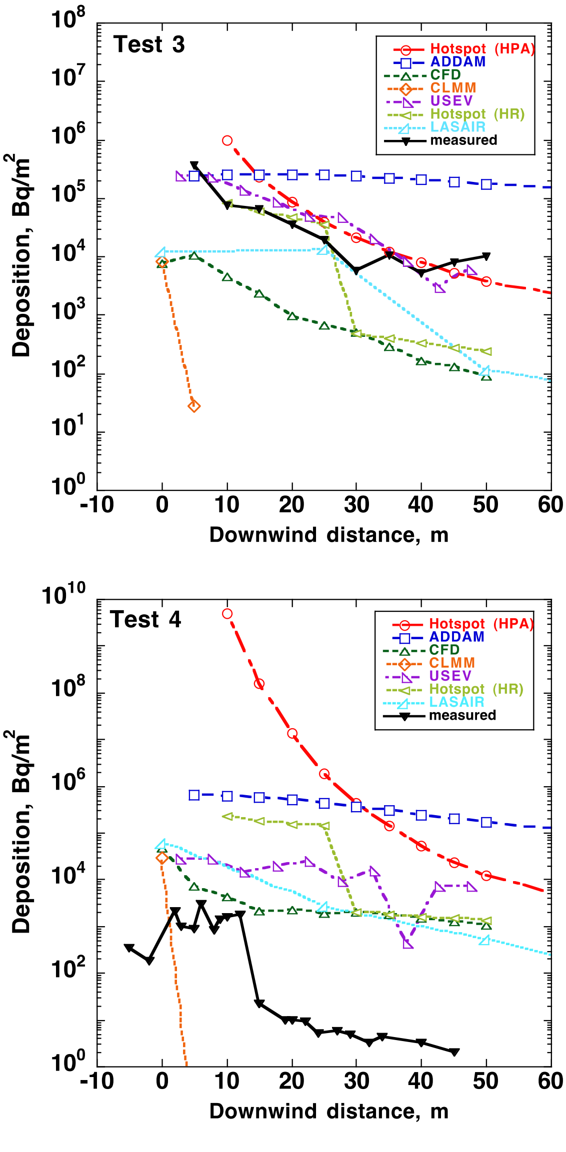


Figure 5. Examples of model predictions and measured deposition down the center line of the grid (x = 0; ADDAM, CFD, CLMM,USEV, LASAIR, measurements) or the plume center line (Hotspot).

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 ***RP*** 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.

Five sets of modelling results have been presented for this exercise (January 2011 and June 2011). Discussion at the October 2011 meeting included how best to make comparisons among model predictions, with an emphasis on the types of information likely to be useful for emergency response. This information includes the time for a plume to reach a location (i.e., the time available to undertake a response action) and how much contamination to expect.

Examples of predictions for deposition are shown in Figures 5 and 6. For several models, using neutral atmospheric conditions, the predicted route of the plume did not intersect Madrid.

Plans for the mid-range exercise call for completion of all calculations by the end of 2011. Model documentation, including values for key parameters, is also to be completed at that time.

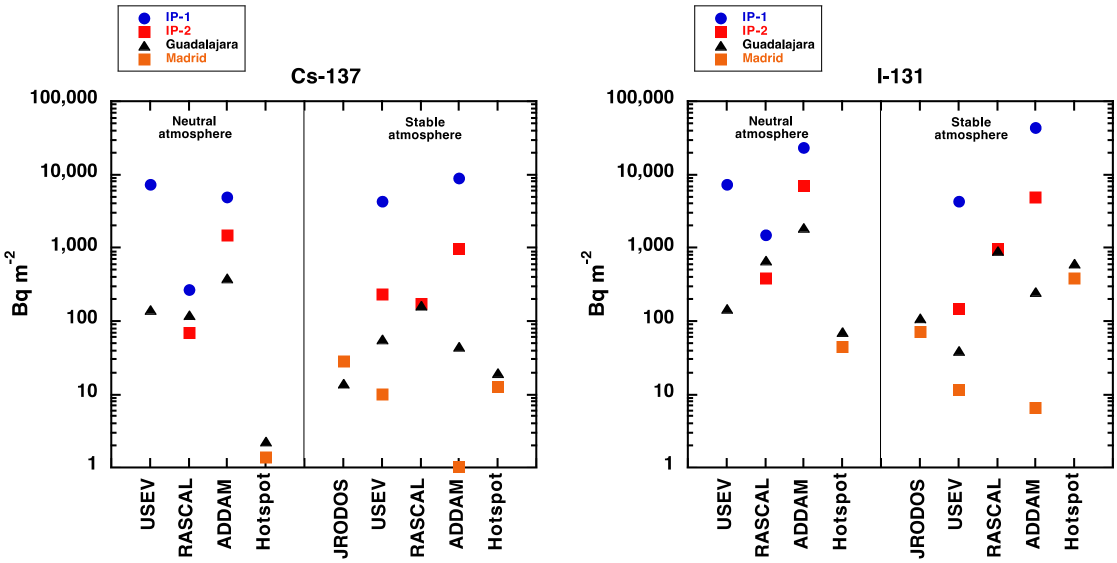


Figure 6. Examples of model predictions for deposition of Cs-137 (left) and I-131 (right) at selected locations downwind from the Trillo NPP.

Future plans and next meetings

The WG had anticipated a final (4th) EMRAS II Technical Meeting early in 2012. After the close of this WG meeting it was learned that plans have changed, now calling for a meeting in November 2012 to start a new program (see below). WG9 still plans to complete its WG report in 2012, with the schedule depending on availability of funding (KT). Once the WG report is completed, the WG might try to have a brief meeting for a final discussion of the 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), Part 2

IAEA Headquarters, Vienna
17-19 October 2011

DRAFT AGENDA

Monday, 17th October 2011

09:30–12:30	1. Welcome	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	Juraj Duran (Slovak Republic), Raúl Periañez (Spain), Dejan Trifunovic (Croatia), other WG participants
12:30-13:30	*Lunch break*	
13:30–17:00	3.2. Analysis of modeling results	Jan Helebrant (Czech Republic), other WG participants
	3.3. Material for draft WG report	All WG Participants
17:00	*Close*	

Tuesday, 18th October 2011

09:00–12:30	4. "Countermeasures" scenario	
	4.1. Modeling results	Won Tae Hwang (Republic of Korea), Charley Yu (USA), other WG participants
	4.2. Analysis of modeling results	All WG Participants
	4.3. Material for draft WG report	All WG Participants
12:30–13:30	*Lunch break*	
13:30–17:00	5. "NPP" scenario	
	5.1. Modeling results	Gerd Sdouz (Austria), Raúl Periañez, Francesco Mancini (Italy), other WG participants
	5.2. Analysis of modeling results	All WG Participants
	5.3. Material for draft WG report	All WG Participants
17:00	*Close*	

Wednesday, 19th October 2011

09:00–12:30	6. Other topics	All WG Participants
	6.1 Completion of draft WG report	
	6.2 Future plans	
	7. Remaining business	All WG Participants
12:30	*Close of Meeting*	Kathy Thiessen, WG Leader (USA) Volodymyr Berkovskyy, WG Scientific Secretary (IAEA)