INTERNATIONAL ATOMIC ENERGY AGENCY

Minutes of the Meeting

Urban Remediation Working Group Meeting

"Environmental Modelling for Radiation Safety"(EMRAS Project)

Third EMRAS Meeting, 21-25 November 2005

IAEA Headquarters, Vienna, Austria

(November 2005)

CONTENTS

1. INTRODUCTION - SCOPE AND OBJECTIVES OF THE MEETING

The EMRAS project has reached its mid term and held its third joint meeting of all project working groups (WGs) from 21 to 25 November 2005 at the IAEA headquarters in Vienna. Over one hundred participants took part in the meeting, which was organised as a series of parallel working group sessions and plenary sessions.

The Urban Remediation WG held its fifth meeting during that week. This WG has the following overall objectives: (1) to test and improve the capabilities of models to characterise the radiation environment, including external exposure rates and concentrations of radionuclides, in urban areas contaminated with dispersed radioanuclides as a function of location and time following a contamination event; (2) to use the results to estimate the doses to humans, including the identification of important exposure pathways; and (3) to evaluate reductions of human exposures that could result from specific countermeasures or remediation efforts. The goal of the WG is to develop the capabilities of models as tools for decision making to address long-term radiological concerns after an urban contamination event has occurred and to assist in identifying required remediation measures.

The Urban Remediation WG was attended by eighteen experts from ten countries (see Appendix B). The meeting followed the agenda presented in Appendix A and was chaired by Ms. K. Thiessen (USA). The objectives of the meeting were:

a) to review the modelling approaches available worldwide;

b) to present and review the preliminary results for scenario 1 (District 1 of Pripyat, in Ukraine);

c) to identify further necessary information and finalise the scenario 1;

d) to discuss the proposed hypothetical scenario for deliberate radioactive contamination in an urban environment.

e) to discuss possible interfaces with other EMRAS WGs – and in particular the NORM WG, and

f) to develop future work plans.

2. WORK PERFORMED

A review of the modelling approaches for radionuclide transfer in urban environments has been developed by Ms F. Gallay (IRSN, France). The current status and outcomes of this review were presented by Ms Gallay and discussed in the meeting. The presentation was supported by a draft report entitled "Bibliographic Survey of Modelling Approaches for Radionuclide Transfer in Contaminated Urban Environments, Associated Dose Calculations and Assessment of Rehabilitation Strategies". This draft report is about 70% developed in both French and English and is expected to be finalised by June 2006.

Preliminary results for the scenario 1 (District 1 of the town of Pripyat, Ukraine) were presented by three experts: T. Charnock (HPA, UK), W.-T. Hwang (KAERI, Rep. of Korea)

and S. Golikov (Institute of Radiation Hygiene, Russian Federation). The models used and modelling approaches and results were presented and discussed by the WG. These discussions made clear that the starting point for calculations needs to be clearly defined (e.g., air concentration or deposition on soil), and additional information available for August - October 1986 will be required. J Tomás (CPHR, Cuba) described the compartmental model that he is planning to use; he plans to present the results for this scenario at the next WG meeting.

A. Baklanov (Danish Meteorological Institute, Denmark) presented an overview of a ***parallel international project*** of the European Union (EU) that is also focused on modelling urban environments – FUMAPEX (Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure". Although the FUMAPEX project is focused on meteorological forecasts, a series of commons aspects were considered relevant for both the EMRAS and FUMAPEX projects, such as classification of urban areas, parameters, and urban effects.

The WG discussed the scope and objectives of ***a hypothetical scenario*** in an urban environment. It established the framework of the scenario, which will be outlined in a draft report by January 2006. Possible assistance and interaction with the FUMAPEX project on calculation of the dispersion and deposition of radionuclides on different surfaces (indoors and outdoors) will need to be clarified by the end of 2005, and in particular the specification of the starting point - radionuclide deposition on different urban surfaces.

A joint meeting of the Urban and NORM WGs was held on Tuesday morning to present the current status of the WGs' activities and any other national projects that might be of interest for the two WGs. Presentations were made by R. O'Brien (Chairman of the NORM WG), R. Zelmer (Canada), B. Zlobenko (Ukraine), A. Arkhipov (Ukraine), and S. Golikov (Russia). The meeting provided an opportunity for experts with interest in the activities of both EMRAS WGs to exchange views and experience. In the future such meetings will be useful to ensure a consistent approach for modelling an urban environment (e.g., the NORM scenario of a former gas mantle factory considers a facility location in an urban location), as well as for the documentation of the WG outcomes.

Documentation of the ongoing WG activities and the WG's outcomes was also discussed, based on the content of the WG report discussed in May 2005 and the similar and more detailed content suggested by the EMRAS Steering Committee.

Future activities of the WG were also discussed in order to achieve the project target date for finalisation of the project outcomes – 2007. ***The work plan*** for 2006 has been agreed as presented in section 4.

3. OUTCOMES

3.1. Review of models

The WG felt that the overview developed by Ms Gallay is a very helpful consolidation of the existing experience and work in the field of modelling urban environments. Based on the discussions at the meeting it was also decided that:

— the review will need to include the models that are used for model intercomparison in the Urban WG (Korea, Russia and Cuba);

— the review also establishes a link or reference to the FUMAPEX or other international projects;

— it will be useful to summarise the codes, characteristics, and applications in a table format that could be included in the WG report.

3.2. Pripyat scenario (District 1)

The WG agreed that the description of the scenario needs to be revised to include the additional available data for the selected nine points in district 1 for the August-October 1986 period. The revised scenario will be developed by K. Thiessen with the assistance of A. Arkhipov before 15 Dec 2005.

The WG also discussed the need for modelling more than a district - the city, and it felt that due to the limited time this may be achieved through the hypothetical scenario.

The description of the modelling approaches, assumptions and results will be developed by the modellers following the proposed structure of the Steering Committee. The draft reports for each model will be developed prior to the next Urban WG meeting in 2006.

Possible remediation actions were also discussed for future evaluation of this scenario. Mr Charnock, Mr Golokov and Mr Zlobenko have agreed to provide references to decontamination factors for various technologies that can be used in the intercomparision modelling of an urban environment.

3.3. Hypothetical scenario

The framework of the hypothetical scenario was agreed upon. This scenario will be developed with the view to model contamination within the city in a way that will complement scenario 1, which is representative of fallout from a big radiological accident. Its scope of modelling will be contamination of a city as a result of deliberate contamination with one of three radionuclides – Cs-137, Sr-90 and Pu-239. The city to be considered will be a hypothetical one with a representative set of urban buildings. The WG discussed but has not reached an agreement on the “representativeness” of the buildings, which can be different for Europe, America, etc. The timeframes to be considered are – one week, one month, one year, and one-year increments up to 20 years.

3.5. Reporting and documentation

As with all EMRAS WGs, the Urban Remediation WG will document the results in a separate report. The format of the document (safety report, TECDOC or miscellaneous publication similar to the BIOMASS series) is still to be decided. However the content as agreed and presented in Appendix C will be followed.

It was suggested that a CD with additional information related to the Urban Remediation WG activities can be added, as for example the French version of the bibliographic survey of modelling approaches.

4. FUTURE WORK PLANS

The EMRAS WG reports are expected to be prepared by spring of 2007 in order to be reviewed, finalised and presented at the final project meeting in autumn of 2007.

Taking this in mind the Urban WG plans for next year are summarised as follows:

Action	Responsible expert	Deadline
Preparation of minutes of the meeting	K. Thiessen/B. Batandjieva	2 Dec 2005
Revision of the scenario for district 1 of Pripyat and distribution to WG participants	K. Thiessen/A. Arkhipov	8 Dec 2005
Description of hypothetical scenario	K. Thiessen/A. Baklanov	January 2006
Overview of referenced decontamination coefficients used in modelling of urban environments	T. Charnock/S. Golikov/B. Zlobenko	January 2006
Description of models	T. Charnock/S. Golikov/J. Tomás/W.-T. Hwang/F. Gallay	2 May 2006
Description of modelling of District 1-approach, assumptions, and results	T. Charnock/S. Golikov/J. Tomás/W.-T. Hwang	2 May 2006
Development of Urban WG report based on inputs received	K. Thiessen/B. Batandjieva	End of May 2006
6th Urban WG meeting	K. Thiessen/B. Batandjieva	June 2006 Slavutich, Ukraine (tentatively)
7th Urban WG meeting/4th EMRAS meeting	K. Thiessen/B. Batandjieva	6-10 November 2006, IAEA, Vienna
International Conference on Environmental Monitoring – presentation of EMRAS activities	IAEA	Spring 2007
Final EMRAS meeting (Urban WG meeting)	IAEA	Autumn 2007

APPENDIX A

International Atomic Energy Agency

3rd EMRAS Meeting
Urban Remediation Working Group Meeting

21 - 25 November 2005, IAEA, Vienna, Austria

AGENDA

Monday, 21 November 2005

9.30	**1. Plenary session – Opening of 3rd EMRAS Meeting**	*All WGs*
12.30	*Lunch break*	
13.30	**2. Welcome to Urban WG participants**	*K. Thiessen, Chairman*
	Adoption of agenda	
	Objectives and expected outcomes of the meeting	
	3. Current status of WG activities	*K. Thiessen, Chairman*
15.30	*Coffee break*	
16.00	**4. Results of FUMAPEX Project - Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure**	*A. Baklanov (Denmark)*
	5. Discussion	*(all)*

Tuesday, 22 November 2005

9.00	**6. Plenary session**	*All WGs*
10.30	**7. Joint session with EMRAS NORM WG**	
	- Presentation of NORM WG activities	*R. O'Brien (Australia)*
	- Presentation of Urban Remediation WG activities	*K. Thiessen (USA)*
	8. Discussion of cross-cutting issues	*(all)*
12.30	*Lunch break*	

13.30	**9. Presentation of modeling approaches and initial results for Pripyat scenario**	*T. Charnock (NRPB)* *W.-T. Hwang (Korea)* *S. Golikov (Russia)*
	10. Discussion of modeling approaches for Pripyat scenario	*(all)*
	Wednesday, 23 November 2005	
9.00	**11. Plenary session**	*All WGs*
10.30	**12. Finalization and agreement on the scenario for District 1 of Pripyat and expected outcomes**	*(all)*
	13. Discussion of hypothetical scenarios for urban contamination	*(all)*
12.30	*Lunch break*	
13.30	**14. Bibliographic survey of modeling approaches for radionuclide transfer in contaminated urban environments**	*F. Gallay (France)*
	15. Further discussion of modelling approaches and modeling scenarios	*(all)*
	Thursday, 24 November 2005	
9.00	**16. Plenary session**	*All WGs*
9.00	**15. Further discussion of modelling approaches and modeling scenarios (continued)**	*(all)*
	17. Discussion of the way forward for the WG	*(all)*
12.30	*Lunch break*	
13.30	**18. Development of WG document**	*(all)*
	19. Development of a WG plan (short-term and long-term)	*(all)*
	Friday, 25 November 2005	
9.00	**19. Plenary session**	*All WGs*
	20. Discussion	
12.30	**21. Closing of 3rd EMRAS Meeting**	*(Chairman, IAEA)*

APPENDIX B

LIST OF PARTICIPANTS

Experts	Country
R. Zelmer	Canada
J. Tomás	Cuba
A. Baklanov	Denmark
F. Gallay	France
B. Batandjieva	IAEA
D. Reisenweaver	IAEA
W.-T. Hwang	Korea, Rep.
V. Filistovic	Lithuania
T. Sazykina	Russia
S. Golikov	Russia
T. Charnok	UK
G. Linsley	UK
A. Arkhipov	Ukraine
S. Gaschak	Ukraine
M. Klimenko	Ukraine
B. Zlobenko	Ukraine
K. Thiessen	USA
S. Kamboj	USA

APPENDIX C

6 December 2005

IAEA

SAFETY REPORT

SERIES

Status: Draft from WG meeting
21-25 November 2005

Environmental Modelling of Remediation of Urban Contaminated Areas

Environmental Modelling for Radiation Safety Programme (EMRAS)

(Draft 0.0)

DRAFT SAFETY REPORT

INTERNATIONAL

ATOMIC ENERGY AGENCYVIENNA

CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

The general objectives of the IAEA's international programmes on radioecological modelling are to test the accuracy of model predictions, to improve models and specify their parameters, to provide a forum for exchange of ideas, experience and information, and to recommend priorities for future research. In keeping with these objectives, the EMRAS (Environmental Modelling for RAdiation Safety) programme has three major areas of interest: Theme 1, Radioactive Release Assessment; Theme 2, Remediation Assessment of Sites with Radioactive Residues; and Theme 3, Protection of the Environment. Theme 2 consists of two working groups, one designed to deal with modelling of naturally occurring radioactive materials (NORM) releases and of the remediation benefits for sites contaminated by extractive industries, and the other concerned with remediation assessment for urban areas contaminated with dispersed radionuclides. This report describes the activities of the Urban Remediation Working Group.

There are several types of events that could result in dispersal or deposition of radionuclides in an urban situation. These include both intentional and unintentional events, and releases could range from major events involving a nuclear facility or a nuclear weapon to small events such as a transportation accident. The extent of the contamination and impact on the environment would depend greatly on the specific event and the radionuclides involved. However, many aspects of assessing and remediating the situation will be the same or similar regardless of the spatial scale and specific radionuclides involved.

The intent of the Urban Remediation Working Group is to compare and test approaches and models to describe the behaviour of radionuclides in an urban setting. The Working Group has sought to develop realistic scenarios for use in comparing and testing modelling approaches and models. Major issues that must be considered include a high density of buildings, relative lack of importance of agricultural issues, disposal of contaminated debris or water as a result of remediation measures, high potential for resuspension due to vehicular traffic, and movement of contamination within and outside the initial area of contamination due to human, vehicular or other means.

1.2. OBJECTIVES

The primary objective of the Urban Remediation Working Group is to test and improve the prediction of dose rates and cumulative doses to humans for urban areas contaminated with dispersed radionuclides, including (1) prediction of changes in radionuclide concentrations or dose rates as a function of location and time, (2) identification of the most important pathways for human exposure, and (3) prediction of the reduction in radionuclide concentrations, dose rates, or doses expected to result from various countermeasures or remediation efforts. Specific objectives include (1) the identification of realistic scenarios for a wide variety of situations, (2) comparison and testing of approaches and models for assessing the significance of a given contamination event and for guiding decisions about countermeasures or remediation measures implemented to reduce doses to humans or to clean up the contaminated area, and (3) improving the understanding of processes and situations that affect the spread of contamination (e.g., fire, high winds, runoff, uncontrolled access and egress) to aid in the development of appropriate models and parameter values for use in assessment of

these situations. The Working Group's report is intended to describe what models are currently available and in what situations they might be useful, and to assist in the development of tools to be used for assessing the radiological impact (in terms of dose rates and doses) of a situation, for determining when remediation is required, and for evaluating proposed remediation measures in terms of the expected reduction of dose rates and doses.

1.3. SCOPE

The major activities of the Working Group have included three areas. The first of these is a review of the available modelling approaches and computer models for use in assessing urban contamination and potential countermeasures or remediation activities. The second area of work is a modelling exercise based on data obtained in Ukraine following the Chernobyl accident. This exercise provides an opportunity to model large-scale contamination events such as the result of a nuclear accident. The exercise is designed to permit intercomparison of model results from different participants as well as, for some endpoints, comparison of model results with actual measurements. The third area is a modelling exercise based on a hypothetical situation involving a point-release of a radionuclide in an urban situation, specifically a release resulting from a radiological dispersal device involving an explosion. This exercise is intended to provide an opportunity for intercomparison of model results among participants. For both modelling exercises, the intent is to model the radiological situation over time in the absence of any remediation and with the effects of selected remedial measures. This approach is intended to permit comparison of the effects of various remedial measures in terms of their short- or long-term effect on dose rates and resulting doses in the areas of interest, for the purpose (in part) of aiding decisions about when to remediate and which remedial measures to use.

1.4. STRUCTURE OF THE REPORT

Section 1 provides a brief description of the background of the Urban Remediation Working Group, the Working Group's objectives, and the scope of its activities. Section 2 provides a review of major models and modelling approaches designed for assessment of urban contamination situations. This section also includes a brief description of each model used by a participant in the Working Group's modelling exercises. Section 3 describes the first modelling exercise, based on Ukrainian data following the Chernobyl accident. Section 4 describes the second modelling exercise, based on a hypothetical situation of a point release of a radionuclide in an urban setting. Sections 3 and 4 include comparative analyses of model predictions and reasons for different predictions or mispredictions. Section 5 provides the conclusions and recommendations of the Working Group based on the model review and the modelling exercises. Annexes I and II include the scenario descriptions and documentation for each of the modelling scenarios. Annex III includes more detailed descriptions of the models used in these exercises by Working Group participants, including individual evaluations of their model performance. Annex IV includes tables of the model predictions and (where available for the Ukrainian scenario) measurements. A CD accompanying the printed version of this report contains full scenario descriptions and supporting information (electronic files) for both scenarios, as well as a complete report (in French and English) on available models and modelling approaches for assessing urban contamination and remediation measures.

APPENDIX III-1. DESCRIPTION OF MODELS

Generic Model Descriptions [*TO BE COMPLETED BY EACH PARTICIPANT SUBMITTING MODEL CALCULATIONS]*

1. Introduction

- model name
- purpose of the model (research, assessment or scoping; conservative or realistic)
- type of model (steady-state or dynamic; analytical or numerical; compartment or process-oriented)
- biological/environmental compartments considered
- transport processes considered
- endpoints
- references

2. Key assumptions

3. Modelling approaches (conceptual and mathematical)

- how transfers between compartments are modelled
- how concentrations in compartments are calculated
- temporal and spatial discretization of the model
- input data required

4. Parameter values

- values of the parameters used in the model
- spatial and temporal averaging

5. Uncertainties

- approach to estimating uncertainties in the model predictions

6. Application of the model to Scenario 1 (Ukrainian scenario)

- how the data given in the scenario description was used to drive the model
- what assumptions were made to match the model to the conditions of the scenario

7. Application of the model to Scenario 2 (Hypothetical scenario)

- how the data given in the scenario description was used to drive the model
- what assumptions were made to match the model to the conditions of the scenario

CONTENTS OF ACCOMPANYING CD

1. Bibliographic survey of modeling approaches for radionuclide transfer in contaminated urban environments, associated dose calculations and assessment of rehabilitation strategies. [Report by Ms. Gallay, versions in French and English]
2. Ukrainian scenario (complete version, including GIS files)
3. Scenarios for District 1 and District 4 of Pripyat, with supporting files
4. Hypothetical scenario (complete)