

8th Meeting of the Urban Remediation Working Group Meeting

18-20 April 2007
IAEA Headquarters, Vienna

MINUTES

1. Background

The Urban Remediation Working Group (WG) of the EMRAS project held its eighth meeting during the period 18-20 April 2007, at the IAEA headquarters in Vienna.

The Urban Remediation 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 radionuclides 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.

2. Scope and Objectives of the Meeting

The main objectives of the meeting were:

- a) to present and review the preliminary results for the hypothetical scenario for deliberate radioactive contamination in an urban environment;
- b) to present and review the preliminary results for the Pripyat scenario (Districts 1 and 4 of Pripyat in Ukraine); and
- c) to develop future work plan, including completion of the WG report prior to the 5th Joint EMRAS meeting (5-9 November 2007).

The meeting followed the agenda presented in Appendix A. It was chaired by K. Thiessen (USA) and was attended by thirteen experts from nine countries (see Appendix B). Due to problems with air

travel, K. Thiessen arrived in the afternoon of the first day of the meeting, so the meeting was opened by B. Batandjjeva (IAEA), IAEA Scientific Secretary for the Urban WG. The meeting was also attended during the first day by L. Jova-Sed (Acting Section Head of the Dischargeable Unit), Scientific Secretary of the EMRAS project.

3. Work performed

3.1. Hypothetical scenario

A revised version of the hypothetical scenario was distributed in January 2007. The simulation of the starting deposition pattern that was used for the scenario was presented at the April 2007 meeting by D. Trifunovic (Croatia) and C. Kaiser (Germany). Preliminary modeling results for the scenario from three participants (W. T. Hwang, South Korea; S. Kamboj, USA; and J. Tomás, Cuba) were presented and discussed. These presentations were followed by a presentation by K. Thiessen on the preliminary results of the comparison of the three model results. Explanations for the differences in the models and modeling results were compiled. The WG also made plans for completing the modeling exercise and the corresponding parts of the draft Urban WG Report *before September 2007*.

3.2. Pripyat scenario

Based on the revised scenario distributed in January 2007, modeling results for the Pripyat scenario from four participants (T. Charnock, UK; V. Golikov, Russian Federation; W.T. Hwang, South Korea; and J. Tomás, Cuba) were presented and discussed. These presentations were followed by a presentation by K. Thiessen on the preliminary results of the comparison of the three model results. Explanations for the differences among the model predictions were compiled. Comparisons were also made between the predictions and the available test data. The WG also made plans for completing the modeling exercise and the corresponding parts of the Urban WG report *before September 2007*.

3.3. WG plans and schedules

The WG discussed the remaining work to be performed before the EMRAS project ends in November 2007, including the completion of the WG report. Several sections of the draft WG report have been revised, but a new version of the draft report has not yet been compiled. The revised sections include the most recent versions of the scenario descriptions and the section dealing with sources of information about countermeasures. In addition, the WG now has model results (in spreadsheets and graphical comparisons) and some of the model descriptions. These materials, with any revisions made in the next few months, will be included in the WG report prior to the 5th Joint EMRAS meeting in November 2007.

The WG also discussed the paper on the WG's activity that was presented by K. Thiessen at the International Conference "Environmental Radioactivity – From Measurements and Assessment to Regulations" the week following the WG meeting (23-27 April 2007). The WG plans to submit a paper based on this presentation for the conference proceedings this year. The WG also plans to consider additional opportunities for publication of its work, and the participants were encouraged to send proposals to K. Thiessen prior to the November 2007 meeting.

4. Outcomes

4.1. Hypothetical scenario

- Based on discussions at the June 2006 and November 2006 WG meetings, an improved hypothetical scenario was distributed to participants in January 2007. For this scenario, the initial dispersion and deposition of an assumed deliberate dispersion were simulated using the Hotspot code (D. Trifunovic, Croatia). Further simulation of the deposition pattern was then

made with the IAMM code (Inhabited Areas Monitoring Module; C. Kaiser, Germany). Both of these simulations were presented at the April 2007 WG meeting. The January 2007 scenario included a revised set of test locations and clarifications on the set of countermeasures to be simulated. Additional clarifications, circulated since January 2007, will be incorporated into the final scenario description that is included in the WG report.

- Three sets of model predictions for the hypothetical scenario were submitted (W.T. Hwang, South Korea; S. Kamboj, USA; J. Tomás, Cuba); two of these modelers (Hwang and Kamboj) presented their results at the WG meeting. Comparisons of all three sets of model predictions were made for various endpoints (Figs. 1-3; Appendix C), and explanations for the differences in predictions were discussed. These explanations include consideration of different contributing surfaces (e.g., not all models included trees or internal surfaces) and differences in assumptions about how to model specific contributing surfaces (e.g., the models that included trees modeled them differently). Models also differed with respect to the assumed effectiveness of some countermeasures. In general, the effectiveness of a countermeasure in terms of the reduction in dose was related to the time period in question and the time of application of a countermeasure. For example, relocation was obviously very effective in reducing the dose for the first year. Removal of contaminated material reduced the dose rates and consequent doses for a number of years.
- The sections of the Urban WG report dealing with the hypothetical scenario are being revised to reflect the final scenario description. In addition, comparisons of the model results will be added, together with a discussion of those results. Material to be included in that discussion was compiled at the WG meeting. Any revisions in results are to be submitted by the beginning of August 2007, along with model descriptions and evaluations by each modeler of their modeling results (e.g., success, problems, any changes made, things that would be done differently next time, lessons learned). Remaining parts of the WG report will be completed during the summer.
- As Juan Tomás was not present at the meeting, a set of questions was prepared concerning issues that needed further clarification, especially differences between the results of his model and the other model results.

4.2. *Pripyat scenario*

- Based on discussions at the November 2006 meeting, a revised format for reporting model predictions was distributed in January 2007. The previous “phased” approach was changed, and model predictions were requested simply for Districts 1 and 4, with predictions for District 4 to include the effects of countermeasures and estimates of doses for reference individuals. In addition, the specifications of the countermeasures and their dates of application were revised. New or revised results were intended to take advantage of these revisions to the scenario and of the discussions at the previous meetings.
- Four sets of results were submitted for the Pripyat scenario (T. Charnock, UK; V. Golikov, Russia; W.T. Hwang, South Korea; J. Tomás, Cuba). Three of these (Charnock, Golikov, Hwang) presented their results at the WG meeting. All sets of results included the effects of various remediation efforts for District 4. Results for selected endpoints were compared among modellers (Figs. 4-11; Appendix C), and reasons for differences were discussed. Major differences seemed to be how the short-lived radionuclides were treated, which contributing surfaces were included in the estimation of total dose rates, and how a given surface was handled in the model. Due to the importance of the short-lived radionuclides (referring primarily to Zr-95, Nb-95, and Ru-103) to estimated doses in this scenario, relocation during the early period after the accident decreased cumulative doses substantially over both the short term and the long term. Removal of contaminated material (e.g., soil, grass, trees) was especially important in decreasing the long-term cumulative doses. A combination of relocation

during the early period and removal of contaminated material produced as much as a factor of ten reduction in the estimated cumulative dose over a 20-year period (Fig. 11).

- Measurements of dose rates are available for some locations in 1996 or 1999 (Fig. 5); the locations of the measurements are near the test locations, but not necessarily in the exact location. In addition, the originators of the Pripjat scenario (A. Arkhipov and S. Gaschak, Ukraine) made some additional measurements in July 2006, for the actual test locations (Figs. 4-5). While it is helpful to have some measurements, it should also be remembered that the locations might not be exactly the same, and the available measurements might not be fully representative of their locations. In addition, the absence of human activity and traffic appears to be associated with altered weathering patterns, including accumulation of detritus, such that levels of activity are probably higher than would have been the case in an inhabited city. Fig. 4 shows that the measurements for all locations cover a range of about an order of magnitude, while the model predictions for any single location may span 3 or 4 orders of magnitude.
- The sections of the Urban WG report dealing with the Pripjat scenario are being revised to reflect the revised scenario description. In addition, comparisons of the model results will be added, together with a discussion of those results. Material to be included in that discussion was compiled at the WG meeting. Any revisions in results are to be submitted by the beginning of August 2007, along with model descriptions and evaluations by each modeler of their modeling results (e.g., success, problems, any changes made, things that would be done differently next time, lessons learned). Remaining parts of the WG report will be completed during the summer.
- As Juan Tomás was not present at the meeting, a set of questions was prepared concerning issues that needed further clarification, especially differences between the results of his model and the other model results.

4.3. Preparation of Urban WG report

Several sections of the draft WG report have been revised since the November 2006 draft was distributed, including the revised scenario descriptions and the section dealing with sources of information about countermeasures. In addition, some of the model descriptions have been submitted. The model results (in spreadsheets and graphical comparisons) will be added to the report, with any revisions made in the next few months. Sections describing each modelling exercise will be completed with specific attention to the clear description of the assumptions and caveats associated with each scenario, based on the discussions of the recent WG meeting. Material to be included in Chapter 5 (lessons learned, recommendations, and conclusions) was compiled at the WG meeting. The materials currently available will be compiled by the beginning of August 2007 and distributed for comments. An intermediate draft of the report will be prepared in September, either by e-mail or possibly with a small group meeting. The final draft report will be distributed to WG participants in mid-October 2007 to be discussed at the 5th EMRAS meeting in November 2007.

4.4. Plans for November 2007 meeting and beyond

The WG's next meeting will take place 5-9 November 2007, in conjunction with the final plenary meeting of the EMRAS programme. However a small group of participants is being considered to meet in September 2007 to work on the draft WG report and prepare it for review. Final conclusions of the WG will be discussed at this meeting, and the WG's report will be finalized. In addition, the WG will discuss possibilities for a follow-up project, in the context of an IAEA programme to succeed the EMRAS programme. There may also be a joint session with the NORM WG of EMRAS to share information of interest to both groups.

The WG's work was presented by K. Thiessen at an IAEA conference the week following the WG meeting. Based on this presentation, the WG plans to submit a paper for the conference proceedings.

The draft conference paper will be circulated for comment in mid-May; the deadline for its submission is 1 June 2007. The WG also plans to consider additional opportunities for publication of its work, probably one paper for each modelling exercise.

A detailed work plan was prepared and presented in Appendix D. In addition, proposals for the 9th Urban WG meeting and topics for a possible follow-up project dealing with modelling of contaminated urban environments were collected and discussed as follows:

<i>Topics for November 5th – 9th</i>	
<i>Finalize report</i>	
<i>NORM group</i>	<i>Possible joint session Coordinate conclusions</i>
<i>Other group reports</i>	<i>Relevance to Urban Group</i>
<i>Additional publications</i>	<i>One paper for each scenario – to describe the results in more detail than conference paper</i>
<i>Ideas for future work</i>	<i>Issues and types of exercises that would be useful Different modeling exercises etc (e.g. data assimilation IAMM) Different scenarios – different pathways</i>

The participants were encouraged by K Thiessen and B. Batandjieva to send their suggestions by email, as more detailed discussion is planned to take place at the 5th EMRAS meeting in November 2007.



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 国际原子能机构
 International Atomic Energy Agency
 Agence internationale de l'énergie atomique
 Международное агентство по атомной энергии
 Organismo Internacional de Energía Atómica

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AGENDA

Wednesday, 18th April 2007

09:00–12:30	1. Welcome	Kathy Thiessen, WG Leader (USA) Borislava Batandjieva WG Scientific Secretary (IAEA) Kathy Thiessen
	2. Overview of meeting	
	2.1. Progress since Nov 2006	
	2.2. Scope, objectives and expected outcomes	
	3. Hypothetical scenario	Kathy Thiessen, Christian Kaiser, Dejan Trifunovic
	3.1. Current status of scenario description (version distributed in early 2007)	
	3.2. Initial modelling results for hypothetical scenario	Sunita Kamboj, Won Tae Hwang
12:30–13:30	<i>Lunch break</i>	
13:30–17:30	3.3. Intercomparison of modelling results	Kathy Thiessen, WG participants
	3.4. Discussion of hypothetical scenario and modelling results, lessons learned	All WG Participants
	3.5. Plans for completion of hypothetical scenario	All WG Participants
17:30	<i>Close</i>	

Thursday, 19th April 2007

09:00–12:00	4. Pripjat scenario	Kathy Thiessen
	4.1 Current status of scenario description (version distributed in early 2007)	
	4.2. Modeling results, Districts 1 and 4, including remediation activities	Tom Charnock, Vladislav Golikov, Won Tae Hwang
12:30–13:30	<i>Lunch break</i>	
13:30–17:30	4.3. Intercomparison of modelling results, comparison with test data	Kathy Thiessen, WG participants
	4.4 Discussion of modelling results, lessons learned	All WG Participants
	4.5. Plans for completion of Pripjat modelling exercise	All WG Participants
17:30	<i>Close</i>	

Friday, 20th April 2007

09:00–12:30	5. Completion of WG report	All WG Participants
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	5.1. Discussion of scenarios (hypothetical scenario, Pripyat scenario) and their documentation in the Urban report	All WG Participants
12.30-13.30	5.2. Documentation of models and model predictions	All WG Participants
13.30-15.30	<i>Lunch break</i>	
	6. Plans for future activities	All WG Participants
	6.1. International Conference, April 2007	Kathy Thiessen, WG participants
	6.2. Publication of Conference paper	
	6.3. Other publications?	
	6.4. Finalisation of the Urban WG report	All WG Participants
15:30	6.5. 5 th EMRAS Combined Meeting – November 2007	
	<i>Close of Meeting</i>	Kathy Thiessen, WG Leader (USA) Borislava Batandjieva WG Scientific Secretary (IAEA)

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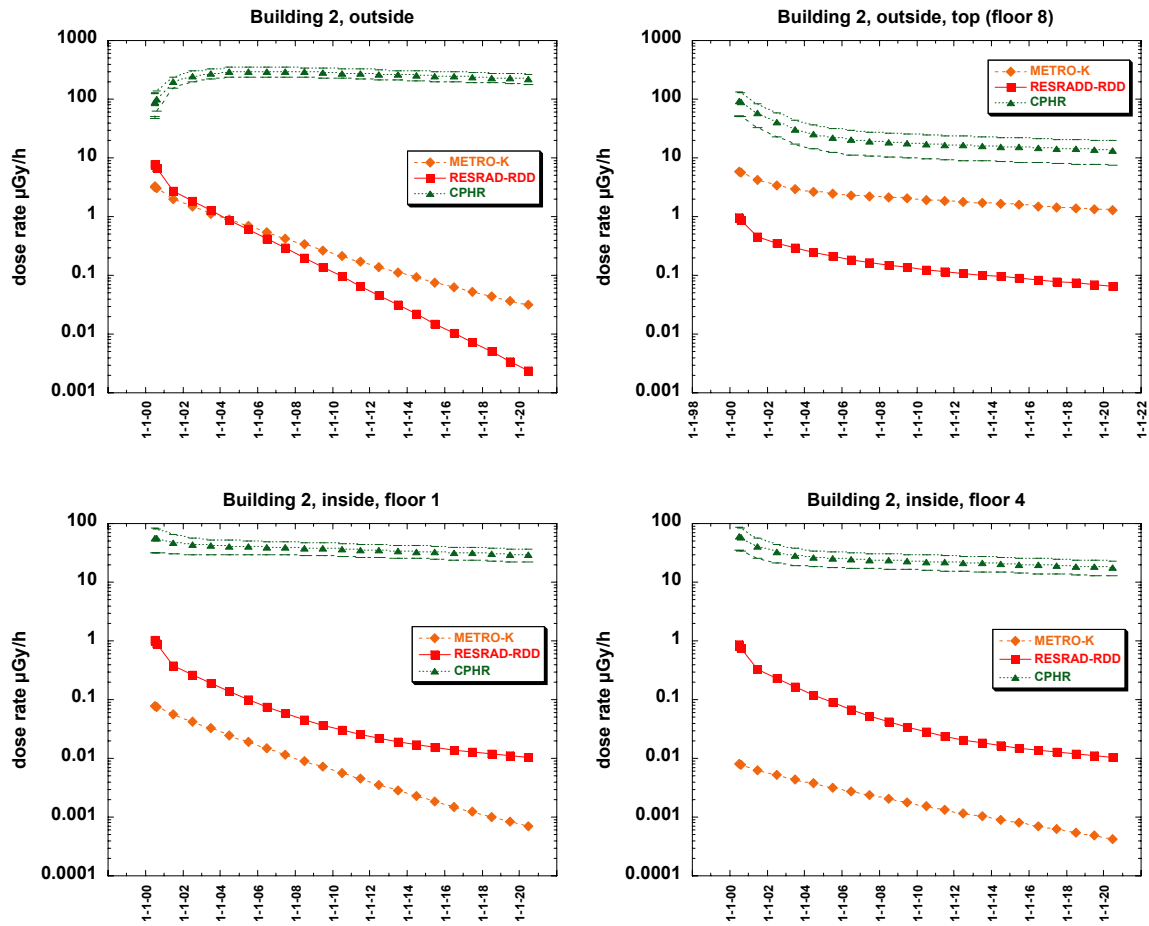


Fig. 1. Examples of model predictions for the dose rate over time at Building #2 (top left, outside at ground level; top right, outside on top of the building; bottom left, inside on the first floor; bottom right, inside on the 4th floor). Building #2 is a parking garage with the top of the building used as the top level of parking area.

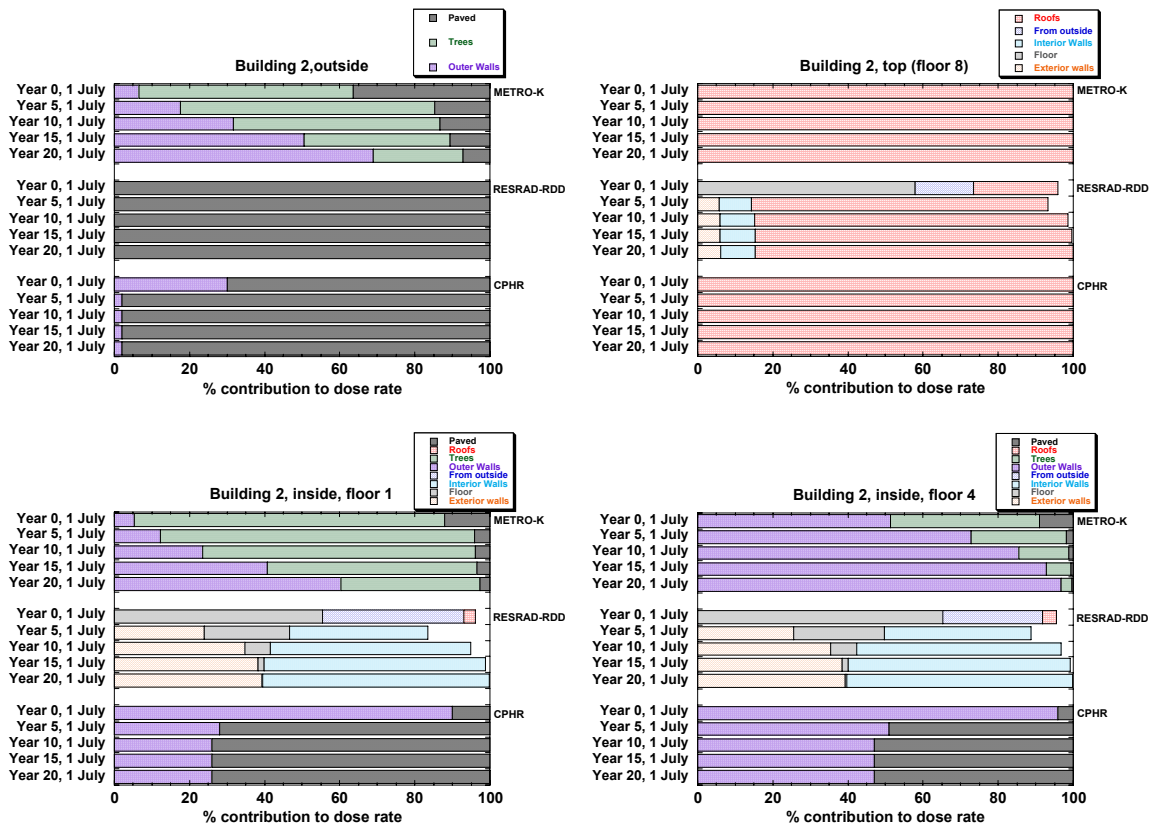


Fig. 2. Examples of model predictions for the percent contribution to dose rate by various surfaces at selected times at Building #2 (top left, outside at ground level; top right, outside on top of the building; bottom left, inside on the first floor; bottom right, inside on the 4th floor). Building #2 is a parking garage with the top of the building used as the top level of parking area.

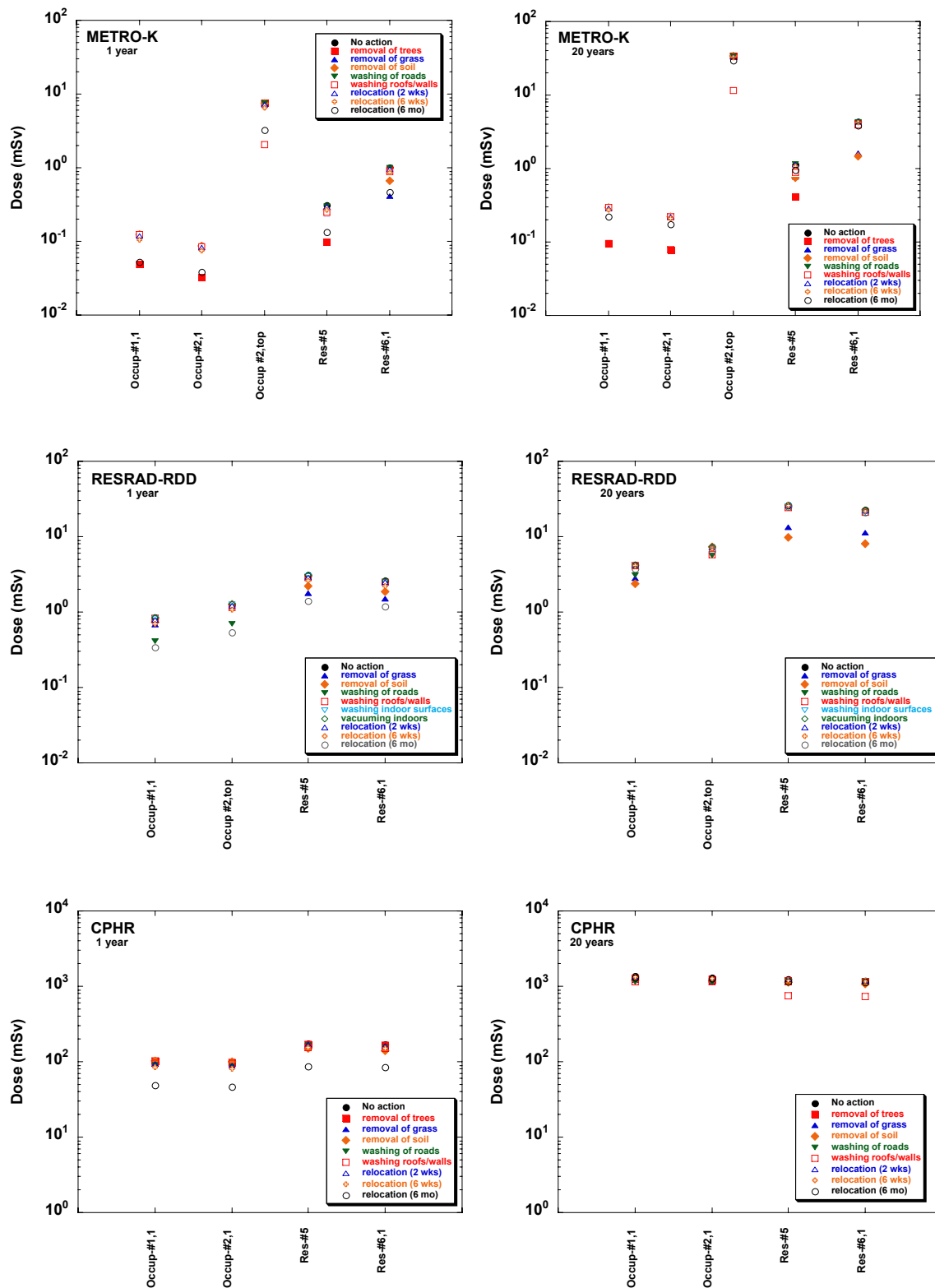


Fig. 3. Examples of predicted cumulative doses at 1 year (left) and 20 years (right) for reference exposures, with and without selected countermeasures. The reference exposures are defined as occupational (Building 1, floor 1; Building 2, floor 2; Building 2, top) or residential (Building 5; Building 6, floor 1).

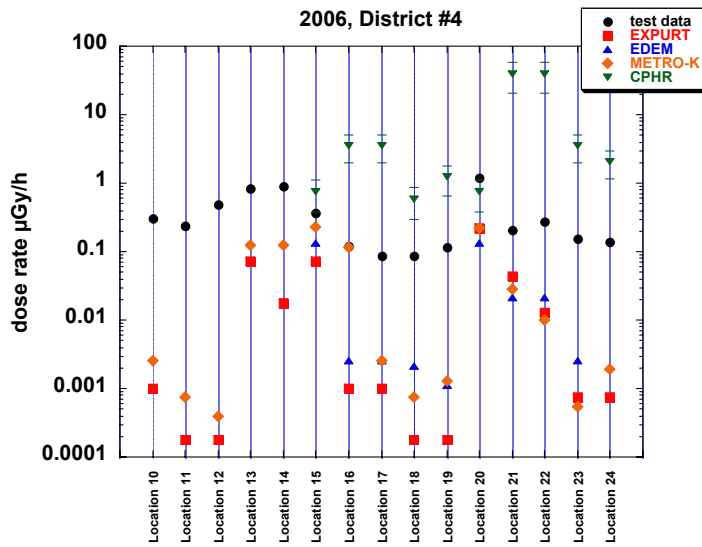


Fig. 4. Comparison of measured and predicted dose rates for test locations in District 4 of Pripjat, for 2006.

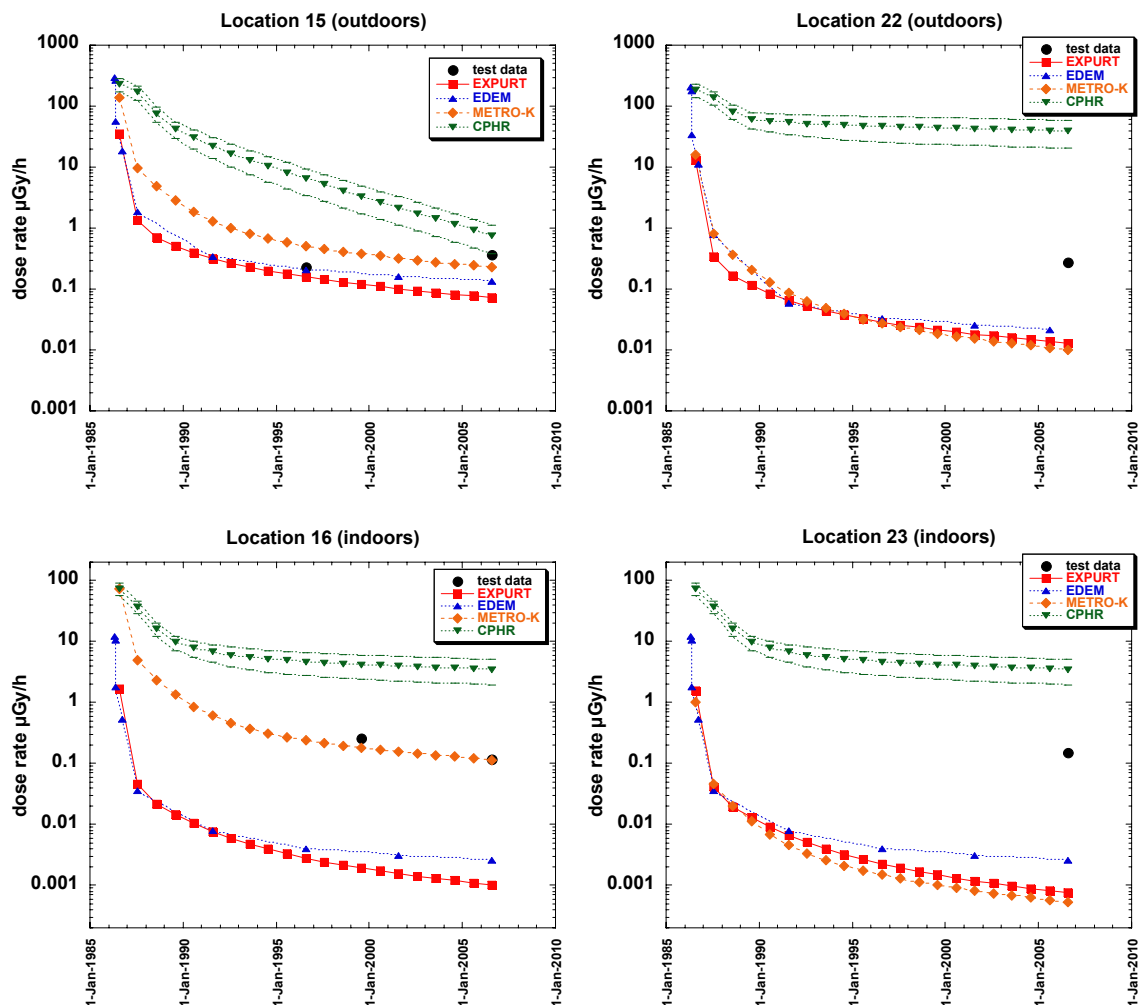


Fig. 5. Examples of model predictions for total dose rate (all surfaces, all radionuclides) at four locations in District 4 of Pripjat, compared with measurements made in 1996, 1999, and 2006.

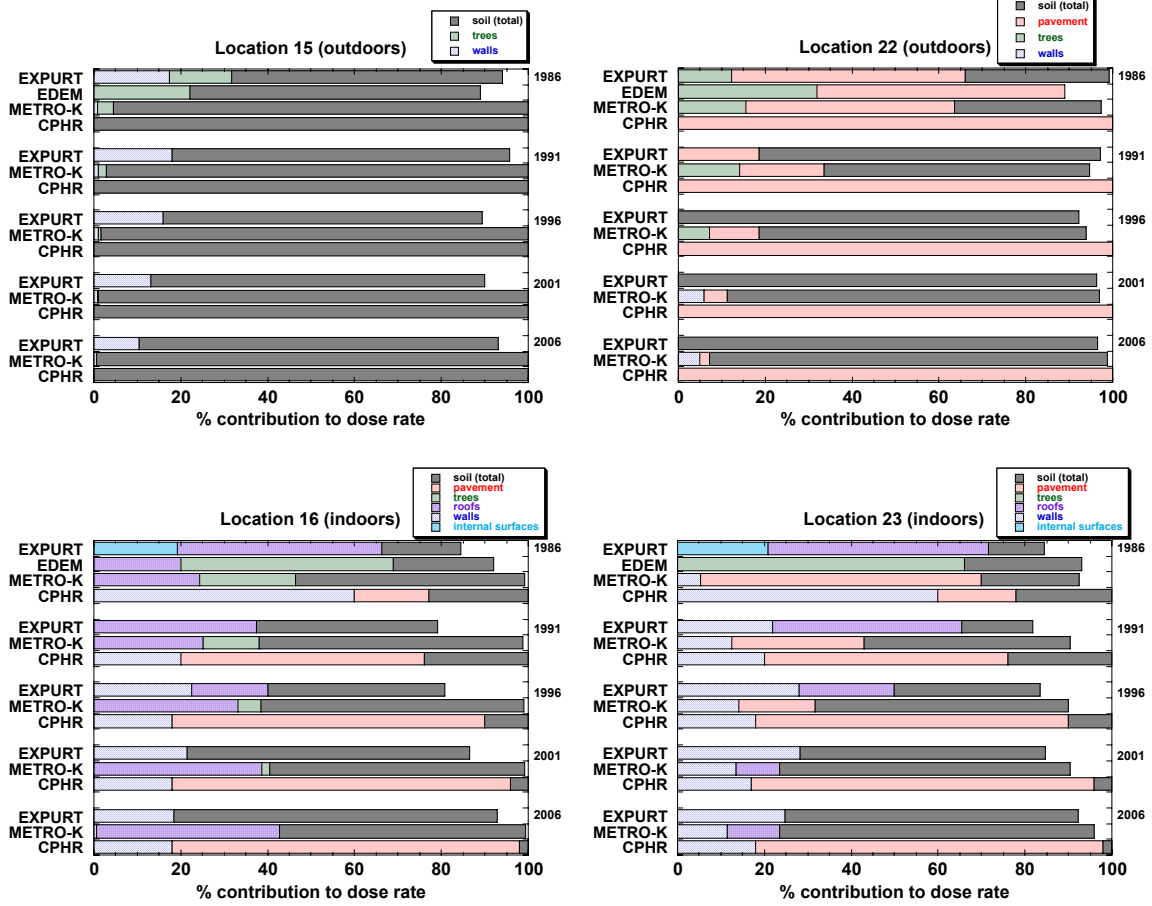


Fig. 6. For the same locations as in Fig. 5, comparisons of the predicted contributions (%) to the dose rate by the most important surfaces.

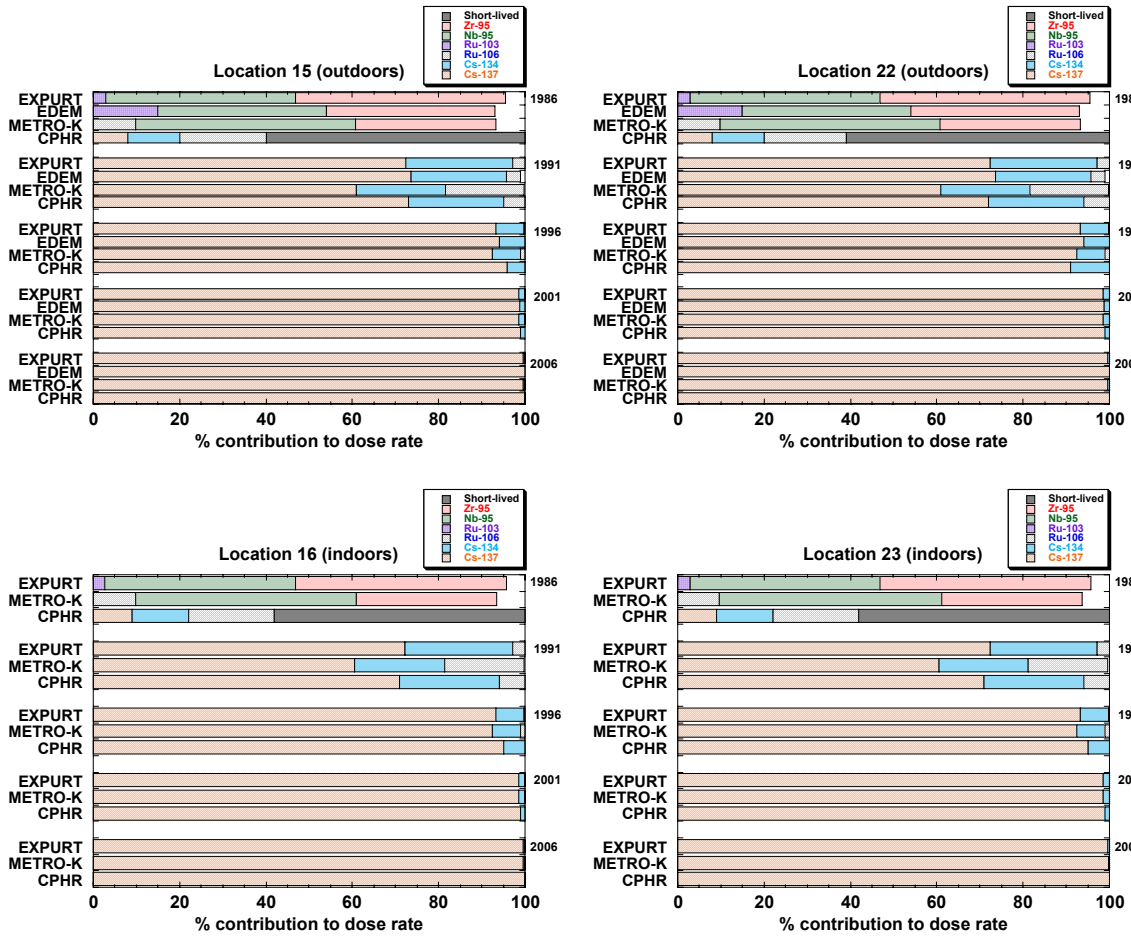


Fig. 7. For the same locations as in Fig. 5, comparisons of the predicted contributions (%) to the dose rate by the most important radionuclides.

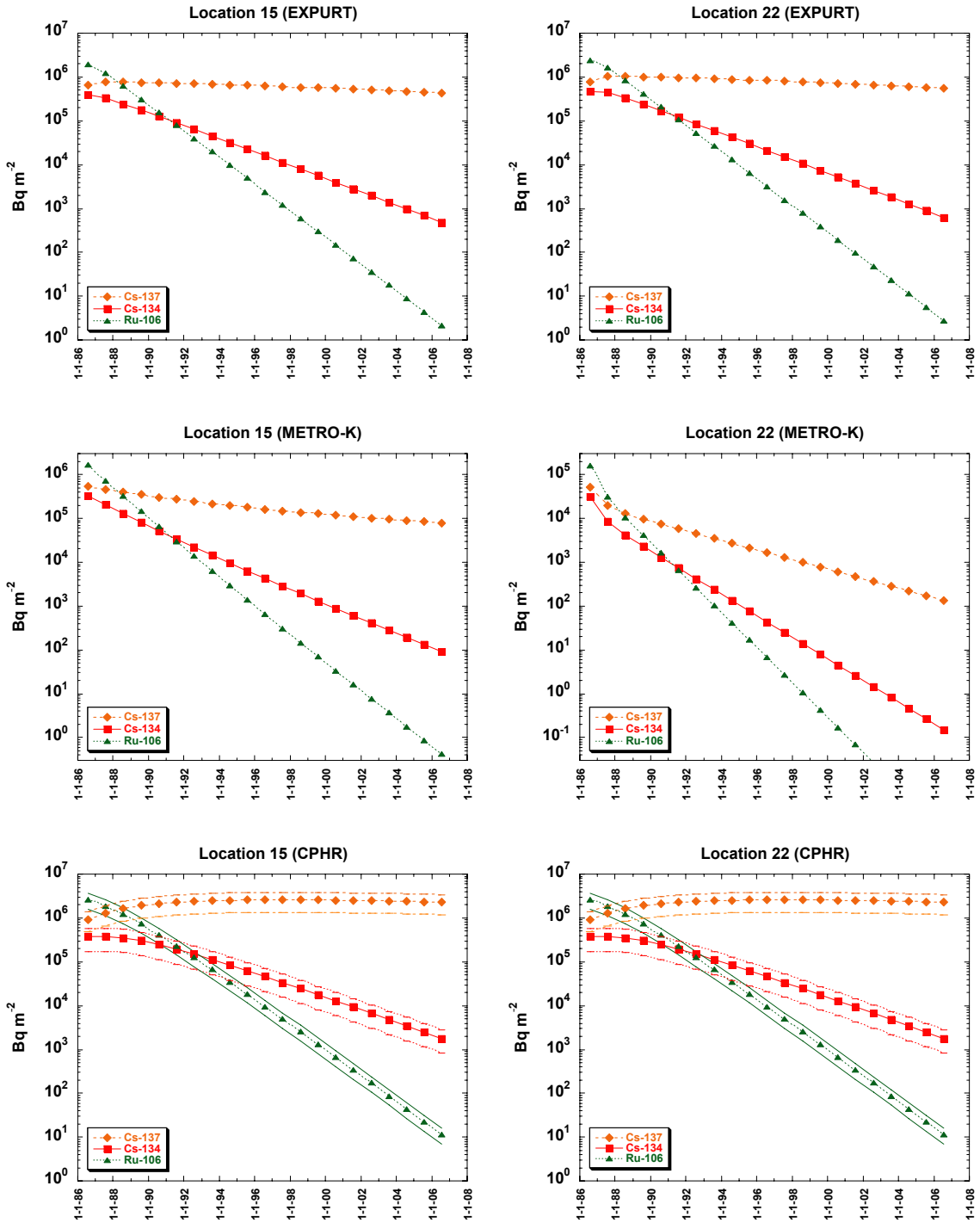


Fig. 8. For two outdoor locations in District 4, predictions for the contamination densities of Cs-137, Cs-134, and Ru-106.

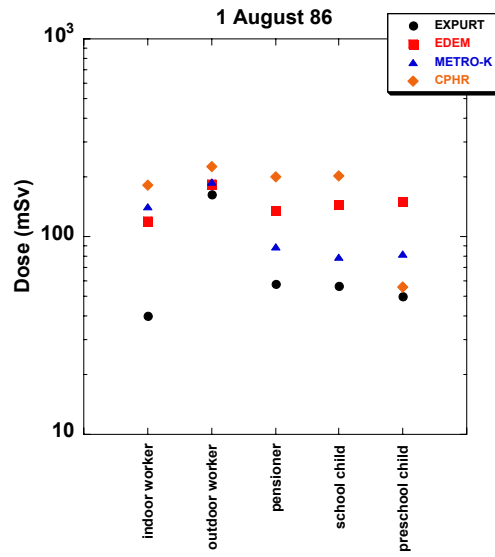


Fig. 9. Predicted doses for reference individuals in District 4, through 1 August 1986, assuming no countermeasures.

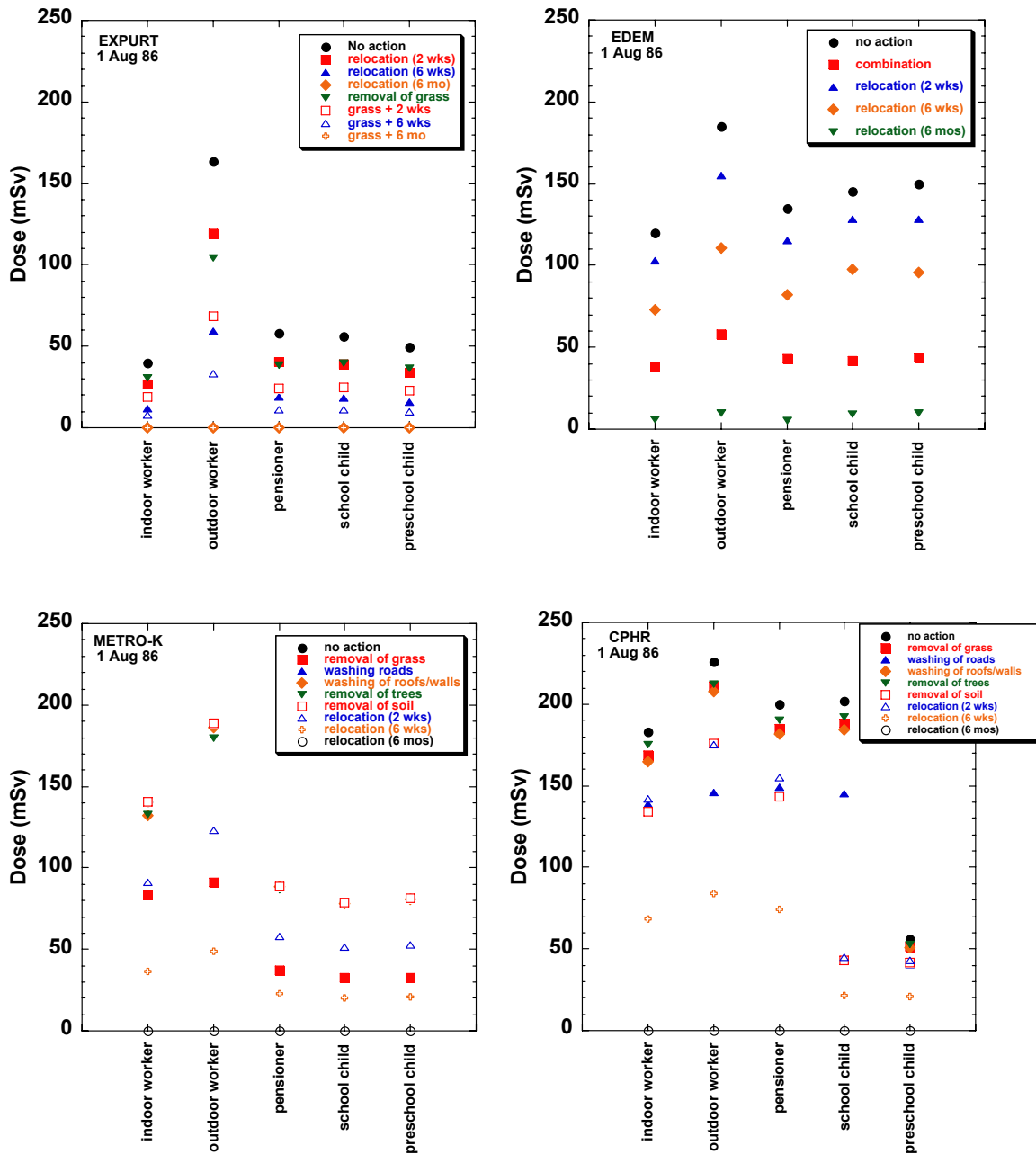


Fig. 10. Comparisons of predicted doses through 1 August 1986 for reference individuals in District 4, for no action and for various countermeasures or combinations of countermeasures. [For EDEM, “combination” refers to cutting and removal of grass; washing of roads, roofs, and walls; removal of trees; and removal of soil (5 cm).]

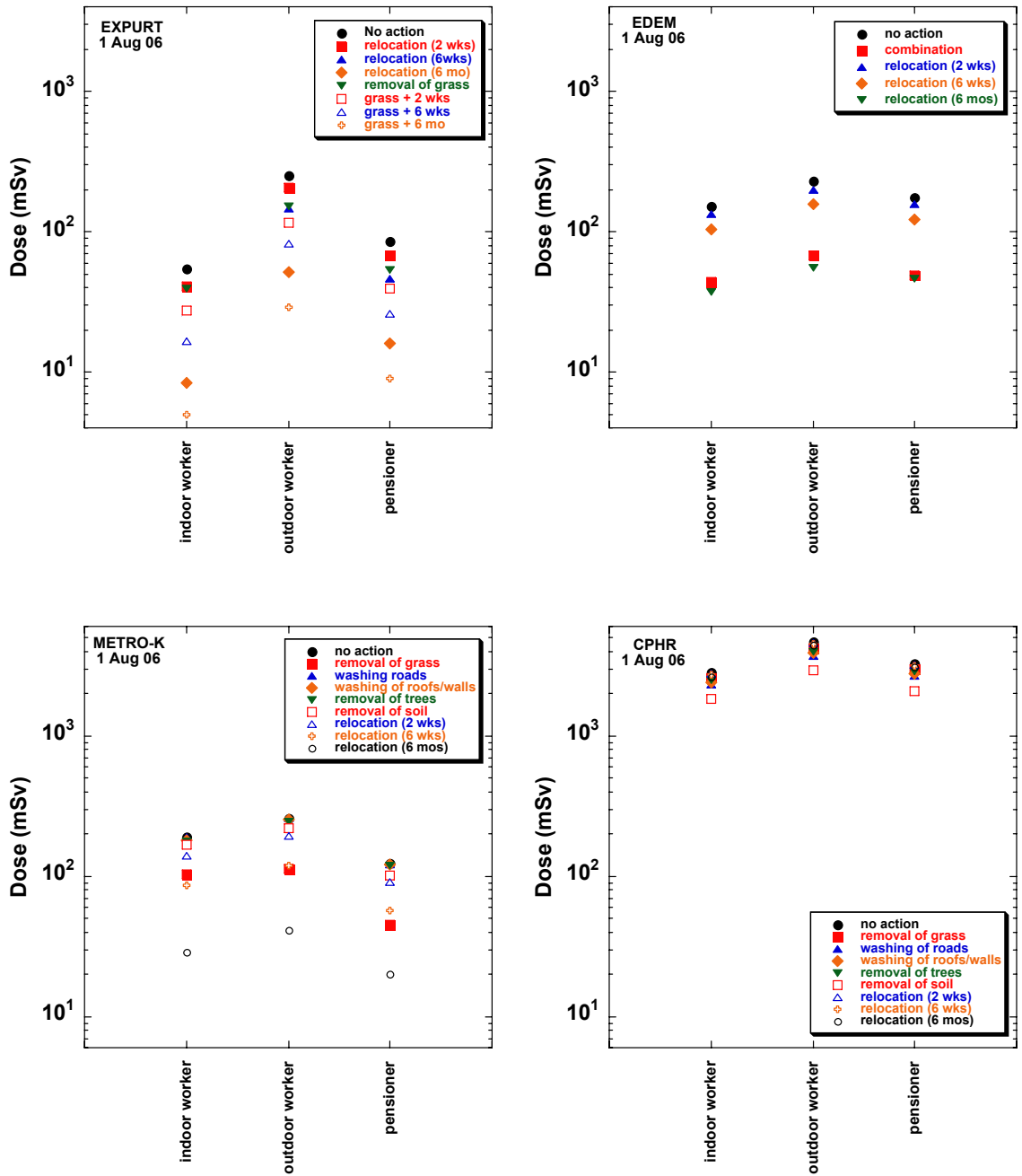


Fig. 11. Comparisons of predicted doses through 1 August 2006 for reference adult individuals in District 4, for no action and for various countermeasures or combinations of countermeasures.

DETAILED WORK PLAN FOR 2007

Action	Deadline	Responsible	Comments
1. General – Draft Urban WG Report			
Section – lessons learnt	Start of August	Kathy	For each scenario and general, for the group
Section - recommendations and conclusions	Start of August	Kathy	
Intermediate draft by email or small meeting	September	Kathy	
Send final draft report to all participants of urban working group	15 th October	Kathy, Borislava	
2. Hypothetical Scenario			
Questions for Tomás	May	Kathy, Juan Tomás	
Revision of calculations	Start of August	Won Tae Sunita Juan Tomás	Everyone to check units
Documentation of model including parameter values*.	Start of August	Won Tae Juan Tomás	
Evaluation of model results, success, lesson learnt etc.	Start of August	Sunita Won Tae Juan Tomás	
Hotspot description	Start of August	Dejan	
Map of hotspot results	Start of August	Christian	
Intercomparison and discussion of all models	Start of September	Kathy	
3. Pripjat Scenario			
Questions for Tomás	May	Kathy, Juan Tomás	
Revision of calculations	Start of August	Tom Juan Tomás Won Tae Vladislav	Everyone to check units
Documentation of model including parameter values*.	Start of August	Tom Won Tae Juan Tomás	
Evaluation of model results, e.g. success, lesson learnt etc.	Start of August	Tom Won Tae Juan Tomas Vladislav	
Discussion of measurements and comparison with model (not validation)	Start of August	Vladislav, Andriy, Sergiy	
Intercomparison and discussion of all models	Start of September	Kathy	
4. Other			
Circulate conference paper	Middle of May	Kathy	
Paper submission	1st of June for submission	Kathy	

*Template in Appendix 3-1