Assessing emergency situations and their aftermath in urban areas: The EMRAS II Urban Areas Working Group

Thiessen, K.M.; Andersson, Kasper Grann; Berkovskyy, V.; Charnock, T.W.; Chouhan, S.; de With, G.; Duran, J.; Fuka, V.; Helebrant, J.; Hukla, J.; Hwang, W.T.; Kuca, P.; Malatova, I.; Mancini, F.; Navarro, E.; Perianez, R.; Sdouz, G.; Tomas, J.; Trifunovic, D.; Urso, L.; Walter, H.

Publication date:
2011

Assessing emergency situations and their aftermath in urban areas: The EMRAS II Urban Areas Working Group

K.M. Thiessen[a], K.G. Andersson[b], V. Berkovskyy[c], T.W. Charnock[d], S. Chouhan[e], G. de With[f], J. Duran[g], V. Fuka[h], J. Helebrant[i], J. Hůlka[i], W.T. Hwang[j], P. Kuca[i], I. Malátová[i], F. Mancini[k] E. Navarro[l], R. Periáñez[m], G. Sdouz[n], J. Tomás[o], D. Trifunovic[p], L. Urso[q], H. Walter[r]

[a]SENES Oak Ridge, Inc. Oak Ridge, Tennessee, United States of America
[b]Risø-DTU National Laboratory for Sustainable Energy, Roskilde, Denmark
[c]International Atomic Energy Agency (IAEA), Seibersdorf, Austria
[d]Health Protection Agency (HPA), Chilton Didcot, Oxfordshire, United Kingdom
[e]Atomic Energy of Canada Limited (AECL), Chalk River, Ontario, Canada
[f]Nuclear Research & Consultancy Group (NRG), Arnhem, Netherlands
[g]VÚJE a.s., Trnava, Slovakia
[h]Charles University, Prague, Czech Republic
[i]National Radiation Protection Institute (SÚRO), Prague, Czech Republic
[j]Korea Atomic Energy Research Institute (KAERI), Daejeon, Republic of Korea
[k]SOGIN S.p.A., Rome, Italy
[l]Institut de Radioprotection et de Sûreté Nucléaire (IRSN), Fontenay-aux-Roses, Cédex, France
[m]Universidad de Sevilla, Sevilla, Spain
[n]Austrian Institute of Technology (AIT), Vienna, Austria
[o]Centro de Protección e Higiene de las Radiaciones (CPHR), Havana, Cuba
[p]State Office for Radiation Protection, Zagreb, Croatia
[q]Helmholtz-Zentrum München GmbH, Neuherberg, Germany
[r]Bundesamt für Strahlenschutz (BfS), Oberschleißheim, Germany

E-mail address of main author: kmt@senes.com

The Urban Areas Working Group was organized within the International Atomic Energy Agency's EMRAS II (Environmental Modelling for Radiation Safety) program, as part of a theme entitled "Approaches for Assessing Emergency Situations." Building on the work done by the Urban Remediation Working Group of the first EMRAS program, the goal of this Working Group 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. The Working Group has developed three modeling exercises, which are designed to permit intercomparison of model predictions and (in one case) comparison of model predictions with measurements. Reasons for similarities and discrepancies among model predictions are discussed in terms of the modeling approaches, models, and parameter values used by different assessors. An important objective is the identification of areas in which models or selection of parameter values could be improved.

The short-range atmospheric dispersion exercise is based on data from experimental explosions carried out in the Czech Republic. This exercise permits comparison of model predictions with measurements of surface contamination, time-integrated air concentrations, and dose rates, up to

50 m downwind. Intercomparisons of model predictions are possible for longer distances and for additional modeling endpoints.

The mid-range atmospheric dispersion exercise is based on a hypothetical accident at a nuclear power plant and the resulting predicted deposition in urban environments up to 70 km downwind. The scenario assumes a 1-hour release from a rupture of a steam generator tube and uses actual geographic and meteorological information for a European location. This is a model intercomparison exercise for all endpoints, including deposition of ^{131}I and ^{137}Cs on a reference lawn surface at selected locations and time-integrated air concentrations of both radionuclides.

The contaminant transport and countermeasures exercise starts with an assumed concentration of ^{60}Co or ^{239}Pu in air, in parts of a city for which detailed geographic and building information is available. Deposition is to be predicted for several kinds of weather conditions (dry, light rain, heavy rain) and for both a business area (buildings and asphalt) and a park area. Additional modeling endpoints for model intercomparison include contamination densities, dose rates, countermeasure effectiveness, and doses for specified reference individuals.

Final conclusions from the Working Group's activities will be drawn as the modeling exercises are completed in 2011-2012. Comparison of preliminary results illustrates the importance of explaining individual approaches and understanding the effects of different assumptions and parameter values on the modeling results.