Editorial

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Biographical notes: Bent Lauritzen is the Head of the Radiation Physics Program at Risø National Laboratory, Technical University of Denmark. He received a PhD in Nuclear Physics from Niels Bohr Institute, University of Copenhagen. Postdoctoral research was carried out at Michigan State University, Nordita (DK) and Massachusetts Institute of Technology covering topics in theoretical nuclear and many-body physics and in non-linear dynamics. From 1995 onwards he has been engaged in the field of radiation physics with current research focused on atmospheric transport modelling, data assimilation and risk assessment from nuclear accidents.

Per Hedemann-Jensen graduated in 1969 from the University College of Engineering in Aarhus, Denmark. He has been working for 32 years at Risoe National Laboratory of which, more than 25 years as the Head of the Section of Applied Health Physics. His major areas of work are radiation protection philosophy in theory and practice, risk assessment of nuclear facilities, internal dosimetry, radiation transport and biological risks of radiation. Since 2003, he has been the Head of the Section of Radiation and Nuclear Safety in Danish Decommissioning, a State Company formed in 2003 to decommission the nuclear facilities at Risoe National Laboratory.

The objective of this Special Issue of the *International Journal of Emergency Management* is to discuss both the interplay between monitoring and modelling of radiation levels following a nuclear or radiological emergency and their use in decision-support systems for emergency management. In the event of widespread radioactive contamination or even the threat of such, good emergency management needs a continuous assessment of the radiological situation. Only a reliable estimate of the radiation and contamination levels allows an adequate response.

Both monitoring and modelling are needed to assess the radiological situation. In the early phase of a nuclear accident, radiological assessment must necessarily be based, first of all, on model predictions combined with some indication of the radionuclide source term. Modelling alone, however, will not capture the complex radionuclide transport patterns associated with atmospheric dispersion, deposition and transfer to the human food chain, but must be supplemented by measured radiation and contamination levels.

Later, as large numbers of radiation and/or contamination measurements become available, the assessment will be increasingly based on these new data, to a large degree ignoring previous model forecasts. On the other hand, monitoring data themselves do not allow extrapolation to space-time coordinates other than where and when the measurements are performed. Relying on sparse measurement data may give a false picture of the radiation hazard. Rather, during an evolving accident, one should aim at combining modelling forecasts with radiation measurements, for example, through data assimilation schemes. In such schemes one exploits previous forecasts to update the radiological assessment as new data becomes available.

In Europe and in the USA, decision-support systems have been developed that allow for incorporation of both model forecasts and measurements. The interplay between these different types of data and approaches to the resolution of conflicting data, has still not been adequately addressed. Unsolved questions remain on how to merge different types of data or even on how to move from a modelling to monitoring-based assessment. The introduction and presentation of uncertainties related both to the model forecasts and to the measurement data will be a central issue in resolving disparate data and model calculations. A large number of models have been devised or are currently being developed to address different scenarios for data acquisition. Only a few types of model, however, have found their way into actual decision-support systems used to assist decision-makers in the emergency management process. These issues all deserve the attention of researchers in the field of emergency preparedness.

In this Special Issue two invited papers describe monitoring techniques and strategies in Europe and in the USA following a nuclear or radiological emergency and give a European and a US perspective on the emergency response structure and the application of the measurements in assessing the radiological consequences. Differences are found between the USA and the European approaches, for example, the use of dose limits for practices in an emergency situation in the USA, compared with the use of intervention levels in terms of avertable dose in Europe. A third invited paper on decision support in nuclear or radiological emergency situations reviews the achievements on the incorporation of models in decision-support systems. It raises the important question if too much emphasis is being placed on the modelling aspect of decision-support systems and suggests that the emergency management community should pause and consider priorities for developing such systems.

A number of scientific/technical papers cover specific topics related to environmental radiation and contamination monitoring, modelling the dispersion and transport of radionuclides in various human exposure pathways and the use of model forecasts and monitoring data in decision-support systems. Throughout, the emphasis has been on accidental atmospheric releases from nuclear installations, but also radiological accidents including orphan radioactive sources and acts of terrorism using radioactive materials are dealt with.