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Title

An investigation of the effectiveness of sheltering versus evacuation

Authors – Please underline corresponding author

J Sherwood[1], K Mortimer[1], T Charnock[1], S Haywood[1], T Hamburger[2], F Gering[2]

1 Public Health England (PHE), UK
2 Federal Office for Radiation Protection (BfS), Germany

Text

This is an international collaboration between PHE (UK) and BfS (Germany) to investigate whether sheltering or evacuation is the consistently better

countermeasure option for reducing exposure of the public in the event of an airborne release of radioactive material. The study compared the dose reduction potential of the two countermeasures for the scenario of an accident at a nuclear power plant over a wide range of weather conditions, source term characteristics, evacuation routing and location options.

The collaboration involved two different modelling approaches. Both methodologies are based on consistent input parameters (including the release source term) as much as possible and include a large set of simulations to probabilistically assess the influence of atmospheric dispersion in a wide range of weather conditions. The method used by PHE employed the PACE (Probabilistic Accident Consequence Evaluation) tool to model atmospheric dispersion and dose rates and a subsequent network analysis tool to generate realistic evacuation routes based on real road networks. The BfS approach used the RODOS (Real time On-line DecisiOn Support) tool to model atmospheric dispersion and resultant doses with simplified evacuation routes.

It is clear from the results that the performance of one countermeasure against another is dependent on the circumstances and geographical features around the release. One major factor next to the total magnitude of the release is the impact of the duration of release: for longer releases, evacuation is likely to be a more attractive option. Probability distributions have been created that display the extremes and most common equivalent results from the two countermeasure regimes. Some broad conclusions about the effectiveness of sheltering versus evacuation for a combination of local properties can be made on the basis on these. Significantly, it has been demonstrated that under the circumstances considered in this study neither the evacuation or the sheltering option is consistently the best. Under some circumstances, evacuation results in larger radiological impact and in other circumstances sheltering gives rise to greater impact.

Importantly, consideration is also given to factors affecting the favourability of countermeasures other than reduction of radiological exposure. Some of the risks associated with evacuation – such as road traffic accidents, moving people with special care needs – are not quantified in this assessment but are relevant, potentially increasing the favourability of sheltering as either a stand-alone countermeasure or as a precursor to evacuation.

Further work is planned to investigate a wider range of source term configurations and evacuation routing options, for example allowing routes and evacuation centres to be adapted in the light of more (but still uncertain) information about the plume direction.