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Title

Building a dataset for near-range validation of dose rate estimations from atmospheric dispersion calculations

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Text

For real-time dose and impact assessments based on atmospheric dispersion modelling during a nuclear or radiological event the knowledge of the released quantities to the atmosphere as a function of time is of utmost importance. If this source term and/or its time evolution is not available from, for instance, stack monitoring, source term estimation or data assimilation techniques based on measured data in the environment can complement the missing information. Data from early warning stations, installed around nuclear installations (fence monitoring), are optimal for this purpose because of the short time delay they allow a fast feedback between measurements and models. However, for the development of and building confidence in models and data assimilation techniques, validation datasets of high quality are required. Although far below any health standard, routine releases from specific nuclear installations in combination with environmental monitoring can offer datasets over extended periods covering for instance a large range of meteorological conditions.

In this paper we discuss the construction of a data set based on the routine releases of the Belgian Reactor 1 (BR1) at the Belgian Nuclear Research Centre (SCK•CEN), gamma sensors of the environmental network at SCK•CEN, fence monitoring stations comprising NaI(Tl) detectors of the TELERAD early warning network of the Belgian Federal Agency for Nuclear Control (FANC-AFCN) and on-site meteorological data from a meteorological tower. All these data are collected with a relative high temporal resolution (5-10 minutes) and are available for many years. Although far below any regulatory limits, during operation, the released Ar-41 which is produced by neutron activation of Argon in the reactor air stream (air-cooled, graphite moderated reactor) can give rise to limited but increased dose rate levels in the surrounding environmental stations. The spectroscopic capabilities of the fence early warning stations allow to correlate increased dose rate levels with Ar-41 releases. Dose rate results are also in emergency situations the primary data available.

The use of the data set for model validation will be illustrated based on calculation results with different atmospheric dispersion models. Because of the proximity of the environmental measurement stations to the point of release, the BR1 chimney, building effects and 3 dimensional extent of the plume can have an influence on the dose rate from the plume. Also the possibility of collecting high temporal resolution monitoring data (at the level of seconds) for dedicated time periods with large volume detectors, complementing the standard data set, for studying the variability of the dose rate at the near-range will be discussed. Finally, a short overview will be given of other potential locations for collecting similar data sets allowing model and data assimilation validation for different environments, radionuclides and meteorological conditions.