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Abstract title: Use of relative doses for estimation of the air pollution event consequences following a release into the atmosphere from a nuclear plant or SEVESO accident

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Abstract text

Nuclear power plants must implement accident prevention measures. This has been a pressing issue when implementing security upgrades since Fukushima. Despite upgrades, plants must be prepared to protect the population should accidental emissions into the atmosphere occur.

A criterion for assessing the impact on the population is the dose received by each individual. The dose has to be calculated for the geographical locations in the immediate vicinity of the plant. The key data for calculating the dose are the calculation of dispersion in the atmosphere and determination of the source term (emission). At the beginning of an accident the source term is usually unknown and its determination is not trivial. To quickly ascertain the form of radioactive cloud dispersion, US NRC Regulatory Guides have introduced the calculation of relative concentrations (dilution coefficients), which calculate pollution dispersion in the atmosphere with a unit emission, which is constant from – infinity to + infinity.

As this simplification is not valid for actual situations when a limited emission of substances occurs with a known beginning, predicted end and a known temporal form, a different way of calculating “relative doses” is recommended.

The article presents the theoretical introduction of relative doses, which enable a normalized calculation of the atmospheric pollution event following a release from a nuclear plant. This enables us to calculate the right dose as soon as emission is determined. Formulas for relative dose calculation have been developed for the impact of radionuclide inhalation, cloud radiation and deposition (the last two do not apply to non-radioactive materials).

The article also demonstrates the practical implementation of calculations. It presents the possibilities for use in case of accidents, during training, and in an advance or periodic assessment of the intensity of potential impact on the local population (e.g. in a USAR document).

This can be applied to the non-nuclear industry as well, e.g. for examining SEVESO events, where we encounter the problem of emission not being available on time. It can also be used for "classic" air pollutants to better assess their impact on the health of the population.

Motivation

Establish common frame for evaluation procedure for air pollution events where detail quantified emission is not known immediately (nuclear accident, SEVESO accident).

Dose calculation is important for proper determination of health effects for exposure to radionuclides and to other toxic substances.

The purposed method solves many practical troubles when handling air pollution emergency situation.