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Assessment of possible airborne impact from risk sites: methodology for probabilistic atmospheric studies

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Abstract. The main purpose of this study is to develop a methodology for a multidisciplinary nuclear risk and vulnerability assessment, and to test this methodology through estimation of a nuclear risk to population in the Northern European countries in case of a severe accident at the nuclear risk sites. For assessment of the probabilistic risk and vulnerability, a combination of social-geophysical factors and probabilities are considered. The main focus of this paper is the description of methodology for evaluation of the atmospheric transport of radioactive releases from the risk site regions based on the long-term trajectory modeling. The suggested methodology is given from the probabilistic point of view. The main questions stated are: What are probabilities and times for radionuclide atmospheric transport to different neighbouring countries and territories in case of the hypothetical accidental release at the nuclear risk site? Which geographical territories or countries are at the highest risk from the hypothetical accidental releases?

To answer these questions we suggest applying the following research tools for probabilistic atmospheric studies. First tool is atmospheric modelling to calculate multiyear forward trajectories originated over the sites. Second tool is statistical analyses to explore temporal and spatial structure of calculated trajectories and evaluate different probabilistic impact indicators: atmospheric transport pathways, airflow, fast transport, typical transport time, maximum possible impact zone, maximum reaching distance, etc. These indicators are applicable for further GIS-analysis and integration to estimate regional risk and vulnerability in case of accidental releases at the risk sites and for planning the emergency response and preparedness systems.

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