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Mathematical model of atmospheric dispersion and module for the calculation of radiation doses

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This paper presents an algorithm for the calculation of internal and external doses, which is an integral part of the mathematical model of atmospheric dispersion. Results of modeling were compared with values from an IAEA publication for a given scenario of radionuclide emission to the atmospheric boundary layer. Due to small differences in the results, compared to the IAEA recommended model, model presented in the paper can be used as a basis for this type of analysis. In order to illustrate the application of this mathematical model using data of the hypothetical emission of radionuclides, ventilation parameters, then 3D topography and meteorological data, field of total annual dose received by a hypothetical resident in the vicinity of the reactor, during its routine operation over one-year period is presented. This study presents fields of activity concentration in air, deposition on soil and field of total annual dose to a hypothetical resident in the vicinity of nuclear reactor,contaminated by air. In the analysis is used computer code based on straight line Gaussian model for atmospheric dispersion, under conservative assumptions about the continuous operation of nuclear reactors and on the strength of the source based on the inventory of radionuclides that are for one year continuously emitted into boundary layer of the atmosphere. Based on this results, it can be concluded that a nuclear reactor, under stated conditions of its operation, could not influence the environment above the limit values of 10 μSv.

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