Application of the COSMYA Code for Comparative Analysis of a Certain Accidental Release of Radioactivity

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Abstract

Both COSYMA and MACCS codes are included in the list of program tools being used at EGP Prague or IITA (the institute is a member of MACCS User Group) in the field of nuclear safety calculations. The first part of this paper relates to the unification of the local input data. Within the process of adaptation of the software on the Czech conditions there is a certain effort to unify the local data for common use in all bunch of the programs. As detailed as possible primary input data were collected and pre-processed to the formats suitable for the respective codes. Detailed gridded data for elevations, landuse (and land fraction), surface roughness and population were collected for both localities of the Czech nuclear power stations Dukovany and Temelin.

In the vicinity of 160 x 160 km around the NPPs the information is given in high resolution on the tiles 0.0025 dec. deg. latitude and 0.0025 dec. deg. longitude. A set of conversion programs enables to transform the data for proper polar coordinations required by COSYMA, MACCS and other codes. Then, the realistic local input data for landuse, roughness and population are constructed for a given windrose and selected number of radial zones around the source of pollution. In addition, the reconstruction of the rough data for agricultural production primarily given only such an average district values are transformed to the calculation grid when using the associated database of landuse characteristics.

The second part of this report presents the results of an intercomparison of code HAVAR and COSYMA for case of postulated Large Break Loss Of Coolant Accident (LB-LOCA) scenario closely connected with the WWER 1000 reactor configuration. The deterministic calculations are provided for a single set of "worst case" atmospheric conditions. Input data for the LB-LOCA scenarios are adjusted in order to reach reasonable conditions for the final comparison of the HAVAR and COSYMA results. Near-ground activity concentrations of radionuclides in air and their time integrated values together with the activity deposited on the ground for each radionuclide are calculated and then the various kinds of doses are generated. Contributions of each irradiation pathways are analysed and uncertainties resulted both from model parameters and conversion coefficients are discussed.

The preparation of local input data for the probabilistic COSYMA calculations has been started. Time series of meteorological measurements, originally used for the construction of annual weather statistics, are now adjusted into the proper format for the COSYMA probabilistic calculations.