MONTE CARLO METHOD APPLICATION FOR NEUTRON TRANSPORT CALCULATIONS IN IFMIF-DONES NUCLEAR SAFETY ASSESSMENT

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The International Fusion Material Irradiation Facility DEMO-Oriented Neutron Source (IFMIF-DONES) is an accelerator based d-Li neutron source which aims at the qualification of materials at the fusion irradiation conditions. IFMIF-DONES is a complex nuclear facility. In order to assure safe operation and exploitation, Monte Carlo method based codes are used for safety analyses. Monte Carlo method allows simulation of physical experiments in realistic objects. Distribution function is used to repeatedly take random samples in order to obtain numerical results and the method is based on the law of large numbers and the central boundary theorem. This paper presents neutron transport equations and the application of Monte Carlo method as well as subsequent activation analysis.

The neutron-induced activities and dose rates at shutdown were calculated by the means of FISPACT-2010 code with data from JEFF-3.1.2 nuclear data library. Neutron fluxes and spectra were obtained with MCNP neutron transport calculations. The activities and the dose rates were calculated at the end of the irradiation and for further cooling times of 0s, 1s, 5 min., 30 min., 1 h., 3 h., 5 h., 10 h., 1 day, 3 days, 1 days, 2 weeks, 4 weeks, 8 weeks, 181 days, 1 year, 10 years, 100 years, 300 and 1000 year. In addition, radionuclides with contribution for at least 0.5% to the total value of activation characteristics at previously mentioned cooling times were identified.