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TRANSPORTATION CASK AND CONCRETE MODULE DESIGN FOR MANAGING NUCLEAR SPENT FUEL PRODUCED IN BUSHEHR NUCLEAR POWER PLANT

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Bushehr Nuclear Power Plant, commercially operated in Sep 2013, is a Russian type VVER 1000/446; its reactor core consists of 163 fuel assemblies which have 3 up to 4 years'fuel life time. In this pressurized water reactor, removed spent fuel assemblies are transferred into a pool near the core. This pool has been designed to store spent fuels for 9 years and after this period, this pool will reach its maximum storage capacity and spent fuel assemblies will be transferred away from the reactor. The aim of this study was to design a safe and economic approach to manage spent fuel assemblies before the pool reaches to its maximum storage capacity. The study conducted in 3 stages. In the first stage, gamma and neutron flux calculated for spent fuel assemblies have 47000 burnup, 4.2 % enrichment, 4 years fuel life time and 3 and 6 years cooling time by using Origen 2.1. Dose rate and criticality by dint of Origen output were investigated for spent fuel assemblies by means of MCNPX 2.6. In the second stage, the thickness of transportation cask including stainless steel canister and the main body of the carbon steel cask was determined. Based on limitation in casting and fabrication in Iran, twelve fuel assemblies were considered for capacity of a transportation cask. Finally, the concrete module with 36 spent fuel assemblies capacity including 3 canisters and each canister contains 12 assemblies was designed. According to results, the thickness of stainless steel canister and the carbon steel cask were determined 2 cm and 35.5 cm respectively. Dose rates on the surface and 2 meter from the surface of the canister were calculated 5.23E+05 mSv/hr and 8.22E+04 mSv/hr respectively. Neutron multiplication factor was obtained 0.31463 for cask filled by air. Also, the dose rates obtained on the surface of the cask and in 2 meter from cask surface were about 10.21 μSv/h and 4.56 μSv/h respectively. It should be noted that these derived values met transportation regulations approved by Iran Nuclear Regulatory Authority. In addition, maximum dose rates on the surface and 2 meters from the surface of the concrete module were obtained 0.011 mSv/hr and 0.192 mSv/hr for front side (door side) and roof side respectively.

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Yes

Country or International Organization

Iran, Islamic Republic of

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