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Shielding analysis for the In-Flight Fragment target facility of the RAON complex in Korea

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The In-Flight Fragment (IFF) target facility of the heavy-ion accelerator facility complex, named RAON, is under a construction in Korea. It is planned that various rare isotope beams will be produced using by the IFF target. In this study, the radiation shielding analysis for the IFF target facility was performed. At first, conservative neutron source term was evaluated with the candidate beam-target conditions and as a result, the neurons produced from the nuclear reaction of the oxygen beam and graphite target was applied as the source term for the prompt shielding calculation. In the shielding calculation, design optimization of the shield and facility walls was performed while the design satisfies the domestic regulations about the exposure for the radiation workers and public. The combination of the iron and concrete was used as the high energetic neutron with a few hundred of MeV. In the activation analyses, induced activities for the air, coolant, equipment (target and beam line), iron shield and concrete walls were estimated and finally and decay gamma dose distribution was calculated. To reduce tha activation concentration in the air, additional shield was installed around the IFF target. Additionally, skyshine dose, soil activation and ground water migration were analyzed to evaluate the public exposure level around the facility. The PHITS ver.2.64 and MCNPX ver.2.7 were used in the particle transport calculations. DCHAIN/SP-2011 and Advantg ver.3.1 were used in the activation calculation and weigh window generation, respectively. As a result, the radiation shielding design was determined for the IFF target facility of the RAON complex, being expected the exposure level under 10 mSv/yr and 0.5 mSv/yr for the radiation workers and public, respectively.

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