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Radiation Dose Assessment in RAON ISOL building Due to Production of Rare-Isotope Beams

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A Korean heavy-ion accelerator complex called RAON is currently under development. Isotope Separation On-Line (ISOL) system can produce rare isotope (RI) beams of high purity and intensity by shooting 70 MeV proton beam from cyclotron driver onto a Uranium Carbide (UCx) target to induce nuclear fission reaction process and it is preferentially considered in order to produce RI beam in RAON. The RI beams are transported into Superconducting Linac 3 (SCL3) for acceleration through pre-separator room and RIB separation and transportation room (RIB-STR). Normally, the pre-separator room is considered to be extremely high-level radiation zone. Because most of the unwanted contaminants from UCx is removed in pre-separator room besides desired isotopes for ISOL system. During the transport of RI beams, those are likely to be deposited in pre-separator room. Therefore, RI beams are important radiation source to be protected as well as prompt neutrons from UCx target on operation. In addition, RIB-STR has several components that help to prepare acceleration of RI beams such as RF cooler buncher, EBIS charge breeder, and A/q separator. The RI beams can be either leaked in the beamline or deposited in the several main components in the middle of transportation. For safe operation of ISOL, radiation safety by accumulation of RI beams should be carefully reviewed in pre-separator room, RIB-STR, and near the RI beam line. However, it is not easy to evaluate the residual dose occurred from accumulation of RI beams due to absence of an established analytical method in RI production and transportation system like both ISOL and IF. So, we have developed the analytical method and evaluated the radiation dose in ISOL building due to RI beams transportation and accumulation.

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