

Shielding Design and Dose Assessment for the Transport Vehicle of Radioisotopes Produced at the Jordan Research and Training Reactor

Demand for Jordan Research and Training Reactor (JRTR) radioisotope products is rising, requiring round-the-clock transport scheduling to ensure timely delivery, especially for short-lived isotopes. JRTR now transports its products using its own vehicles. Radiological Protection (RP) measures are taken during the transport of Radioactive Material (RAM) to protect both personnel and the public nearby. One such measure is the installation of shielding within the transport vehicle, including shielded boxes and driver back shields. This paper presents the shielding design and dose assessment for the new JRTR RAM transport vehicle. A conservative methodology was employed, utilizing three independent computational tools—the Monte Carlo code (MCNP), the hybrid Monte Carlo and deterministic approach code (MAVRIC), and the point-kernel code (MicroShield)—to simulate radiation transport and determine the required shielding configuration. Furthermore, a systematic assessment of the annual effective dose to the transport team from the transport activity was conducted, based on the expected source terms of JRTR-produced radioisotopes. Simulations identified optimal shielding thickness and placement based on peak dose rates among the used calculation tools. The final design ensures robust compliance with regulatory dose limits, effectively mitigating uncertainties inherent in the simulation methodologies and nuclear data. Considering the results of the conducted simulations, regulatory requirements of annual doses, operational conditions, and JRTR applied ALARA principle, a 0.2 cm lead for the wooden boxes, and a 0.4 cm lead behind the driver cabinet are installed in the transport vehicle.

Country or International Organization

Instructions

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