Shielding Outlines of a High Activity ^{241}Am-Be Multi-Source Mixed Field Irradiation Facility

N.A. Kotb[a], A.H.M. Solieman[b], T. El-Zakla[a], T.Z. Amer[c], S. Elmeniawi[c] and M.N.H. Comsan[b]

[a]Radiation Protection Department, Hot Laboratories Centre, Atomic Energy Authority, Egypt
[b]Experimental Nuclear Physics Department, Nuclear Research Centre, Atomic Energy Authority, Egypt
[c]Physics Department, Faculty of Science, Al-Azhar University, Girls Branch, Cairo, Egypt

This study investigates shielding strategies for a complex irradiation facility consisting of six ^{241}Am-Be neutron sources of 30 Ci total activity and 6.6×10^7 n/s total neutron yield. The study's main objective is to optimize the shielding layers of the previously planned neutron irradiation facility. Materials are chosen according to their particular characteristics and the way they react to gamma and neutron radiation. While certain materials are good at absorbing thermal neutrons, others behave well as neutron moderators. Furthermore, some high-density materials are good at absorbing gamma rays which are released during the process. The primary objective is to ensure that absorbed doses remain within recommended limits for worker safety, as per ICRP guidelines. To achieve the optimum shielding design, a Monte Carlo simulation technique was employed using the MCNP-5 code. At the end of the simulation, we chose the best design based on our main goal, which is to create a shield that keeps absorbed doses for occupational exposure within the ICRP's suggested limits. The three main factors that drive this selection process are making the most use of the materials that are readily available and efficient, maintaining a minimum volume, and minimizing the facility's weight as much as is practical.

Keywords: ^{241}Am-Be irradiation facility, neutron and gamma shield design, ^{241}Am-Be neutron and gamma spectra, dose rate calculation, MCNP-5.