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Application of Monte Carlo Techniques to Dose Rate Calculations of Gamma Irradiation Facility

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Monte Carlo simulations for a gamma irradiation facility of Turkish Atomic Energy Authority's Sarayköy Nuclear Research and Training Center (SANAEM) in Ankara, Turkey are carried out to calculate dose rate inside and outside of the irradiation room. MCNP Monte Carlo code is employed. Various variance reduction techniques that are effective not only on random walk sampling but also on calculation results are investigated to improve analog Monte Carlo results which have large relative errors and failed statistical checks of the MCNP code. Several variance reduction techniques are introduced and key points on their applications are discussed. It is observed that variance reduction techniques are very effective enhancing the calculation results with a reasonable number of particles so that time consuming simulations are avoided. All simulations are completed with results having a relative error less than 5 %, a variance of the variance less than 10 %, and all statistical checks being passed. The dose rate calculations show that 200 cm concrete wall results in very low dose rates outside of the irradiation room therefore proposed gamma irradiation facility is very well shielded.

Country or International Organization

Turkey

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