

Monte Carlo Simulation for Safety and Security Assessment of Radioactive Material Transport Packages

Ensuring the safe and secure transport of radioactive material requires robust evaluation methods that address both regulatory requirements and practical operational challenges. This work explores the application of Monte Carlo simulation codes, specifically MCNP and PHITS, to support safety and security assessments of transport packages across different modes of transport. The study investigates shielding design, dose evaluation for workers and the public, and potential exposure scenarios under both normal and accident conditions. Special attention is given to the optimization of package design, including innovative materials and geometrical configurations, to ensure compliance with international standards and reduce effective dose. By comparing simulation results with regulatory dose limits and safety guidelines, the study demonstrates how computational modeling provides a reliable decision-support tool for regulatory bodies, package manufacturers, and operators. This contribution also highlights the role of simulation in facilitating harmonized practices among Member States by improving transparency, knowledge sharing, and confidence in safety margins. Overall, the integration of Monte Carlo methods into transport safety assessments strengthens international cooperation and supports the continuous improvement of radiological protection measures in the transport of nuclear and radioactive material.

Keywords: Radiological protection, transport safety, Monte Carlo simulation, MCNP, PHITS, shielding optimization, regulatory compliance.

Country or International Organization

Instructions

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