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SHIELDING CALCULATIONS OF THE VVR-SM RESEARCH REACTOR WITH ENHANCED MONTE CARLO TECHNIQUES

The VVR-SM research reactor, operated by the Institute of Nuclear Physics, serves a pivotal role in scientific research and medical isotope production. Accurate shielding calculations are critical to ensure the safety of both personnel and the surrounding environment. This study utilizes advanced Monte Carlo techniques, specifically employing the OpenMC code, to perform detailed shielding analyses of the reactor. The Monte Carlo method's capability to accurately model complex geometries and heterogeneous materials makes it ideal for this application. The analysis includes simulations of neutron and gamma-ray transport through various shielding configurations, evaluating different materials and thicknesses to optimize radiation protection while balancing cost and structural feasibility.

Our findings highlight the enhanced predictive accuracy achieved through the use of state-of-the-art Monte Carlo techniques, allowing for precise estimation of radiation dose distributions within and around the reactor facility. The study also explores the impact of different shielding materials on neutron and gamma attenuation, providing insights into the most effective configurations for minimizing radiation exposure. The integration of these advanced computational tools into the shielding design process demonstrates significant improvements in radiation safety standards, setting a benchmark for future reactor safety assessments.

This research contributes to the broader field of nuclear reactor safety, emphasizing the importance of utilizing advanced simulation tools in the design and evaluation of radiation shielding. The application of OpenMC, a state-of-the-art Monte Carlo code, is particularly noted for its flexibility and accuracy in complex simulations, supporting the ongoing development of effective shielding solutions for nuclear facilities.

References:

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Section

Radiation ecology and methods of analysis (Section 3)

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