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Estimation of Neutron Flux Distribution in Bandung TRIGA 2000 Reactor Core Components: A Focus on Biological Shielding and its Implications for Decommissioning Planning

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The Bandung TRIGA 2000 Research Reactor, a TRIGA Mark II-type facility upgraded to 2 MW in 1996, is currently undergoing preparations for decommissioning in accordance with national regulatory requirements. One of the critical components in this process is biological shielding, which serves as a protective barrier against neutron and gamma radiation. Accurate estimation of neutron flux distribution within this shielding is essential for assessing activation levels, classifying radioactive waste, and determining appropriate dismantling strategies. This study utilizes OpenMC Monte Carlo simulations to estimate neutron flux distribution across the biological shielding by segmenting the structure into 0.25 m^3 concrete cells aligned with planned dismantling units.

Simulation results across operational configurations 93 to 100 reveal that neutron flux peaks occur near tangential and piercing beam ports, where values exceed 2.3×10^{10} $cm^{-2}s^{-1}$, particularly in configuration 93. These localized flux maxima are attributed to neutron streaming effects, confirming the need for geometry-specific analysis. In contrast, outer shielding cells consistently register neutron flux below 10^6 $cm^{-2}s^{-1}$, indicating minimal activation potential. A clear attenuation trend is observed in both spatial and temporal domains, as neutron flux decreases with distance from the core and across successive reactor configurations.

These findings highlight the significance of incorporating spatial partitioning and historical operational data into decommissioning assessments. The high-resolution flux data enable targeted dismantling efforts, optimized waste classification, and enhanced radiological safety. Furthermore, the results demonstrate the utility of advanced simulation tools for reactor-specific decommissioning planning, reinforcing the need for tailored radioprotection strategies in zones with elevated neutron activation.

Technical Track

Research Reactors

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