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Thermal Performance Modeling of Deep Geological Repositories for High-Level Nuclear Waste in Bangladesh

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This study investigates the thermal behaviour of deep geological repositories (DGRs) designed to isolate high-level radioactive waste (HLW) and spent nuclear fuel (SNF) in Bangladesh. Given the long-term heat generation from radioactive decay, understanding temperature evolution within the repository is crucial for safety and design optimization. Using ANSYS software, this study simulates the heat transfer process from waste canisters into surrounding engineered and geological barriers, focusing especially on bentonite buffers and different regional clay types found in Bangladesh. The research compares two types of heat source models: line heat source and volumetric heat generation. It also evaluates various initial decay power levels to reflect realistic reactor waste scenarios. The study incorporates regional clay data such as smectite, Illite, and kaolinite; to assess their thermal performance under repository conditions. The key findings show that both the type of clay and the waste's initial heat output strongly influence the surrounding repository temperature by about 50–100℃ and 10–20℃, respectively. Illite-kaolinite-rich regions show better thermal insulation, whereas Smectite results in higher peak temperature of 324℃. Overall, this study offers a region-specific thermal assessment for nuclear waste disposal in Bangladesh. It highlights how geological variation influences repository safety and provides guidance for future repository site selection and engineering design. The work will contribute to the long-term nuclear waste management strategy of Bangladesh and emphasize the importance of localized modelling in nuclear safety assessments.

Technical Track

Fuel Cycle and Waste Management

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