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GEANT4 Simulation of passive water shielding for low-level radioactivity measurements

GEANT4 Monte Carlo toolkit was used to design a passive water shielding to reduce back-ground radiation from the measurement environment reaching the detectors. The shield was then constructed using a large water tank allowing detectors to be mounted inside the shield. Measurement were performed using two LaBr3:Ce detectors without shielding and the same two LaBr3:Ce detectors inside the constructed water shield. Measurements were also carried out using a NaI:Tl detector without shielding and inside the water shield. Both the simulated and measured results show that the water shield attenuates 2614.5 keV (208Tl/232Th series) gamma rays by 90 %. This energy is the maximum full-energy peak centroid in the gamma-ray spectrometry spectrum of naturally occurring radioactive material (NORMs).

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