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Measurements of natural radioactivity in sands using an array of lanthanum -bromide scintillator detectors

LaBr3:Ce detectors have been shown to be 1.2–1.65 times more efficient than NaI:Tl detectors above 350 keV, for 3.8 cm×3.8 cm (1.5 in.×1.5 in.) detectors and have an energy resolution of 2.5–3% at the 662 keV gamma-line of 137Cs, compared to 6–7% for NaI:Tl detectors[1]. The detector crystal has other advantages such as a high scintillation light output with a fast decay time[2]. An array of 8 2in x 2in LaBr3(Ce) scintillators with an XIA PIXIE-16 Digital Signal Processing system data acquisition system will be used to measure sands placed in the centre (17.5 cm from each detector) of the array (with all detectors lying in the horizontal plane) for 12 hours. The gamma-gamma coincidence method has the advantage of virtually eliminating all background peaks that do not exist in coincidence with other peaks, significantly improving detection limits of useful radionuclides[3][4]. By employing a gamma-gamma coincidence condition, the background from the radioisotopes in the LaBr3:Ce scintillator is eliminated, providing a means for improving detection limits[5]. The absolute gamma–ray energy detection efficiency of each detector will be determined and compared. Data from each detector will be analyzed. The activity concentration of 238U, 232Th and 40K in the sands will be determined and compared to certified values. Radiation hazard indices will be calculated for the soil samples and compared to certified values.

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