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Low level counting using a NaI(Tl) detector

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In this work a 7.5 cm x 7.5 cm NaI (Tl) detector was used to study activity concentrations of primordial radionuclides in soil and sand samples. The detector and the sample were placed inside a lead castle to reduce background measurements from the surroundings such as the wall and the floor. The samples were placed inside a 1L Marinelli beaker which surrounds the detector for better relative. Additional lead bricks were placed below the detector to further reduce the background by 10A Full Spectrum Analysis (FSA) method was used to extract the activity concentrations of ^{238}U , ^{232}Th and ^{40}K from the measured data. The FSA method uses standard spectra corresponding to the radionuclides being investigated, which are multiplied by the activity concentrations and then added to fit the measured spectrum. Accurate concentrations are then extracted using a chi-squared (χ^2) minimization procedure. Eight samples were measured using the NaI detector and analyzed using the FSA method. The samples were measured for about 24 hours for good statistics. The ^{238}U activity concentration values varied from 10 ± 2 Bq/kg (iThemba soil, HS6) to 256 ± 10 Bq/kg (Kloof sample). The ^{232}Th activity concentration values varied from 7 ± 1 Bq/kg (Anstip beach sand) to 45 ± 5 Bq/kg (Rawsonille soil B31). The ^{40}K activity concentration values varied from 45 ± 27 Bq/kg (iThemba soil, HS6) to 120 ± 9 Bq/kg (Rawsonille soil, B28). The χ^2 values also varied from sample to sample with the lowest being 0.13 (Anstip beach sand) and the highest being 6820 (iThemba soil, HS1). A high χ^2 value usually represents incomplete gain drift corrections, improper set of fitting functions, proper inclusion of coincidence summing or the presence of anthropogenic radionuclides.

Level (Hons, MSc, PhD, other)?

Msc

Consider for a student award (Yes / No)?

Yes

**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

No

Primary author: Mr NONCOLELA, Sive (UWC)

Co-author: Prof. LINDSAY, Robert (UWC)

Presenter: Mr NONCOLELA, Sive (UWC)

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