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Assessing the impact of phosphate rock storage on uranium and thorium concentration in soil samples from Richards Ray using Neutron Activation Analysis.

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Uranium-238 (U-238) and thorium-232 (Th-232) are the parent primordial nuclides who along with their progenies are sources of radiation exposure to which humans are exposed directly or indirectly. U-238 decay to Pb-206 after 14 different alpha or beta decays, while Th-232 decay series terminate at Pb-208 after 10 successive alpha or beta decays. In this study, gross alpha and beta activity concentration of sixty (60) soil samples collected from 30 sampling sites around a phosphate rock storage facility at Richards Bay were first performed using a gas flow proportionality counter to estimate the total activity of each sample without regards to specific nuclides. The samples were further analyzed for U-238 and Th-232 concentration using neutron activation analysis (NAA). The samples were irradiated by thermal neutrons with a neutron flux of about 7 × 1011 ncm-2.s in NECSA's nuclear research reactor (SAFARI 1). The maximum and minimum gross alpha activity for the soil samples analyzed were obtained to be 5692 Bq.kg-1 and 34 Bq.kg-1 respectively with a mean of 597 Bq.kg-1. Similarly, 4072 Bq.kg-1 and 24 Bq.kg-1 were obtained to be the maximum and minimum values of gross beta activity concentrations respectively with a mean of 518 Bq.kg-1. A correlation coefficient of 0.658 indicating a strong correlation among U-238 and Th-232 concentration was established. Furthermore, specific activities of U-238 and Th-232 in a reference phosphate rock samples were analyzed and obtained to be 118 Bq.kg-1 and 783 Bqkg-1 respectively. These activity concentrations of these primordial radionuclides (238U and 232Th) in the analysed samples were found to be below the limits set out by International Council on Radiation Protection (ICRP).

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Primary author: Mr MASOK, FEILIX (University of Johannesburg)

Co-authors: Dr MAVUNDA, Dazmen (Necsa/UJ); Prof. WINKLER, Hartmut (Dept. Physics, University of Johannesburg); Dr MASITENG, Paulus (University of Johannesburg); Dr MALEKA, Peane (iThemba LABS)

Presenter: Mr MASOK, FEILIX (University of Johannesburg)

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