

Assessment of Shielding Potentials and Radiological Safety Indices of Nigerian Granite Rocks

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Abstract

The activity concentration of primordial radioisotopes (^{238}U , ^{232}Th and ^{40}K) in granite rock samples from Minna, North central Nigeria were measured using a sensitive HPGe detector for gamma spectrometric measurement. Five granite rock samples were collected from Maikunkele, Bosso, Maitumbi, Chanchaga and Paiko areas of the town. The average activity concentrations for the radionuclides in the rocks were: 27 ± 4 Bq/kg; 48 ± 7 Bq/kg and 874 ± 86 Bq/kg for ^{238}U , ^{232}Th and ^{40}K respectively. The average absorbed dose rate, effective dose; radium equivalent (R_{eq}) and internal hazard index (H_{in}) were 65 ± 10 nG/h; 0.32 ± 0.05 mSv/y; 140 ± 21 Bq/kg and 0.45 ± 0.07 respectively. All the rock samples had R_{eq} less than the recommended safety value of 370 Bq/kg. All evaluated radiological safety indices fell within the recommended safety limits and world average values. The analysis of radionuclide content of the granite rocks showed that they do not pose environmental radiation risk to humans when used as structural shielding materials. Mass attenuation coefficients of the granite samples evaluated via the WinXcom computer code suggested that the granite rocks considered have good shielding capacity comparable to that of ordinary concrete.

Keywords: Radionuclide; radiation effect; shielding; dose assessment; granite

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Received: 2018/11/26

Accepted: 2019/02/03

DOI: <https://dx.doi.org/10.4314/njtr.v14i2.11>