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Natural Radioactivity in soils of Ijero, Nigeria: measurements and risk assessment

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Soil samples were obtained from Ijero, Nigeria where the chemical and radiotoxicity of soil is under question due to ongoing and unprofessional mining activities. The soil samples were crushed, sieved, dried and sealed in identical cylindrical containers. The activity concentration of primordial radionuclides 238U, 232Th and 40K was measured using a High-Purity Germanium (HPGe) detector coupled with the Palmtop MCA. Subsequently, radiological risk factors were calculated to assess the risk, on average, to an individual living in Ijero.
The measured activity concentration for 238U ranged from 11.87±1.06 to 94.02±6.81 Bq/kg with a mean value of 40.76 Bq/kg. For 232Th the activity concentration ranged from 18.29±6.71 to 111.2±1.89 Bq/kg with a mean value of 43.59 Bq/kg. Finally, 40K ranged from 66.56±26.2 to 1195±35.8 Bq/kg with a mean value of 568.1 Bq/kg. Thus the mean values for the activity concentration of primordial radionuclides 238U, 232Th and 40K were higher than the global averages of 30 Bq/kg, 39 Bq/kg and 400Bq/kg respectively.
In total, 30 soil samples were evaluated. Of these samples, only 1 had hazard indices outside of the permissible limit of 1 mSv/yr. Exactly 10 samples were above the permissible limit for the Annual Effective Dose rate, where indoor and outdoor dose rates must sum to 1 mSv/yr. The Annual Gonadal Equivalent Dose limit of 300 μSv/yr was surpassed by 25 samples. For the Excess Lifetime Cancer Risk and Percentage Risk, 7 samples were outside of the 5% limit, with the highest risk at 61%. The average risk across all the soil samples was well below the limit. Therefore there are certain high risk locations where the activity concentration of primordial radionuclides is significant in Ijero, Nigeria.

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