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Spatial Distribution of Natural Radionuclides in Soil, Sediment and Waters in Oil Producing Areas in Niger Delta Region of Nigeria

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Abstract : Activity concentrations of natural radionuclides (226Ra, 232Th and 40K) in the soil, sediment and water of oil producing communities in Delta and Rivers States were determined using γ-ray spectrometry. The mean soil/sediment activity concentration of 226Ra, 232Th and 40K in onshore west in Delta state is 40.2±5.1Bqkg-1, 29.9±4.2Bqkg-1 and 361.5±20.0Bqkg-1 respectively, the corresponding values obtained in onshore east1 of Rivers state is 20.9±2.8Bqkg-1, 19.4±2.5Bqkg-1and 260.0±14.1Bqkg-1 respectively. While the mean activity concentration of 226Ra, 232Th and 40K in onshore east2 of Rivers state is 29.3±3.5Bqkg-1, 21.6±2.6Bqkg-1 and 262.1±14.6Bqkg-1 respectively. These values obtained show enhanced NORMs but are well within the world range. All the radiation hazard indices examined in soil have mean values lower than their maximum permissible limits. In drinking water, the obtained average values of226Ra, 228Ra and 40K is 8.4±0.9, 7.3±0.7 and 29.9±2.2Bql-1 respectively for well water, 4.5±0.6, 5.1±0.4 and 20.9±2.0Bql-1 respectively for borehole water and 11.3±1.2, 8.5±0.7 and 32.4±3.7Bql-1 respectively for river water in onshore west. For onshore east1, average activity concentration of 226Ra, 228Ra and 40K is 8.3±1.0, 8.6±1.1 and 39.6±3.3Bql-1 respectively for well water, 3.8±0.8, 4.9±0.6 and 35.7±4.1Bql-1 respectively for borehole water and 5.5±0.8, 5.4±0.7 and 36.9±3.8Bql-1 respectively for river water. While in onshore east2 average value of 226Ra, 228Ra and 40K is 10.1±1.1, 8.3±1.0 and 50.0±3.9Bql-1 respectively for well water, 4.7±0.9, 4.0±0.4 and 28.8±3.0Bql-1 respectively for borehole water and 7.7±0.9, 6.1±0.8 and 27.1±2.9Bql-1 respectively for river water and the average activity concentrations in the produced water226Ra, 228Ra and 40K is 5.18□2.14Bql-1, 6.04□2.48Bql-1 and 48.78□13.67Bql-1 respectively. These values obtained are well above world average values of 1.0, 0.1 and 10Bql-1 for 226Ra, 228Ra and 40K respectively, those of the control site values and most reported values around the world. Though the hazard indices (Raeq, Hex, Hin) examined in water is still within the tolerable level, the committed effective dose estimated are above ICPR 0.1 mSvy-1 permissible limits. The overall results show that soil and sediment in the area are safe radiologically, but the result indicates some level of water pollution in the studied area.

Keywords : radioactivity, soil, sediment and water, Niger Delta, gamma detector
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