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Elevated concentrations of terrestrial radionuclides in sand: An essential raw material used in Bangladeshi dwellings

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Abstract

Sand is one of the main materials used in the construction industry. Elevated concentrations of terrestrial radionuclides in sand may cause great harm to dwellers. Present study determines concentrations of terrestrial radionuclides in sand that is widely used as a raw material in the construction industry in Bangladesh, via conventional HPGe γ-ray spectrometry. The average activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in the analysed samples were found as 36.8 ± 3.9, 58.9 ± 6.0 and 755 ± 91 Bqkg^{-1} in Base sand, 68.1 ± 5.3, 185.7 ± 9.9 and 1032 ± 104 Bqkg^{-1} in Sylhet sand, and 38.1 ± 3.6, 74.7 ± 5.9 and 636 ± 77 Bqkg^{-1} in Aster sand. All data show relatively higher values than the world average of 35, 30, 400 Bqkg^{-1}, respectively. Key hazard parameters were estimated to realize the radiation effects on human health due to the use of sand as construction and building materials. The estimated parameters for Sylhet sand show relatively higher values than the population-weighted world average values, prescribed by regulatory bodies. Results show that the Sylhet sand may pose a significant radiation hazard to the dwellers via prolonged exposure, and necessary precautionary steps need to be taken to ensure safe dwellings while using this sand for construction and decorative purposes.

Keywords

Sand, γ-Ray spectrometry, Terrestrial radionuclides, Radiation hazard, Dose rate, Excess lifetime cancer risk

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Introduction

Terrestrial radionuclides (^{238}U, ^{232}Th and ^{40}K) is ubiquitous in every geological formations including soil, plant, building materials, air, water, food and the human body. Building materials are made of rock, sand, soil and industrial by-products such as fly ash, phosphor-gypsum and certain slags. The presence of radionuclides in building materials is responsible for external and internal radiation exposures to dwellers; however, their concentrations in building materials vary depending on the local geology and the geochemical characteristics of the material. Internal exposures to dwellers arise via the inhalation of short-lived

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