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Assessment of Radiological Contamination of Soils Due to Shipbreaking Using HPGe Digital Gamma-Ray Spectrometry System

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ABSTRACT

A systematic study of the distribution of the Naturally Occurring Radioactive Materials as well as the anthropogenic radionuclide in the working environment of the Shipbreaking yards of Sitakunda, Chittagong, Bangladesh, has been carried out with an objective of establishing reliable base line data on the radiation level and hence to measure the radiation dose expose to the workers and to the inhabitants of the studied area. Fifteen Soil samples have been col-lected from five different Shipbreaking yards. Three sampling spots in each yard have been selected for having repre-sentative samples for the assessment of radioactivity releasing from 226Ra (238U), 232Th and their daughters and 40K us-ing the Digital Gamma-ray Spectrometry system coupled with a High Purity Germanium (HPGe; Canberra, 40% rela-tive efficiency, 1.8 keV resolution at 1332 keV of 60Co) detector and PC based Multichannel Analyzer (MCA, upto 16k channel). The software Genie 2000 (Canberra) and Hypermet PC have been used for data acquisition and gamma peak analysis, respectively. Each of fifteen soils (~200g) and two standards (IAEA-Soil-6 and 800Bq liquid 226Ra sprayed in Al2O3) were counted in cylindrical plastic pot using gamma spectrometry system for 20000 sec for the determination of activity concentrations of the radionuclides. The samples and standards were kept in air tied condition at least for 4 weeks before gamma counting to attain the radioactive equilibrium between daughters and parents of 226Ra (238U) and 232Th decay series. The Al2O3 based 226Ra standard was used for the construction of efficiency curve covering the wide gamma energy range. The IAEA-Soil-6 was used for quality control (QC) of the analysis. The homogeneity test and density corrections of Al2O3 based 226Ra standard were performed and implemented for the analysis. The results of ac-tivity concentrations have been used to assess the radium equivalent activities (Raeq) and the representative level index (Iγr) values in the experimental soil samples. The results have been compared with other global radioactivity measure-ments and evaluations.

KEYWORDS

Shipbreaking Yards, HPGe Detector, Radionuclides, Activity Concentrations, Dose Rates, Radium

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