

Study of Naturally Occurring Radioactive Material (NORM) present in Deep Soil of Malwa Region of Punjab State of India using Low Level Background Gamma Ray Spectrometry

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Naturally Occurring Radioactive Material (NORM) namely ²³⁸U, ²³²Th and ⁴⁰K have been present in our surroundings since time immemorial. The carcinogenic gas Radon as well as one of the most potent radiocarcinogens Polonium is produced from their decay. Anthropogenic intervention like agriculture, industrial and mining activities have many a times led to the increase in their concentration so much so that need for their control through regulation has been suggested by experts to avoid enhanced radiation exposure to the general population.

Lately there has been an increasing concern about harmful health affects arising due to NORM in the Malwa region of Punjab State located in the North Western part of India. The State of Punjab being food bowl of India has seen excessive use of chemical fertilizers in the past few decades. Therefore contribution from phosphate fertilizers which are known to be enriched with NORM also cannot be ruled out. In the present work the Low Level Background Gamma Ray Spectrometry set up of Hochschule Mannheim has been employed to obtain concentration of NORM in soil samples collected from Malwa region of Punjab. The soil samples were collected from depths ranging between 60-120 cm which was deeper than the root zone of the plants cultivated by the local farmers to avoid affects if any due to agriculture practices, bioaccumulation, soil erosion, soil rotation etc. The activity concentration of ²³⁸U was found to range between 65.5 Bq/kg and 154.4 Bq/kg. The activity concentration of ²³²Th was found to vary between 52.0 Bq/kg and 77.5 Bq/kg where as the activity concentration of ⁴⁰K was observed to be between 585.3 Bq/kg and 895.2 Bq/kg. In addition to the aforementioned radioisotopes the radioisotope ¹³⁷Cs with activity concentration ranging between ≤ 0.5 Bq/kg to 1.5 Bq/kg was also observed. The later is known to have its origin in the fall out of atomic bomb test explosions carried out couple of decades ago in the northern atmosphere. The mean and standard deviation of ²³⁸U, ²³²Th and ⁴⁰K was estimated to be 101.3 ± 23.5 Bq/kg, 65.8 ± 7.3 Bq/kg and 688.6 ± 93.9 Bq/kg respectively. A comparison of the data obtained in the present work with data reported in literature for soils from locations in regions around Malwa region shows that the activity concentration of the above mentioned radio nuclides obtained in the present work is generally higher. It is further observed that if the data obtained in the present work is compared with the global average data (²³⁸U=35 Bq/kg, ²³²Th=45 Bq/kg and ⁴⁰K= 420 Bq/kg) reported by the United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR) the ²³⁸U activity concentration is nearly three times higher where as the activity concentration of ²³²Th and ⁴⁰K is one and half times higher.

In conclusion it can be stated that the activity concentration of NORM present in the deep soil of the area studied in the present work where local population have been found to be affected by detrimental health affects arising due to NORM seems to be higher than the normal. A more detailed study is needed to be carried out to get a clearer picture of the existing problem.

