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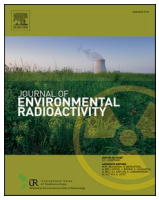

Generation of map on natural environmental background absorbed dose rate in India

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ABSTRACT

A systematic mapping of natural absorbed dose rate was carried out to assess the existing exposure situation in India. The mammoth nationwide survey covered the entire terrestrial region of the country comprising of 45127 sampling grids (grid size 36 km^2) with more than 100,000 data points. The data was processed using Geographic Information System. This study is based on established national and international approaches to provide linkage with conventional geochemical mapping of soil. Majority (93%) of the absorbed dose rate data was collected using handheld radiation survey meters and remaining were measured using environmental Thermo Luminescent Dosimeters. The mean absorbed dose rate of the entire country including several mineralized regions, was found to be 96 ± 21 nGy/h. The median, Geometric Mean and Geometric Standard Deviation values of absorbed dose rate were 94, 94 and 1.2 nGy/h, respectively. Among the High Background Radiation Areas of the country, absorbed dose rate varied from 700 to 9562 nGy/h in Karunagappally area of Kollam district, Kerala. The absorbed dose rate in the present nationwide study is comparable with the global database.

1. Introduction

Earth is surrounded by radiation of various kinds and intensities. Radiation arising from the decay of naturally occurring radionuclides along with cosmic radiation comprises natural background radiation at any location. Exposure to human being from natural resources is continuous and inescapable. In fact, the human race has evolved into its present form in the presence of background radiation (UNSCAER, 2000). The assessment of background gamma radiation dose from natural sources is of special interest considering the fact that it is the highest contributor to dose received by world population. Natural background radiation (NBR) can arise due to two major components, namely, external sources and internal sources. Sources include radioactivity in water, soil, food etc., which are incorporated in human body, building materials and the products that incorporate radioactive sources from nature. The main sources of natural background radiation are radioactive substances in the Earth's crust, emanation of radioactive gases from the Earth, cosmic radiation from outer space and trace amount of radioactivity in human body. The natural radiation from external sources varies by several orders of magnitude due to the variation in radioactive mineral content present in the lithosphere. The external component is divided into cosmic and terrestrial. The cosmic radiation is extraterrestrial in origin and generated by bombardment in the upper sphere of Earth by very high-energy alpha particles, protons, gamma rays, X-rays and other heavy charged particles. Terrestrial radiation is mainly emitted due to the presence of primordial radionuclides, with half-lives comparable to the age of the Earth, comprising of uranium, thorium, their daughter products and single radioisotopes like ^{40}K, ^{87}Rb, ^{147}Sm, ^{115}Ln, ^{138}La, ^{176}Lu etc. Inhalation exposure of the human population occurs primarily due to radon, thoron and their progeny. Radionuclides contributing to the dose to human population through the ingestion route are, primarily, ^{238}U, ^{232}Th series, their daughter products, and single isotopes like ^{40}K (UNSCEAR, 2000).

Rapid economic growth involves many human activities. Mining and milling of natural resources, extraction of petroleum products, use of ground water for domestic purposes and living in different types of houses alter the exposure levels. Naturally occurring radionuclides may be mobilized either by moving from inaccessible locations to areas where humans are present or concentrating the radionuclides present in the environment. In order to curb the global climate crisis, India has

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