



Assessment of Natural Radioactivity Levels and Local Geology of Building Materials Used for the Construction Of Mud Houses In Kanke Area, Plateau State, Nigeria.

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Abstract

An assessment of outdoor radiation in parts of Kanke Local Government Area of Plateau State Nigeria was carried out using a Portable Handheld Gamma ray Spectrometer/Scintillometer (RS-230). Readings of radiation counts of Uranium, Thorium, Potassium and distribution of dose rates (DR) were taken from rocks and soils, which are the main building material used in the construction of mud houses in the study area. Samples were also taken to ascertain elemental compositions and show co-relation of the elements Uranium, Thorium and Potassium to radiation. From the results, the highest values observed in the activity concentration of Uranium, Potassium, and Thorium for rock were 2325 Bq kg⁻¹ (K), while the lowest values were 0.000 for all the three elements. The highest values observed for the activity concentration for soil were 2232 Bq kg⁻¹ (K), while the lowest values were 20.3253 Bq kg⁻¹ (Th).

Keywords

Basement complex rocks; Natural Radioactivity; Building Materials; Gamma ray Spectrometry; Radiological hazard.

Introduction

The potential radiological hazards were assessed by calculating the estimated Absorbed Dose Rate (DR), Annual Effective Dose Rate (HR), Radium Equivalent Activity (Raeq) and External Radiation Hazard (HEX). These parameters were all calculated and compared with other works on the basement complex rocks within and outside Nigeria and the results obtained were found to fall within the acceptable limits of 1mSv/yr, UNSCEAR (2000), IAEA, NEA-OECD and WHO. Humans are exposed to radiation in their environment with or without their knowledge, and the exposure to this natural background radiation is an unpreventable event on earth

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The building materials mainly used by the local dwellers in the study area are soil and gravel, with soil being the by-product of weathering of rocks. This study, besides investigating the associated human health hazards of gamma radiation/natural radioactivity of these building materials, also seeks to establish the relationship between natural radioactivity levels and local geology of the study area.

A natural radiation background exists everywhere, and every natural substance contains some amount of radioactive material. The natural radiation environment consists of cosmic rays and naturally radioactive materials. Some of the materials are cosmogenic, others are primordial, and others exist naturally because of the radioactive transformation of substances produced by these processes (James, 2006). Natural terrestrial radiation exists constantly as background radiation in the environment due to the existence of radio isotopes present in the soils and rocks, they emanate readily from the soil to build up in air at concentrations that depend on meteorological conditions and ventilation in dwelling volumes. The terrestrial component of natural background radiation is therefore strongly influenced by local geology (Farai and Vincent, 2006), thus Jos Plateau is reputed to be of high radiation levels since its Younger Granite Complexes are rich in accessory minerals such as xenotime, monazite, zircon, fergusonite and pyrochlore which are very radioactive.

Exposure to radiation has deleterious effect on man thus the practice has been to keep exposure to manmade sources as low as possible or reasonably achievable, usually termed the 'ALARA' principle (ALARA is an acronym for As Low As Reasonably Achievable). This is a radiation safety principle for minimizing radiation doses and releases of radioactive materials by employing all reasonable methods. ALARA is not only a sound safety principle but is a regulatory requirement for all radiation safety programs according to United State Nuclear Regulatory Commission (US NRC) federal regulations. An accurate knowledge of the natural background radiation in an environment is essential for a correct assessment of radiation level due to radiation pollution. The knowledge of the radioactivity present in construction materials helps to (i) assess radiological hazards to human health and (ii) develop the standard guidelines for the use and management of these materials. In this work, 135 measurements of concentration of natural radionuclides materials used in the construction of mud houses in Kanke local Government area of Plateau State, Nigeria were taken by means of gamma ray spectrometry. The aim is to assess the radiological hazards due to external gamma ray exposure in the dwellings. The results obtained were compared to the recommended values to assess the radiation hazards to humans resulting from these mud houses and the materials used in the construction to the corresponding values of the building materials from different countries of the world.

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