Ain Shams University
Faculty of Science
Physics Department

Investigation of mineralogical and radiological content of rock samples, from Abu Zenima Region, South Sinai, Egypt

Thesis

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By

Mourad Mahmoud Mourad
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Supervisors

Prof. Dr/ Samir Usha El-Kamisy
Professor of Nuclear Physics
Ain Shams University

Dr/ Hala Mahmoud Hosny
Assistant Professor of solid state
Ain Shams University

Dr./ Abdullah Sulaiman Abdullah
Assistant Professor of Nuclear Materials Authority

Ain Shams University
Faculty of Science
Physics Department

Degree: M.Sc. degree in Physics

Title: Investigation of mineralogical and radiological content of rock samples, from Abu zenima region, south Sinai, Egypt.

Name: **Mourad Mahmoud Mourad**

Supervisors: **Approved**

Prof. Dr. Samir Usha El-Kameesy …….....

Physics Department, Faculty of Science,
Ain Shams University

Dr/ Hala Mahmoud Hosny …….

Physics Department, Faculty of Science,
Ain Shams University

Dr./ Abdullah Sulaiman Abdullah …….

Geology Dep. Nuclear Materials Authority

Ain Shams University
Faculty Of Science
Physics Department

Name: Mourad Mahmoud Mourad

Degree: Master

Department: Physics

Faculty: Science

University: Ain Shams

Registration Date: 10-2015

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ABSTRACT

There is increasing interest in radiological assessment of discharges of naturally occurring radionuclides in the terrestrial environment also an important pathway for human exposure is via ingestion and radon inhalation. For most contamination scenarios radioactive contamination of animal fodder and hence animal products are along with drinking water a key element in determining the internal dose to man this study is concerned with the measurement of the radon concentration, work level in two mines and naturally occurring radionuclides Ra-226, Th-232 and K-40 in forty samples. The radon progeny concentration is determined by (EDA) device and then we calculated work level. The average of radon concentration and the work level for two mines are 167.5042, 1310.429 Bq/m^3 and 0.0219, 0.1771 respectively. The activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in rock samples from ALLOUGA area, Abu Zenima Region, southwestern Sinai, Egypt were determined using gamma-ray spectrometry in order to assess the associated radiation hazard impacts. The mean activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K were found to be 212.63±3.01, 75.80±1.13 and 553.56±6.43 $Bqkg^{-1}$ respectively for (mine I) and 152.54, 61.19and 307.42$Bqkg^{-1}$ respectively for (mine II). These values exceed the limits of maximum international value. Radium equivalent (Ra_{eq}), the external hazard index (H_{ex}), the internal hazard index (H_{in}), the representative level index (I_γ), dose rate, annual effective dose, excess lifetime cancer risk (ELCR) and annual gonadal dose equivalent (AGDE) were estimated and discussed. Further investigations of the samples have been performed using X-ray Fluorescence and remarkable concentrations of Al, Fe, Ti, Rb and Zr have been observed.

Key Words: Natural Radioactivity, HpGe device, X-Ray Fluorescence, Radon Emanation, Absorbed Dose, South Sinai.

Summary

Um Bogma formation represents the main target of this study where most of the uranium occurrences are incorporated in its Rock. Um Bogma formation was introduced in (1969) in using the name Um Bogma formation, for the carbonate rocks. There is a mountain of information about the mineral composition and the accompanied radioactivity levels in this region. These information are essential to creating a scientific database of the elemental and radiological baseline level.

The radon progeny concentrations are determined by (EDA RAD 200) device and are calculated work level inside the mines. The elemental analysis has been undertaken by means of the X-ray fluorescence. The observed major elements are Al, Fe, Ti, Rb and Zr, which are strategic elements. The radioactivity concentrations of rock samples have been identified using gamma ray spectroscopy techniques. The observed radionuclides are the naturally occurring radioactive members of uranium and thorium decay series along with the radionuclide ^{40}K. The radiation health hazards due to natural radionuclides were calculated. The radioactivity concentration of the rocks is to great extent higher than and/or comparable with the populated world average except for the activity concentration of ^{40}K which is lower than the populated world average. These radiation hazards indices indicate that the region under study possesses higher values than the international limits. Our data may help in constructing a database for proposing the suitable solution to exploit this region for the sake of the country development in the industrial domain.

Introduction and Aim the work

Introduction

All living things have been exposed to radiation, from the beginning of life on earth. It is disquieting to people that they coexist with radiation yet it cannot be seen, heard or felt. Natural radioactivity is wide spread in the earth's environmental it exists in soil, plants, water and air. Environmental natural gamma radiation is formed from terrestrial and cosmic sources. The exposure of human beings to ionizing radiation from natural sources is a containing and inescapable feature of life on earth. For most individuals, this exposure exceeds that from all man-made sources combine. There are two main contributors to natural radiation exposures high energy cosmic ray particles incident on the earth's atmosphere and originated radioactive nuclides in the earth's crust and are present everywhere in the environment, including the human body itself. Both external and internal exposures to humans arise from these sources. The natural radioactivity comes mainly from the ^{226}Ra, ^{232}Th decay series, and natural ^{40}K, respectively [1] .The average activities of ^{226}Ra and ^{232}Th in the undifferentiated earth crust are in the range of 25- 50 Bq/Kg, but due their large ion radius, both elements may be especially concentrated in late-crystallizing rocks such as granites and other alkaline magmatic ores, often accompanied by other incompatible elements like Rare Earth Element (REE).

Uranium is characterized by both radiotoxicity and chemical toxicity, but it is the latter which limits its exposure to humans whereas thorium is to be considered as only radiotoxic[2].The health hazards associated with these radionuclides stem from their ability to accumulate in human tissues. During the processes of nuclear transformation, the radionuclides emit gamma rays as well as high energy particles, thereby causing intensive damage to the tissues where they are localized and, to a lesser extent on the neighboring