OPEN ACCESS Freely available online

Advanced Techniques in Biology & Medicine

Research Article

Radioactivity Natural Environmental Radiation in Middle of Iraq Governorates

Entesser F.Salman[1]* Mohsin Kadhim Muttelab[1], Jwad K.Manii[2]

[1]Department of Science-Physics, University of Babylon, Iraq; [2]Department of Science-Geology, University of Babylon, Iraq

ABSTRACT

In this study 145 sites were modeled for the purpose samples of studying the activity concentrations of naturally occurring 40K, 238U, and 232Th radionuclides and its effect on the population of the selected areas within the study area the probability cancer risk is the main objective of the study absorbed gamma dose rate (DR), annual effective dose, gamma annual gonadal dose (AGDE). The activity concentration 238U, 232Th and 40K radionuclides are within the ranges The concentrations of uranium in the studied area extend (37.091 ± 3.634 to 0.081 ± 0.0008) Bq/kg in soil of Babylon, from (27.913 ± 0.871 to 0.027 ± 0.023) Bq/kg in soil of Najaf, from (109.940 ± 1.730 to 2.478 ± 0.259) Bq/kg in rocks of Najaf, from (37.363 ± 0.700 to 0.190 ± 0.023) Bq/kg in Qadissiya finally from (37.962 ± 0.962 to 0.027 ± 0.233) Bq/kg in soil of Karbala in the area of study, The correlations between both the probability of cancer with 238U equal to (0.3724) it means that the relationship of uranium to cancer is weak, but with 232 Th and 40K, annual effective dose in air, γ-radiation index, radiation greater than this positive correlation in study area. The correlation between annual gonadal dose (AGDE) and absorbed gamma dose rate RA (nGyh−1) outdoor AGDE and ADRA (nGyh−1) indoor indicating that most areas of study pose a clear risk to individuals in these areas.

KEYWORDS: Excess lifetime; Cancer risk; Radioactivity; Annual gonadal dose

INTRODUCTION

The importance of soil in general is the fact that it represents the important and main centre of the various organisms of plants and microorganisms and many animals, and is the first and main component in the production of food necessary for human life wherever it exists, so any negative impact or pollution of any kind affects the soil affects directly on all the living things that are connected to them and to the human who lives on them [1]. Radiation pollution is a form of pollution with global influence. Since ancient times, humans have been subjected to natural radiation from cosmic rays and other radioactive materials found in the earth's crust since its inception, if they are composed of radioactive neutrons. The particles of alpha, beta and gamma are dissolved to the human body through food [2].

Natural radionuclides found in air, soil, water and building materials are the main source of radiation background nature three important isotopes are uranium, thorium and potassium, uranium heavy and radiant metal dissolves by emitting alpha particles (α) with a constant dissolution of 1.5X10-10 each year and with a radioactive activity of 12.4 X 103 Bq/kg and its density at 25°C (19.05 g/cm3) Characteristics: silver white, Toxic, melting point (1132°C). Uranium is found in various amounts in nature in rocks, soil, water, air, plants, animals, human body and elsewhere. The concentration of uranium depends on the soil type and then on the type of rock forming the soil [3].

Uranium was originally found in two groups of rocks that have long existed in addition to groundwater and fractures in the soil. The first group is granite rocks and contains about 4 gm/ton. In this group, the liquid magma comes from the underground with uranium. In this case, we get rich raw materials with a high percentage of uranium (5%). The second group is deposits accumulated on the mountainous masses, In general, uranium is found as a by-product in some other materials, such as phosphates and gold ores, as in South Africa, and sometimes uranium is accompanied by coal ores [4].The highest concentration of uranium is in acidic volcanic rocks, but its concentration in igneous rocks depends on the abundance of silicates. The rocks that contain silicates have high concentrations of uranium. It accounts for about 99.27% of the total natural uranium, about 0.72%, about 0.0055%, and uranium isotopes of half–life, the half–life of uranium is around 4.5 billion years, uranium about 700 million years, uranium, (About 250,000 years). It is believed that much of the heat of the Earth's surface is produced by uranium radiation. There have been several important exploratory studies that examined the radiation

***Correspondence to: Entesser F Salman**, Department of Science-Physics, University of Babylon, Iraq, Email: entesserfarhan@gmail.com

Received: June 08, 2020; **Accepted:** July 23, 2020; **Published**: July 30, 2020

Citation: Salman SF, Muttelab MK, Manii JK (2020) Radioactivity Natural Environmental Radiation in Middle of Iraq Governorates. Adv Tech Biol Med. 8:272. doi: 10.4172/2379-1764.1000272

background in the soil for the three natural radionuclides that emit gamma doses measurement soil radiation content is important in appreciation the risks resulting from it, such as anemia, leukemia, cancer, hepatic skin and mental retardation affects children whose mothers have been exposed to this radiation during pregnancy [5]. Approximately 4.7 annual effective doses received by persons as recognized UNSCEAR 2016 other human health damage caused by exposure to uranium is the genetic effects of reproductive cell damage, which leads to genetic mutation [6].

MATERIALS AND METHODS

Study area

The study area extends between longitudes (44°00' 00" to 45°16' 00" E) and latitudes (31°27'00" to32°58' 00" N). The Middle Euphrates is the geographical area in the south of Baghdad in the Euphrates region, which is located in Najaf, Karbala, Diwaniyah and Babylon Together, these governors comprises an area, of 98. 87 thousand square kilometres, equivalent to 22.7 percent of the country's total area of 438,317 square kilometres. It is divided between two natural regions the western plateau and the sedimentary plain, most of which are only a few meters above sea level [7].

Sample preparation

The sites were selected from the governorates for the purpose of studying their radioactivity locations at a depth of 15 cm, about 1.00 kg were neatly packed in well-labeled polyethylene bags properly sealed and transported to the radiation laboratory that were sifted and removed the impurities and then dried samples and stored for 30 days before counting to allow secular equilibrium to be attained between ^{222}Rn and its parent ^{226}Ra in uranium chain before measurement using a gamma spectrometry system.

Samples analysis

Usinng γ-ray spectrometer Iodide Sodium activated by Thallium NaI (Tl) of (3"×3") crystal dimension, supplied by (Alpha Spectra, Inc 12I12/3), coupled with a multi-channel analyzer (MCA) ORTEC–Digi Base with range of 4096 channel joined with ADC (Analog to Digital Convertor) unit, through interface, the spectral data was converted directly to the PC of the laboratory introduced using (Maestro-32) software. Measurements were made to check the background level of radioactivity in the laboratory the γ-ray photo peaks corresponding to 11747 kev of 40K, 203kev for 238U and 62kev of 232Th. The calibration of the detector enables us to find the linear relationship between the pulse coming out of the detector and the gamma energy falling on the crystallization of the detector. The relationship between the channel number in the multichannel analyzer and the spectral line energy of the studied isotopes. The (MCD) consists mainly of memory with storage locations equal to the number of (MCD) channels where the pulses are stored in these channels according to the energy of each pulse.

Evaluated of radiation hazard parameters

Estimating the risk factor for cancer due to exposure to radiation was an important issue that was appreciated by several international organizations such as the International Commission on Radiological Protection [8], and the United Nations Scientific Committee on the Effects of Atomic Radiation [9]. The absorbed dose in the air is ADRA and measured at a distance of one meter from the surface of the ground containing the naturally occurring radionuclide depending on the concentrations of natural radionuclides in the soil, calculated by equation [9]

$$A=Cnet/(\varepsilon.I\gamma\ m.t)\mp\sqrt{(Cnet)}/(\varepsilon.I\gamma\ m.t) \quad (1)$$

C_{net} the net count, ε efficiency of detector, t: time for spectrum, m: weigh of the samples in kg. Iγ the transition probability of the emitted gamma ray. The outdoor absorbed dose rate also evaluted by[10]

$$ADRA\ (nGyh^{-1})=0.642A+0.604A+0.0417A<80nGyh^{-1} \quad (2)$$

The annual effective dose rate defined by equation [11]:

$$AEDE=(0.49A_U+0.76\ A_{Th}+0.048\ A_K)\times 8.76\times 10^{-3} \quad (3)$$

Assumption that human about 20 of his time out calculated formulas as [12]:

$$AEDE\ (outdoor)\ (\mu Sv/yr)=AEDR(nGy/h)\ X\ 8760h\ X\ 0.7Sv/Gy\ X\ 0.2\ X\ 10^{-3} \quad (4)$$

$$AEDE\ (indoor)\ (\mu Sv/yr)=AEDR\ (nGy/h)\ X\ 8760h\ X\ 0.7Sv/Gy\ X\ 0.8\ X\ 10^{-3} \quad (5)$$

When 8760 time conversion factor, dose conversion factor is $0.7SvGy^{-1}$, but occupancy coefficient 0.2 the represents that human spends about 20 of his time outdoor and indoor 0.8 [12]. The excess lifetime cancer risk (ELCR) for outdoor exposure, which represented the risk of developing cancer of time as a result of radiation exposure from natural radionuclides in the air can be calculated from equation [13]:

$$ELCR=AEDE\times DL\times RF\times 10^{-3} \quad (6)$$

DL: is the average duration of life (estimated to 66 years), and Risk Factor by samble RF (Sv^{-1}) this mean fatal cancer risk per Sievert ICRP uses RF as (0.05) for public [8]. The gamma Index (Iγ) was estimated using equation [14]:

$$I\gamma=A_U/150(Bqkg^{-1})+A_{Th}/100(Bqkg^{-1})+A_K/1500(Bqkg^{-1}) \quad (7)$$

Annual Gonadal Equivalent Dose (AGED). The effects of three radionuclides on bone marrow and bone marrow cells were assessed using the dose equivalent calculation [15]:

$$AGED\ (Sv/yr)=3.09A_U+4.18A_{Th}+0.314A_k \quad (8)$$

RESULTS AND DISCUSSION

Measured activities for three isotopes (^{238}U, ^{232}Th and ^{40}K and ^{235}U) with radium equivelent radiation dose location points are calculated by equations (1) and (2) respectively displayed in Table1. The activity concentration ^{238}U, ^{232}Th and ^{40}K radionuclides are within the ranges 0.19 ± 0.07 $Bqkg^{-1}$ to 30.52 ± 0.91 $Bqkg^{-1}$, 0.34 ± 0.03 $Bqkg^{-1}$ to 32.45 ± 0.83$Bqkg^{-1}$, and 374 ± 3.69 $Bqkg^{-1}$ to 211 ± 2.77 $Bqkg^{-1}$ ^{238}U, ^{232}Th and ^{40}K respectively in the area of study, The correlations between both the probability of cancer and the activity of uranium radiation were 0.3724 it shows that the relationship of uranium to cancer is weak in the study area (Figure 1).

CONCLUSION

The activity concentration of the naturally occurring radionuclide of 238U,232 Th and 40K in soil samples were determined by gamma spectrometry, the correlations between both the probability of cancer and the activity of uranium radiation were 0.3724 it shows that the relationship of uranium to cancer is weak in the study area but correlation between ELCR activity of 232 Th and 40K radiation greater than this value. The correlation between probability of cancer and internal and external absorbed dose was high in study area. Excess lifetime cancer risks factor was directly

Table 1: Activity concentration (Bq/kg) of natural radioactivity in soil samples for Babylon city.

No	S.C	Activity Concentration (Bq/kg)			
		^{238}U	^{232}Th	^{40}K	^{235}U
1	H1	16.476 ± 0.669	4.415 ± 0.307	269.442 ± 3.131	0.759 ± 0.187
2	H2	8.169 ± 0.471	10.159 ± 0.466	327.276 ± 3.451	0.376 ± 0.131
3	H3	20.887 ± 0.754	10.866 ± 0.482	311.116 ± 3.365	0.962 ± 0.210
4	H4	35.920 ± 0.989	14.939 ± 0.565	364.874 ± 3.644	1.655 ± 0.276
5	H5	2.015 ± 0.234	0.192 ± 0.064	244.511 ± 2.983	0.092 ± 0.065
6	H6	37.091 ± 1.005	0.900 ± 0.094	312.208 ± 3.370	1.709 ± 0.280
7	H7	22.712 ± 0.786	16.825 ± 0.600	317.158 ± 3.397	1.046 ± 0.219
8	H8	14.515 ± 0.628	17.939 ± 0.620	359.560 ± 3.617	0.668 ± 0.175
9	H9	16.830 ± 0.677	8.766 ± 0.433	293.828 ± 3.270	0.775 ± 0.189
10	H10	35.920 ± 0.989	10.888 ± 0.483	377.940 ± 3.708	1.655 ± 0.276
11	H11	2.450 ± 0.989	3.0006 ± 0.253	274.138 ± 3.158	0.112 ± 0.072
12	H12	20.996 ± 0.756	7.437 ± 0.399	340.270 ± 3.519	0.967 ± 0.211
13	H13	21.595 ± 0.766	29.471 ± 0.794	316.103 ± 3.391	0.995 ± 0.214
14	H14	13.916 ± 0.615	25.270 ± 0.735	303.764 ± 3.325	0.641 ± 0.171
15	H15	15.250 ± 0.644	30.649 ± 0.810	349.478 ± 3.566	0.702 ± 0.179
16	H16	11.955 ± 0.570	17.961 ± 0.620	371.098 ± 3.675	0.550 ± 0.159
17	H17	26.089 ± 0.842	11.231 ± 0.490	312.718 ± 3.373	1.202 ± 0.235

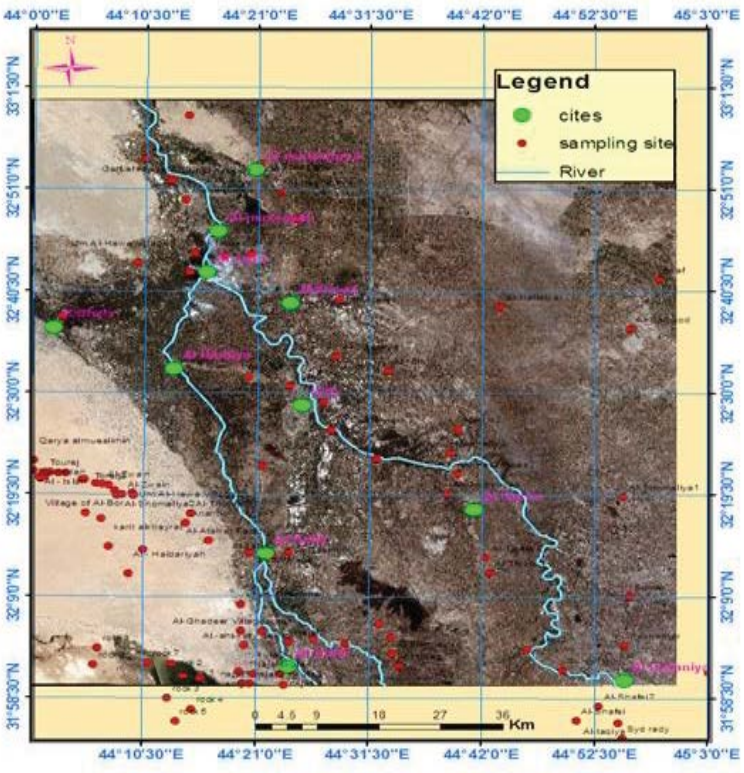

Figure 1: Map of distribution of sites in middle Euphrates region (Karbala, Babylon, Diwaniyah and Najaf).

determined using the annual effective dose radiation which is solely dependent on the measured radiation dose rate in the area of study. Correlation ADRA (nGyh−1) both outdoor and indoor with AGED Annual Gonadal Equivalent Dose (AGED) very high within the study area.

REFERENCES

1. Oyeyemi KD, Usikalu MR, Aizebeokhai AP, Achuka JA, Jonathan O. J Physics 2017;**852:** 012-042.
2. Al Mugren KS. Natural Science. 2015;7:238-247.
3. Eisenbud M, Gesell T. Environmental Radioactivity. Academic press, 4th Edition, USA, **1997.**
4. WHO. Depleted Uranium, Department of protection of the Human Environment, Geneva, 2001.
5. ATSDR. Toxicological Profile for Uranium, Report of the Agency for Toxic Substanc and Disease Registry Atlanta, Georgia, 2011.
6. United Nations Scientific Committee. Effects of Atomic Radiation report Sources and effects of ionizing radiation sources United Nations Publications.2016.
7. https://reliefweb.int/report/iraq/iraq-qadissiya-governorate-profile-jul-2009

8. ICRP. Age-dependent Doses to Members of the Public from Intake of Radionuclides - Part 3 Ingestion Dose Coefficients. JAICRP. 1995; 32(2):1-2.

9. Beretka J, Mathew PJ. Natural radioactivity of Australian building materials, industrial wastes and by-products. Health Phys. 1985; **48:**87–95.

10. Stranden E. Some Aspects on Radioactivity of Building Materials. Physica Norvegica. 1976; 8:167-173.

11. Kolo M, Aziz S, Khandaker M, Asaduzzaman K, Amin Y. Environ Science Pollution Res. 2012; 2: 13127-13136.

12. Taskin H, Karavus M, Ay P, Topuzoglu A, Hidiroglu S, Karahan G.Radionuclide concentrations in soil and lifetime cancer risk due to gamma radioactivity in Kirklareli, Turkey. J Environ Radioact. 2009; 100:49-53.

13. Sabiha JM, Tufail M, Asghar M. Hazard of NORM from phosphorite of Pakistan. J Hazardous Mat.2010; 176:426-433.

14. Ravisankar R, Vanasundari K, Suganya M, Raghu Y, Rajalakshmi A, Chandrasekaran A, et al. Assessment of natural radioactivity and radiological hazards in building materials used in the Tiruvannamalai District, Tamilnadu, India, using a statistical approach. App Radiation Isotopes.2014; **85**: 114-127.

15. Taskin H, Karavus M, Ay P, Topuzoglu A, Hidiroglu S, Karahan G. Radionuclide concentrations in soil and lifetime cancer risk due to gamma radioactivity in Kirklareli, Turkey. J Environ Radioact.2009; **100**: 49-53.