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EVALUATION OF RADIATION DOSE FOR SELECTED SCHOOLS IN THE NORTH SECTION AT AN-NAJAF GOVERNORATE, IRAQ

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ABSTRACT

In the present study, a gamma background radiation dose at indoor and outdoor for selected schools was determined in the north section at An-NAJAF governorate, Iraq. Measurements were performed using a portable dosimeter survey "Inspector Alert model RAP RS1, S.E. international, Inc, USA". Average of indoor and outdoor mean rate dose was ranged from (307.543 - 66.744nGy/h) respectively, Amount of minimum and maximum mean dose were ranged from (269.808 ± 63.331 and 55.188± 15.832 nGy/h) and (343.398± 40.054 and 73.584±10.013 nGy/h) successively. Annual Effective Dose indoor and outdoor were enumerated between (0.33 and 0.27 mSv/y), (0.42 and 0.36 mSv/y) respectively, while the average of Annual Effective Dose ranged between (0.376 – 0.34). So, according to the results of the area under study, this would not pose a significant risk to human beingswhich is recommended by UNSCEAR (2000).

KEY WORDS : Annual Effective Dose, portable dosimeter, Mean rate dose, An-Najaf governorate, Iraq.

INTRODUCTION

Natural radioactivity includes rudimentary and terrestrial radionuclides that are common in rocks, water, soil and oceans that make up our planet (Tsomy, 2000). Also, it is found in buildings materials constituting major sources of radiation exposure for a human being. Radionuclides are inhaled and absorb daily through breathing and food chain (Chikasawa and Shii, 2001; Dhawal, *et al*., 2013).

Greatest interest for many researchers all over the world is a measurement of natural radioactivity in the soil, which led to worldwide national surveys in the last two decades (Allawi Hamed, 2016; Gholami, *et al*., 2011).

Because of Soil is one of the most important natural resources, which is present in an upper layer of the earth crust's and is composed of mineral particles, organic matter, water, air and organisms (Srilatha, 2014).

Natural background radiation, which is equivalent to 2.4 mSv per person, makes up approximately 80% of the total Radiation dose a person is exposed in a year (Dizman, 2016).

However, there is no study related to locating Gamma background radiation in the air for selected schools in the north section at An-Najaf Governorate locally in the literature.

The objective of this work, therefore, was to measure Gamma background radiation of some selected schools in An-Najaf, southern Iraq with the aim of evaluating Gamma background radiation at (indoor and outdoor) and corresponding Annual Effective Dose from the external and internal exposure due to the presence in the air.

Experimental Measurements

The measurements were conducted in April 2018, thirteen schools were chosen for the different residential quarter in the north section of An-NAJAF Governorate, Iraq. Fig. 1 shows a topographic map of the selected area obtained from the Department of the Geological Survey of An-Najaf Governorate, Iraq.

Gamma background radiation level in the selected areas was measured by using portable dosimeter survey "Inspector Alert model RAP RS1,

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S.E. international, Inc, USA". This device is supplied with a mica window, sensitive to Alpha, Beta and (X-ray and Gamma-ray). The G.M. detector was calibrated by Germany Secondary Dosimeter laboratory.

Indoor and outdoor radiation measurements were calculated by placing the detector at least one meter away from the ground. Gamma background radiation was estimated both indoor and outdoor in 13 schools, three readings were listed at each location (residential quarters).

Mean absorbed a dose of indoor and outdoor Gamma background radiation was calculated using (OF),the occupancy factor which is 20% and 80% respectively. Annual Effective Dose (AED) was determined as follow (UNSCEAR, 2000):

$(AED)_{Indoors} = D_{in} \times T \times OF \times$ the conversion coefficient …(1)

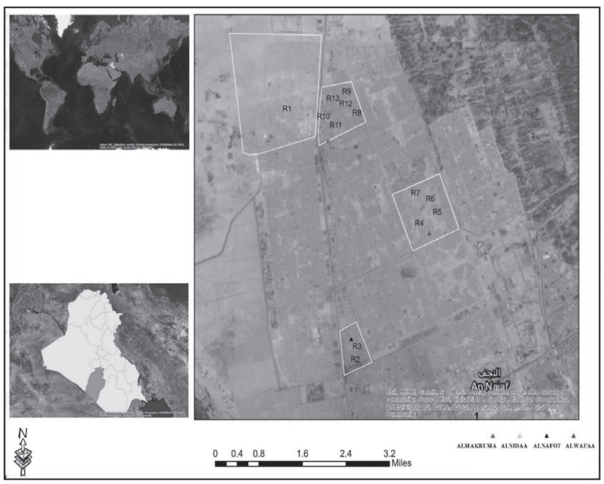

Fig. 1. Shows a topographic map of the selected area.

$(AED)_{Outdoors} = D_{out} \times T \times OF \times$ the conversion coefficient … (2)

Where $D_{Indoors}$ and $D_{Outdoors}$ are the mean absorbed dose rates at indoor and outdoor.The conversion coefficient which is reported by UNSCEAR 2000 is (0.7 Sv / Gy) to convert the absorbed dose in the air to Annual Effective Dose received by adults.

The standard deviation is assumed as below (Ali Abid Abojassim, 2017):

$$\tilde{O}_n \text{ (S.D)} = \sqrt{\frac{\sum_i^n (Xi - X)2}{n-1}} \quad .. (3)$$

Survey radiation had been done to the selected areas (thirteen schools of the residential quarter in the north section of Al-Najaf governorate).

RESULTS AND DISCUSSION

The results of gamma background radiation of selected locations of Al-Najaf governorate are presented in Tables (1 and 2) below.

Fig. 1. Showed the minimum and maximum of the indoor and outdoor mean rate dose which was (269.808±63.331 and 55.188±15.832 nGy/h) and (343.398± 40.054 and 73.584± 10.013 nGy/h) Respectively.

The minimum and maximum of indoor and outdoor of Annual Effective Dose in Fig.(2) Were (0.33 and 0.27 mSv/y), (0.42 and 0.36 mSv/y) respectively.

CONCLUSION

Table 1. Indoor and outdoor mean rate dose of selected locations

School name	Location	Indoor Mean Dose Rate ± SD (nG/h)	Outdoor Mean Dose Rate ± SD (nG/h)
Al- muzamel/ALNIDAA	R1	343.392 ± 40.054	73.584 ± 10.013
Kafilat Al aytaam/ALNAFOT	R2	282.072 ± 46.967	61.32 ± 10.013
Abdulrazaaq muhialdeen/ALNAFOT	R3	318.863 ± 63.331	67.452 ± 15.832
Noor alhussein/ALWAFAA	R4	318.864 ± 63.331	73.58 ± 10.013
Asia/ ALWAFAA	R5	306.6 ± 46.967	61.32 ± 10.013
Al-khisaal alhamida/ALWAFAA	R6	294.336 ± 40.054	73.584 ± 10.013
Zain alabideen/ ALWAFAA	R7	282.072 ± 46.967	61.32 ± 10.013
Al- Bayaa/ ALMAKRUMA	R8	343.392 ± 40.054	61.32 ± 10.013
Katem alanbiyaa/ ALMAKRUMA	R9	282.072 ± 61.727	61.32 ± 10.013
Ali alsakheer / ALMAKRUMA	R10	269.808 ± 63.331	55.188 ± 15.832
Jabber al ansari/ ALMAKRUMA	R11	282.072 ± 46.967	70.518 ± 15.431
Al-zahraa/ ALMAKRUMA	R12	331.128 ± 46.967	73.584 ± 10.013
Al-hur alriyahi/ALMAKRUMA	R13	343.392 ± 40.054	73.584 ± 10.013
AVERAGE		307.543 ± 49.735	66.744
MINIMUM		269.808 ± 63.331	55.188 ± 15.832
MAXIMUNM		343.392 ± 40.054	73.584 ± 10.013

Table 2. Indoor and outdoor Annual Effective Dose of selected locations

School name	Location	Indoor Annual Effective Dose (mSv/y)	Outdoor Annual Effective Dose (mSv/y)
Al- muzamel/alnidaa	R1	0.42	0.36
Kafilat Al aytaam/alnafot	R2	0.345	0.3
Abdulrazaaq muhialdeen/alnafot	R3	0.391	0.33
noor alhussein/Alwafaa	R4	0.391	0.36
Asia/Alwafaa	R5	0.376	0.3
Al-khisaal alhamida/alwafaa	R6	0.36	0.36
Zain alabideen/awafaa	R7	0.345	0.36
Al- Bayaa/almakruma	R8	0.42	0.36
Katem alanbiyaa/almakruma	R9	0.345	0.36
Ali alsakheer /almakruma	R10	0.33	0.27
Jabber al ansari/almakruma	R11	0.345	0.34
Al-zahraa/almakruma	R12	0.4	0.36
Al-hur alriyahi/almakruma	R13	0.42	0.36
AVERAGE		0.376	0.34
MINIMUM		0.33	0.27
MAXIMUNM		0.42	0.36

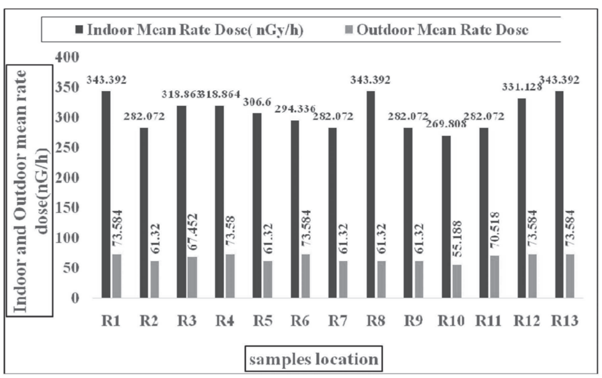

Fig. 1. Showed the indoor and outdoor mean rate dose of Gamma radiation in selected locations.

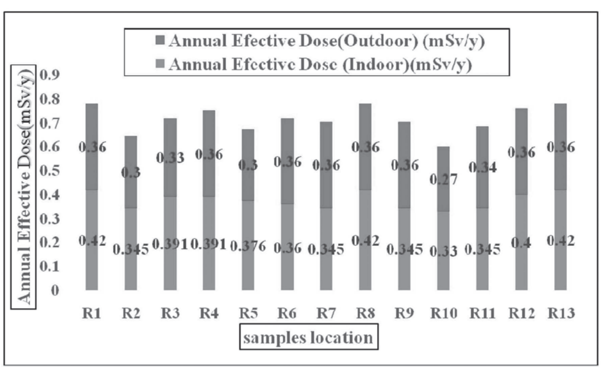

Fig. 2. Indoor and outdoor of Annual Effective Dose in selected locations.

The Gamma background radiation level has been determined in order to evaluate the health hazards parameter around the selected schools in Al- Najaf Governorate, Iraq. So, Indoor and outdoor of Annual Effective Dose were computation is found to be less than acceptable ranges, according to the UNSCEAR 2000 (1-3 mSv/y). Finally, all the schools investigated are within the safe limits of Gamma background exposure.

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