IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 12, Issue 6 Ver. I (June. 2018), PP 08-11
www.iosrjournals.org

Outdoor and Indoor Radiation Levels Measurement in Ozoro,Delta State, Nigeria

[1]K. Emumejaye and [2]R.A. Daniel-Umeri
[1,2]*Department of Science Laboratory Technology,Delta State Polytechnic P.M.B 5, Ozoro. Delta State, Nigeria.*
Corresponding author's email: ekugbere@gmail.com

Abstract: *Human beings are exposed to ionizing radiation from natural sources everyday and it is an inescapable feature of life on earth. Outdoor and indoor ambient radiation levels were measured using Geiger-Muller (GM) based system "BlueGeiger PG-15". A total of 15 locations were surveyed and measurements of dose rates for both indoor and outdoor were taken and each was repeated five times and the standard deviation was determined to take care of errors in data. The dose rate for indoor and outdoor ranged from 0.12 ± 0.02 – 0.22 ± 0.02 and 0.12 ± 0.03 – 0.20 ± 0.02 μSvhr^{-1} respectively. The annual equivalent dose rates were computed using relevant equations. The mean annual equivalent dose rates in mSvyr^{-1} for indoor was 1.09 ± 0.17 and that of outdoor was 0.27 ± 0.04. The values of the dose rate and annual equivalent dose rate for both indoor and outdoor were found to be below world average. The indoor and outdoor radiation exposures in this study area have not been reported in literature, so these results provide the essential information for future assessment of radiation activities in the area.*

Keywords: *Dose rate, BlueGeiger PG-15, ionizing radiation, indoor, outdoor.*

Date of Submission: 25-05-2018 Date of acceptance: 09-06-2018

I. Introduction

Natural radioactivity has great contributions in ionizing radiations to the human and non-human population due to its presence in the surrounding at different quantities because of natural existence [1]. Ionizing radiation in our environment can occur either naturally or can be produced artificially through human activities such as mining, oil exploration, nuclear weapon tests, accidental or normal releases from nuclear power reactors, etc. [2]. The effects of artificial and naturally occurring radiation are the same [3].

It is important to develop capacity to delineate the influence of such activities on the natural background radiation levels, and it is equally imperative to be able to establish the baseline levels. Environmental surveys meant for establishing the gamma dose rates baseline within a country may be carried out using a number of different techniques and methods [2].

Indoor and outdoor measurements of dose rates in various parts of Nigeria at different times have been reported in [4,5,6]. These studies reported values that are within the permissible limits recommended by ICRP [11].

Previous studies around the globe particularly in high background radiation areas in places such as Ramsar (Iran); Yangjiang in China, Malaysia and Hong Kong have reported maximum outdoor and indoor dose rates [10].

This present study attempts to measure equivalent dose rate in Ozoro town, the results of this survey would provide baseline information for future references.

II. Materials and method

2.1 The study area

The study area is the headquarters of Isoko North Local Government Area of Delta State and lies within the Niger Delta sedimentary basin which is characterized by both Marine and mixed continental quaternary sediments that are composed of abandoned beach ridges and mangrove swamps [7]. The area lies along latitude 5^0 33'23''N and longitude 6^0 14'58''E. The area experiences wet and dry seasons which are typical seasons in Nigeria [8, 9].

2.2 Materials and Method

The indoor and outdoor background radiation levels of 15 locations in the study area were measured one metre above the ground using a Geiger-Muller (GM) based system "BlueGeiger PG-15" from Kindenoo, France. It logs dose rate as well as Global positioning system (GPS). The device is very simple to use and is designed for determining normal background radiation levels and responding to high levels of gamma and beta

radiation. It is a compact Geiger counter which can be linked to an Android smart phone through Bluetooth. The reading of dose rate of each location was repeated five times and standard deviation of each data was determined to account for errors in data.

III. Theory and calculation

Indoor and outdoor occupancy factor of 0.8 and 0.2 respectively as recommended by UNSCEAR (1988) were used. Occupancy factor is the proportion of the total time during which an individual is exposed to radiation field [10]. Conversion of meter readings in hours to years was done using 8760hr/yr [11].
Equations (i) and (ii) were used to convert dose rate in μSvhr^{-1} into annual equivalent dose rate in mSvyr^{-1}.

$$R_i = T(\mu Svhr^{-1}) \times 8760\, hryr^{-1} \times 0.8 \times 10^{-3} \quad \text{(i)}$$

$$Ro = Y(\mu Svhr^{-1}) \times 8760\, hryr^{-1} \times 0.2 \times 10^{-3} \quad \text{(ii)}$$

Where

R_i is indoor annual equivalent dose rate in mSvyr^{-1}
R_o is outdoor annual equivalent dose rate in mSvyr^{-1}
T is the indoor meter reading in μSvhr^{-1}
Y is the outdoor meter reading in μSvhr^{-1}

IV. Results and discussion

The blueGeiger PG-15 mean readings and annual equivalent dose values obtained by using equations (i) and (ii) are presented in table 1, figure 1 and 2. The highest dose rate was in location 10 with 0.20 ± 0.02 and 0.22 ± 0.02 for outdoor and indoor respectively. The high dose rate may be due to the presence of radon in air in the area and probably the geology of the area.

Table 1. Dose rate and annual equivalent dose rate at different locations of Ozoro

		Dose rate in μSvh^{-1}		**Annual equivalent dose rate (mSvh^{-1})**	
SN	Location	Y	T	R_i	R_o
1	Poly shopping mall	0.12 ± 0.03	0.12 ± 0.02	0.84±0.14	0.21±0.05
2	Hostel	0.12 ± 0.04	0.12 ± 0.02	0.84±0.14	0.21±0.07
3	Library	0.20 ± 0.02	0.20 ± 0.02	1.40±0.14	0.35±0.04
4	School of business studies	0.17 ± 0.02	0.17 ± 0.02	1.19±0.14	0.30±0.04
5	Accountancy office	0.15 ± 0.02	0.15 ± 0.01	1.05±0.07	0.26±0.04
6	Hospital road	0.16 ± 0.03	0.16 ± 0.03	1.12±0.21	0.28±0.05
7	NDC	0.12 ± 0.02	0.12 ± 0.04	0.84±0.28	0.21±0.04
8	Owhelogbo road	0.16 ± 0.04	0.17 ± 0.02	1.12±0.28	0.30±0.04
9	Idheze road	0.14 ± 0.02	0.14 ± 0.02	0.98 ±0.14	0.25±0.05
10	Ughelli road	0.20 ± 0.02	0.22 ± 0.02	1.54 ±0.14	0.35±0.04
11	Ozarighe road	0.16 ± 0.02	0.16 ± 0.03	1.12±0.21	0.28±0.04
12	Etevie	0.14 ± 0.03	0.14 ± 0.02	0.98±0.14	0.25±0.05
13	Rendevous hotel	0.17 ± 0.02	0.17 ± 0.04	1.19±0.28	0.30±0.04
14	Mission road	0.16 ± 0.02	0.16 ± 0.02	1.12±0.14	0.28±0.04
15	School of engineering	0.14 ± 0.02	0.14 ± 0.02	0.98±0.14	0.25±0.04
		Annual average		1.09 ± 0.17	0.27 ± 0.04

The mean annual equivalent dose rate in mSvhr^{-1}for outdoor was found to be 0.27 ± 0.04 while the indoor was found to be 1.09 ± 0.17. The general public is not in any danger since these values were found to be lower than the world average dose of 2.4mSv/yr for a human being [12]. The mean outdoor annual equivalent dose rates is lower compare to the indoor annual equivalent dose rates probably due the rocks and sand used for the foundation of the buildings were mostly igneous rocks which are believed to be rich in potassium and other primordial radionuclides [13]. .

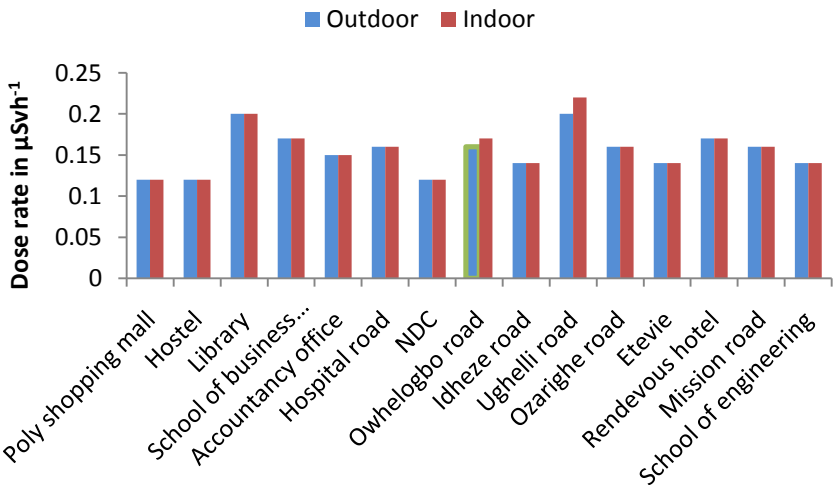

Figure 1. Outdoor and indoor dose rates in Ozoro

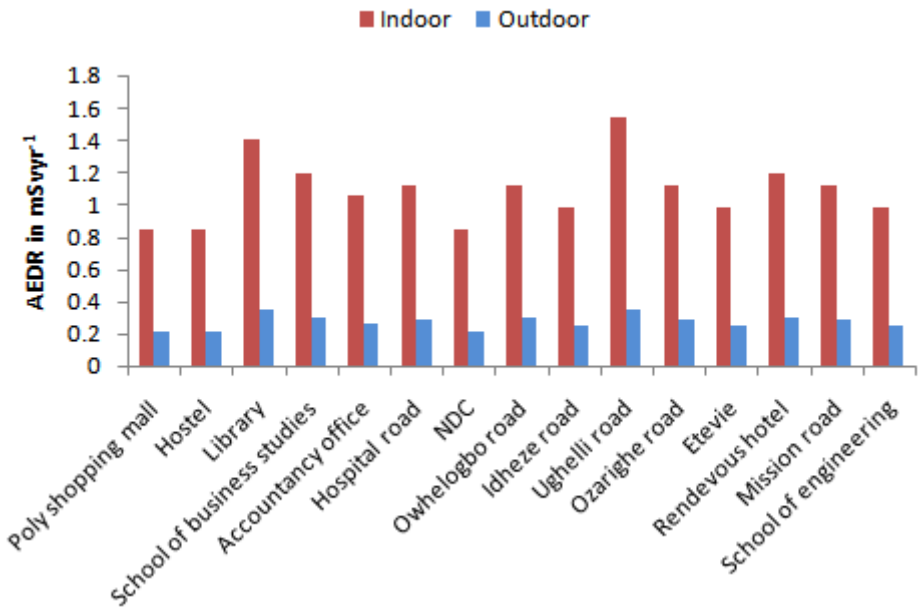

Figure 2. Annual equivalent dose rates in Ozoro

The results quite agree with previous studies done in other places in Nigeria as reported in [4,5,6,10, 13,14,15, and16]. Areas with slightly higher values (as shown in figure 1 and 2) should be further investigated using the techniques specified for radon gas measurement in buildings to ascertain the radiation level [10]. Since no similar work has been done in this study area, the result of this work will be a bench mark for future studies.

V. Conclusion

In this study it revealed that the dose rate and the annual equivalent dose rate are within the limit of the world average. However, there should be continuous monitoring by the relevant agencies since long time exposure to these could be harmful. The indoor and outdoor radiation exposures in this study area have not been reported in literature, so these results provide the essential information for future assessment of radiation activities in the area.

VI. Acknowledgement

We which to thank Professor A.O. Mustapha of the Department of Physics, Federal University of Agriculture, Abeokuta, Nigeria, for making the gamma survey meter available for this work and Osanebi Moses for assisting in the field work.

References

[1]. Ahmad, N.,Jaafar, M.S., Muhammad, B. & Muhammad, R. (2015) an overview on measurements of natural radioactivity in Malaysia. J. of radiation research and applied sciences

[2]. Al-Azmi, D. (2014) Gamma Dose Rate Measurements in Kuwait Using a Car-Borne GPS Integrated Dosimetric System. World Journal of Nuclear Science and Technology, **4**, 163-169.http://dx.doi.org/10.4236/wjnst.2014.43021

[3]. (RPII) Radiological Protection Institute of Ireland fact sheet (n.d) sources of ionizing radiation retrieved from www.rpii.ie on 23rd March, 2018.

[4]. Farai I.P and Vincent U.E (2006). Outdoor radiation level measurement in Abeakuta Nigeria, by Thermoluminescent Dosimetry. Nig. Journ. Phys. 18(1): 121-123

[5]. Farai I.P and Jibri N.N (2000). baseline studies of terrestrial outdoor gamma dose rate levels in Nigeria. Radiat. Prot. Dosim. 88(3): 247-254

[6]. Sadiq, A.A., Agba, E.H. (2011) Background radiation in Akwanga, Nigeria. Working and living environmental protection vol.8.N^{0}.pp7-11

[7]. Anoliefo. G.O (1991), Forcados Blend crude oil effects in Respiratory mechanism, mineral element composition and growth of citrulus vulgaris school unpublished doctoral thesis, university of Benin.

[8]. Eteng Inya A., (1997). The Nigerian State, Oil Exploration and Community Interest: Issues and Perspectives. University of Port Harcourt, Nigeria conf paper

[9]. Etu – Efeotor J.O (1998). Hydrochemical analysis of surface andground waters of Gwagwalada area of central Nigeria. Globa J Pure Appl. Sci – 4 (2): 153 – 163.

[10]. Ramli,A.T.,Aliyu, A.S., Agba, A.H. & Saleh, M.A (2014) Effective dose from natural background radiation in Keffi and Akwanga towns, central Nigeria, international journal of radiation research,12(1): 47 - 52

[11]. UNSCEAR (1988) Exposure from natural radiation sources. United Nations Scientific Committee on the Effects of Atomic Radiation report.

[12]. International Commission on Radiation Protection (ICRP, 1990), "Age Dependence Dose to the Member ofPublic from Intake of Radionuclides", Part 1. Pergamon Press Oxford

[13]. Masok, F.B., Dawam, R.R & Mangset, E.W (2015) Assessment of indoor and outdoor background radiation levels in Plateau State University Bokkos Jos, Nigeria. Journal of environment and earth science 5(8): 1-4.

[14]. Ononugbo, C.P. & Ishiekwene, M (2017) A survey of environmental radioactivity levels in science laboratories of Abuja campus University of Port-Harcourt, Nigeria. Archives of current research international 9(3): 1-10

[15]. Jwanbot, D.I., Izam, M.M., Nyam, G.G., & Yusuf, M (2014) Indoor and outdoor gamma dose rate exposure levels in major commercial building materials distribution outlets in Jos, Plateau State, Nigeria. Asian Review of Environmental and Earth Sciences 1(1) : 5-7 URL www.asianonlinejournals.com

[16]. Jwanbot, D.I., Izam, M.M., Nyam, G.G., & Agada, I.S (2012) Evaluation of indoor background ionizing radiation profile in some hospitals in Jos, Plateau State, Nigeria. Journal of natural sciences research 2(7): 35-40

k. Emumejaye "Outdoor and Indoor Radiation Levels Measurement in Osorio, Nigeria." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 12.6 (2018): 08-11.