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Contribution of Building Materials to Background Radiation Dose in Nigeria

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ABSTRACT : *The radioactivity in some building materials mostly used in Nigeria have been investigated using Al-91-207 Griffin Digital Timer scaler and frequency meter which houses Geiger Muller counter. The mean absorbed dose rate from the building materials was found to be 39.0 ± 2.5 μGy/week. Textured paint was found to have the highest absorbed dose rate of 42.7± 2.4 μGy/week while Portland cement has the lowest absorbed dose rate of 33.8 ± 2.5μGy/week. The mean annual effective dose estimated from the materials was found to be 0.28mSv/year with highest value of 0.31mSv/year from textured paint and lowest value of 0.24mSv/year obtained in Portland cement. The means values obtained in this study are less than the recommended values of 67.20μGy/week and 1mSv/year for absorbed Dose rate and annual effective dose respectively.*

I. INTRODUCTION

Building raw materials are products derived from rocks soil and industrial additive such as the hyproduct of fly ash from power station [1]. In addition to the naturally occurring radioactivity in the soil and rock these building materials additives also contain trace amount of natural radionuclides [2, 3].The radionuclides present in the building materials are responsible for external and internal exposures of individuals living in dwelling that vary depending on the geology and the geochemical characteristics of the building materials. Internal exposure arises following the inhalation of alpha parties emitted from the short lived radionuclide of radon (^{222}Rn, the daughter product of ^{226}Ra) and Thoron (^{220}Rn the daughter product of ^{224} Ra). External exposure is due to gamma radiation from the radionuclides present in the building materials [4].

Since individual spent 80% of their times in dwellings [5] knowledge of radiation dose level in Building materials is very important issues in the overall assessment of background radiation dose in every society. Such knowledge would be used to set national standard in the light of global recommendations [6].This knowledge also will help to assess the level of potential radiological hazard to humans caused by the use of specific building materials. The aim of this research is to determine the absorbed dose rate and annual effective dose in building materials commonly used in Nigeria using G.M counter.

II. MATERIALS AND METHODS

12 different samples of Building materials were obtained these include clay Bricks, light weight blocks, Portland cement, Ashaka cement limestone, sand gravel, granites marble, water wash paint textured point and oil paint. The solid samples like blocks clay bricks etc were taken to the laboratory of minerals resources Engineering Department of Kaduna Polytechnic where they were Crushed to tiny bits and kept for 30 days in a container for homogeneity. Direct counting was conducted 5 times for all the samples using G.M. The efficiency of the G.M was determined to be 70% before the counting commences. The average dose rate detection factor for G.M counter is approximately 2 count per minute for each μR/h of radiation flux or 30 C.P.M for 15R/h of radiation flux, and $1R = 10^{-2}$Gy.

III. RESULTS AND DISCUSSION

The average count per minute for each sample was converted to μGy/Week after background were subtracted and re tabulated in table 1 – below.

TABLE 1 Absorbed Dose Rate

Building Materials	Average C.P.M	Absorbed Dose µGy/week
Clay Bricks	45.4	38.0 ± 2.0
Light Weight Blocks	42.9	36.1 ± 1.9
Portland Cement	40.2	33.8 ± 2.5
Ashaka Cement	49.8	41.8 ± 3.0
Limestone	47.5	39.9 ± 2.6
Sand Gravel	48.9	41.1 ± 2.6
Granite	44.7	37.5 ± 2.3
Marble	45.9	38.6 ± 2.0
Water Wash Paint	48.9	41.1 ± 2.5
Textured Paint	50.8	42.7 ± 2.4
Oil Paint	46.6	39.1 ± 2.0
	Mean	**39.0 ± 2.3**

The results show that the mean absorbed dose rate was 39.0 ± 2.30 µGy/week with highest contribution of 42.7 ± 2.40 µGy/week with from the texture paint and lowest contribution of 33.8 ± 2.5µGy/week from Portland Cement as shown in figure 1.

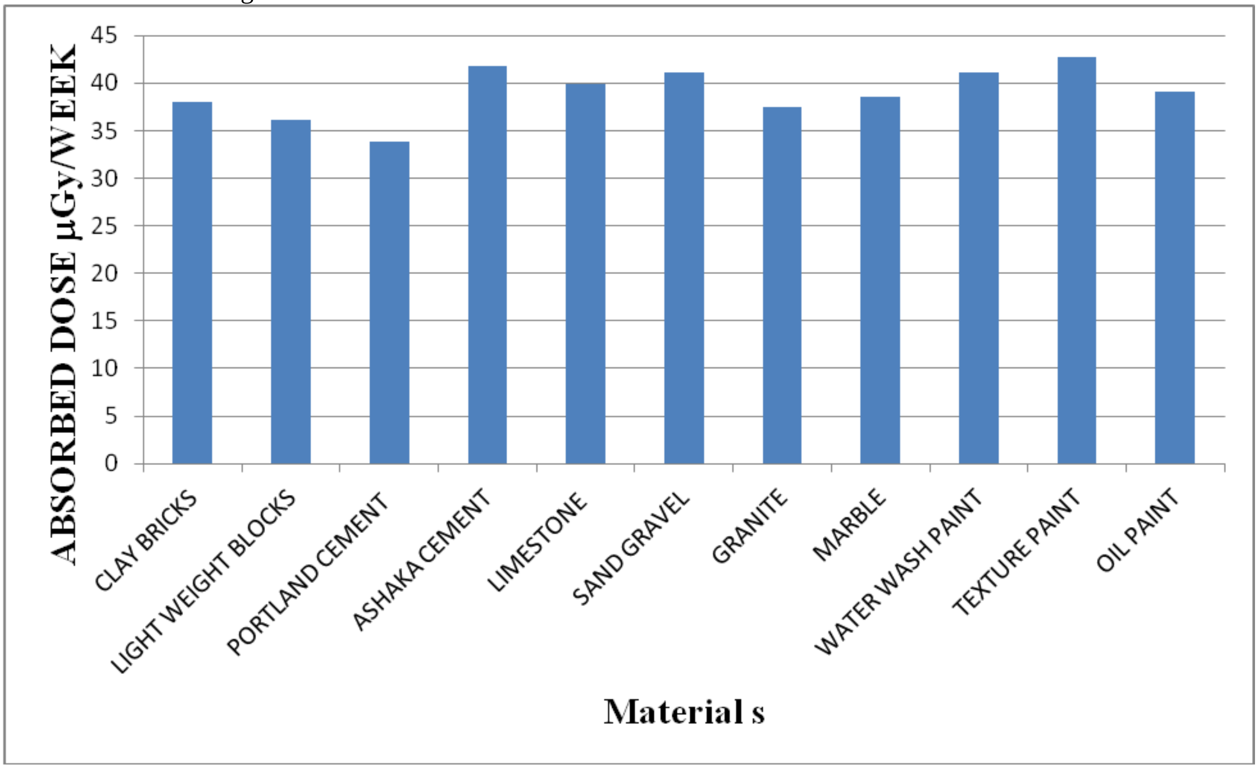

Fig. 1: Plot of absorbed dose rate by materials

The 95% confidence interval for the mean absorbed dose rate in this study lies between (33.8 ± 2.5 – 42.7 ± 2.4) μGy/week. In other words there is 95% assurance that the mean absorbed dose rate in this study lies between the limit (33.8 ± 2.5 – 42.7 ± 2.4) μGy/week.

The annual effective dose rate measured in mSv was determined from the absorbed dose rate by applying the dose coefficient of 0.7Sv Gy^{-1} and 0.2 in door occupancy factor was calculated for each building material as shown in table-2 below.

TABLE 2: Annual Effective Dose

Building Materials	Annual effective Dose in mSv/year
Clay Bricks	0.271
Light weight Blocks	0.26
Portland cement	0.24
Ashaka cement	0.30
Limestone	0.29
Sand Gravel	0.29
Granite	0.27
Marble	0.28
Water Wash Paint	0.29
Textured paint	0.31
Oil paint	0.28
Mean	**0.28**

The mean annual effective Dose is 0.28mSv/year with the highest values of 0.31mSv/year from texture part and the lowest value of 0.24msv/year from portland cement as shown in table above

IV. CONCLUSION

The study revealed that the mean contribution of building materials to absorbed dose rate was 39.0 ± 2.3 μGy/week or 0.2μGy/h which is less than 67.20μGy/week recommended by ICRP [7]. The annual effective dose rate estimated was 0.28mSv/year which is less than 1mSv/year dose limit recommends by UNSEAR [8] for public radiation exposure control.

REFERENCE

[1] Huda Al-Sulati, N. Alkhomashi, N. Al-dahan, M. Al-Dosani, D.A Bradly, S. Bukhari, Determination of Natural radioactivity in Qatarian building materials using high resolution gamma-ray spectrometry. Nuclear Instrument and Methods in Physics Research A 652 (2011) 915-919.

[2] Bereka, J. Mathew P.J., Natural Radioactivity in Australian building materials, industrial wastes and by products. Health Physics 48 (1985).

[3] Amnani. D., and Tahtat, M., Natural Radioactivity in Algerian building materials. Applied Radioactivity and Isotopes 54 (2001) 687 – 689.

[4] Barrier, L. How safe is safe? Radioactivity controversies explained. 1st Edition Union Hyman Limited (1990) 144 – 159.

[5] ICRP protection against Radon – 222 at home and at work publication 65. Ann ICRP 23, 2 Pengamon Press Oxford and York (1994).

[6] IAEA International Basic safety standard for protection against ionizing radiation and for the safety of radiation sources, safety series No. 115 IAEA Vienna (1996).

[7] ICRP 2006 Recommendation of the international commission on radiological protection, ICRP publication 103, Peregamon Press Oxford (2007).

[8] UNSEAR. Exposure from natural sources of Radiation 2000 Report to General Assembly Annex B New York (2000).