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Radiological Survey of Soil Samples from Dumpsites in Ede and Environs, Ede, Osun State,Nigeria

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Abstract*—Results of the investigation revealed that activity concentration ranges from 307.18 ± 22.5Bq/Kg to 932.65 ± 62.42Bq/Kg for K-40; for U-238, 4.02 ± 1.04Bq/Kg to 28.67 ± 8.45Bq/kg and Th-232 ranges from 6.09 ± 3.01Bq/Kg to 26.18 ± 6.34bq/Kg and the absorbed dose ranges from 26.00nGyh^{-1} to 58.46nGyh^{-1}. The mean value for legal dumpsites visited was 39.029nGyh^{-1} and the illegal dumpsites were 43.26nGyh^{-1}.

All the 24 sampled locations were within the recommended value by UNSCEAR (60nGyh^{-1}) as such there should be no fear of serious health hazards due to exposure level of the emitted radiation on the entire populace of Ede and its environs. However, focus should be on proper waste management. This study is aimed at measuring the level of radionuclides from wastes generated in the city to prevent outbreak of diseases and to reduce the radiation exposure level in the dumpsites around Ede and environs.

***Keywords*—Ionizing radiation, natural radionuclides, cosmic rays, activity concentration, radiation dose, UNSCEAR.**

1.0 INTRODUCTION

Humans are exposed to ionizing radiation from numerous sources in the environment. Among them include the cosmic rays and natural radionuclide sources in air, food and drinking water [1].

Primordial radionuclides have been found to exist since the earth was formed. The earth was formed about 6 x 10^9 years ago. Thus a primordial radionuclide needs at least a half-life of 10^8 years to still be detectable today. The three most prominent ones till now are K-40, U – 238 and Th – 232. A large percentage of human exposure to ionizing radiation comes from natural origin, the major contributors being the naturally occurring radioactive elements of the uranium and thorium series, and the non-series radioactive potassium [2];[3];[4].

Due to the process of soil formation, these radionuclides find their way from the host rocks to the soil. The decay schemes of the various natural radionuclides also results to generation of their progeny which contribute to the natural background radionuclide in any geographical location.

Radiation sources also include anthropogenic or man-made sources. The major man-made radiation sources that result in exposure of members of the public are; tobacco, lantern, smoke, television, nuclear medicine detectors, medical x-ray, building materials etc.

IAEA [5] estimate of dose contribution in the environment shows that 85% of doses are derived from the natural radionuclides while the remaining 15% is from cosmic rays and nuclear processes.

Radioactive waste are materials that contain or that are contaminated with radionuclides at concentrations or radioactivity levels greater than tolerance levels established by the appropriate regulatory authority and for which no use is foreseen.

Radioactive waste management is a process of disposing of waste in a way that safeguards the environment and the health of the public. In this sense, radioactive waste management is a tool of public health control and for applying policy on public exposure to the area of waste disposal.

In this study, we investigated the legal and illegal dump sites of wastes with a view to determine the concentrations of primordial radionuclides, in order to determine the radiological significance of such dump sites.

Thus, the objective of this research was to:

i. Survey sites for the possible presence of radioactive wastes due to improper disposal by users in Ede and environs.

ii. Establish a base line for radioactivity levels at these sites.

2.0 MATERIALS AND METHOD

2.1SAMPLE COLLECTION AND PREPARATION

The samples used for the work were soil samples collected from the two major legal dump sites and from three illegal dump sites in Ede environs, Osun State, Nigeria. Five samples were collected from each of the five location areas, randomly spreading out the sample location as much as possible to ensure a good

representation. The soil samples were collected from the dump sites by digging approximately, 10-15cm below the top soil as a good representation of what has been dumped over time. These samples were packed in polythene bags for easy conveyance.

The soil samples were air dried after collection. Next, after drying, they were sealed in cylindrical plastic containers. A total of twenty five samples were packed for subsequent analysis.

The samples were stored for 28 days before counting in order to allow radioactive equilibrium to be reached between the parent primordial radionuclides and decay product radionuclides or progeny.

2.2 Counting Procedure

The counting procedure adopted was gamma spectroscopy. A Sodium Iodide (Tallium-activated) detector coupled to a Canberra series 10 multi-channel analyzer was employed. The counting was done for a period of 36,000 seconds (10 hours). The region of interest (ROI) setting was used to define the regions of interest for the expected radionuclides. Region one was photo-peak corresponding to the gamma energy 1.465 MeV from K-40, region two was the photo-peak energy 1.765MeV for U-238 and region three was the photo-peak of energy 2.615 MeV for Th-232. Each sample containing 200g of soil in sealed plastic container was placed on the detector inside a 5cm thick Canberra lead castle to shield the detector against environmental background for counting.

DOSE RATES

Table 1.OKE-BAALE (LEGAL)

	K-40	U-238	Th-232	Total Dose (nGy/hr)
A	17.45±38.00	7.48±3.14	14.4±5.16	39.60
B	21.05±45.75	11.26±3.99	13.91±2.65	46.22
C	33.77±70.01	3.94±3.01	11.88±2.08	49.59
D	18.30±35.55	3.64±4.59	4.06±3.07	26.00
E	22.06±45.77	4.31±3.38	4.36±3.07	30.73

Table 2.SABO (ILLEGAL)

	K-40	U-238	Th-232	Total Dose (nGy/hr)
A	32.18±60.64	8.41±6.40	9.94±5.43	50.53
B	38.85±85.07	7.31±4.95	12.30±6.24	58.46
C	24.40±54.10	2.72±1.91	7.35±3.24	34.47
D	27.31±66.56	9.38±5.11	11.50±3.29	48.19
E	20.30±47.32	8.03±3.24	5.38±2.85	33.71

Table 3.IDO OSUN (LEGAL)

	K-40	U-238	Th-232	Total Dose (nGy/hr)
A	19.84±47.03	3.85±3.57	9.14±1.98	32.53
B	13.50±25.86	4.60±3.57	10.58±2.40	28.68
C	33.2±69.98	5.05±6.48	17.44±6.34	55.69
D	33.78±64.99	7.80±3.10	11.40±4.53	52.98
E	13.01±37.75	6.51±3.56	4.63±1.66	28.15

Table 4.OLOYIN-EDE (ILEGAL)

	K-40	U-238	Th-232	Total Dose (nGy/hr)
A	26.33±57.41	11.34±3.75	15.54±4.09	53.08
B	15.57±39.22	10.75±8.49	10.08±1.09	36.40
C	20.83±8.75	5.49±4.97	8.22±5.33	34.59
D	12.90±22.56	4.05±2.01	6.05±2.00	23.80
E	28.02±54.87	1.75±1.04	9.30±2.13	39.07

Table 5.AKODA-EDE (ILLEGAL)

	K-40	U-238	Th-232	Total Dose (nGy/hr)
A	38.06±75.53	8.27±8.21	8.54±2.60	54.87
B	30.95±81.21	12.30±8.46	4.98±1.06	48.23
C	39.17±62.42	5.53±4.12	6.19±3.41	50.89
D	29.53±66.61	6.35±7.25	4.22±1.29	40.10

Table 6.OKE-BAALE (LEGAL)

	K-40 (Bq/Kg)	U-238 (Bq/Kg)	Th-232 (Bq/Kg)
A	415.43±38.00	17.43±3.19	22.03±5.16
B	501.18±45.75	26.25±3.99	20.88±2.65
C	804.00±70.01	9.19±3.01	17.83±2.08
D	435.60±35.55	8.49±4.59	6.09±3.01
E	825.16±45.77	10.00±3.38	6.54±3.64

Table 7.SABO OSOGBO (ILLEGAL)

	K-40	U-238	Th-232
A	766.09±60.66	19.61±6.40	14.93±5.43
B	924.88±85.07	17.03±4.95	18.47±6.21
C	580.87±59.10	6.35±1.91	11.03±3.24
D	650.41±66.56	21.81±5.17	17.27±3.29
E	483.26±47.32	18.72±3.24	8.07±2.85

Table 8.IDO OSUN (LEGAL)

	K-40	U-238 (Bq/Kg)	Th-232 (Bq/Kg)
A	465.22±47.03	8.97±3.57	13.72±1.98
B	321.54±25.81	10.73±6.28	15.89±2.40
C	790.48±69.86	11.76±6.48	26.18±6.34
D	804.38±64.99	18.91±3.12	17.12±4.53
E	404.94±37.75	15.18±3.56	6.95±1.66

Table 9.OLOYIN EDE (ILLEGAL)

	K-40 (Bq/Kg)	U-238 (Bq/Kg)	Th-232 (Bq/Kg)
A	626.82±57.41	26.44±3.75	23.4±4.09
B	370.77±39.22	25.05±8.49	15.13±1.09
C	495.59±48.75	12.80±4.97	12.42±5.33
D	307.18±22.56	9.45±2.01	9.09±2.00
E	667.11±54.87	4.07±1.04	13.97±2.13

Table 10.AKODA (ILLEGAL)

	K-40 (Bq/Kg)	U-238 (Bq/Kg)	Th-232 (Bq/Kg)
A	906.11±75.53	19.28±8.21	12.82±2.60
B	736.96±81.21	28.67±8.45	7.48±1.06
C	932.65±62.42	12.89±4.12	9.29±3.47
D	202.98±66.61	14.80±7.25	13.97±1.29

3.0 Discussion

The least total absorbed dose rate of soil samples from legal dumpsites in use is 26.00nGyh^{-1} and this was found in OKE-BAALE while the highest total absorbed dose rate of legal dumpsites is 55.69nGyh^{-1} and this was found in IDO-OSUN.

The least total absorbed dose rate of illegal dumpsites was 23.00nGyh^{-1} and this was found in OLOYIN EDE, while the highest total absorbed dose was found in SABO which is 58.46nGyh^{-1}.

Also the mean value of the total absorbed dose for the legal dumpsite is 39.029nGyh^{-1} and the mean value for illegal dumpsites is 43.26nGyh^{-1}. The absorbed dose rate for all the 24 sampled locations are within the recommended value by UNSCEAR (i.e 60nGyh^{-1}).

4.0 CONCLUSION

The activity concentration measurement of the radionuclides have been carried out and their attendant radiation doses have been investigated. The mean absorbed dose rates obtained are 39.029nGyh^{-1} (Legal) and 43.26nGyh^{-1} (Illegal). Despite the fact that all the levels of ionizing radiation are hazardous to human health, the exposure level of the emitted radiation on the populace of Ede and environs is low compared to Nigeria [6] and world average[7]. Hence, fear of serious health hazards arising from exposure to ionizing radiation emanating from these dump sites should not be entertained, but there is still strong need for proper waste disposal and management norms.

REFERENCES

[1] National Council on Radiation Protection and Measurement. *Enviromental Radiation Measurements*.,No.50, 1976.

[2] I.P. Farai and Jibiri N.N,*Baseline studies of terrestrial outdoor gamma dose rate levels in Nigeria*. Radio. Protection.,88,247-254,2000.

[3] I.P. Farai and N.N Jibiri, *Baseline studies of terrestrial gamma radiation sources , effects and risk of ionizing radiation*, Oxford University Press,15,pp.14-16,2003.

[4] I.P. Farai and J.A Ademola ,*Radiation equivalent activity concentrations in concrete building blocks in eight cities in south western Nigeria,* Radio. Protection.79, pp.119-125,2005.

[5] International Atomic Energy Agency (IAEA). *Facts about low level radiation exposure*.IAEA Publications, Paris, France.No. A.N.E 985-06482, 1986.

[6] R.I. Obed, I.P. Farai and N.N Jibiri, *Population dose distribution due to soil radioactivity concentration levels in 18 cities across Nigeria*, Radio. Prot.,25:305, 2005.

[7] United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). *Sources, effects and risks of ionizing radiation*. United Nations, New York. Annex A.B,1988.