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RADIATION MONITORING ALONG THE CREEKS OF CALABAR RIVER AND ITS ENVIRONS.

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ABSTRACT

Measurement of gamma-ray exposure rate using a portable dosimeter was taken. The exposure rate was taken one meter above water and ground levels for radiological assessment at the Calabar River and its environs of Cross River State, Nigeria.

The study reveals equivalent dose rate of 0.007μSv/hr and 0.115μSv/hr within the river and its environs respectively. Subsequently, the values are considered far below the radiation limits of 1mSv stipulated for members of public per year.

KEYWORDS: Gamma-ray, radiological assessment, Calabar river, Environs, members of public.

INTRODUCTION

Man lives in an environment in which he is continuously being bombarded with ionizing radiation from both natural and man-made sources (Tchokossa, 1999, UNSCEAR, 1988).

The environment in this context is the geographical and physical location in which we live, work and produce Inegbedion, (1998). According to Adeniyi (1986), the environment consists of the following three classifications:

(1) The physical environment, which consist of the air, surface topography climate and soil.
(2) The biological environment, which comprises living things such as plants, animals and micro-organisms;
(3) The cultural and social environment which comprises the family, organization of society, culture (including beliefs and attitudes), urbanization, politics, government, law and the judicial process.

All three systems interact in a complex interdependent manner. For example, the influence of the physical environment on the biological environment determines the distribution of plants and animals, which provide materials for food, clothing and shelter for man.

Water is essential to life as the air breathed by humans. Thus, the presence of natural radioactivity in ground, surface and domestic water has been studied with great efforts in many countries of the world by many investigators for example, (Cross, 1985; Cothern, 1986 and 1983). The production of man-made radionuclides was a result of fission process and/or by accelerating electrically charged subnuclear particles such as protons, deutrons, tritium and alpha particles to very high energies and directed onto a target material therefore causing nuclear reactions that result in the formation of radionuclides (Tchokossa, 1999). It is further reported by Joshi, (1991) that during these processes, some of these artificially produced radionuclides usually got released into the global environment thereby undoubtedly adding to the levels of the ubiquitous natural radiation.

Therefore, everyman anywhere in the world according to Furlan, (1991) is exposed to natural radiation. However, this exposure can deviate significantly from what is considered "normal", largely depending on the radionuclide concentration in the geological subsoil and or the altitude above sea level. The purpose of environmental monitoring therefore is to seek a way for determining the possibility of an individual receiving radiation exposures as a result of activities. The dose for natural radiation sources, usually referred to as background radiation is estimated as 2 mSv per year, Elegba, (1998). This usually involves measurement of such factors as the background radiation from radioisotopes in the ground, cosmic radiation and radioisotopes in the air.

According to Muth (1974), a dose rate of 0.015μGyh^{-1} is absorbed per ion cm^{-3}s^{-1} assuming a mean energy of 33.7eV for the formation of ion pair in air. 2.41 ion pairs cm^{-3}s^{-1} are considered to be formed at sea level by the direct ionization of cosmic radiation. Without considering the shielding by buildings, this presents an average dose in air of 0.28 mSv (UNSCEAR, 1982). This component has been found to decrease with lower geographical altitudes and increase with altitudes above sea level.

Effects of radiation exposure have gained prominence through International Atomic Energy Agency reports (1981). Also it is the opinion of Uwah, (1992) that even very low level radiations depending on the rate of exposure can cause genetic effects which may appear after many generations.

This paper therefore aims at using the experimental results of the radiation survey along the Creeks of Calabar and its environs to assess whether or not the people living around the area under study are free from radiation hazards.

Experimental Procedure

A dosimeter with a 9-volt battery was used for the radiation measurement. It is designed to measure radiations such as gamma-ray, alpha particle and x-rays in counts/minute usually recorded on the liquid crystal display (LCD) unit.

The instrument has a temperature range from 0°C – 50°C and therefore considered to be sensitive for

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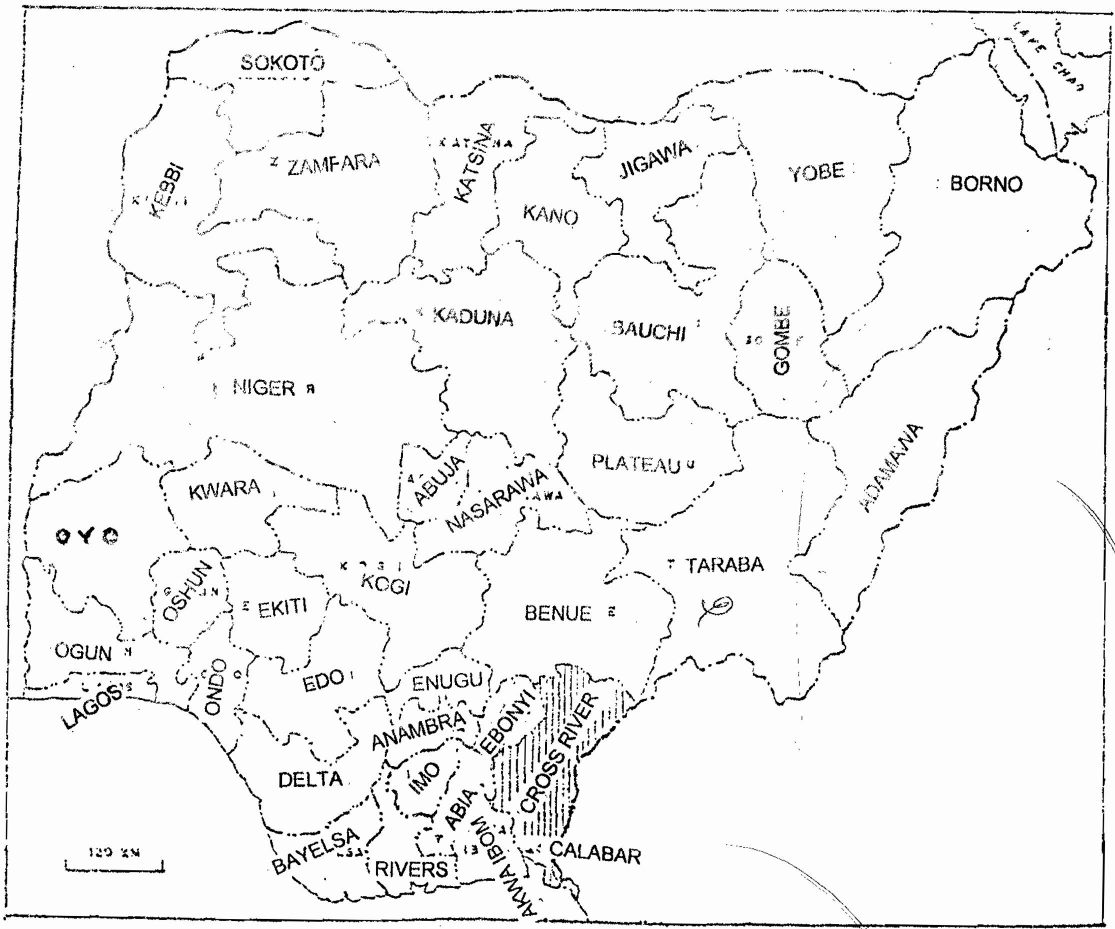

Fig. 1 Map of Nigeria showing location of Cross River State.

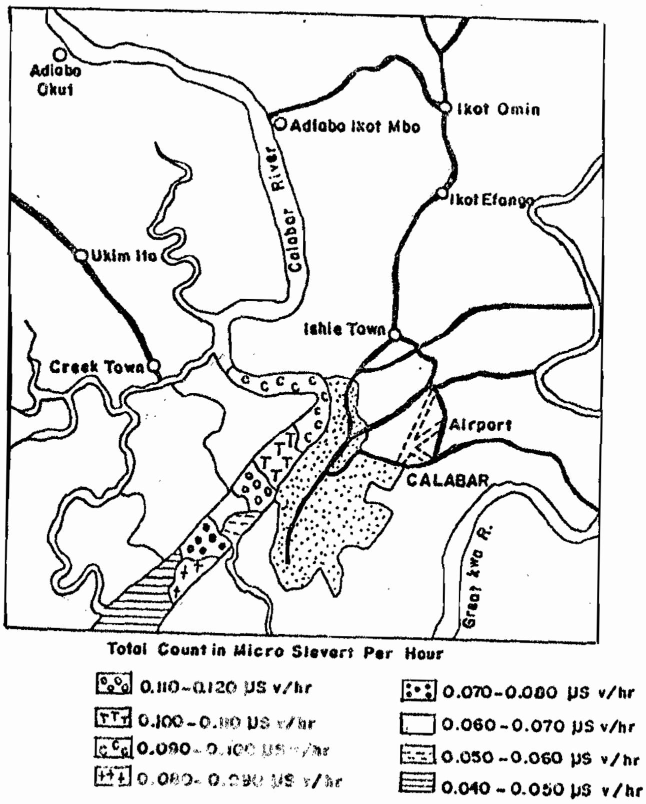

Fig. 2 : Shows the [illegible] of Calabar River and its Environs

the detection of radioactive rays. It is calibrated using Cobalt 60 at 1000 cpm per mR/hr and Cesium 137 at 137 cpm per mR/hr.

The direct reading dosimeter was held 1m above sea level. Consequently, to check the rate of radiation from an object, the instrument was put near to it. Where the count was higher than **normal**, the object is considered radioactive. The reading at any distance from the object indicates the radiation exposure one could obtain at that distance.

Using the dosimeter, data were taken within the mid-stream of Calabar River and its bounds covering the period February – March, 1999. The areas covered were: Marina, the Naval Base and the Creek Town. A map of Nigeria showing the location of Cross River State is shown in Figure 1. The sampling areas and the corresponding radiation dose levels at each sampling point are shown in Figure 2 and Figure 3.

Observation obtained within the midstream and along the bound of the Calabar River with the corresponding frequencies using the class width of eight and ten units are shown on table 1 and 2 respectively.

RESULTS AND DISCUSSION

Histogram of the exposure rate estimated from the dosimeter data for the mid-stream and along the bound of Calabar River are illustrated in Fig. 4 and Fig.

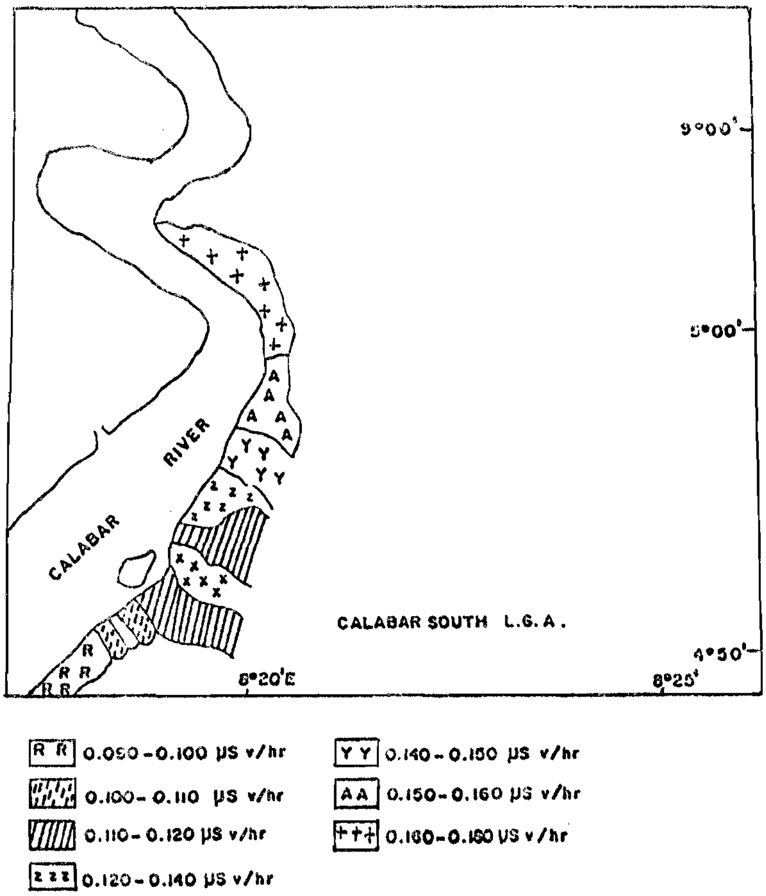

Fig. 3 : Radiation Monitoring Area of Calabar Creeks 1m From the Ground

Table 1: Data obtained within the midstream of Calabar River

No.	Class limit	Class mark	Frequencies
1	0.040 – 0.049	0.045	1
2	0.050 – 0.059	0.055	9
3	0.060 – 0.069	0.065	10
4	0.070 – 0.079	0.075	28
5	0.080 – 0.089	0.085	21
6	0.090 – 0.099	0.095	10
7	0.100 – 0.109	0.105	4
8	0.110 – 0.119	0.115	1

Table 2: Data obtained along the bounds of Calabar

No.	Class limit	Class mark	Frequencies
1	0.090 – 0.099	0.095	10
2	0.100 – 0.109	0.105	1
3	0.110 – 0.119	0.115	23
4	0.120 – 1.129	0.125	14
5	0.130 – 0.139	0.135	14
6	0.140 – 0.149	0.145	13
7	0.150 – 0.159	0.155	12
8	0.160 – 0.169	0.165	5
9	0.170 – 0.179	0.175	5
10	0.180 – 0.189	0.185	5

5. Fig. 4 shows that the main exposure rate (that is, the statistical mode) for the entire area is about 0.075 . This reveals the concentration rate of the gamma-ray within the river. Fig. 5 shows an estimated exposure rate of about 0.115 μSv/hr. Although the radiation level in the river is low according to the measurements along the midstream, however, measurement along the bound though higher in some cases, correlate fairly well with

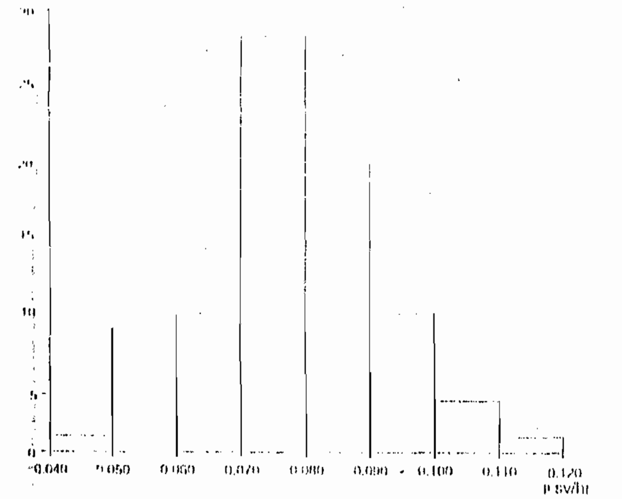

Fig. 4 Histogram of Data for the mid-stream of Calabar River

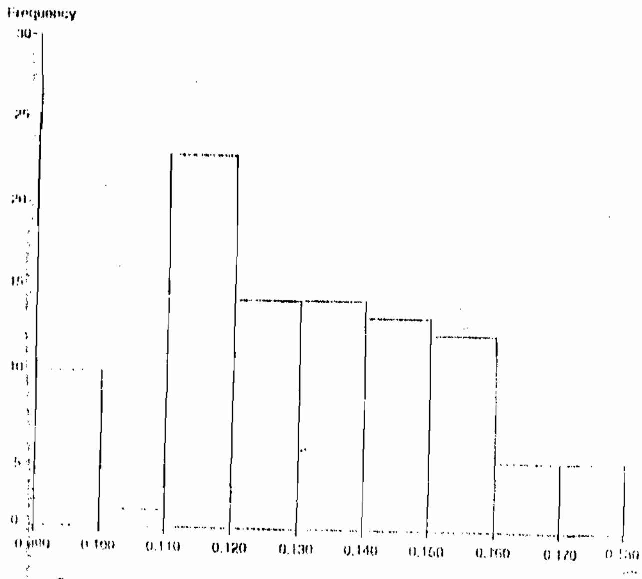

Fig. 5 Histogram of Data Rate along the bound of Calabar River

the mean estimate. The difference between the water and ground measurements is about 0.04 μSv/hr. This may be due to background reflection of cosmic-ray, which is considered to be very high on land than the sea level.

CONCLUSION

This study shows that in Calabar River and its environs, the mean estimate on the exposure rate is 0.075μSv/hr and 0.115μSv/hr, respectively. These values are considered far below the radiation limits stipulated by the International Commission on Radiation Protection (ICPR). For members of public the radiation limit is 1 mSv per year. Subsequently, people living along the Creeks of Calabar River and its environs are likely not to be affected by any major source of radiation hazards as shown in this study.

REFERENCES

Adesia, H. O and Adejiyi, E. O., 1986. Environmental Management and Development in Nigeria" Development and the Environment. Proceedings of National Conference. Pp 75 – 82.

Elegba, S. B. and Funtua, I. I., 1998. Determination and handling of Naturally Occurring Radioactive Material (NORM), in Petroleum Production Waste. pp 795.

Cline, W., Adamovitz, S., Blackman, C., Kahn, B., 1983. Health Phys. 50: pp 33.

Furlan, G. and Tammosino, L., 1991. Proceedings of the second workshop on random monitoring in radioprotection, environmental and or Earth Sciences pp 44 – 54.

IAEA, 1981 Fact about low-level radiation. World Health Organization, Geneva. Pp 19.

Joshi, S. R., 1991. Sci. Total Environs. 100: Pp 61.

Inegbedion, E. S., 1998. Paper presented at the internal seminar on the petroleum industry and the Nigerian environment. Pp 818.

Muth, H., 1974. Radiation exposure and occupational risk Pp. 129 – 139.

Fasai, M. K, Tchokossa, P., Ojo, J. O., Balogun, F. A. ,1999 Occurrence of natural radionuclides and fallout Cesium-137 in dry season agricultural land of South Western Nigeria. Journal of Radioanalytical and Nuclear Chemistry, 240 (3): 949 – 952.

Tchokossa, P.; Oloo, J. B. and Osibote, O. A., 1999 Radioactivity in the community water supplies of Ife-Central and Ife-East Local Government Areas of Osun State, Nigeria. Nucl. Inst and Meths in Physics Research; A 422: 784 – 789.

UNSCEAR, 1982. Sources and effects of the ionizing radiation. United National Scientific Committee on the Effects of Atomic Radiations. Report to the UN General Assembly, with Annexes, United Nations.

Uwah E. J. and Ajakaiye, D. E., 1992. Effects of over-estimation of background radiation surveys; Journal of Mining and Geology. P.54-- 55.