Journal of Environmental Issues and Agriculture in Developing Countries
Volume 16, Number 1, April 2024
ISSN(p): 2141-2731 ISSN(e): 2795-2967
Published By
International Centre for Integrated Development Research, Nigeria
In collaboration with
Copperstone University, Luanshya, Zambia

Background Ionizing Radiation (BIR) in Ogbia Local Government Area, Bayelsa State, Nigeria

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ABSTRACT

This investigation was conducted in the communities of Ogbia Local Government Area in Bayelsa state. Three localities were chosen for this study based on the criteria that they serve as host communities for international oil firms. These communities are Imiringi, Elebele, and Emeyal, located within the Ogbia local government area. The research used a standard Radiation Monitoring Device, namely the Radalert x100. The ambient ionising radiation (BIR) in the three villages was measured randomly. Readings were collected from five different places, as shown in the tables below. At 0.009mSv/y, the Emeyal community recorded the lowest Background Ionising Radiation (BIR) mean value, whilst the Imiringi community had the highest value, at 0.014mSv/y. A mean BIR value of 0.011mSv/y was recorded by the Elebele community. The absorbed dose rate (AbD) ranged from 0.075nGy/h in Emeyal to 0.120nGy/h in Imiringi, with the former having the lowest value. The average AbD value for Elebele was a 0.096nGy/h. Emeyal has the lowest known mean Annual Effective Dose Equivalent (AEDE) rate of a 0.115mSv/y. The average AEDE measured in Elebele was 0.147 mSv/y, while in Imiringi and Elebele it was 0.184mSv/y. What follows is a breakdown of the three groups' average ELCR values: The mean values for the three groups were as follows: 0.405 x10-3 for Elebele, 0.508 x10-3 for Imiringi, and 0.317 x10-3 for Emeyal. The UNSCEAR 2000 World Permissible Limit was used as a benchmark for comparing the generated values. There is no imminent risk to the health of individuals in the research area from radiation.

Keywords*: Radiation, Background Ionizing radiation, Dose rate, Dose Distribution, Permissible limits.*

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INTRODUCTION

The distance between the Earth and the Sun is mostly without matter, making it very difficult for heat to be transferred by convection or conduction. In these instances, the transport of heat occurs by radiation. Essentially, the heat from a body releases electromagnetic waves that our skin absorbs. These waves may spread without the need for a medium (Engineering LibreText, 2022). Natural background radiation refers to the ionising radiation that we are constantly exposed through natural sources. Man-made radiation is be produced by various medical, commercial, and industrial operations. Hence, we are continuously exposed to ionising radiation from both natural and man-made sources (NIEHS, 2022). Our daily surroundings is inherently exposed to natural background radiation. Soil radiation levels are conditional on their geological source (WHO, 2022). Radiation levels are often higher in igneous rocks like granite and lower in sedimentary rocks (Sadiq and Agba, 2012). Radon is a gas that seeps out of the Earth's crust and ends up in the air we breathe. It's responsible for a large chunk of our natural exposure. Natural radioactivity inside the body, as well as radiation from the earth, gas, and the cosmos, are the principal sources of environmental radiation (Osiga, 2014). A worldwide annual equivalent dose rate of ionising radiation of 2.4mSv/yr was set as the upper limit for human health protection by the International Commission on Radiological Protection (ICRP, 1990). Background ionising radiation (BIR) can cause health hazards on human health if it is in reasonable high concentration, hence measuring it is crucial. The following are some of the aims of this research project:

- to estimate the radiation dosage of communities within Ogbia local Government Area
- to determine the absorbed dose rate of communities within Ogbia local Government Area
- to determine the effective absorbed dose rate (AbD) of communities within Ogbia local Government Area
- determination of the annual effective dose equivalent rate (AEDE) of communities within Ogbia local Government Area

STUDY AREA

This research work was carried out within communties in Ogbia Local Government Area, Bayelsa state. For this research work, three (3) communities were selected which includes Imiringi community, Elebele Community and Emeyal community within the local government area and the communities was used to in the study to estimate the BIR level in the area. The local government which is known as oil

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producing communities, and host to oil and gas plant that is constantly supplying electricity to the state. Emeyal community is large community divided into Emeyal 1and Emeyal 2 . Apart from the crude oil operation, there is also the presence of economic activities in the three communities been studied.

The Ogbia people are a native population residing in Bayelsa State, located in the Niger Delta area of Nigeria. Ogbia Town is renowned for its abundant reserves of crude oil, since it is home to the first oil well in Nigeria. Ogbia has a land area of 695 square kilometres and is home to a population exceeding 200,000 people. Its historic importance is widely recognised as a crucial pillar of the Nigerian state's economy today. The primary occupations of the residents of Ogbia land are fishing and farming. The community is divided into four distinct clans: Abureni, Anyama, Kolo Creek, and Oloibiri. The inhabitants of Ogbia are members of the Ijaw ethnic group. GPS locations of the three communities as follows

Imiringi: Latitude $4^0$51’18 North and Longitude $6^0$22’16 East

Elebele: Latitude $4^0$51’30 North and Longitude $6^0$20’38 East

Emeyal: Latitude 04^{0}24’26 North and Longitude $6^0$15’45 East

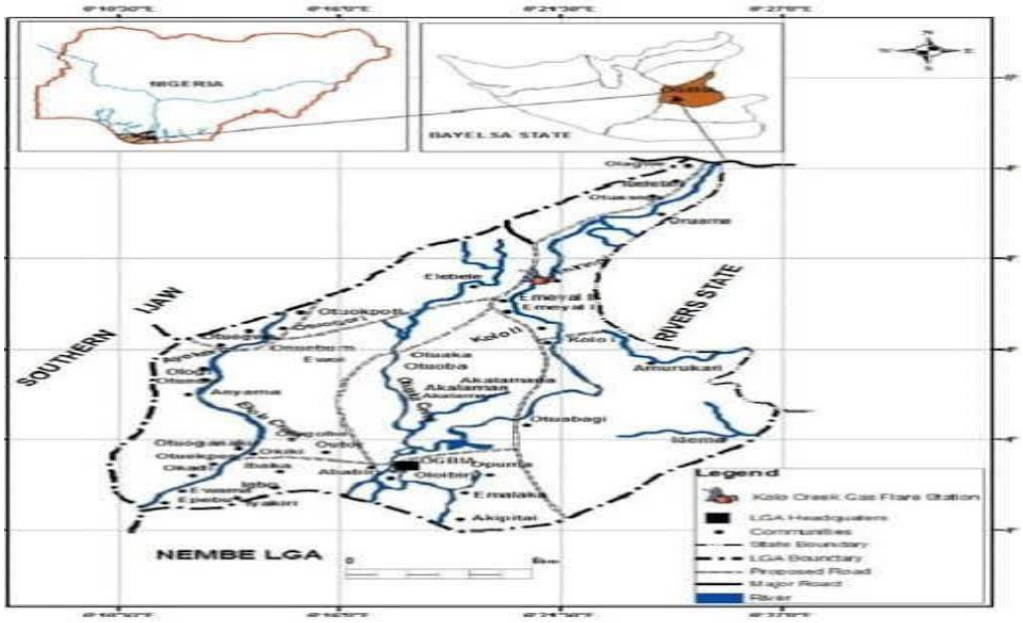

Figure 1: Showing map of Ogbia Local Government Area, Bayelsa State.
Source: ResearchGate.

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MATERIALS AND METHODOLOGY

The resources used for this inquiry include a portable radiation measuring apparatus. The statistical analysis was performed using Microsoft Excel, a computer software application. A portable radiation metre was used to test the ambient radiation levels in the three communities of Imiringi, Elebele, and Emeyal in the Ogbia Local Government Area. The assessment was conducted at five randomly chosen locations within each village. The radiation metre was placed at a height of one metre above the ground to measure the mean level of radiation exposure to the human body. Throughout the measurement, the device's window was deliberately positioned at an upward vertical angle to assure exposure to incoming radiation. A total of five readings were gathered for each neighbourhood. The measured BIR reading was converted to other radiological parameters with their established conversion factors as shown in the table below:

Fig 1: Back and Front view of the Radiation Monitoring Device- Radalert x100

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RESULTS

Table 1: Showing the Outdoor Background Ionization Exposure rate in Imiringi community and other calculated parameters.

LOCATIONS	BIR(mR/h)	AbD(nGy/h)	Eqv(mSv/y)	AEDE (mSv/y)	ELCR x10-3
POINT 1	0.014	0.122	1.226	0.187	0.515
POINT 2	0.016	0.139	1.402	0.213	0.589
POINT 3	0.010	0.087	0.876	0.133	0.368
POINT 4	0.015	0.131	1.314	0.200	0.552
POINT 5	0.014	0.122	1.226	0.187	0.515
AVERAGE	**0.014**	**0.120**	**1.209**	**0.184**	**0.508**

Table 2: Showing the Outdoor Background Ionization Exposure rate in Elebele community and other calculated parameters.

LOCATIONS	BIR(mR/h)	AbD(nGy/h)	Eqv(mSv/y)	AEDE(mSv/y)	ELCR x10-3
POINT 1	0.012	0.104	1.051	0.160	0.442
POINT 2	0.010	0.087	0.876	0.133	0.368
POINT 3	0.011	0.096	0.964	0.147	0.405
POINT 4	0.008	0.070	0.701	0.107	0.294
POINT 5	0.014	0.122	1.226	0.187	0.515
AVERAGE	**0.011**	**0.096**	**0.964**	**0.147**	**0.405**

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Table 3: Showing the Outdoor Background Ionization Exposure rate in Emeyal community and other calculated parameters.

LOCATIONS	BIR (mR/h)	AbD (nGy/h)	Eqv (mSv/y)	AEDE (mSv/y)	ELCR x10-3
POINT 1	0.011	0.096	0.964	0.147	0.405
POINT 2	0.006	0.052	0.526	0.080	0.221
POINT 3	0.011	0.096	0.964	0.147	0.405
POINT 4	0.010	0.087	0.876	0.133	0.368
POINT 5	0.005	0.044	0.438	0.067	0.184
AVERAGE	**0.009**	**0.075**	**0.753**	**0.115**	**0.317**

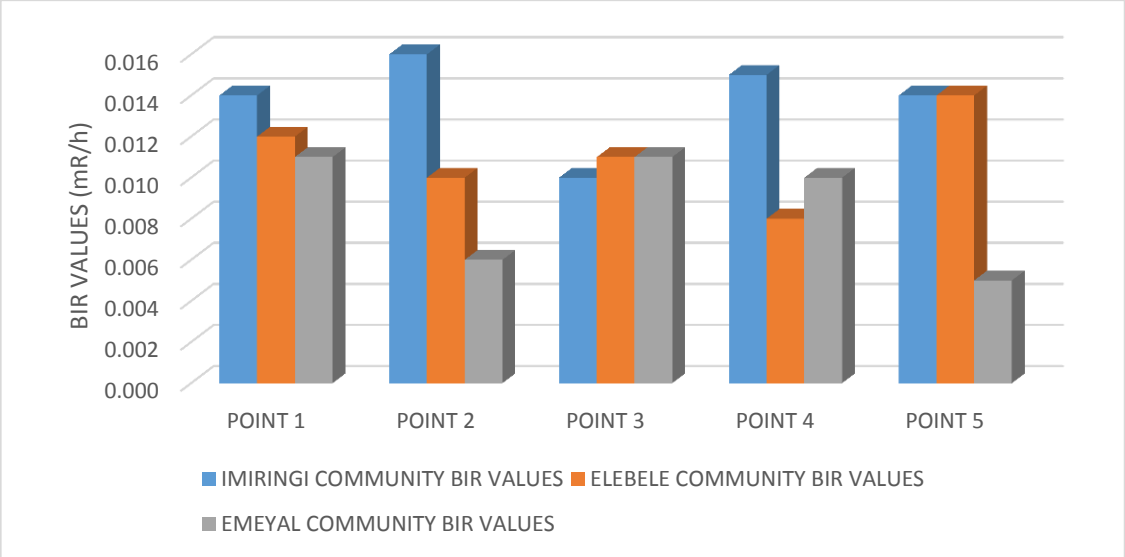

Fig 1: BIR exposure rate locations in Imiringi, Elebele and Emeyal communities, Ogbia L.G.A.

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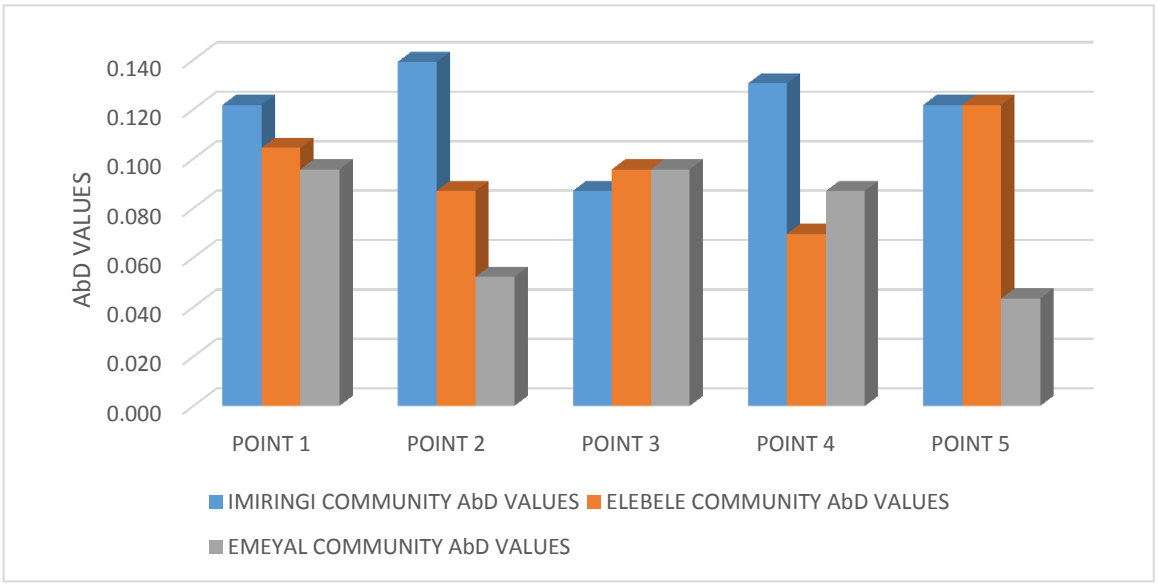

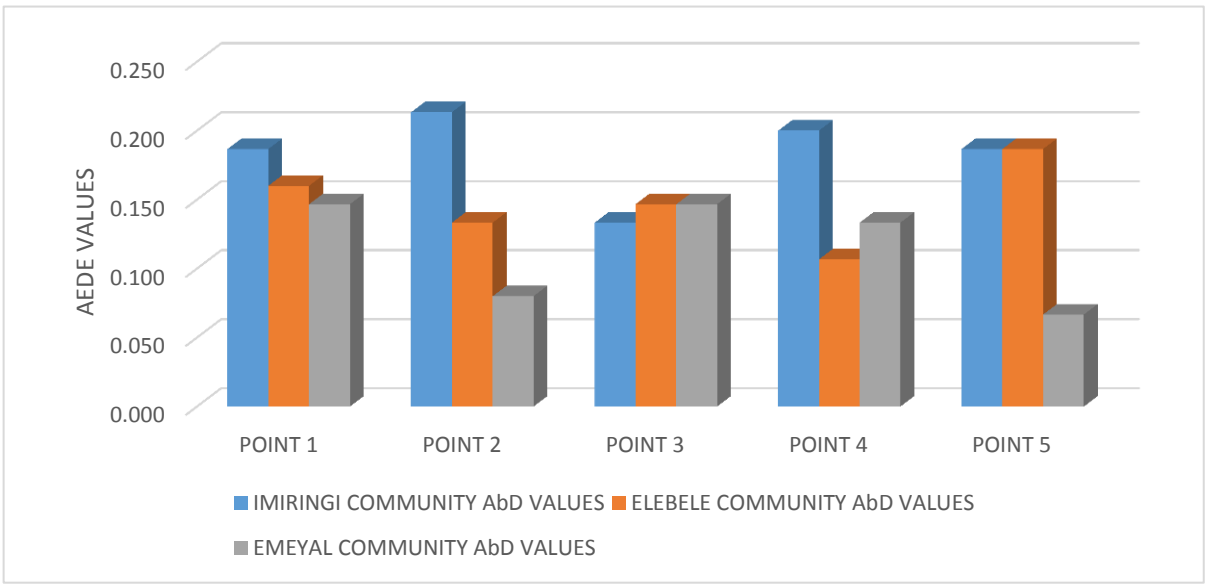

Fig 3: AEDE exposure rate locations in Imiringi, Elebele, and Emeyal communities, Ogbia L.G.A.

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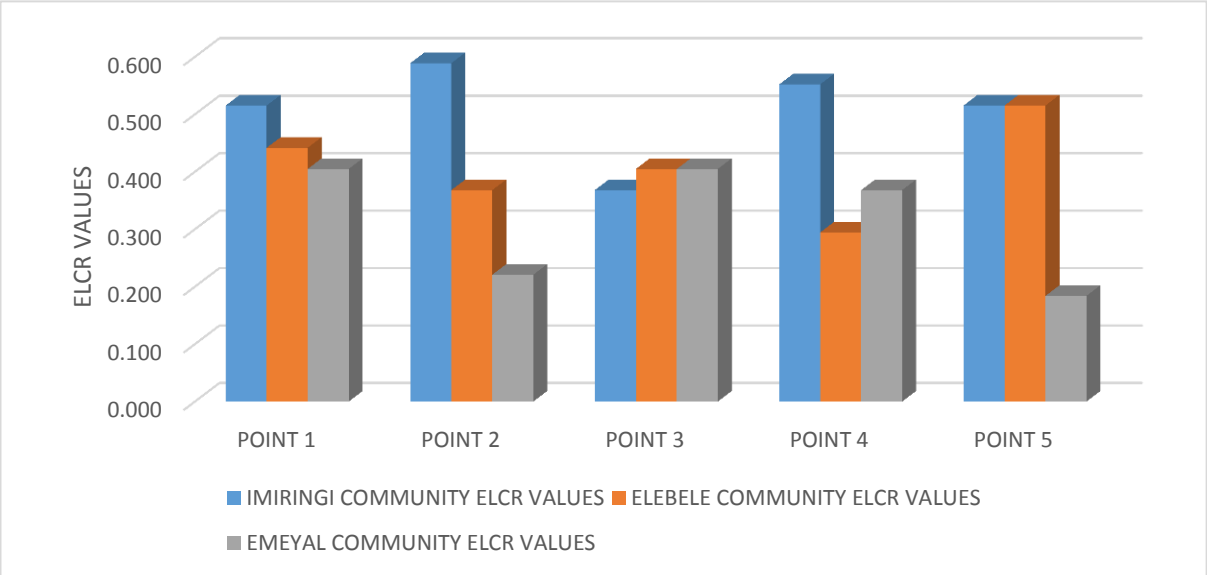

Fig 4: ELCR rate locations in Imiringi, Elebele, and Emeyal communities, Ogbia L.G.A.

DISCUSSION

Table 1 displays the measurements of Outdoor Background Ionising Radiation (BIR) exposure rates for five (5) distinct locations in the Imiringi community, along with other calculated radiological parameters. Table 2 similarly displays the Elebele community's five(5) BIR exposure rate data and other computed radiological characteristics. Along with other computed radiological parameters, Table 3 displays the BIR measurements for five (5) separate sites in the Emeyal community. Bar charts showing BIR exposure rate values at several sites in Imiringi, Elebele, and Emeyal are shown in Figure 1. At point 2, the population of Imiringi has the highest Background Ionising Radiation (BIR) value at 0.016mSv/y. While at point 5, the Emeyal community's BIR value is 0.005mSv/y, which is the lowest. Figure 2 shows the Imiringi, Elebele, and Emeyal sites' AbD (Absorbed Dose) exposure rate data in bar charts. Emeyal has the lowest value at 0.139nGy/h, whilst Imiringi has the highest. Workplace radiation exposure is below the UNSCEAR 2000-recommended

average of 0.013mSv/y, according to the results. The one and only outlier is the BIR mean value of 0.014mSv/y that has been recorded by the Imiringi community. There is no immediate danger to radiological health from this. The ELCR exposure rate values for three locations—Imiringi, Elebele, and Emeyal—are shown in Figure 4, which is a bar chart. Imiringi has the greatest value among these places at 0.589 x10-3, while Emeyal has the lowest at 0.184 x10-3. Note that both Imiringi and Emeyal's levels are lower than the global permitted limit of 0.29 x10-3, as specified by UNSCEAR 2000.

CONCLUSION

This research study presents the levels of Background Ionising Radiation in three communities: Imiringi, Elebele, and Emeyal, all located in the Ogbia Local Government Area of Bayelsa State. A total of five (5) BIR values of different locations within the communities were measured using a typical handheld radiation. The results in the tables and charts show that Imiringi community recorded the highest radiological values, followed by Elebele community and Emeyal community. The radiological values recorded does not indicate immediate radiological health hazard. Hence, further research works can be carried out to justify this research.

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