

Survey on the Level of Ionization and Non-Ionization Radiation: Causes, Effects and Controls in Warri Metropolis, Delta State

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Abstract– An extensive survey on the level of ionization and non-ionization radiation with respect to causes, effects and controls in Warri metropolis, Delta State is carried out. The research shows an average radiation dose of about 0.0156mRh^{-1} against the standard radiation dose of about 0.013mRh^{-1} across the sampled locations in Warri metropolis, Delta State, Nigeria, attributed mostly to industries with known radioactive activities and also construction companies during breaking of rocks etc. The study employed the use of Radiation detection equipment (Radiation metre) for the collection of radiation dose in the locations, GPS, questionnaires for social survey and SPSS for the statistical analysis and graphing. The study recommends that industries with known use of radioactive elements in their activities should contain radiation in the smallest space possible from the reach of outside environment, sensitization programs should be carried out by relevant agencies to sensitize people on the eminent dangers of radiation and lastly, an Environmental Impact Assessment (EIA) on radiation should be carried out on communities of high industrial activities.

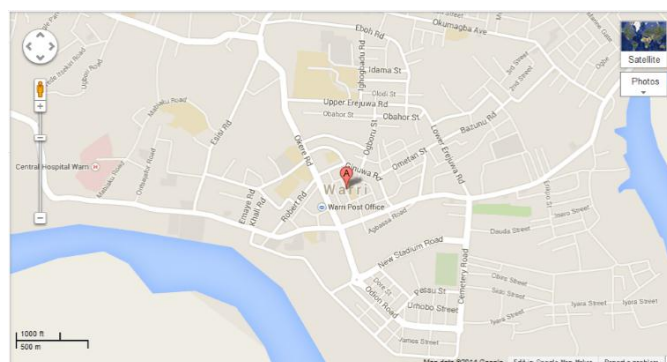
Keywords– (Radiation, Warri, Effects of Radiation, Delta State)

I. INTRODUCTION

When people hear the word radiation they often think of radiation as atomic energy, nuclear power and radioactivity; Radiation refers to an emitted energy that travels as electromagnetic waves. In [1] radiation is defined as the emission of streams of particles such as electrons, protons, high-energy photons or an emission of a combination of these; radiation can also be defined as energy in motion, in the form of waves or streams of particles ([http://www.nuclearsafety.gc.ca/..](http://www.nuclearsafety.gc.ca/)) that can cause severe or fatal health problems to people who are exposed to it. Radiation has different forms and comes from many other sources. Sound and visible light are familiar forms of radiation; other types of radiation include ultraviolet radiation (that produces *suntan* i.e. darkening of the skin), infrared radiation (a form of heat energy) and radio & television signals. But basically radiation is of two types, namely: ionization and non-ionization radiation.

II. THE STUDY AREA

Warri is located on coordinates $5^{\circ} 31' 0'' \text{ N}$, $5^{\circ} 45' 0'' \text{ E}$ 5.516667, 5.75, in the heart of Delta State. Warri as a city is undergoing considerable industrialization and urbanization. This economic growth and industrial development is ongoing in this ancient city with little or no concern for its inhabitants with regards to possible negative effects of these activities.



III. AIM AND OBJECTIVES

This research work is aimed at surveying the level of Ionization and Non-Ionization radiation with respect to causes, effects and controls by determining the level of radiation in some selected locations in Warri metropolis, ascertain the activities of man that has also contributed to the level of radiation in Warri metropolis, ascertain the risk level of exposure to radiation in Warri metropolis, find out the different sources of radiation in our environment, effects of radiation on the people residing in Warri metropolis and suggest ways of avoiding the negative effects of radiation that hazardous to human health.

IV. RELATED LITERATURE

[1] surveyed the gross alpha and beta radionuclide activity in Okpare Creek situated in an oil field in Delta State and reported average alpha activities in the three classified zones as 1.03 ± 0.097 , 4.26 ± 0.109 and $10.29 \pm 0.489 \text{ Bq l}^{-1}$ respectively, and beta activity in the three zones as 0.19 ± 0.100 , 0.52 ± 0.003 and $0.793 \pm 0.010 \text{ Bq l}^{-1}$ respectively. These values are far above the 0.1 Bq/l for alpha and 1.0 Bq/l for beta WHO maximum recommended level for the screening for drinking water [2]. The results reflected the influence of the activities in the environment.

V. METHODOLOGY

The research uses, a radiation meter to measure the level of radiation emitted into the atmosphere and also Questionnaires/Social Survey is used to gather facts on the level of awareness to radiation by people living in these locations.

A. Field Measurement

Radiation levels were taken at different locations within and around Warri metropolis using the radiation level meter also the coordinates of these locations were taken with the use of Geographical Positioning System (GPS).

TABLE 1. RADIATION LEVELS SAMPLE LOCATIONS WITHIN THE STUDY AREA

S/N	Locations	Radiation Dose (mRh ⁻¹)	GPS Location
1	Isoko Estate Junction	0.0152	N 05° 33.369' E 005° 46.869'
2	Jakpa Junction	0.0172	N 05° 33.374' E 005° 47.059'
3	Refinery Junction	0.0202	N 05° 34.176' E 005° 47.057'
4	Effurun Round About Junction	0.0164	N 05° 34.307' E 005° 47.029'
5	P.T.I Junction	0.0138	N 05° 34.397' E 005° 47.968'
6	Masoje Junction (P.T.I Road)	0.0180	N 05° 33.929' E 005° 47.726'
7	UTI Junction (PTI Road)	0.0162	N 05° 33.601' E 005° 47.573'
8	Alegbor Junction (PTI Road)	0.0182	N 05° 33.458' E 005° 47.486'
9	Effurun Market	0.0162	N 05° 33.327' E 005° 47.211'
10	Warri – Refinery	0.0280	N 05° 33.962' E 005° 43.438'
11	EkpanJuntion	0.0180	N 05° 33.748' E 005° 44.595'
12	Link Road Junction	0.0150	N 05° 32.366' E 005° 44.848'
13	Giwa-Amu Junction – (Airport Road)	0.0174	N 05° 32.400' E 005° 44.957'
14	Airport Road by Bright Hope Junction	0.0166	N 05° 32.464' E 005° 45.168'
15	Ugborikoko Junction (Airport Road)	0.0148	N 05° 32.451' E 005° 45.831'
16	Delta Palace Junction (Airport Road)	0.0166	N 05° 32.476' E 005° 45.744'
17	Airport Junction	0.0156	N 05° 32.843' E 005° 46.765'
18	Water Resources Junction	0.0130	N 05° 32.449' E 005° 46.652'
19	Urhobo College School	0.0116	N 05° 32.043' E 005° 46.642'
20	Enuhen Junction	0.0170	N 05° 31.686' E 005° 46.413'
21	1 st Marine Gate Junction	0.0086	N 05° 31.470' E 005° 46.083'
22	Neco Junction	0.0120	N 05° 31.346' E 005° 45.986'
23	Mademort Junction	0.0130	N 05° 31.170' E 005° 45.910'
24	Hausa Quarters	0.0110	N 05° 31.063' E 005° 45.774'
25	Lower Junction	0.0116	N 05° 30.971' E 005° 45.480'
26	Okere Round-About	0.0148	N 05° 30.865' E 005° 45.003'
27	Main Market Junction	0.0150	N 05° 30.820' E 005° 44.766'

Reference [3] estimated the occupational radiation profile of oil and gas facilities during and off – production periods in Ughelli oil field. We reported a maximum exposure rate of $26.00 \pm 5.1\mu\text{Rh}^{-1}$ obtained during production period and concluded that the elevated levels indicated a measure of radiation health hazard on the field workers and suggested regular monitoring, job rotation and reduction in radionuclide bearing input materials as precautionary measures, reference [4] assessed the natural radioactivity concentration and distribution in River Forcados, Delta State using exploranium - The-Identifier GR-135 model and reported the average specific activity values obtained for ^{40}K , ^{232}Th and ^{226}Ra as 113.9 ± 9.70 , 12.80 ± 2.84 , and $34.62 \pm .71\text{BqL}^{-1}$ respectively. The values obtained are comparable to other reported values obtained elsewhere in Nigerian rivers and well below international standards, thus may not pose any serious radiological health hazards on the populace that uses the river.

The presence of an industry or factory can contribute to the elevation of the background ionizing radiation of the immediate environment. The effect/impact of industrial production on its host environment essentially depends on the nature of the input raw materials, effluents from the production process and the output products. [5] studied the background radiation pattern of pre- and post- industrial activities of a fertilizer plant and reported an increase in the level of background radiation in the post-industrial activities.

[6] studied the external environmental radiation in the Trans-Amadi industrial area and other sub-industrial areas of Port Harcourt and reported an average value of 0.014mRh^{-1} . The result indicated some level of impact of the environment and a significant elevation from the standard background radiation level for similar environment. Also, a determination of radionuclide levels in soil and water around cement companies in Port Harcourt revealed mean dose rate equivalent of 0.18mSv/y and 0.39mSv/y for water and soil samples respectively. These results were lower than the International Commission on Radiological Protection (ICRP) maximum permissible levels but were higher than other non-impacted environments [7]. Furthermore, [7] surveyed the radionuclides concentration of soil, sediments and water in Aba River, Abia State and reported higher concentrations compared to previous studies already reported [8, 9]. This significant increase was attributed to the activities of the Industrial Zone in Aba where the industries discharge their effluents untreated directly into the river. A similar work on the radiological impacts of natural radioactivity along Aleto River due to the petrochemical industry in Port Harcourt showed a significant level of elevation of the radionuclide at the point of discharge of their effluents into the river [10].

Assessment of the natural radionuclide in borehole water in some selected wells in Port Harcourt revealed that the mean specific activity and the resulting annual effective doses for ^{226}Ra , ^{228}Ra and ^{40}K were 3.51 ± 2.22 , 2.04 ± 0.29 at 23.03 ± 4.37 and 0.36 ± 0.12 , 0.51 ± 0.02 and $0.05 \pm 0.01\text{mSy/y}$ respectively [10]. The results of this survey are within the range obtained elsewhere. Generally, public places showed the highest activity concentration due partially to poor sanitation. Recent studies of the radionuclide contents and background ionizing radiation of some selected dumped sites in Port Harcourt showed some reasonably high values of the radionuclide levels due to the various types of non-segregated wastes ranging from medical, domestic and industrial [11].

S/N	Locations	Radiation Dose (mRh ⁻¹)	GPS Location
28	NPA	0.0166	N 05° 31.384' E 005° 43.449'
29	Shell Contractor Junction	0.0144	N 05° 31.709' E 005° 43.381'
30	Angle Park	0.0130	N 05° 31.750' E 005° 43.909'
31	Total Round About	0.0150	N 05° 31.900' E 005° 44.405'
32	Estate Junction	0.0190	N 05° 31.788' E 005° 47.773'
33	Ojagbugbe Junction	0.0164	N 05° 31.635' E 005° 45.345'
34	Sinebiren Junction	0.0156	N 05° 31.593' E 005° 45.515'

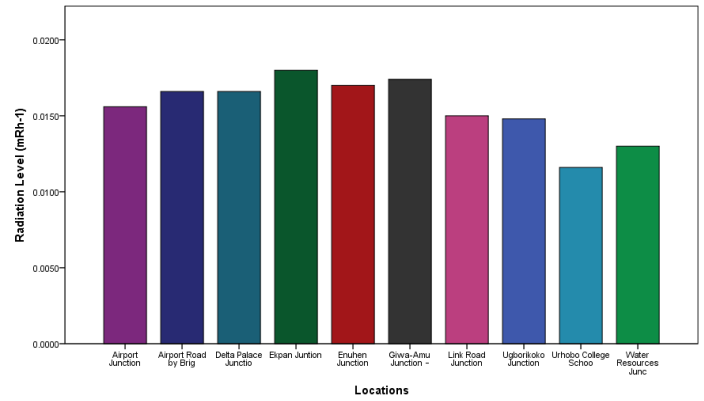


Fig. 3 Histogram Showing the Radiation Level in 10 Different Locations in Warri Metropolis

B. Questionnaires and Social Survey

A total number of 200 questionnaires were distributed randomly and on a scale of 5 responses randomly.

C. Graphical Analysis

Graphical representation of the data which was gathered in the course of this research work is presented below.

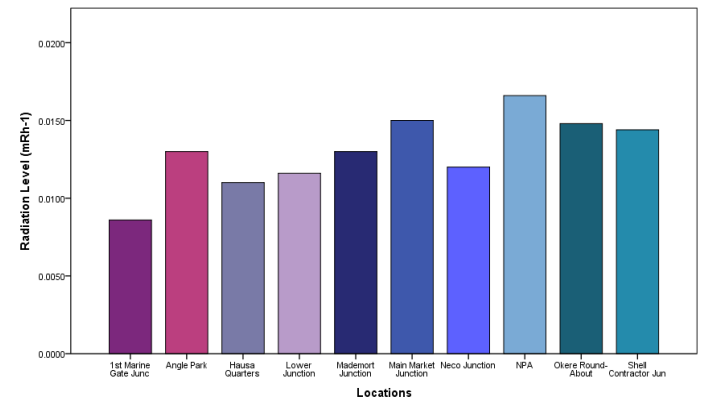


Fig. 4 Combined Histogram Showing the Radiation Level in all sampled Locations in Warri Metropolis

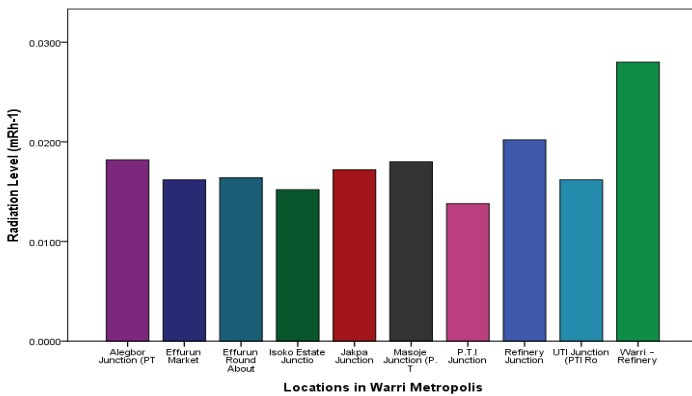


Fig. 1 Histogram Showing the Radiation Level in 10 Different Locations in Warri Metropolis

VI. RESULTS AND DISCUSSION

Excessive exposure to radiation courses severe damage to the human skin and consequently poses health problems on individual. The negative effect radiation has on people's Health are considered. The study comprises the use of radiation detectors in the likes of radiation meter, and the applications of questionnaires for social survey work.

Table 1 shows the data obtained for radiation levels at the various locations and their coordinates of these locations within the Warri metropolis.

Fig. 1 shows a histogram of radiation levels of ten locations. Fig. 1 shows that the radiation levels at Warri Refinery Junction and Warri Refinery having the highest level of radiation of about 0.028mRh⁻¹ against the standard radiation of 0.013mRh⁻¹; this high level of radiation is expected due to the activities that are carried out in the refinery which involve exploration, exploitation, drilling, production, logging etc. Some of these activities utilize explosives made of uranium, radium, strontium and other radioisotopes. During drilling, three primary radioactive sources which are logging, stabilization and calibration sources are identified. These sources emit gamma rays and neutrons into the atmosphere thus increasing the radiation level, thereby endangering the lives of personnel and staff on oil platforms and the immediate environment. Fig. 2 shows yet another histogram of radiation levels of ten locations having the Ekpan Junction recording the highest level of radiation amongst its counterparts. Fig. 3 shows yet another histogram that shows radiation levels of ten

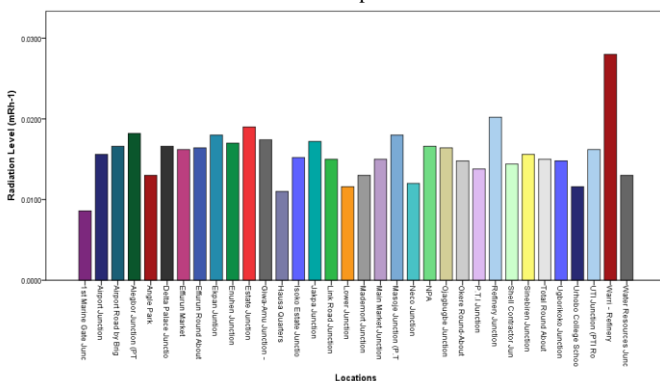


Fig. 2 Histogram Showing the Radiation Level in 10 Different Locations in Warri Metropolis

locations having the NPA (Nigerian Ports Authority), recording the highest radiation level. Fig. 4 shows a combined histogram of all the 34 locations mentioned in Table 1. From the histogram the highest point noted is the Warri-Refinery having about 0.028mRh^{-1} . This location is expected to have the highest point ever because of the petroleum activities that are carried out on daily basis.

VII. SUMMARY AND CONCLUSION

This research work was carried out on radiation. The research deals with the factors that increase radiation in the environment. This research work also deal with effects of radiation to people and consequently the environment. Industrial activities in the city of Warri have contributed to the radiation level, mostly at areas of high population. As a developing city, Warri has quite a number of industries in the likes of Telecommunication industries, Construction companies etc. these entire industries use one or more radioactive elements like Uranium in their day to day activities.

VIII. RECOMMENDATIONS

1. Industries with known use of radioactive elements in their activities should contain radiation in the smallest space possible from the reach of outside environment
2. Sensitization programs should be carried out by relevant agencies to sensitize people on the eminent dangers of radiation
3. An Environmental Impact Assessment (EIA) on radiation should be carried out on communities of high industrial activities

IX. REFERENCES

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