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A SURVEY OF THE BACKGROUND RADIATION LEVELS OF THE SUB-INDUSTRIAL AREAS OF PORT HARCOURT.

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ABSTRACT

Environmental pollution due to human and industrial activities is daily on the increase in the Rivers State of Nigeria as both the human population and the number of industries increase astronomically in the State. This problem results in a marked but gradual elevation of the Background Ionization Radiation (BIR) that poses health hazard to the populace.

This survey reports on the study of BIR levels of ten sub-industrial areas in the Rivers State using the conventional method. A mean exposure rate of 0.014m R/Hr was observed. This figure represents a 23.9% elevation from the standard BIR level determined for such areas thus showing the possible presence of radioisotopes in the atmosphere. The continued exposure of humans to this level of radiation in the atmosphere may eventually translate to medical problems later. We are therefore recommending that legislative procedure and engineering controls based on sound radiation protection principles be adopted by government environmental agencies and companies respectively, to achieve acceptable levels of radiation in the industrial and high population areas of Nigeria.

Keywords: Environment, Background ionization, Sub-Industrial Area and health hazards.

INTRODUCTION

The issue of environmental degradation i.e. the deterioration of the land, air and water qualities with their impact on human health, sanitation, environment [illegible] of global concern. This led to the United National Conference on Environment and Development (UNCED) popularly known as the 'Earth Summit' held in Rio De Janeiro in 1992. Among the notable environmental pollutants is the issue of elevated Background Ionization Radiation (BIR) due to its numerous health hazards (Cameron and Skofronick 1978).

The gradual increase in the BIR could be associated with the quest for technological advancement apart from the naturally occurring radiation in the atmosphere and terrestrial deposits. Patel (1988) reported an increase in the natural Background radiation in Japan due to nuclear power production. He also studied the effects of increased background radiation resulting from nuclear explosives on the natural environment and reported the destruction of plants and animals.

Ebong and Akpan (1992) reported an elevation of the background radiation at Onne due to the industrial activities of the National Fertilizer Company of Nigeria (NAFCON) situated there.

The industrial nature and the coastal location of Port Harcourt have attracted a number of companies, and are sited in the sub-urban areas of the city. The activities of these industries involve the importation and the use of industrial chemicals, which are unfriendly to the environment and to the around habitation. Because with an elevated background radiation and the population explosion in these settlements, there is need therefore for a quantitative survey of the background radiation of these areas and recommendations for the appropriate control measures for maintaining occupational doses of radiation.

Table 1: Station for experiment.

Station	Names
1	PHRC
2	PHRC Juct. Alesa
3	NPA Onne
4	NAFCON, Onne
5	Bori/Onne Juct.
6	Rumuokoro Juct.
7	Choba (Wilbros)
8	Nkporlu village
9	Arker Base
10	Mobil Area.

METHODOLOGY

An *in situ* measurement approach was used in taking all readings. A set of 2 well-calibrated Geiger-Muller assembly systems with an MX123 type tube and a Digilert Nuclear radiator monitor v are used. The tubes, with their windows facing downwards according to NCRP recommendation were mounted at a standard height of 1.0m above the ground (NCRP, 1976). The time for all measurements was 600 seconds for 10 successive reading per station. Since the sub-urban industrial areas are scattered around five local government areas of the State, ten stations were strategically selected for adequate and spatial coverage. as indicated in Table 1 below. The data were subjected to a T-test analysis (Hayslett and Murphy, 1981) as

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follows:

a) **Standard Deviation**
The standard deviation(s) was computed using the relation

$$S = \left\{ \frac{1}{1-n} \left(\sum X_i^2 \frac{\left(\sum X_i^2\right)}{n} \right) \right\}^{1/2}$$

Where n = sample size and X_i = count rates

b) t = test distribution

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

Where $\bar{x}$ is mean count rate μ is the mean background radiation, S is the standard deviation and n is the sample size.

RESULTS AND DISCUSSION

The results are presented in the Table 2 and figure 1 below. Table 2 shows the t-test for all stations at 5% confidence level and (n-1) degrees of freedom. The mean counter rates, mean background radiation and standard deviation are also shown in the Table 2. Figure 1 shows the summary of results compared with standard background radiation for such an environment (Shapiro,1981).

The measured radiation exposure rates for sub-urban areas are higher than the typical values recommended by the U.S National Council on Radiation Protection Measurements (NCRP, 1976). This could be associated with the industrial activities carried out in the environment. The raw materials, products or effluent of these industries could be radionuclide since there is no trace of radioactive materials in the sub-soil of these areas.

Stations 6 and 10 have the highest exposure rate of 0.0147mR/Hr and 0.0157mR/Hr respectively. The companies here are involved in oil drilling (using drilling chemicals), rock crushing, fertilizer production (NAFCON), and general metal work. However, station 9 has the least value. The area lacks manufacturing companies. Shipping and temporary storage of imported materials dominate the operation here. The t-test shows the authenticity of the results since t> tc for 18 out of 30 tests. These further show that the mean background radiations of the 10 stations are to be accepted to represent the population mean of the areas.

CONCLUSION

The study has revealed that the background ionization radiations of these sub-industrial areas of Port Harcourt are higher than the US recommended occupational dose. A mean exposure rate of 0.014mR/Hr, which represents 23.9%, has been obtained. This affirms that the industrial inputs, products or effluents of the companies operational in these areas may be radioactive and there is a potential increase due to the daily influx of companies into these areas. It is hereby recommended that:

1. Procedures and experimental controls based on sound radiation protection principles should be designed by companies and environmental related agencies to achieve occupational doses

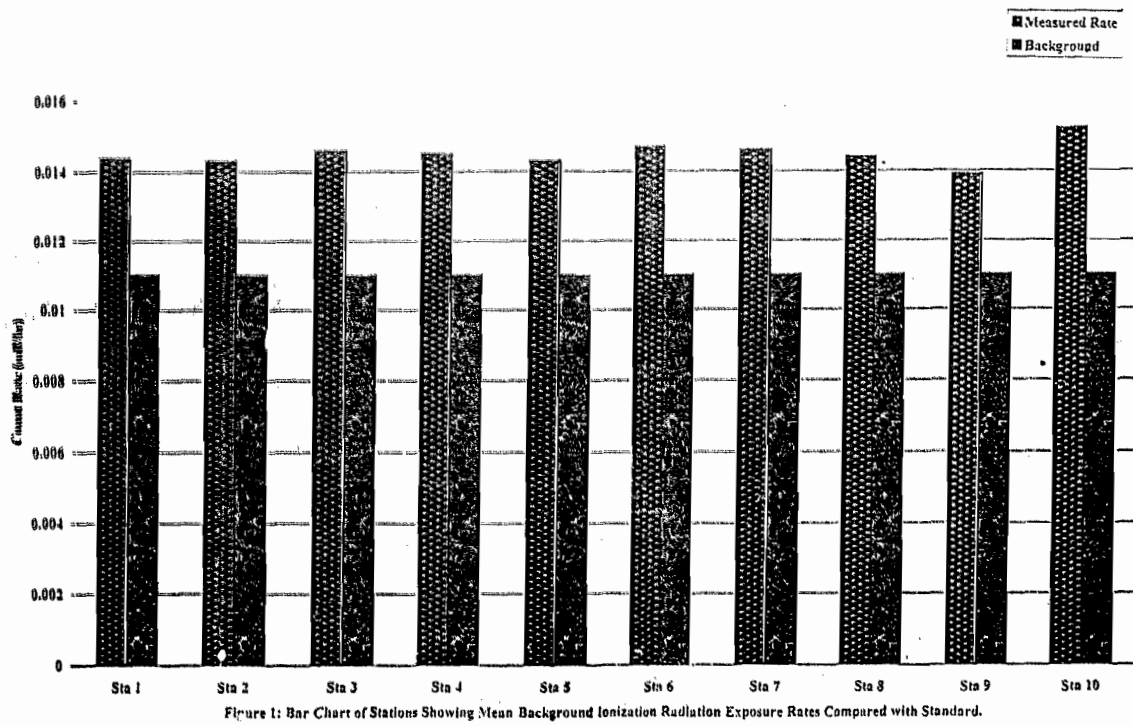

Figure 1: Bar Chart of Stations Showing Mean Background Ionization Radiation Exposure Rates Compared with Standard.

TABLE 2: T-test for stations at 5% confidence level and (n-1) degrees of freedom showing mean counter rate (*), mean background radiation (μ), standard deviation (s), computed t and critical t (tc) with sample size (n) of 10.

STATION	COUNTER	*mR/Hr	S	μ	t	tc	REMARKS
1	3	0.0149	0.0008	0.0144	1.98	2.26	t<tc
	2	0.0154	0.0006	0.0144	5.27	2.26	t>tc
	1	0.0128	0.0008	0.0144	-6.32	-2.26	t<tc
2	3	0.0148	0.0008	0.0143	1.93	2.26	t<tc
	2	0.0159	0.0007	0.0143	7.23	2.26	t>tc
	1	0.0122	0.0010	0.0143	-6.04	-2.26	t<tc
3	3	0.0145	0.0006	0.0146	-0.53	-2.26	t>tc
	2	0.0156	0.0011	0.0146	6.04	2.26	t>tc
	1	0.0138	0.0022	0.0146	-1.15	-2.26	t>tc
4	3	0.0151	0.0007	0.0145	2.71	2.26	t>tc
	2	0.0159	0.0011	0.0145	4.02	2.26	t>tc
	1	0.0124	0.0007	0.0143	-4.50	-2.26	t<tc
5	3	0.0150	0.0006	0.0143	3.69	2.26	t>tc
	2	0.0150	0.0006	0.0143	3.69	2.26	t>tc
	1	0.0121	0.0007	0.0143	-9.94	-2.26	t<tc
6	3	0.0148	0.0009	0.0147	0.032	2.26	t<tc
	2	0.0160	0.0008	0.0147	4.30	2.26	t>tc
	1	0.0136	0.0019	0.0147	-2.00	-2.26	t>tc
7	3	0.0147	0.0003	0.0147	-0.109	-2.26	t>tc
	2	0.0155	0.0008	0.0147	3.35	2.26	t>tc
	1	0.0138	0.0006	0.0147	-4.688	-2.26	t<tc
8	3	0.0141	0.0009	0.0144	-0.94	-2.26	t>tc
	2	0.0155	0.0012	0.0144	3.00	2.26	t>tc
	1	0.0135	0.0015	0.0144	-1.83	-2.26	t>tc
9	3	0.0130	0.0006	0.0140	-5.47	-2.26	t<tc
	2	0.0154	0.0006	0.0140	7.79	2.26	t>tc
	1	0.0135	0.0004	0.0140	-3.25	-2.26	t<tc
10	3	0.0155	0.0007	0.01520	1.26	2.26	t<tc
	2	0.0168	0.0013	0.01520	3.86	2.26	t>tc
	1	0.0132	0.0006	0.01520	-10.89	-2.26	t<tc

2. Environmental impact Assessment projects should have background radiation as one of the parameters to give a basis for future assessment of the industrial activities in the environment.
3. There should be public awareness on radiation and its environmental and health hazards.

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