



## Background radiation study of Offa industrial area of Kwara State, Nigeria

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**ABSTRACT:** A study of the external background radiation in Offa industrial area of Kwara State is hereby reported. An in-situ measurement using two Digilert radiation monitors at five different stations were carried out. A mean exposure rate of 0.0132mR/hr, which represents 20% elevation from the standard background radiation, was obtained. This suggests the possibility of the presence of radionuclide sources in the Offa environment. @JASEM

Background radiation is the radiation of man's natural environment, consisting of what comes from Cosmic rays, the naturally radioactive elements of the earth and from within man's body (Ballinger, 1991).

At about the turn of last century, it was found that materials containing uranium gave off some kind of radiation that penetrates or passes through ordinary materials (Turk and Turk, 1977). Apart from the naturally occurring radiation in the atmosphere and terrestrial deposits, human activities has gradually led to the increase of background ionizing radiation (Sanni, 1973; Patel, 1988; Folland et. al., 1995). A study on the natural background radiation in Japan were conducted in 1977 by Japan's Natural Institute of Radiological Studies and was reported to have increased due to nuclear power production (Patel, 1988). Ebong and Alagoa, (1992) studied the background radiation pattern of pre- and post-industrial activities and reported an increase in the background radiation due to the fertilizer industry.

Offa is one of the major industrial cities in Kwara State. Some of the industries operating in the area are involved in bottling, manufacturing, processing and automobile/mechanical services. These industries may be using raw materials which are either radioactive, corrosive or toxic which can be harmful to the human and affect the human environment. Excessive and prolonged exposures of live to radioactive elements however, do have a general deteriorating side effect on health (Nobel, 1990). There is therefore, the need to document the background ionizing radiation of the area.

Hence, the aim of this report is to measure the external background radiation level of Offa industrial area and determine whether it is within a tolerable limit as recommended by the US Nuclear regulatory commission (CFR, 1979).

### MATERIALS AND METHODS

An in-situ measurement of the background radiation level was carried out using two Digilert Nuclear Radiation Monitors. The Digilert Nuclear Radiation Monitors were calibrated with Strontium-90 and conversion to miliRem per hour (mR/hr) was obtained in count per minute (cpm)  $\times 10^{-3}$ . Five stations were strategically selected for the study to give adequate coverage of the various companies operating in the area. The map of the studied area showing sampled stations is presented in Fig 1.

The study area is shown in Fig 1. Measurements with the 2 monitors were taken simultaneously at 15 minutes interval for 10 successive readings per station. The count rate is read off in count per minute (cpm),

### RESULT AND DISCUSSION

The results obtained from the measurements were harnessed and the results from the two monitors compared for each station. This is done in figure 2 to see if there is any observable or significant difference between them.

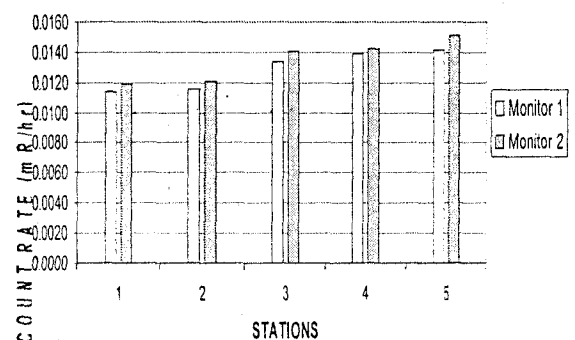


FIGURE 2. MEASURED COUNT RATES

While the values at the stations differ, the values obtained from the two monitors indicate the corresponding changes and themselves do not differ significantly. As a follow up therefore, they were then plotted against the recommended US Nuclear Regulatory Commission (CFR, 1979) standard values (Table 1) in figure 3.

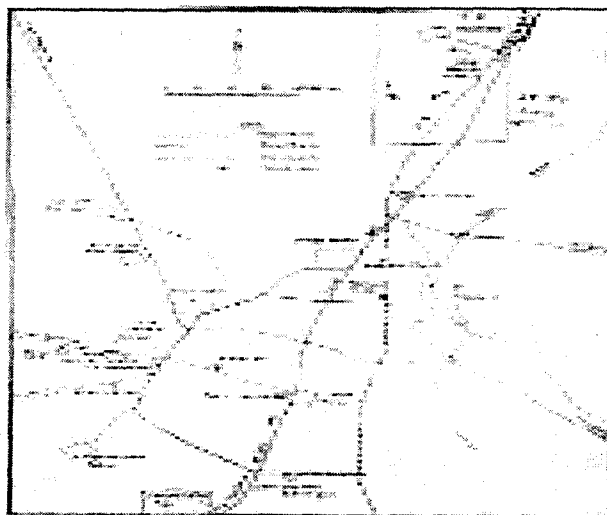


FIGURE 1. MAP OF OFFA SHOWING THE STUDY AREA

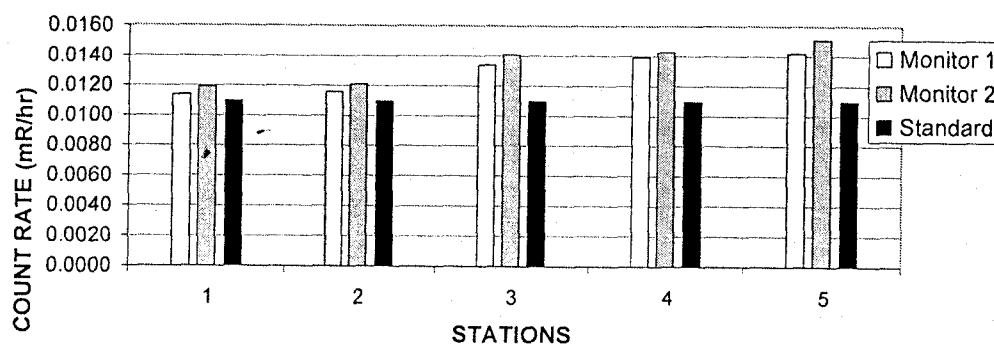


FIGURE 3. MEASURED COUNT RATE COMPARED WITH STANDARD

Table 1. Standard external radiation levels (adapted from cfr, 1979)

S/No	Exposure	Significance
1	0.011 mR/hr, Continuous whole body	Background radiation, sea level out of door
2	0.010 mR/hr, Continuous whole body	Radiation inside wooden house at sea level
3	0.021 mR/hr, Continuous whole body	Background radiation, ground level
4	0.625 mR/hr	Limit for occupational exposure of whole body
5	9.375 mR/hr	Limit for occupational exposure of hands
6	0.0625 mR/hr	Limit for non-occupational exposure (including exposure of minors)
7	<2mR/hr and <100 mR/hr in any 7 consecutive days	Unrestricted area. No control or sign required
8	<2mR/hr or >100 mR/hr in any 7 consecutive days	Radiation area. Sign required
9	>5mR on one hour to major portion of the body	Radiation area. Sign required

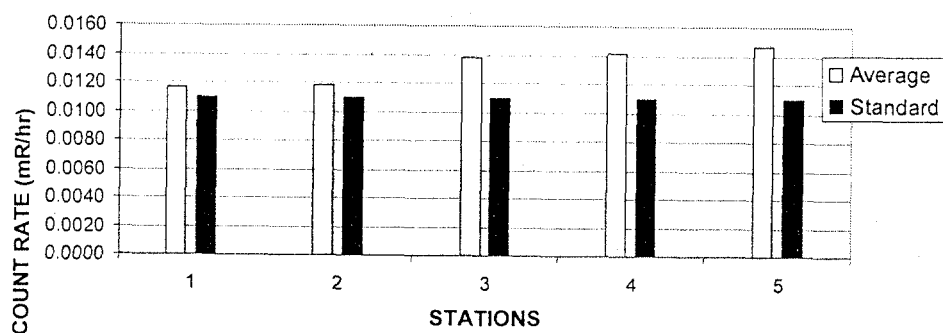


FIGURE 4. AVERAGE COUNT RATE COMPARED WITH STANDARD

The next step was to average the count rates from the two monitors for each station and compare it with the said standard. This is shown in figure 4. It can be seen that all the measured values exceed the standard value though not by same amount. While the observations in the distributed stations show some difference, the geographical size can be considered a point when compared to either the state or national map. It is therefore, proper to average the values for the five stations and compare with the standard. This is done in fig 5.

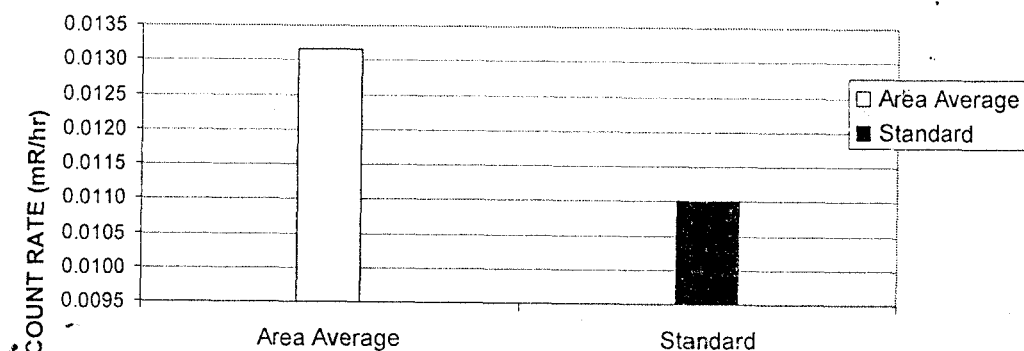


FIGURE 5. AVERAGE COUNT RATE OF THE AREA COMPARED WITH STANDARD

As shown in the graphs, the mean background exposure rates of 0.0117mR/hr, 0.0119mR/hr, 0.0138mR/hr, 0.0141mR/hr and 0.0147mR/hr were obtained for stations 1 to 5 respectively. Unlike stations 1 and 2, the background radiation levels of stations 3 to 5 are very close. This would depend on the nature of activities carried out by the companies in these areas. Measurement made in station 1 has the lowest count rate of 0.0117 mR/hr which is likely to be as a result of the absence of major industries in the area. The highest count rate of 0.0147 mR/hr is obtained at station 5, where there is a high concentration of major industries in the area. An average of 0.0132 mR/hr count rate was obtained for the background radiation level of the studied area. This value of the background radiation level is higher than the standard external radiation level of 0.011 mR/hr (CFR, 1979). The implication of the result suggest that some of the raw materials used in the industries and consequently the effluents generated during and after the production processes may be

radioactive. It could also be that the waste disposal system is poor leading to accumulation that could lead to possible multiplication effect.

**Conclusion:** This study has revealed that the background ionizing radiation of Offa Industrial area is higher than the recommended standard. An average of 0.0132mR/hr obtained for the area is 20% higher than the standard. From the ongoing, it is recommended that control mechanism based on sound radiation protection principles should be incorporated into the engineering design of the companies to achieve allowed occupational dose level, dose levels to members of the public that approach the area as well as to protect the environment.

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