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Monitoring of external background radiation level in Asa Dam Industrial area of Ilorin, Kwara State, Nigeria

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ABSTRACT: An external background ionizing radiation study has been carried out within the Asa Dam Industrial Layout of Ilorin in Kwara State. The study was carried out in 5 stations within the industrial area using two Digilert Nuclear Radiation Monitors. The study has revealed that the external background ionizing radiation is averagely 0.0134 mR/hr with a deviation of about 22% which is relatively higher than the standard background radiation of 0.011 mR/hr. This result suggests the possibility of the presence of radionuclide sources in the environment. @JASEM

Increasing environmental regulation and more exact standards for the quality of water, air, soil and food have led to a significant expansion of the environmental monitoring industry throughout the world (Menzies et. al., 2002). Consequently, scientists and environmental professionals make critical, objective and what can be considered legally defensible use of analytical data. These data are obtained from sound laboratory and in-situ techniques with adequate understanding of the theory and practice of toxicity testing and proven competence in calculating the risk that a given level of contamination may present to an ecosystem.

Background radiation is the radiation of man's natural environment, consisting of that which comes from cosmic rays, the naturally radioactive elements of the earth and that within the body of living matter (Ballinger, 1991). Apart from these naturally occurring radiation in the atmosphere and terrestrial sources, it has been reported and proven that human activities such as those due to the quest for technological advancement and comfort application, have gradually led to the increase of background ionizing radiation and even in some cases, much above recommended tolerable level (Patel, 1988). Sanni (1973) reported an increase in the background radiation of the Southern parts of Nigeria due to north-easterly wind that moves dust particles from the Sahara region to the coastal parts of Nigeria. Folland et. al. (1995) reported that human activities have led to the depletion of the ozone layer, increased the cosmic rays reaching the earth's surface and thereby affect the background radiation. Avwiri et. al. (1998) studied the external environmental radiation in the Trans-Amadi industrial area of Port Harcourt, Rivers State, Nigeria and reported an increase in the background radiation due to the industrial activities related to the oil industry in the area.

For over a span of 3 years, Asa dam industrial area of Ilorin in Kwara State has recorded a significant increase in industrial activities. These industrial activities include manufacturing, processing, packaging as well as automobile/mechanical services. It is possible that these industries use a lot of raw materials which may be either radioactive, corrosive or harmful which can affect the human environment. Excessive and prolonged exposure of live to radioactive elements however, have a general deteriorating side effect on health (Nobel,1990). Against this background, this study was conducted to monitor and quantitatively document the background ionizing radiation levels in the said industrial area.

Experimental Procedure

An in-situ measurement of the background radiation has been made. The measuring equipment were two Digilert nuclear radiation monitors and a stop-watch. The measurements were taken simultaneously using the two monitors at every 15 minutes interval for 10 successive readings per station. Five stations were strategically selected in the study for adequate coverage of the various companies' operational areas.

RESULT AND DISCUSSION

The results obtained from the measurements represent the external background radiation level of the studied area. 10 successive readings were obtained for each monitor. The mean of these data was determined for each monitor. A comparative plot for the 5 means from the 5 stations data is made in fig 1.

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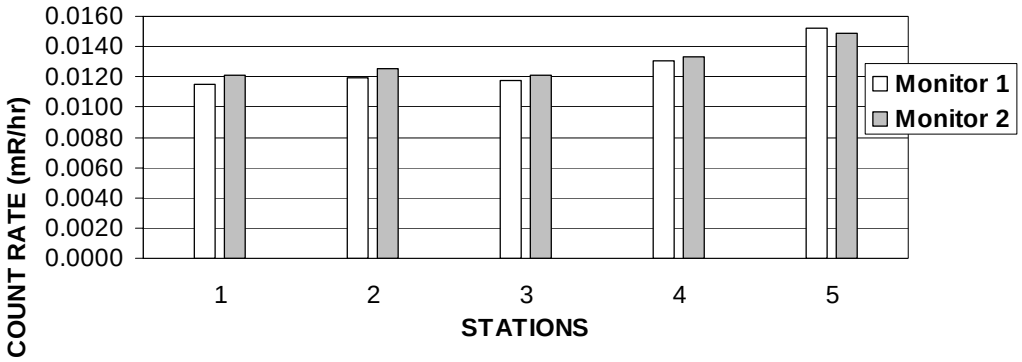

FIG 1. MEASURED COUNT RATES

These values are then plotted alongside the standard external background radiation value of 0.011mR/hr as recommended by the US Nuclear Regulatory Commission (CFR, 1979) in fig 2.

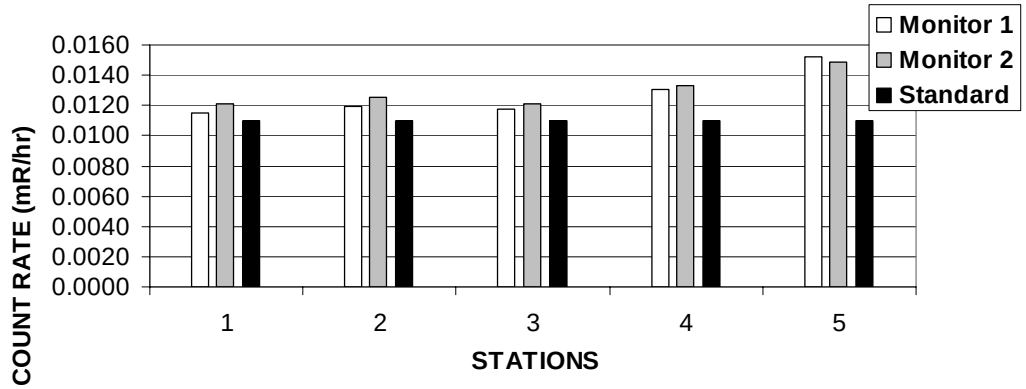

FIG 2. RESULTS OF MEASURED COUNT RATES WITH STANDARD

Other standard background radiation levels for various environments as recommended by the US Nuclear regulatory commission (CFR, 1979) are presented in table 1.

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

The average of the two mean count rates obtained from the 2 monitors per station was computed. They were plotted alongside the standard external radiation value as shown in fig 3.

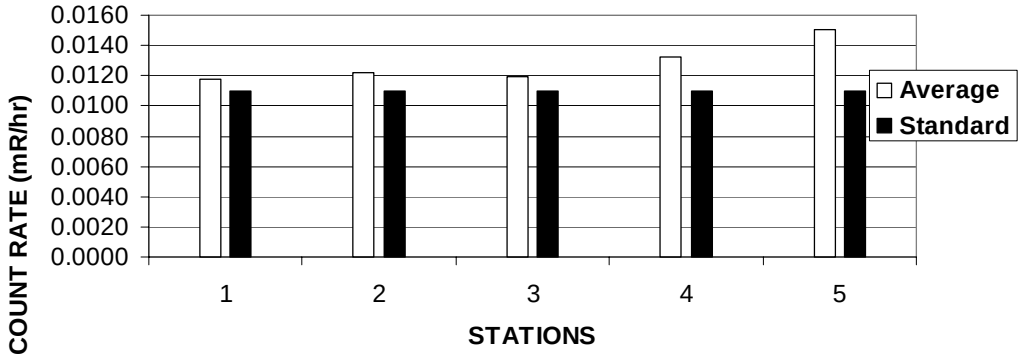

FIG 3. AVERAGE COUNT RATES WITH THE STANDARD

This average of means represent the count rate at each station. This new average value per station is found to differ from station to station.

It can be seen that station 1 measurements has the lowest count rate of 0.0118 mR/hr. This will be expected as a result of the absence of major industries in the area. The highest count rate of 0.0151 mR/hr however, is obtained at station 5, where there is concentration of major industries in the area. Lastly, the mean of the 5 stations count rates was also computed. This represents the overall count rate for the studied area. The overall count rate plotted alongside the standard external background radiation value is presented in fig 4.

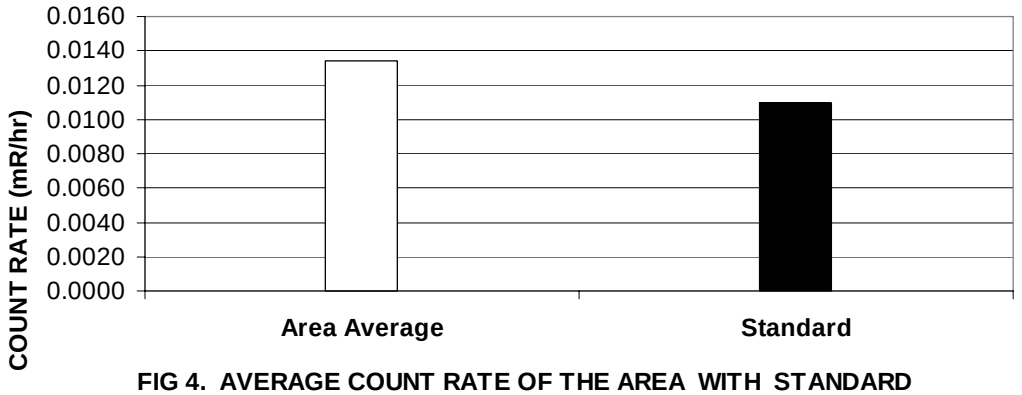

FIG 4. AVERAGE COUNT RATE OF THE AREA WITH STANDARD

The overall of 0.0134 mR/hr count rate was obtained for the background radiation level of the studied area. It is higher than the standard external radiation level of 0.011 mR/hr (CFR, 1979) and not only station 5.

Conclusion: The background radiation level of the studied area have been observed in this study to be above the recommended standard external radiation level by the US Nuclear Regulatory Commission (CFR, 1979). The elevation above this recommendation could be considered moderate while the setting itself had been generously set for safety reason. The general average of 0.0134 mR/hr count rate which represents 22% deviation from the standard is recorded for the studied area. This shows 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.

Since enormous health problem are associated with radioactive radiation phenomenon, it is therefore, necessary to recommend that industries operating in this area should device means of recording their radioactive inputs as a first step followed by corrective effect to lower the value. The Federal Environmental Protection Agency and other pertinent regulatory bodies would be advised to regularly visit the companies to ensure that they adhere strictly to environmental safety regulations.

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