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The Effects of Power Line on Environmental Radiation Levels in Jos and Environs–Plateau State, Nigeria

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Abstract: *Electricity is one of the special services desired by man in any community. There have been suggestions that the electric and magnetic fields created by electric power lines may be harmful to health. In this paper, the radiation levels around electric power lines environment were measured using gamma scout. It is a digitalized, portable device that measures radiation in* $\mu Sv/hr$. *The results obtained which ranged from (0.2-0.48)* $\mu Sv/hr$ *for 330kV, (0.16-0.45)* $\mu Sv/hr$ *for 132kV, (0.13- 0.40)* $\mu Sv/hr$ *for 33kV, (0.08-0.38)* $\mu Sv/hr$ *for 0.415kV and (0.1-0.35)* $\mu Sv/hr$ *for free zone. This showed that some of the values obtained were more than 20 × 10^{-8}Gy/hr (0.20* $\mu Sv/hr$ *) which according to IAEA was the minimum standard for radiation to cause health hazard. There is a strong indication that health hazards may be manifested after a long period of time on the people living close to the power lines since from the result obtained, it showed that the cumulative radiation levels effects increased with time.*

Key words: *Radiation levels, power line, Gamma scout, Jos and environs.*

I. Introduction

An electric field exists when two objects have a voltage difference between them. For example there is an electric field between a power and the ground below because the power line is at a large voltage relative to the ground. A magnetic field exists when electric current flows through a wire. Thus magnetic field surrounds the power lines conducting current from the power station to our homes. Electric and magnetic fields are also different in the way they interact with our bodies(Antunes, 2009). Electric fields have very little penetration; while magnetic fields canpenetrate to our inner organs

Communication mast, power lines and appliance all produce electrical and magnetic fields and are called electromagnetic fields. Electromagnetic sources produce both radiant energy and non-radiant field. According to their frequency and energy, electromagnetic wave can be classified as either ionizing radiations or non-ionizing radiations. Ionizing radiations are extremely high frequency electromagnetic wave (X-rays, $\gamma-rays$) while non-ionizing radiation has photon energy too weak to break atomic bonds and this includes visible light, radio wave and infrared radiation (Lowe *et al*, 2000). Electric power (60Hz in North America, 50Hz in most of other places) is in the extremely low frequency range, which include frequencies below 300Hz (Bamidele ,2009). Extremely low frequency which is defined as frequencies below 300Hz includes 60Hz fields found in household electricity which had not been considered hazardous to health until the early 1970's. These fields are non-ionizing; they are too weak to disrupt molecular bonds leading to genetic damage in living cells. They are not capable of generating significant amount of heat like microwaves or radar (Moore, 1990). In comparison, electric power frequency fields have wavelengths of more than 500km and consequently have very low energy levels that do not cause heating organization.Calculation shows that the typical maximum power radiated by a power line would be less than $1\times10^{-4}\mu W/cm^2$ compared to the $0.2\mu W/cm^2$ that a full moon delivers to the earth's surface on a clear night (McBride *et al*, 1999).

II. Materials And Method

Radiation levels around four different high tension power lines were measured. They are 330kV, 132kV, 33kV and 0.415kV. The free zone (i.e where there were no high tension power lines was monitored.A gamma scout, which is a digitalized and portable device, was used to measure the radiation level in the environment. The gamma scout consists of a ray selection switch(to measure the ray type required). I n this work, the ray selection switch was adjusted to the right hand side ($\alpha+\beta+\gamma$) window in order to measure all the three ray types. The instrument was moved very close to the radiation source (power lines) and the readings were taken every ten minutes for 120 minutes in each of the power lines. The measurements were carried out by positioning the gamma scout directly under each high tension power line at 1.0m above the ground.

III. Results And Discussion

The results obtained are shown in Figures 1-5 which are plots of cumulative radiation levels against time. The average radiation levels measured from the 330kV was 0.37 $\mu Sv/hr$ with a range from 0.20-0.48, 0.33 $\mu Sv/hr$ was obtained on the 132kV and range of 0.16-0.45. A mean radiation level at the 33kV was 0.28 $\mu Sv/hr$ and a range of 0.13-0.40 while at the 0.415kV was 0.27 $\mu Sv/hr$ and range of 0.08-0.38µSv/hr. For the free zone it was 0.24 $\mu Sv/hr$ and range of (0.10-0.35) $\mu Sv/hr$. In order to have a clear comparison of the different levels of radiation emitted by the system a plot of variation of cumulative radiation close with time are shown on the figures.In figure 5, clear differences are seen under the lines compared with free zone where there was no electric power line. This may be due to suggestion made by Henshaw*et al* (1996) that polarizable particles experience a force towards the source of non-uniform field. Therefore, an increased concentrationof particles will build up in the air around a source of field.

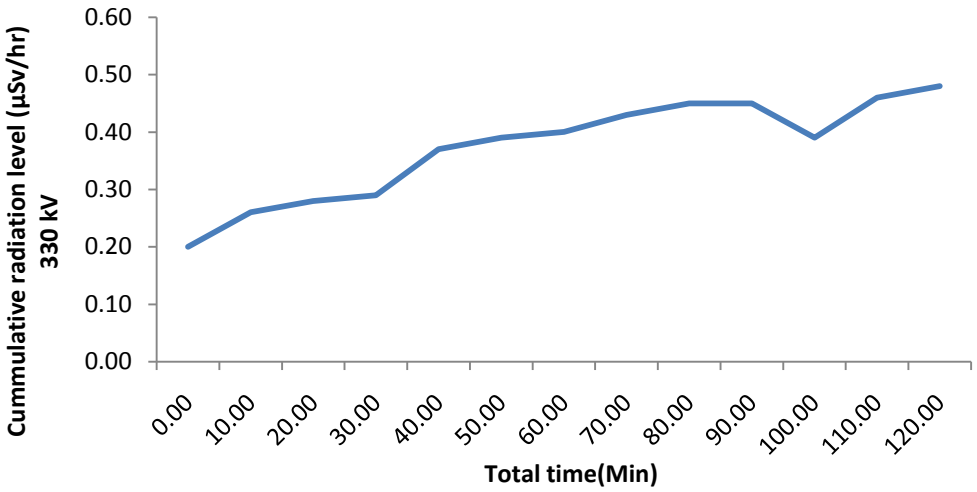

Fig 1: Cumulative radiation levels $\mu Sv/hr$ against time (mins) for 330kV

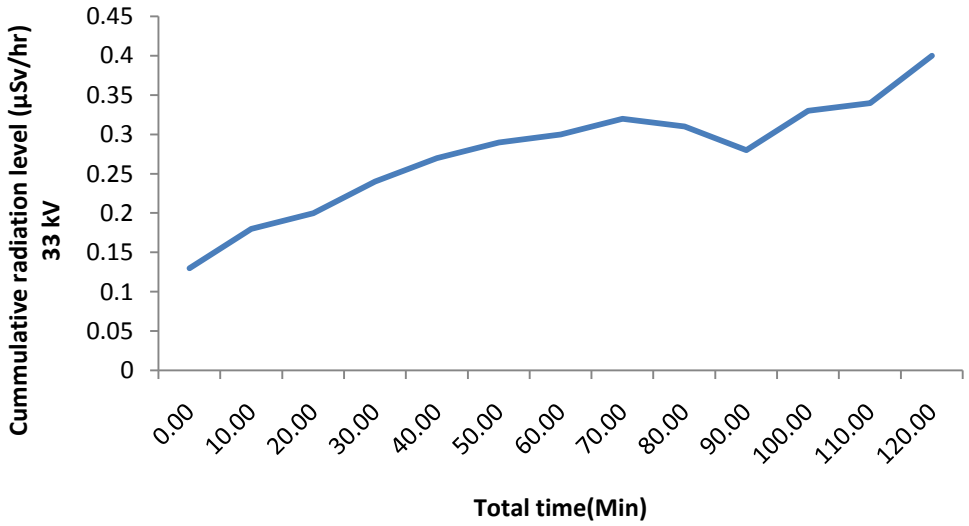

Fig 2: Cumulative radiation levels $\mu Sv/hr$ against time (mins) for 132kV

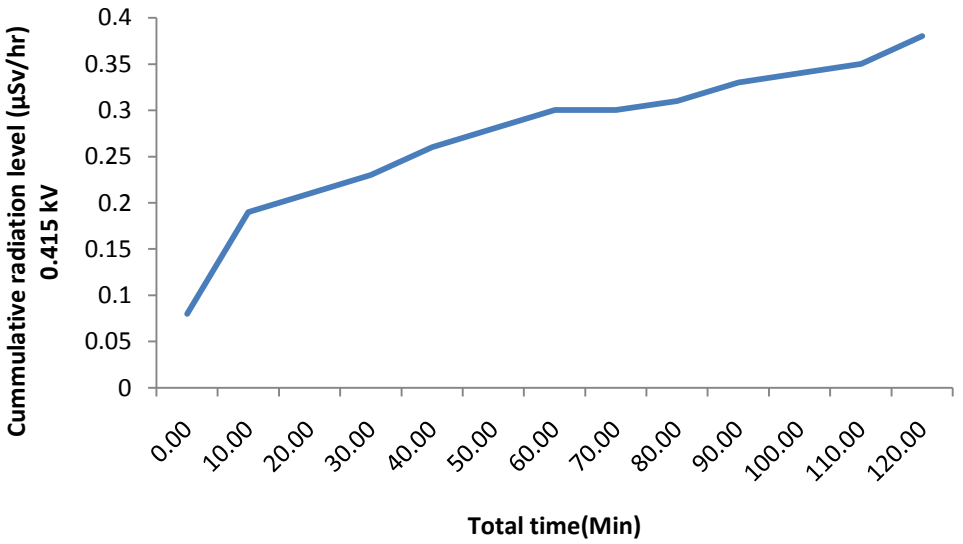

Fig 3: Cumulative radiation levels $\mu Sv/hr$ against time (mins) for 33kV

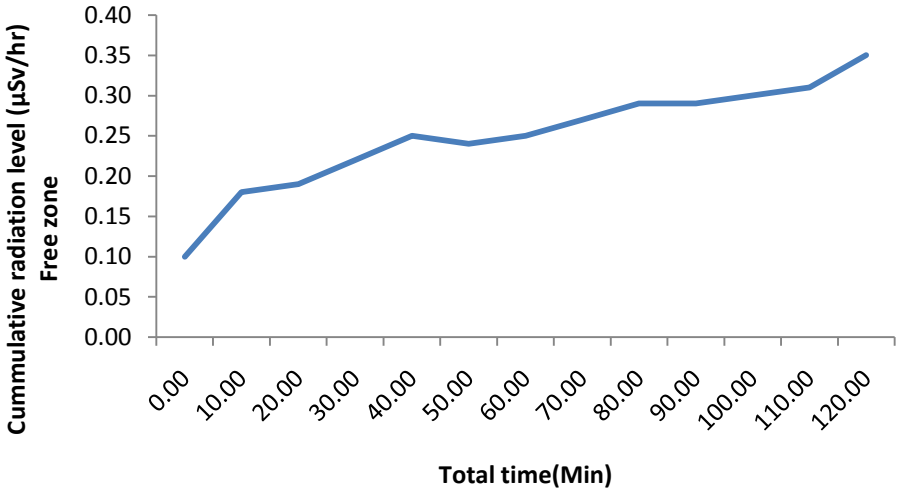

Fig 4: Cumulative radiation levels $\mu Sv/hr$ against time (mins) for Free zone

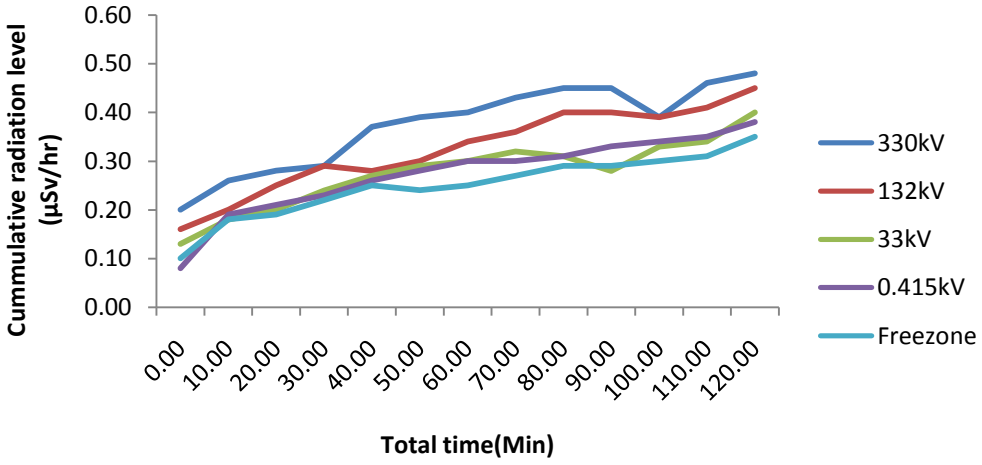

Fig 5: Cumulative radiation levels $\mu Sv/hr$ against time (mins) for 330kV, 132kV, 33kV, 0.415kV and Freezone.

IV. Conclusion

The results obtained in this paper have indicated that the presence of electric power lines influenced the radiation levels in the environment. This is evident from the fact that the radiation levels measured from the power lines environment are higher than that obtained from the free zone. The radiation levels around the power lines range from $(0.08\text{-}0.48)\,\mu Sv/hr$ while for the free zone it range from $(0.10\text{-}0.35)\,\mu Sv/hr$. The results obtained from this work provided a background data on the effect from power lines and that serious measures should be taken towards the possible hazards from electromagnetic radiation emanating from these power lines.There is a strong indication that health hazards maybe manifested after a long period of time on the people living close to these power lines since from the results it showed that the cumulative radiation levels effects increases with time. Some of these effects include adverse effect on mental performance which leads to headaches, nausea and dizziness.

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