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Measurement of Magnetic Field Radiation from Selected High-Tension wires inside Adekunle Ajasin University Campus, Akungba Akoko Nigeria

Olubosede. O
Physics Department, Adekunle Ajasin University Akungba-Akoko Ondo State, Nigeria

***Abstract*—Electromagnetic fields are all around us especially in all the appliances used these days. This paper takes a look at the electromagnetic field radiated from high- tension wire (power lines). This is achieved by measuring with the electromagnetic field tester (EMF -823) the magnetic field around several power lines in an Institution. Results obtained in this work shows that the shape of the field around the power line is stronger when directly under the power line and decreases exponentially with distance. The result obtained were compared with the results obtained by several workers and it follows the trend obtained my most of the works. Comparison is also made based on the previous works on assessment of the magnetic field as it relates to people living around power lines in order to know the health implications on staff in the selected institution.**

***Keywords*—Electromagnetic Field Radiation (EMF), exposure, health effect.**

I. INTRODUCTION

We are all exposed to a complex mix of electromagnetic fields of different frequencies that permeates the environment, this field consist of electric (E) and magnetic (H) waves traveling together. Electric fields arise from electric charges and it governs the motion of other charges situated in them while magnetic field comes from the motion of electric charges, that is, a current. Research has shown that both the electric and magnetic fields underneath overhead transmission lines may be as high as 12kV/m and 30μT respectively while around a generating stations and substations, the electric field may be up to 16kV/m and magnetic fields up to 270μT may be found (Kelly, 2011). He also shows that extremely low fields (ELF) may suppress the secretion of melanin that protects against breast cancer. Coleman, *et. al (1989)* took a look at leukemia and residence near electricity transmission equipment and discovered that there is a relative risk in living close to a power line especially those within 25m range. Cartwright (1989) studied the low frequency alternating electromagnetic fields and leukemia: the saga so far, he took an exclusive look on potential leukaemogenesis but his result was inconclusive based on the limited cases. Myers *et. al (1990)* results indicates no association between the occurrence of childhood malignancies and either the proximity of the magnetic field of over head lines. Though, the statistical power of his study was limited to the small number of children living close to the overhead power lines. Youngston *et. al,(1991)* has a result that shows that if there is an increased risk of haematological malignancies from the residential exposure to magnetic field, then such a risk is likely to be extremely small. Fajardo *et. al* (1993) attributes the risk of leukemia in children to living close to high-tension electric power lines in their paper. Olsen *et. al* (1993) agrees with Youngston et. al paper in that the proportion of children cancer in Denmark possibly caused by 50Hz electromagnetic fields must be very small. Verkasalo *et. al* (1993) finds no relative risk in magnetic fields and living close to a high tension wire. Levallois *et. al* (1995) demonstrates in their study that the 735kv line contributes significantly to residential 60Hz magnetic field exposure. It also concludes that the possible attributable risk from this exposure in the general population is probably low but the relative risk for the few exposed people might be important. Chung-Yi Li *et. al* (1996) associates leukemia positively with magnetic fields in their case control study. Theriault and Yi Li (1997) confirm the presence of an association between exposure to magnetic fields and leukemia among people who resides in the vicinity of high voltage transmission electric lines of ≥ 49kv. Kleinerman *et. al* (2000) shows that the strength of magnetic field decreases with increasing distance from the power lines but his analysis found no suggestion that any of these variables are related to risk. Tynes *et. al* (2003) provides some support for an association between exposure to calculated residential magnetic fields and coetaneous malignant melanoma and requested for further research on the work. Rahman *et. al* (2008) concluded that a significant increased risk has been hypothetically linked with events of childhood acute leukemia on children living within a distance of less than 200m, while a similar study conducted in Iran by Feizi and Arabi also revealed identical consequences on health problems with associated distances as its major key parameter. This is also in agreement with the results obtained by Ahlbom *et.al* (2000). Rahman *et. al*, Studied the simulation approach in evaluating the electromagnetic fields from the new lines of extra high voltage (EHV) circuits near residential areas in Malaysia. Their exact findings shows an agreement with significant results on childhood cancers expose more than 4mG (Olsen.J, 1993, Feychting.M, 1993, Tynes.T, 1997, UK childhood cancer, 2000, Kleinerman.R.A, 2000, Draper.G, 2005). From their studies, efforts to reduce the impact of high intensity magnetic field exposure from the power lines were conducted and examined using industrial based electromagnetic fields software applications. Hassan and Abdelkawi measured the Changes in Molecular Structure of Hemoglobin in Exposure to 50 Hz Magnetic Fields and their results indicated that, exposure of the animals to moderate and strong static magnetic fields resulted in changing in the absorption spectra and conductivity measurements of Hb molecules. Also, the total protein of the plasma increased and the electrophoretic mobilities also changed. It was concluded from the results that exposure to either diagnostic or interventional (MRI) may be hazardous for patients and more hazardous for machine operators. Tynes and Haldorsen (1997) analysis provided some support for an association between early childhood exposure and cancer with an increasing risk for cancers at all sites combined in relation to exposure to magnetic fields during the first year of life.

Rahman *et.al* (2010) shows efforts to reduce the impact of high intensity magnetic field exposure from the power lines; they also introduced protection schemes such as height increment and phase compaction. Rahman *et.al* (2011) measured the magnetic field exposure assessment of electric power substation in high rise building and discovered that the magnetic field exposure there does not violate the international standard and guidelines all that the field is harmless and safe for working personnel. The recommended public exposure to non ionizing radiation is 100µT while that of occupational exposure is 500µT (ICNIRP 1998 recommendation). While most of the works show relative risk for people living close to power station or power lines, few could not directly link the effect on the nearness to the power lines. The health hazards taken into considerations by these works are leukemia, suicides and psychosomatic illness. In 2005, Drappe *et.al* published by the British Medical Journal, the study showed that children living within 200 meters of a high-power line are 70 percent more likely to develop leukemia than children who lived 600 meters or more away from such power lines. In this paper, the magnetic field from the power line in Adekunle Ajasin University Akungba- Akoko was measured using the electromagnetic field tester model: EMF -823 ISO – 9001, CE, IEC1010. The measurements were taken in three different locations and the readings were plotted to find out how safe and conducive it is to work in the environment. The results were compared with the international safety standard for the International Commission on Non - Ionizing Radiation Protection (ICNRP) and it shows that it falls below the limit and so makes the place conducive as a place of work. The measured magnetic field values are within the international acceptable reference values and this indicates that the field is harmless and safe for the working personnel.

II. METHODOLOGY

The measurement of magnetic field generated from selected power lines of between 240 -735KVolts inside the Campus were measured using the electromagnetic field tester EMF 823 with serial number C93392. The tester makes use of a 9v DC battery and its sampling time is 0.4seconds, with range from 20µT to 20,000 µT. note that 1 µT is equivalent to 10milliGauss. Measurements were taken in an area that can be considered as flat area at about 1 meter above the ground level (Gonad level). The measurements were taken at specific interval in this case at 4m intervals, these readings were taken at both sides of the power lines. Though, some measurements were taken at over a higher ground due to the undulating of the terrain, this was however minimized. The measurements were taken to about a distance of 32 meters on both sides using the point under the power line as the reference point (zero point or starting point). The study area was the power line between the Faculty of Science and the ETF Hall represented as Site 1, Site 2 is between the faculty of science and the Mathematics and Geology lecture theatres and finally Site 3 which is between the Female Hostel and the B block. Since the tester is specifically designed to determine the magnitude of electromagnetic field, the results obtained were plotted using the origin 6.5 software and it was compared with the ICNRP regulations as well as the results of other workers. The results shows that there is no harm in working in the considered Institution based on the recommended safety and the health effects based on the works that had been done.

III. RESULTS AND DISCUSSION

The measurement for the magnetic field for the site 1, site 2 and site 3 is represented in tables 1, 2 and 3 respectively. The tables follows the same trend as having the maximum values directly under the high tension line and decreasing as one progresses towards the right and the left hand sides. The distance towards the left hand sides were represented by negative in the plotted graph, this is to make the plotting easy. In Figure 1, the magnetic field measurement was measured in between the faculty of science and the ETF building. The graph shows that the maximum value is at 0.06µT where it has the minimum value and its value is zero at about 20m from the center of the power line, this site is a level plain surface. In figure 2, the measurement taken in between the Faculty of science and the Geology and Mathematics lecture theatres shows that the maximum value is 0.037µT just directly under the wire, the value is lower than the values obtained in the site 1. The surface of site 2 is not too plain and this may account for the shape of the figure. Finally in site 3, this is between the female hostel and the B block shows the maximum value of 0.11 µT, this may be due to the fact that there was a transformer located just beside this selected high tension wire which was missing in the other previous sites. It was also observed that the measurement here follows a trend that was better in terms of accuracy than the second site; this may be due to the fact that here has a level plain ground when compared to site 2. The figure 4 was a comparison of all these values; it was revealed that site 3 has the highest values followed by site 1 while the site 2 has the minimum values. It was also discovered that all these values are lower than the recommended ICNIRP according to their regulations which makes the environment favourable.

IV. CONCLUSION

The paper shows that the maximum magnetic field measured was 0.11 which is far below the international safety recommended for both the public and occupational exposure levels (100µT and 500µT respectively). The campus under consideration is environmental friendly as regards to the magnetic field generated from power lines inside it. However, efforts should be made in reducing the magnetic field generated in the institution as well as our environment as we have seen the health effect of the magnetic field from most of the case controlled papers referenced in this work.

Table 1: **Magnetic field measurement due to high tension distribution power line for site 1.**

Distance from power line (m)	Magnetic field (μT) after 10 seconds	Magnetic field (μT) after 20 seconds	Magnetic field (μT) after 30 seconds	Mean Magnetic field (μT)
20	0.00	0.00	0.00	0.000
16	0.01	0.00	0.00	0.003
12	0.01	0.01	0.01	0.010
8	0.02	0.02	0.02	0.020
4	0.03	0.03	0.03	0.030
0	0.06	0.06	0.06	0.060
4	0.03	0.03	0.03	0.030
8	0.03	0.03	0.03	0.020
12	0.01	0.01	0.01	0.01
16	0.01	0.00	0.01	0.003
20	0.00	0.00	0.00	0.00

Table 2: **Magnetic field measurement due to high tension distribution power line for site 2.**

Distance from power line (m)	Magnetic field (μT) after 10 seconds	Magnetic field (μT) after 20 seconds	Magnetic field (μT) after 30 seconds	Mean Magnetic field (μT)
24	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.000
16	0.01	0.01	0.01	0.010
12	0.01	0.01	0.01	0.010
8	0.02	0.02	0.01	0.017
4	0.02	0.02	0.03	0.023
0	0.03	0.04	0.04	0.037
4	0.02	0.03	0.02	0.023
8	0.01	0.03	0.02	0.020
12	0.01	0.01	0.01	0.010
16	0.01	0.01	0.01	0.010
20	0.01	0.01	0.01	0.010
24	0.01	0.01	0.01	0.010
28	0.01	0.00	0.00	0.003
32	0.00	0.00	0.00	0.00

Table 3: **Magnetic field measurement due to high tension distribution power line for site 3.**

Distance from power line (m)	Magnetic field (μT) after 10 seconds	Magnetic field (μT) after 20 seconds	Magnetic field (μT) after 30 seconds	Mean Magnetic field (μT)
40	0.00	0.00	0.00	0.00
36	0.00	0.00	0.00	0.00
32	0.010	0.010	0.010	0.010
28	0.020	0.020	0.020	0.020
24	0.030	0.030	0.030	0.030
20	0.040	0.040	0.040	0.040
16	0.050	0.050	0.050	0.050
12	0.060	0.060	0.060	0.060
8	0.070	0.070	0.070	0.070
4	0.080	0.080	0.080	0.080
0	0.11	0.11	0.11	0.11
4	0.080	0.080	0.080	0.080
8	0.070	0.070	0.070	0.070
12	0.060	0.060	0.060	0.060
16	0.050	0.050	0.050	0.050
20	0.040	0.040	0.040	0.040
24	0.030	0.030	0.030	0.030
28	0.020	0.020	0.020	0.020
32	0.010	0.010	0.010	0.010
36	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00

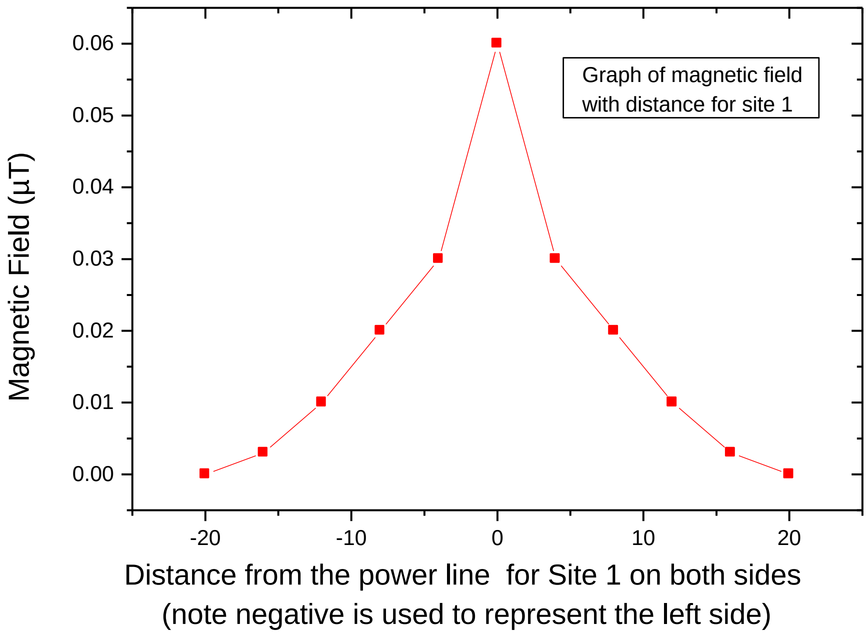

Figure 1: Graph of magnetic filed measurement with respect to distance in the site 1. Note; the left hand side of the reading was represented by negative for ease in the graph.

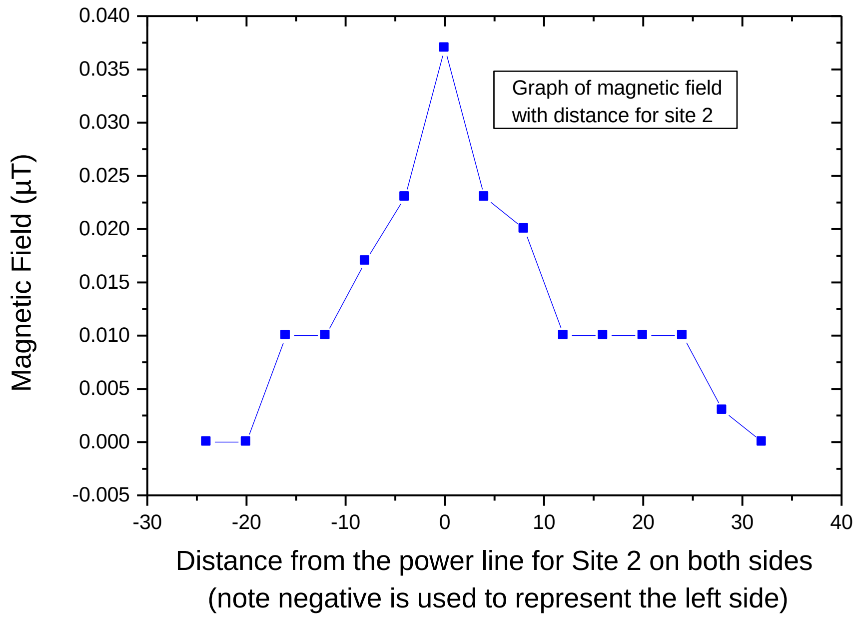

Figure 2*:* Graph of magnetic filed measurement with respect to distance in the site 2. Note; the left hand side of the reading was represented by negative for ease in the graph.

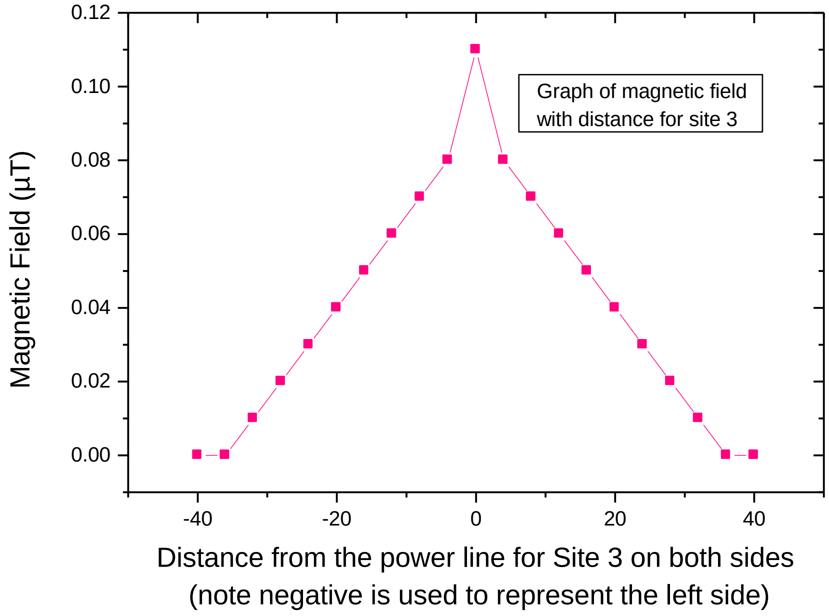

Figure 3: Graph of magnetic filed measurement with respect to distance in the site 3. Note; the left hand side of the reading was represented by negative for ease in the graph.

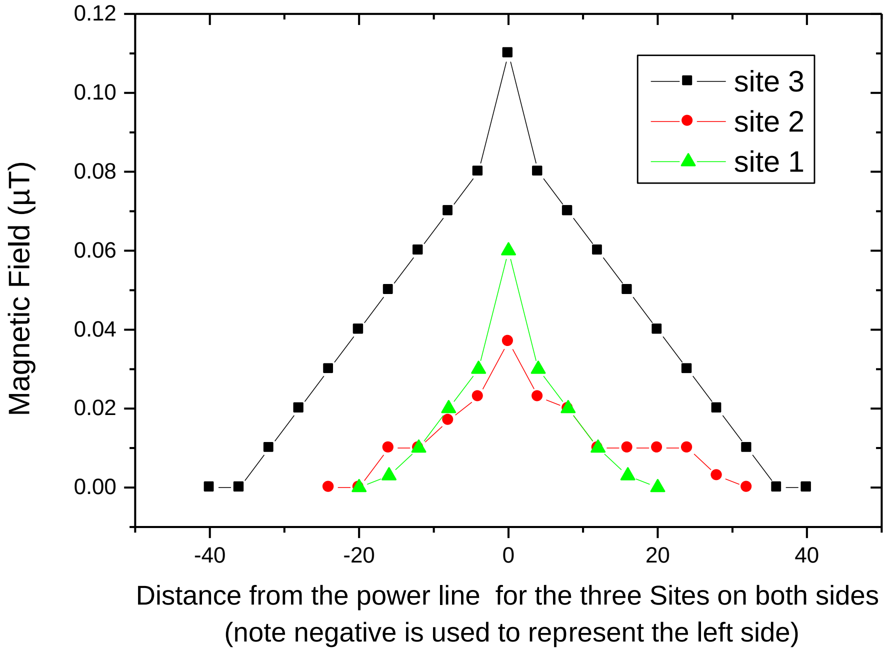

***Figure 4**:* Graph of magnetic filed measurement with respect to distance for all the selected sites. Note; the left hand side of the reading was represented by negative for ease in the graph.

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