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Investigation of extremely low frequency (ELF) hot spots in the College of Science and Technology, Covenant University, Ota

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Abstract

The presence of Extremely Low Frequency (ELF) from electronic devices such as personal computers, laboratory equipment and television sets in selected laboratories and offices at the College of Science and Technology Building, Covenant University, Ota, Nigeria was characterized using an ELF Detection Meter. The study revealed that exposure to ELF fields could be controlled to the minimum depending on the awareness of the occupant. As with all electromagnetic fields, the ELF field decays rapidly with distance from source or hot spots. The average observed value of ELF in the offices ranged from 3.5 to 5.0 mG. A significant hot spot with ELF of approximately 10 mG in an office was detected close to the magnetic board fixed on the wall. From the results, the maximum ELF fields of between 30–50 mG were observed close to some electronic devices, while other areas recorded significant ELF fields of between 4 mG and 25 mG due to the presence of electrical internal conduit wiring with no electrical gadgets in their vicinities. Minimum ELF fields of between 0.1 mG and 0.5 mG were observed in one of the locations surveyed.

Key Words: Extremely low frequency (ELF), ELF field decay, hot

1. Introduction

Exposures to many electromagnetic fields (EMF) are increasing significantly as technology advances unabated and new applications are found. Everybody is exposed to a complex mix of EMF of different frequencies that permeate our environment [1]. In the past two decades the general public has become increasingly concerned about potential adverse health effects of exposure to electric and magnetic fields at extremely low frequencies (ELF). Such exposures arise mainly from the transmission and use of electrical energy at the power frequencies of 50/60Hz [2, 3]. Electromagnetic waves consist of electric (E) and magnetic (H) waves traveling together. They travel at the speed of light in an unbounded free space and are characterized by a frequency and a wavelength. ELF fields are defined as those having frequencies up to 300 Hz. At these low frequencies, the wavelengths in air are very long (6,000 km at 50 Hz and 5,000 km at 60 Hz) and, in practical

situations, the electric and magnetic fields can be thought to act independently of one another for short distance propagation and are measured separately [4] static case approximation.

Electric fields arise from electric charges. They govern the motion of other charges situated in them. When charges accumulate on an object they create a tendency for like or opposite charges to be repelled or attracted, respectively. Any device connected to an electrical outlet, even if the device is not switched on, will have an associated electric field that is proportional to the voltage of the source to which it is connected. Electric fields are strongest when close to the device and diminish with distance [5].

Electric and magnetic fields in a setting depend on many factors, including the distance from local power lines, the number and type of electrical appliances in use in the setting, and the configuration and position of internal conduit electrical wiring. The major way that ELF fields interact with living tissues is by inducing electric fields and currents in them. However, the magnitude of these induced currents from exposure to ELF fields at levels normally found in the environment is often less than the currents occurring naturally in the body. But, research has shown that high ELF magnetic fields can affect human physiology and behavior. Exposure of volunteers for several hours to ELF fields up to 5 mT had significant effect on a number of clinical and physiological tests, including blood changes, ECG, heart rate, blood pressure, and body temperature [6–8]. Some investigators have reported that ELF field exposure may suppress secretion of melatonin, a hormone connected with human day-night rhythms.

2. Methodology

This study focused on selective control precaution in minimizing ELF exposure. The investigations were carried out using an ELF Detection Meter Model 480823 manufactured by Action Electronic, U.S.A. (Figure 1). The study was carried out in nineteen locations within the College of Science and Technology Building, Covenant University, Ota, Nigeria. The locations comprised of offices, laboratories, visitor reception lobbies and their adjoining corridors.

Figure 1. EMF/ELF Meter.

The ELF field investigation was carried out along the three axis x, y, z so as to locate the presence of ELF hot spots. The measurements were carried out between 26^{th} March and 1^{st} April, 2009 during the office hours between 11:00am and 4:00pm with all the electronic gadgets on and in use.

3. Results and discussions

The purpose of this study was to acquire necessary information concerning ELF exposure levels at different locations within the CST Building at Covenant University. The survey determined the area of highest exposure or hot spots in the offices and laboratories investigated.

Most of the hot spots with ELF values ranging from about 30 mG to 50 mG were due to the presence of electronic gadgets within the location. Values between 10 mG and 25 mG were due to the internal electric conduit wiring within the wall and the floors without any electronic gadget in the vicinity.

In general, it was observed that ELF just like other electromagnetic field decays rapidly with distance from the source, Figures 2(a–l). In the Microbiology Laboratory corridor where a giant split air conditioner is erected, a high value of ELF of about 50 mG was recorded within its surroundings. At about 1.5 m away from the air conditioner, the ELF value dropped to 7 mG and at 2.5 m away it was about 2 mG, while at 4 m away from the air conditioner the ELF value recorded was just 0.1 mG. These observations imply distancing oneself from the hot spots can easily control exposure to ELF. Thus, staff and students working in these environments should avoid positioning their seats in the ELF hot spot zone. The same trend was observed in the other major hot spots around the college offices. In another location in the Microbiology Laboratory, the ELF value recorded varied between 10 mG and 30 mG which spread to a distance of 4 m due to the presence of heavy analyzer and a giant standing air conditioner within the vicinity.

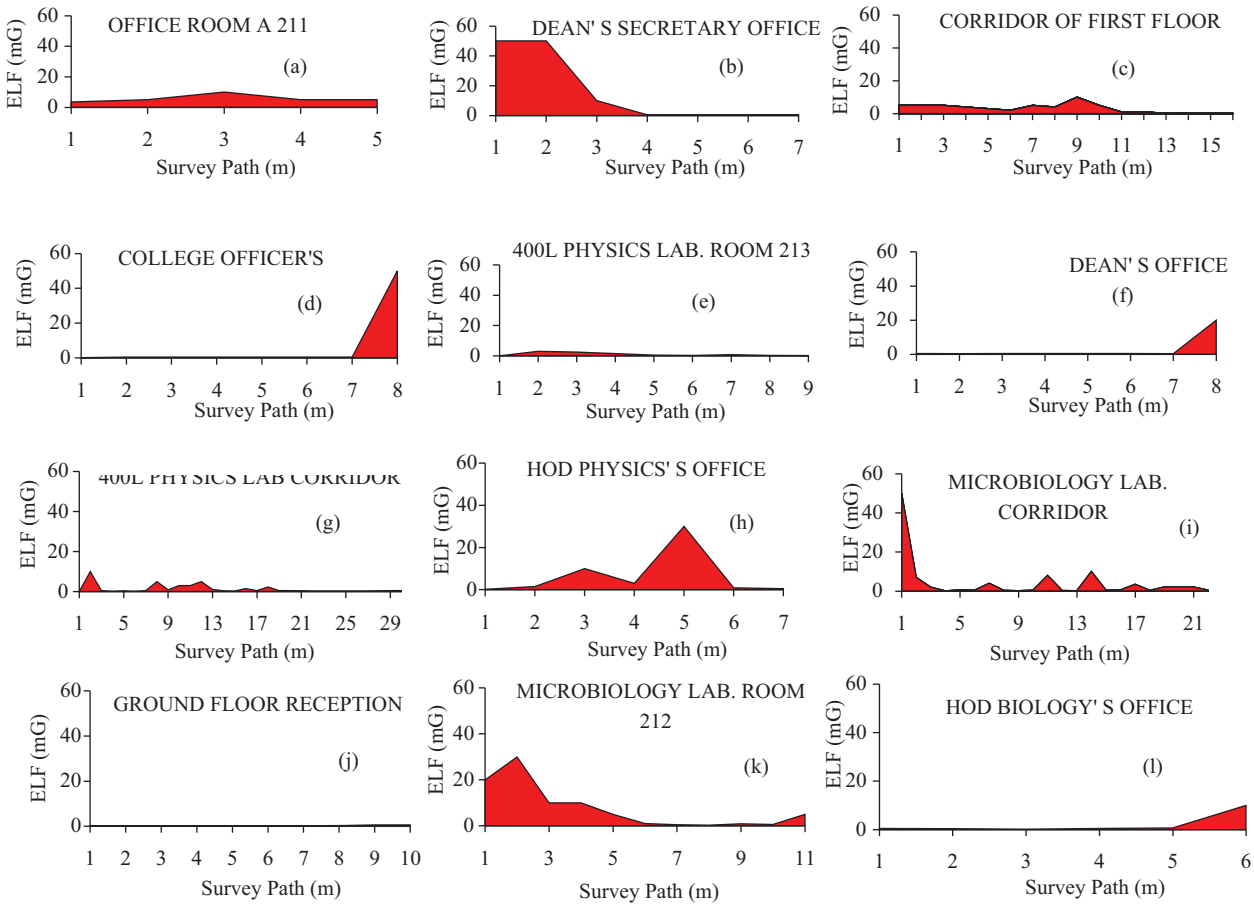

Figure 2. (a-l) Locations surveyed for ELF fields in CST, Covenant University, Ota, Nigeria.

As at the time of the investigation, the visitor reception lobby at the entrance of the college building recorded the least ELF value of between 0.1mG and 0.5mG, which can be considered negligible. At the time of this study, the location was void of any electronic gadget (Figure 2j).

This study confirmed that exposure to ELF hot spot can be easily managed or avoided by the users/occupants in a setting. In locations where hot spots were observed, the percentage of the office and laboratories space under the ELF field influence varied between 9% and 22%. This gives enough space for rearrangement of seat and working space without being stationed for too long in the ELF hot spot zone.

Figures 2(a–l) revealed that ELF hot spot zones are confined and can be easily avoided. For instance, in Figure 2(a), the point where the ELF shots up to about 10 mG is along the wall where a magnetic white board was fixed. The presence of the magnetic white board and internal electrical conduit wiring in this location is suggested to have given rise to the measured ELF value of about 10 mG. The presence of laptop and flat screen in this office did not induce significant value of ELF compared to that recorded along that wall. The same explanation of internal conduit wiring is suggested for the significant ELF values between 4 mG and 10 mG observed along the corridor of these offices for about 11m length consecutively.

From the results, high ELF values were measured in the range of 30–50 mG in four locations. These values though within the World Health organization's recommended limit for radio frequency radiation, it is still not advisable to be exposed continuously to the field for longer time than necessary. Laboratories with big equipment display on the benches, such as in the Microbiology Lab (Figure 2(i) and 2(k)), gave higher values than others, such as the Physics Lab (Figure 2(e)) that has less equipment display on the benches. The study also revealed variations in the values of ELF fields obtained from different devices. Dell Computers gave lower radiation values than Zenox Computers. Likewise, radiation values obtained from Flat Screen monitors were much lower than values obtained from VGA Monitors as expected.

4. Conclusion

This study has established the presence of ELF fields both in the laboratories and offices in the College of Science and Technology, Covenant University, Ota, Nigeria. The study revealed the confinement of ELF hot spot zones and the relative ease of minimizing undue exposure to the fields. The percentage of space with significant ELF presence in all the locations studied varied between 9% and 22%, which leaves ample room for rearrangement of seats and working space without being stationed for too long in the ELF hot spot zone.

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