

ADVERSE EFFECT OF ELECTROMAGNETIC FIELD RADIATION ON HUMANS.

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Abstract.

Researches have shown that electromagnetic Field radiation generated from sources such as handsets (Telephones), electric power lines, communication mast and radio devices may be hazardous to Human Health. In Nigeria, structures are erected very close to power Lines for business or residency purposes and they are exposed to varying magnetic fields generated. This paper outline the risk and evils of exposure to radiation from magnetic fields and possible solutions to address the situation.

INDEX TERMS: Eddy Current, Magnetic Field Density, Right of Way (ROW), Electromagnetic Field (EMF) Radiation, Extremely Low Frequency (ELF)

1.0 INTRODUCTION

Basically, electricity is the study of the electrical properties of matter and its utilization for the benefits of mankind. Electricity is an important facility which is required to power

electrical/electronic equipment for daily domestic, Occupational and recreational activities. It is pertinent to note that though, these equipment do ease our activities and work but, they pose some hazards which

endangers our health. The gravity of the effect depends on the length of time at which we expose ourselves to the dangers of EMF radiation. [1].

1.1 ELECTROMAGNETIC FIELD

An electromagnetic field is created in the region of space around electrically charged bodies. It alters the properties of charged material objects within the vicinity of the field. It is one of the forces of nature just like the force of gravity.

It can be shown that, there exist a relation between current and charges as explain by Lorentz force law and maxwell's equation.

From classical theory, electromagnetic field can be regarded

as a wavelike smooth continuous field, but from quantum theory, the field is regarded as quantized discrete particles, [2].

The electromagnetic field can be seen as composed of two forms;

1. continuous wave nature
2. Discrete particles nature

1.2 Exposure of Population to Magnetic Field Radiation

It is prohibited by law in Nigeria to construct structures under and about 50m close to power transmission lines due to the risk involved in the event of an abnormal condition such as a fault on the line. But people usually ignore such laws in other find daily bread by building of structures which include welder workshop, iron benders workshops, bricks moulding

workshop, trading shops, residential blocks, commercial blocks, worship houses, and workshops on the Right of Way. Therefore, the citizens are constantly being exposed and subjected to varying magnetic fields.

1.3 Pollution Due to Electromagnetic Field Radiation from Power Lines

Extremely low frequency radiation is generated from high voltage electrical power transmission lines. These lines can produce heavy power losses that may be able to bend the ionosphere of the earth and prolong exposure to the field from the line may cause risk of health failures which makes it hazardous to our health. These are two forms of current that could create a magnetic field; eddy's current and

current entering and leaving a junction [3]

These current is capable of altering the biological processes in the human body. The induced eddy current in the body is not conducted to ground thereby creating difference in voltage magnitude within the body which could be as high as 1 mV if the magnetic flux density reaches approximately 0.03 mT [3]. In the region of space around power transmission lines, the electric fields strength is typically of the order of a few kilovolts per metre and the forces exerted by the fields on living cell can cause serious damage, deformation and destruction of living cells because of the conductive nature of living material tissues [5].

1.3.1 Interaction of Human Body with power lines Electric and Magnetic Fields

Magnetic field exposure to power line could lead to internal body currents and absorption of energy in tissues as a result of thermal agitation. This depends on the combined effects of frequency (f) and the electrical conductivity of the medium (σ). In magnetic materials, permeability (μ), magnetic field intensity (H) and magnetic flux density (B) are related by

$$B = \mu H$$

1.0

From Ohm's Law, the current density (J) is given by the equation thus [6]

$$J = \pi R f B$$

-----1.1

Where R is radius of induction loop and f is frequency

For electric field, Ohm's Law gives the relationship between the internal electric field (E) and current density (J) as expressed in equation (1.2).

$$J = \sigma E$$

.....
..... 1.2

A human body located in an electric field causes disturbance of the field leading to uneven distribution of the field around the body [6]. The field causes electric currents by induction

in the exposed body. The frequency of the current is the same as that of the external field. Unlike magnetic field, electric field is reduced from the value of the external field within the body. [7], [8], [9], [10], [11]. The electric - field intensity at the surface of the body and the induced currents passing through each segments of the body can be determined by: the characteristics of the field applied, shape of the body and conduction current from the body to the ground.

The induced electric currents are greatest at the periphery of the body. The maximum ground level magnetic field strengths associated with overhead power transmission lines are of the order of 0.0098 – 0.045 mT and are also related to line height. The

magnetic flux density decreases almost linearly with distance from the conductor [3].

1.3.2 Health and safety

The health effect due to exposure to very low frequency (VLF) EM fields from sources such as transmission lines, communication mast and electrically charged objects are varies depending on the frequency and strength of the magnetic fields. There are on-going research in the areas of EM field effects aim at generating sufficient datas upon which good conclusion can be drawn.

Each country has its own standard limits for EM fields exposure based on guidelines given by the International Commission on Non-

Ionizing Radiation Protection

(ICNIRP).

Some possible biological effects of electromagnetic pollution on humans

are:

- Chronic fatigue
- Asthma
- Nausea
- Neuronal disorders
- Depression
- Parkinson's disease
- Leukemia
- Severe headaches
- Cancerous cells
- Lyme disease
- Depression
- Lupus
- Skin disorder
- weakness
- Insomnia
- Rashes
- Electro-sensitivity
- Sclerosis
- Hypertension
- memory loss
- Electromagnetic hypersensitivity
- Allergies
- Blood sugar content variations
- Cardiac disorders
- Tumors
- Miscarriages and birth defects
- Stress and strain
- Weak Immune System
- Rheumatism
- Heart failure
- Chest pain
- Insomnia Tinnitus/other audible noises
- Arthritis

Upon frequent exposure to EM field radiation for a long period of time cells of the human body react in terms of cell mutation at different rates. But some factors are predisposing factors. They includes:

- Level of stress
- Having high blood pressure
- High frequency of EM field exposure
- Low level of iodine content
- Level of toxicity by heavy mental
- Hypertension and other Health related challenges.

The major reason of these effects is the alteration of Melatonin Secretion due to EM field radiation exposure. Melatonin Secretion is associated

with the growth of tumor, aging, cancerous cells of the breast, normal/abnormal sleep. With population explosion and community expansion, dwelling places is now approaching power transmission line such individuals now erect structures in close proximity to high voltage power transmission lines.

1.4 EM Field Prevention and Control Measures

1.4.1 Buildings near the lines

The Commission requires utilities to provide information about certain types of buildings along any route: residences, hospitals, nursing homes, day-care centers, schools, and workplaces. A utility must report how far these buildings are from any route. The distances from a proposed line are reported from zero up to 300 feet in intervals of 25 to 50 feet. EMF fields are also calculated for the same

distance intervals. They can cause serious environmental problems, depending on their location. (Buried cables require digging trenches which disturbs the soil. Oil-filled cables present the danger of fluid leaks that can result in soil and water contamination.)

1.4.2 Underground lines decrease magnetic fields

Analysis shows that underground power lines, especially on transmission systems, reduce magnetic fields. Underground lines bring the conductors closer together than is possible with an overhead line. Though the magnetic field surrounding an underground power transmission line can be very high, the nearness of the conductors resulted in

a strong effect of rapid field cancellation. This means that the magnetic fields emanating from an underground transmission line will be much more rapidly reduced and attenuated with distance from the line.

A study conducted by the State of Rhode Island indicated that at a distance of as little as 25 feet, an underground transmission line can reduce EMF by more than 99 percent when compared to overhead lines.

Now, underground transmission is being employed in high voltage transmission installations in the developed areas countries of the world. This is so because a good clearances may not be possible to be provided for overhead lines on streets

of congested cities. Typically, lines are buried 3.5 to 4 feet deep.

1.4.3 Protective Clothing and Shields

Protective clothing should be provided for maintenance personnel which would act as screen, shielding the extremely low frequency (ELF) electromagnetic field (EMF) radiation and the reducing drastically the amount of exposure of EMR on personnel staff working as maintenance officer on high voltage transmission lines.

1.4.4 Government Policy

- i. The laws prohibiting citizens from erecting structure at near of under high voltage power lines should be enforced to avoid human dwellings encroaching into the right of way of power lines.
- ii. The public should be sensitized on the dangers of leaving at close to or under power lines to avoid national disaster in the form of an epidemic outbreak.
- iii. Energy transmission company should ensure that the safe allowable EMF radiation limits is not exceeded to avoid jeopardizing with public health.

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