

Study of Electromagnetic Field and Its Effect on Human Body

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ABSTRACT: The various equipments generating electromagnetic radiations such as wireless phones, various electrical equipments etc. have now become a very important part of life. Life cannot be imagined without these equipments. These electromagnetic devices have various uses in domestic, industries and medicine. Induction heating is used in industries, MRI and CT SCAN are used to find out the abnormal conditions in human body and hyperthermia technique is used to treat cancer and tumours. In spite of all uses the electromagnetic fields imposes great danger to the human body. Electromagnetic pollution (or EMF pollution) is a term given to all the man-made electromagnetic fields (EMFs) of various frequencies, which fills homes, workplaces and public spaces. When something in the environment is called a pollutant, it implies that it is somehow harmful to nature and to human beings.

KEYWORDS: Electromagnetic field (EMF), Electromagnetic radiation (EMR), Electromagnetic pollution.

I.INTRODUCTION

Electromagnetic radiation can be classified into ionizing radiation and non-ionizing radiation, based on if it is capable of ionizing atoms and breaking covalent bonds. Ultra violet and higher frequencies, such as X-rays or gamma rays are ionizing. These pose their own special hazards. Non-ionizing radiation is associated with two major potential hazards: electrical and biological. Additionally, induced electric current caused by radiation can generate sparks and create a fire or explosive hazard. The electromagnetic spectrum includes several different classes of radiation: low frequency, radio waves, microwaves, infrared, visible light, ultraviolet light, x-rays and gamma rays. Wave frequency is what differentiates one class of radiation from another. Fig.1 shows the electromagnetic spectrum [1]

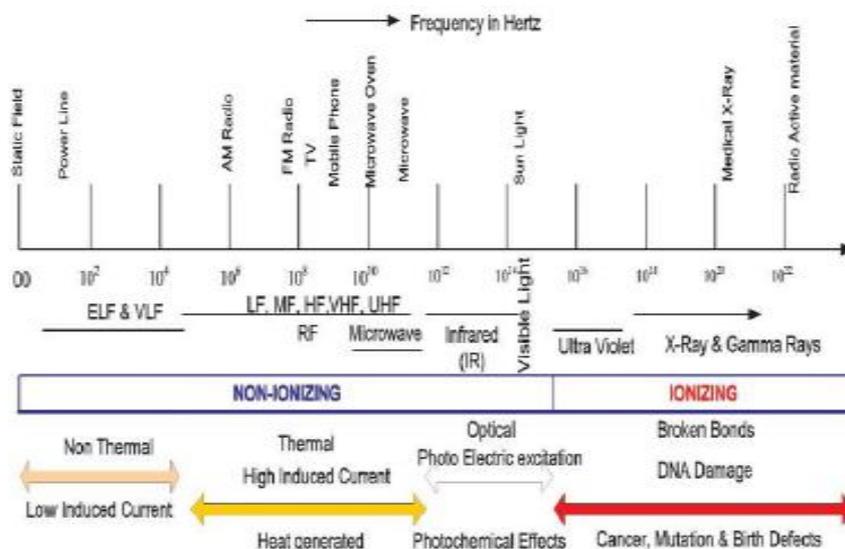


Fig. 1: Electromagnetic Spectrum



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Electromagnetic pollution is due to frequencies below (oscillating slower than) visible light waves. Of course, x-rays and gamma rays (which oscillate faster than visible light) are highly dangerous but homes and workplaces are not filled with these rays. Electromagnetic pollution is everywhere. Here's a short list of the main culprits:

- cell (and other mobile) phones
- computers and related equipment
- electrical and electronic appliances
- radio and TV transmitters
- microwave ovens
- house-wiring
- high and low voltage power lines
- information networks
- cars, motor cycles, buses, trains, planes.

Practically every new invention adds to the pollution. The rate of increase is rising exponentially. This paper provides an overview of electromagnetic fields and its adverse effect on the human body.

II.LITERATURE REVIEW

Electric devices and infrastructure and wireless communication are hallmarks of modern life. The proliferation of these technologies in recent years has dramatically increased our exposure to electromagnetic radiation (EMR), or electromagnetic fields (EMF). While the science on the health impacts of this form of radiation is inconclusive, many people are concerned about how long-term exposure to excessive EMR may impact human health and nature [17].

The World Health Organization maintains that "no adverse health effects are expected." However, the International Agency for Research on Cancer (IARC) has classified extremely low frequency EMR (associated with power lines) and radiofrequency EMR from cell phone use as possible human carcinogens. Compared to cell phones, radiofrequency EMR exposure from other wireless devices is lower — because other devices are typically located farther away from the body — but in some cases continuous. Other wireless devices, such as smart meters, transmit only intermittently. PG&E claims that EMR exposure from a home electricity smart meter transmitting intermittently for 1000 years is equivalent to one month of typical cell phone use. IARC has not drawn any conclusions about an association between cancer and radiofrequency EMR from sources other than cell phones [18].

In 2007, an independent, international collaborative of 14 scientists and public health and policy experts reviewed more than 2000 studies of health effects from EMR (the Bioinitiative project). They concluded, "Chronic exposure to EMF is associated in some scientific studies with increased health risks that vary from impaired learning, headaches, mental confusion, skin rashes, tinnitus and disorientation to a variety of cancers, and neurological diseases like ALS and Alzheimer's." The Bioinitiative Report is probably the most comprehensive literature review on the subject, but some critics claim it is one-sided [17].

A smaller number of studies hint at possible environmental impacts of EMR. In one, scientists found that bees refuse to return to their hives when mobile phones are placed nearby, suggesting that EMR may play a role in colony collapse disorder. Another study linked Wi-Fi exposure to tree leaf damage. The results of these studies are considered preliminary and inconclusive.

WHO also identifies and promotes research priorities for radiofrequency fields and health to fill gaps in knowledge through its research agendas.

WHO develops public information materials and promotes dialogue among scientists, governments, industry and the public to raise the level of understanding about potential adverse health risks of mobile phones.

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III. LOW FREQUENCY ELECTROMAGNETIC FIELDS

Strong electromagnetic fields (EMFs) of low frequency about 50 to 60 cycles per second (hertz, or Hz) and the related electromagnetic radiation (EMR) are harmful. It is easy to shield a house from electric field generated by nearby power lines but is difficult to provide shielding from magnetic field that they generate. The magnetic field can be shielded by burring the transmission lines but the cost is very high.

The long-term exposure of low frequency EMFs may aggravate any existing health problems or diseases and may cause or intensify especially lack or fatigue, irritability, aggression, hyperactivity, sleep disorders and emotional instability.



Fig. 2: Low Frequency Fields

Increasing numbers of individuals are becoming hypersensitive to EMR. EMR exists around power lines, power tools, electric stoves, heaters, boilers, freezers and television sets when in use, extending several feet or yards around the appliance. Using an electric iron or an electric keyboard or working with handheld power tools can quickly drain our energies. Stray currents and radiating fields can still be emitted from electric wires even if appliances are switched off. AC electric fields do not disappear when an appliance is switched off, only AC magnetic fields disappear.

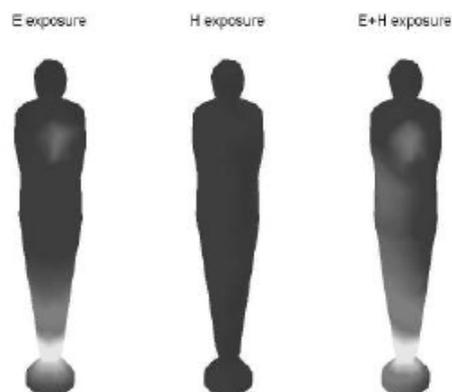


Fig. 3: Effect of Electromagnetic Field on Human Body.

When human body is exposed to electric field, the portions affected are shown in Fig.3. No significant effect was observed on human body on exposure to magnetic field alone. But adverse effect is seen on the human body when it is exposed to both electric and magnetic fields.

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IV. HIGH FREQUENCY ELECTROMAGNETIC FIELDS

High frequency electromagnetic field is mainly generated by the cell phones, microwaves and antennas. High frequency EMFs is due to Radio Frequency energy in the frequency range of LF, MF, HF, VHF, UHF or microwaves and is often referred to as radio energy. The term RF energy is used for all the frequencies between 30 kHz and 300GHz. Following are the biological effects of RF energy:

- The biological effect of RF energy depends upon the rate of absorption of energy.
- The RF energy heats up the tissues in a similar manner a microwave oven heats the food. It can be dangerous in case of prolong exposure.
- Tissues can get damaged if exposed to high level of RF energy because they are not capable of dissipating large amount of heat generated. This can lead to skin burns, deep burns and heat strokes.
- Eyes are most affected by the RF energy. The lack of blood flow to cool the cornea can lead to cataracts.

1. CELL PHONE RADIATION:

Cell phones use wireless technologies that work by emitting radio frequency radiation that are transmitted through the antenna in the phone. When talking on the cell phone, the device and thus its antenna end up right next to the head, letting the radiation from it easily affect the brain.



Fig. 4: Microwave communication Tower.

2. ELECTROMAGNETIC POLLUTION FROM CODLESS PHONES:

Swedish scientists have found that cordless phones raise the risk of developing cancer. Researchers studied malignant brain tumour patients' usage of cell phones and their usage of cordless phones; they found the cancer risk was increased for those who used cordless phones and combining the two made the risk even higher.

V. HAZARDS OF ELECTROMAGNETIC POLLUTION

Hazards from Electromagnetic pollution can be in various forms. It can be electrical hazards, fire hazards, biological hazards and DNA fragmentation.

1.ELECTRICAL HAZARDS:

Strong radiation can induce current capable of delivering an electric shock to persons or animals. It can also overload and destroy electrical equipment. The induction of currents by oscillating magnetic fields is also the way in which solar storms disrupt the operation of electrical and electronic systems, causing damage to and even the explosion of power distribution transformers,[2] blackouts (as in 1989), and interference with electromagnetic signals (*e.g.* radio, TV, and telephone signals).[3]



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2. FIRE HAZARDS:

Extremely high power electromagnetic radiation can cause electric currents strong enough to create sparks (electrical arcs) when an induced voltage exceeds the breakdown voltage of the surrounding medium (*e.g.* air). These sparks can then ignite flammable materials or gases, possibly leading to an explosion. This can be a particular hazard in the vicinity of explosives or pyrotechnics, since an electrical overload might ignite them. This risk is commonly referred to as HERO (Hazards of Electromagnetic Radiation to Ordnance). On the other hand, the risk related to fuelling is known as HERF (Hazards of Electromagnetic Radiation to Fuel).

3. BIOLOGICAL HAZARDS:

The best understood biological effect of electromagnetic fields is to cause dielectric heating. For example, touching or standing around an antenna while a high-power transmitter is in operation can cause severe burns. These are exactly the kind of burns that would be caused inside a microwave oven. This heating effect varies with the power and the frequency of the electromagnetic energy. A measure of the heating effect is the specific absorption rate or SAR, which has units of watts per kilogram (W/kg). The IEEE[4] and many national governments have established safety limits for exposure to various frequencies of electromagnetic energy based on SAR, mainly based on ICNIRP Guidelines,[5] which guard against thermal damage.

4. DNA FRAGMENTATION:

A 2009 study at the University of Basel in Switzerland found that intermittent (but not continuous) exposure of human cells to a 50 Hz electromagnetic field at a flux density of 1mT induced a slight but significant increase of DNA fragmentation in the Comet assay.[6] However that level of exposure is already above current established safety exposure limits.

VI. PROTECTION AGAINST ELECTROMAGNETIC POLLUTION

Since there are two sources of electromagnetic pollution and their effects are different on human body so different protection measures are required for both low frequency and high frequency electromagnetic pollution.

1. PROTECTION AGAINST LOW FREQUENCY ELECTROMAGNETIC POLLUTION:

It must be tried to minimize electromagnetic pollution, especially while sleeping when the pineal gland is most susceptible. Also one should sleep in the dark or at least eyes must be covered to produce the immune-stimulating hormone melatonin. Preferably all power points in the bedroom should be switched off and all electric leads with 2-prong plugs should be unplugged before going to sleep. If the head faces a wall with power-points or other electric wiring inside the wall close to the bed then bed should be moved towards the middle of the room.

While using electric blankets, the bed should be warmed beforehand and the plug should be removed before going to bed. It should be tried not to habitually remain within a few meters of a working electric appliance. Fluorescent lighting, watching television, using video games, computers and even electric typewriters and hand-held electric tools should be avoided.

Television sets also emit harmful X-rays so television watching should preferably be as far away as conveniently possible. The field is strongest directly in front and at the back of the television. Computer monitors apparently have stronger radiations to the sides than to the front.

2. PROTECTION AGAINST HIGH FREQUENCY ELECTROMAGNETIC POLLUTION:

- Less time should be spend on the cell phone.
- Cell phones with a lower specific absorption rate (SAR) should be used.
- Children's use of cell phones should be limited.
- It should be avoided to make calls with a low signal and low battery as the cell phone will generate more radiation in an effort to compensate for it.



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VII.CONCLUSION

After this study it can be concluded that electromagnetic fields are harmful and can have adverse effect on human body depending upon the intensity and frequency of electromagnetic field. It is always a good idea to avoid the unnecessary exposure to electromagnetic fields whenever possible.

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