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Hazards of Electro Magnetic Radiations: An Overview with Special Reference to Mobile Phone Use

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Abstract

Electromagnetic radiation is the name given to whole range of transverse radiations having different wavelengths. Very strong radiations can make electrical, fire & biological hazards. This study reveals the type of radiations, its ranges, uses, effect in general with special attention in human health and mobile phones.

Keywords: Radiations, effects, hazards, health, mobile phones etc.

1.0 Introduction

Electromagnetic radiation is the name given to whole range of transverse radiation having different wavelengths but six common properties, namely

- It is propagated by varying electric and magnetic fields oscillating at right angles to each other
- It travels with a constant velocity of 299792458M/S in a vacuum.
- It is unaffected by electric and magnetic fields.
- It travels straight line in vacuum.
- It may be polarised
- It can show interference and diffraction
- For convenience electromagnetic spectrum is divided into the following.

Gamma rays

Wavelength 10^{-14} - 10^{-11} frequency 10^{22}Hz - 10^{19}Hz . This radiation is normally produced by transitions within the excited nucleus of an atom and usually occurs as the result of some previous radioactive emission. It can result from fission or fusion reactions or the destruction of a particle-antiparticle pair, such as an electron and a positron. It is used in some medical treatment and also for checking flaws in medical castings and it may be detected by photographic plates or radiations detectors such as the Geiger tube or scintillation counter.

X-rays

Wave length 10^{-12}m - 10^{-8}m , frequency 10^{22} Hz - 10^{16} Hz . This occurs due to electron transitions between the upper and lower levels of heavy elements, usually excited by electron bombardment or by the rapid deceleration of electrons (known as bremsstrahlung or braking radiation), X-rays are primarily used in medicine and dentistry, and may be detected using photographic film.

Ultraviolet radiations

Wave length 10^{-8}m - 10^{-6}m , Frequency 10^{17}Hz - 10^{15}Hz . This is produced by fairly large energy changes in the electrons of an atom. It may occur with either heavy or light elements. The Sun produces a large amount of ultraviolet radiation, most of which is absorbed by the ozone layer in the upper atmosphere. UV radiation will cause fluorescence and ionization, promote chemical reactions, affect photographic film and produce photoelectric emission. It will also give you a sun tan although since radiation of the required wavelength will not pass through glass, you will not go brown unless you are exposed to sunlight directly like the preceding

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radiations it can be dangerous in large doses, particularly to the eyes. Its main uses are in spectroscopy and mineral analysis (some minerals exhibit strong fluorescence under UV radiations)

Visible light

Wavelength 10^{-7} m- 10^{-6} m, Frequency 10^{15} Hz- 10^{14} Hz. This is due to transitions in atoms. It effects a photographic film, stimulates the retina in the eye and photosynthesis in plants.

Infrared radiations

Wavelength 10^{-6} m- 10^{-3} m, frequency 10^{14} Hz- 10^{12} Hz. Infrared radiation, discovered around 1800 by William and Caroline Herschel. It is less scattered by fine particles than visible light (because of its longer wavelength). It is useful for haze photography. It is also used by earth resource satellites to detect healthy crops; most of us are familiar with its use for heating, both in the home and in hospitals. It may be refracted by rock salt.

Microwaves

Wavelength 10^{-4} m- 10^{13} m, frequency 10^{13} Hz- 10^9 Hz. These are produced by valves such as a magnetron or with a maser. They are used in radar, telemetry and electron spin resonance studies and in microwave ovens. Microwaves may be detected with crystal detectors or solid-state diodes. The radiation from interstellar hydrogen has a wavelength of 21 cm and so lies at the edge of the microwave region: the detection and analysis of this radiation has added greatly to our knowledge of the structure of the universe.

Radio waves

Wave length 10^{-4} m- 10^3 m, frequency 10^{08} Hz- 10^9 Hz. Many of these have the longest wavelengths of any region of the electromagnetic spectrum and therefore the smallest frequency and hence the lowest energy per quantum. They are produced by electrical oscillations and may be detected by resonant circuits in radio receivers. Their use is of course in radio and television communications.

The effect of mobile phone radiations on human health is a subject of interest and study worldwide, as a result of enormous increase in mobile phone usage throughout the world. As of 2016, there are 7.4 billion subscribers worldwide and to be 5.7 billion by 2020. Mobile phones use electromagnetic radiation on the microwave range of (300 MHz-300GHz). Other digital wireless system such as data communication networks, produces similar radiations.

In 2011, International Agency for research on cancer (IARC) classified mobile phone radiations as Group 2B. Along with this the WHO in 2011 claimed that "to date, no adverse health effects have established as being caused by mobile phone use". A few of the national radiations advisory authorities have recommended to take measure to minimise the exposure as precautionary approach.

2.0 Radiation Absorption

Part of the radio waves emitted by a mobile telephone handset are absorbed by the body. The radio wave emitted by a GSM handset is below a watt maximum power output from a mobile phone is regulated by the mobile phone standard and the regulatory agencies.

In most cases, the telephones and the base stations checks the reception quality and signal strength and the power level is increased or decreased automatically, to

accommodate different situations, such as inside or outside of buildings and vehicle. The rate at which energy is absorbed by the human body is measured by the specific absorption rate (SAR), and its maximum levels have been set by governmental agencies. In US, federal Communications Commission (FCC) has set a SAR limit of 1.6W/Kg, averaged over a volume of 1 gram of tissue, for the head. SAR values are dependent the size of the averaging volume.

SAR data for specific mobile phones, along with other useful information, can be found directly on manufacture's web sites, as well as on third party websites.

2.1 Thermal effects

In case of a person using a cell phone, most of the heating effect will occur at the surface of the head, causing the temperature to increase by a fraction of degree. In this case, the level of temperature increases is an order of magnitude less than that obtained during the exposure of head to direct sunlight. The brains blood circulation is capable of disposing of excess heat by increasing local blood flow, however, the cornea of the eye does not have temperature regulation and exposure of 2-3 hours produces cataracts. Premature cataracts have not been linked with cell phone use, because of the lower power output of mobile phones.

2.2 Non –Thermal Effects

The communications protocol used by mobile phones often result in low-frequency puling of carrier signal. Some researches argue that so called "non-thermal effects" could be interpreted as a normal cellular response to an increase in temperature.

2.3 Blood –brain –barrier effects

Swedish researchers studied the effect of microwave radiations on the rat brains. They found a leakage of albumin into the brain via a permeated blood-brain basin. Finland's radiation and nuclear safety authority found, max legal limit for mobile radiators, one prioritises in particular, HSP 27, was effected HSP27 played a critical role in the integrity of the blood-brain barrier.

2.4 Cancer

In 2006, a large Danish group's study about the connection between mobile phone use and cancer incidence was published. It showed no increased risk of cancer. 13 nation "INTERPHONE" project did not find a solid link between mobile phones and brain tumour. Cancer council Australia, has found no evidence that normal use of mobile phones for a period up to 12 years can cause brain cancer.

2.5 Cognitive effect

In 2009, study examined the effects of exposure to radio frequency radiation emitted by GSM call phone on the cognitive functions of humans. It showed that longer duration of exposure may increase the effects of performance.

2.6 Electromagnetic Hypersensitivity

Some users of mobile handsets reported feeling several unspecific symptoms during and after its use, ranging from burning and tingling sensations in the skin of the head and extremities, fatigue, sleep, headaches, disturbances of the digestive system. Reports have noted that all of the symptoms can be attributed to stress.

2.7 Behavioural Effects

Cell phone use during pregnancy may cause behavioural problems.

3.0 Health Hazards of base station

Major area of concern is the radiation emitted by the fixed infrastructure used in the mobile telephony such as base stations and their antennas. It is because it is emitted continuously and is more powerful at close quarters. Because many base stations operate at less than 100 watts and the antenna is raised up well above ground, the radiation at ground level is much weaker than that from a cell phone, due to power relationship appropriate for that length of antenna. Base station emissions must comply with safety guidelines. Some countries have no health regulations.

Several surveys have found a variety of self-reported symptoms for people who live close to base stations.

3.1 Occupational Health Hazards:

Telecommunication workers also spend time at a short distance from the active equipment, for the purpose of testing, maintenance, installation, may be at risk of much quarter exposure than the general population.

Much time base stations are not turned off during maintenance, but the power being sent through to the antennas is cut off, so that the workers do not have to work near live antennas. A variety of studies over the past 50 years have been done on workers exposed to high RF radiations levels, studies including radar laboratories workers, military radar work, electrical workers and amateur radio operators. Most of the studies found no increase in cancer rates over the general population or a control group. Many positive results attributed to other work environment condition sand many negative also occurred.

3.2 Safety Standards and Licensing:

In order to protect the population living around base stations and near of mobile handsets, Governments and regulating bodies adopt safety standards, which translate to limits on exposure levels below a certain value. There are many proposed national and international standards, but that of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is the most respected one, and has been adopted so far by more than 80 countries. For radio stations, ICNIRP proposes two safety levels. one for occupational exposure, another one for the general population. Currently these are efforts underway to harmonise the different standards in existence.

Radio base licensing procedures have been established in the majority of the urban spaces regulated either at municipal or national level. Many Governmental bodies also require that competing telecommunication companies try to achieve sharing of towers so as to decrease environmental and human impact.

3.3 Precautions

Indian Council of medical Research (ICMR) has informed that in a number of studies it has been reported that exposure to radiation from mobile phones causes adverse health effects. But there is no conclusive data available so far on this issue. The ICMR has further informed that there is no scientific confirmed evidence that use of mobile

phones causes mental and physical diseases. There is no proven scientific evidence yet to suggest that electromagnetic radiations emitted from mobile phone may lead to cancer, tumour, mental imbalances, dementia, and headache and even it can damage DNA of a person.

Any electronic device that emits or receives a wireless or WIFI signal including popular devices like laptops, tablets and cell phones, create a radio frequency(RF), Electro-magnetic field (EMF). The radiation is around us, on trains, on planes and in stores and in restaurants. The human eye cannot detect the electromagnetic radiations, but it is always there.

Studies have shown that men who place laptop computer directly on their laps can experience reduced sperm count and decreased fertility. Some study says that ladies who keep mobile phone near to their breast may experience breast cancer on prolonged exposure. Some health problems were reported in Kerala from PSUs, Kerala Metals and Minerals Limited(Chavara, Kollam) and Indian Rare Earth (Udyogamandal, Ernakulam).Produced some sorts of itching in bodies and Skin colour changing etc from the inmates/residents of the factory areas.

How can we protect from Electromagnetic radiation? First try to limit direct contact with electronics whenever possible; If you can take a break from there, simultaneously switch off the equipment (say laptop, tablet, phone etc) Second, be aware of sources of EMR, avoid to go that place like going to restaurants with no WIFI connectivity and ask Ethernet cords to connect laptop for internet etc. EMR cannot cause immediate damage, it does not interact with our bodies, which can potentially lead to indirect damage, especially long-term exposure.

4.0 Tips for Mobile Phone Uses

Use hand free set to reduce the amount of radiation if you use mobile phones. Hold phone as far down as possible, so it can at low power. (Catch just touch, not catch by full covered).When reception is good, the phone reduces power and radiations, if reception is poor (i.e. signal strength) the phone uses maximum power and radiations.

The amount of radiations is directly connected to the length of time you talk on the mobile phone. For longer call, it is safer (and cheaper) to call from a regular (land phone) phone. Do not use when driving a cover, stop at safe place and talk. Do not bathe with your mobile phone. Don't let small children to take your mobile phone for long periods. They are susceptible than adults.

Show considerations to those around you when you have your phone with you. Do not use mobile phones in places where there is a lot of electrical equipment such as hospital (operation theatre and air craft).Turn off your mobile/keep silent mode when you are in public places such as movie theatre and café. Make a habit of turning it off. It is good for you.

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