

Electromagnetic Pollution due to Industrial Activities

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Electromagnetic waves

Electromagnetic waves are energy waves imperceptible to the human eye. They can travel through empty space, through the air and different substances. They are described with three physical properties, namely frequency, wavelength and photon energy. When we align the electromagnetic waves with respect to their range of frequencies, we get what is called electromagnetic spectrum (Figure 1). As can be noted from Figure 1, the spectrum is in respect of the wavelengths and photon energies. This spectrum is divided into separate bands, and the electromagnetic waves within each frequency band are given different names; radio waves, microwaves, infrared, visible light, UltraViolet (UV), X-rays, and Gamma rays. This is when we start at the low frequency (long wavelength) end of the spectrum and going towards the high-frequency (short wavelength) end. The electromagnetic waves in each of these bands have different characteristics, in terms of how they are produced, how they interact with matter and for what

they can be used for. The electromagnetic radiation is twofold, ionizing radiation and non-ionizing radiation. Ionizing radiation is by high energy electromagnetic waves such as Gamma rays, X-rays and higher frequency UV. They are sitting towards the higher frequency edge of the spectrum. These waves detach electrons and ionize atoms or molecules. Ionizing radiation is used in different fields such as medicine, nuclear power, research, and industrial manufacturing.

Lower energy UV, visible light, laser light, infrared, microwaves, and radio waves are lower energy waveforms. Thus, they contribute to non-ionizing radiation. They have enough energy, just to excite electrons to higher energy states and will not ionize atoms or molecules. These are also being used in different industries, medicine, consumer devices, household devices, etc.

Electromagnetic pollution

Electromagnetic pollution is a newer version of pollution, caused by electric, magnetic, and

electromagnetic fields generated naturally or technically. We observed a rapid development in advanced electrical, electronic, and electromagnetic systems in the recent past, which in terms increase the utilization as well as release of electromagnetic radiation to the environment. Number of investigations carried out in this realm is not that much; yet has proved that electric field strength caused by the electromagnetic radiation, in normal human inhabited areas have been increasing by at least one order in every decade. Electromagnetic pollution caused by non-ionizing radiation is also termed as Radiation Hazard (RADHAZ). When modern domestic and industrial activities are concerned, there is an augmented and widespread use of electronic devices. These devices make use of various parts of the electromagnetic spectrum. They either transmit or receive and process electromagnetic waves. There are innumerable applications residing in quite different domains including, but not limited to satellite communication, terrestrial communication, radio

and television broadcasting, radar, industrial processing, power transmission, and remote controlling. Healthcare and consumer devices can be identified as the recently emerging industrial verticals that are heavily dependent on the electromagnetic radiation related activities.

In some scenarios as in communication, the electromagnetic signal primarily dependent on the distance between the transmitter and receiver units. These units are known as the functional sources of electromagnetic radiation. Also, when used in communications, broadcasting and radar devices, electromagnetic radiation propagates over large areas. Need of speed network covering the full population, brings up telecommunication towers everywhere, and opens the public to the continuous (24x7) exposure of electromagnetic radiation. There are many devices, which emit electromagnetic radiations as incidental sources. Almost all consume electronic products namely washing machines, mixer grinders, microwave ovens, televisions, mobile phones, digital computers, network equipment, etc. fall in this category. Welders, motor-operated machinery, electro-erosion machinery housed in industrial plants are incidental sources and heavily contribute for electromagnetic pollution.

In the medical field electro-medical devices in which electronics are used either for diagnostic or for therapeutic purposes, are coming up. Electronic display devices have opened new era for patient diagnostic and monitoring systems. All these instruments use electromagnetic waves and counts on to the growth of electrical field

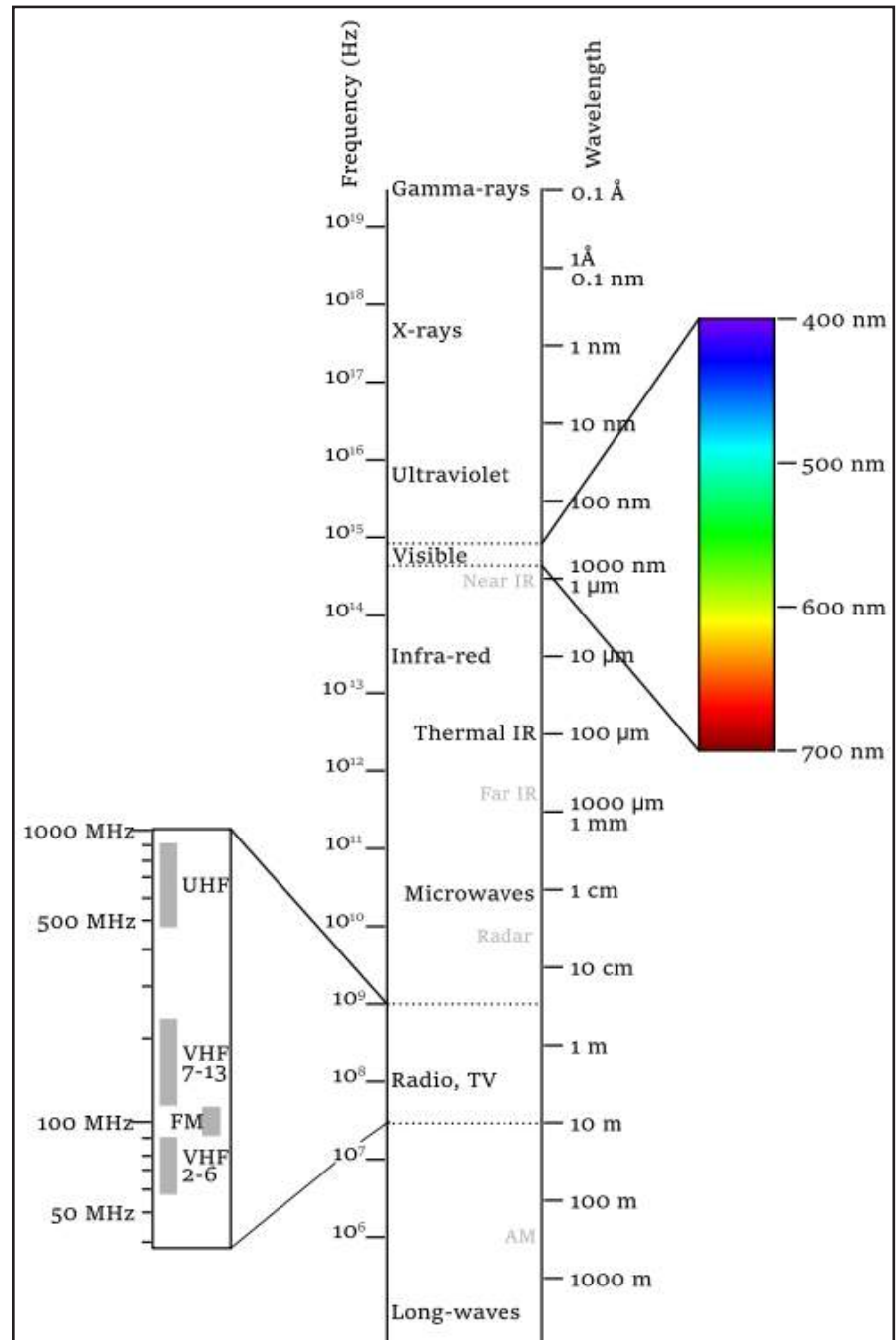


Figure1 : Electromagnetic Spectrum

strength in hospital areas. Urban areas as well as industrial zones have a dense network of utility powerlines which originates ubiquitous power frequency electromagnetic fields. Also, a low frequency electromagnetic field forms with the domestic electricity exposure. When it comes to industrial, medical and consumer

use cases radiation spreads over small areas.

Electromagnetic pollution is somewhat obscure in nature and cannot be treated as other types of pollution as we are already familiar with. Consequential implications are not readily visible. The harm caused by this pollution is still open



Further, some studies have shown that plants can retain electromagnetic radiation adequately. So such evidence may encourage raising plants and flowers around electromagnetically polluted areas.

Conclusion

Electromagnetic radiations are utilized as technological enhancements, and for benefit to mankind in almost all aspects. It has become an inevitable component in today's world. In depth research and investigations are required to realize the real impact of electromagnetic pollution, and to identify potential solutions. All of us need to understand the pitfalls, and work collaboratively to minimize the undesirable aftermaths.



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to question for study and analyses. Some studies conclude that definitive evidence of its negative influence on human health is not enough, while others have identified a correlation in between. This has paved the way for further studies of possible hazards to human health from exposure to ionizing as well as non-ionizing radio frequency with the emerge of electromagnetic pollution. As some studies reveal, the effects depend on the type and strength of electromagnetic field as well as the duration of exposure. A couple of studies reveal that low-frequency range of electromagnetic fields cause infantile leukemia, and is carcinogenic. If proper measures are not taken, high frequency electromagnetic fields or ionizing radiation can cause damage to living tissue, with radiation burns and cancers.

Remedies

With the aim of combating the threat of electromagnetic pollution, different governments, organizations, and authorities have formulated various EMC

(Electro Magnetic Compatibility) standards and safety standards for specific environments/ platforms like industrial, residential, automobile or aircraft. CISPR (International Special Committee for Radio Protection) standards, IEC standards on electromagnetic compatibility IEC6100 family, European standards concerning unwanted electrical emissions, ISO standards, Society of Automotive Engineers standards for EMC are few to mention. IEEE (Institute for Electrical and Electronic Engineers) established the Committee on Man and Radiation (COMAR) in 1972. The purpose of this committee is to evaluate information published on the effects of non-ionizing radiation on biological systems. Environmental Health Division of World Health Organization develops health criteria for non-ionizing electromagnetic radiation. Both the International Non-Ionising Radiation Committee (INIRC) of the International Radio Protection Agency (IRPA), and Environmental Health Division of World Health Organization are collaborating on this issue.