

Hazards of Electromagnetic Radiation Pollution and Its Mechanism

He Zhang

School of Environmental Science and Engineering, North China Electric Power University, Baoding
071000, China.
summerlight@qq.com

Keywords: electromagnetic radiation pollution, thermal effect, non-thermal effect, cumulative effect

Abstract. The electromagnetic radiation is invisible, colorless, odorless, silent, everywhere in our lives, but excessive electromagnetic radiation becomes another important source of pollution besides waste water, waste gas, and noise. This article is focusing on the hazards of electromagnetic radiation pollution and its mechanism, and some protective measures should be taken.

Introduction

With electronic and electrical equipment more widely used, the electromagnetic distribution on Earth has become even more complex. Radio, television, transportation, communications equipment, and household appliances bring human huge convenience, but electromagnetic radiation pollution has also become an environmental issue that human have to face. Electromagnetic fields will benefit human when they are in the low frequency range, an appropriate manner and time, but when the intensity of electromagnetic radiation exceeds the allowable range, the formation of electromagnetic radiation pollution will cause electromagnetic interference, also hazard to human health.

The harm of electromagnetic radiation pollution to human body

In the high-intensity electromagnetic radiation, the body will be subject to different degrees of harm. Studies have shown that the biological activity of electromagnetic fields will increase with the increasing frequency and its degree of harm to human relationships is proportional to the increasing the electromagnetic wave frequency, namely microwave>ultra-short wave> short wave> medium wave> long Wave.

When the intensity of electromagnetic radiation environment exceeds a certain limit, the body's nerve, circulatory and immune systems may be severely affected. Electromagnetic radiation pollution may increase the probability of people suffering from leukemia. The human reproductive system, cardiovascular system, vision systems may be harmed.

Increase the probability of leukemia. Medical research shows that long period of high electromagnetic radiation environment, makes blood, lymph and cell protoplasm change. Data show that the chance of people in electromagnetic fields suffering from leukemia is 2.93 times higher than that of average person, and the children's brains absorb electromagnetic radiation is 2 to 4 times higher than adults. Electromagnetic radiation is likely to be one of the causes of childhood leukemia.

Affect human reproductive system. Electromagnetic radiation will bring the man some hazards, such as sexual dysfunction, reduced sperm quality, hair loss and white hair. The possibility of pregnant women spontaneous abortion, fetal malformations and infertility will greatly increase. A follow-up investigation of 16 female computer operators showed that group operator exposed to electromagnetic radiation pollution had more menstrual disorders, 8 people have 10 times pregnancies and among them, four people have 6 times abnormal pregnancy.

Affect the cardiovascular system. Long, high-intensity electromagnetic radiation can cause human nerve disorders, mainly in the cardiovascular system reactions, such as bradycardia, hypotension or tachycardia, hypertension, manifested as dizziness, fatigue, insomnia, palpitations, memory loss, neurasthenia syndrome.

Affect the visual system. The eyes are sensitive organs to electromagnetic radiation.

High-intensity electromagnetic radiation can cause eye crystal-like protein coagulation, which may result in serious cataracts, and also damage the cornea, iris, leading to vision loss or even total loss.

Mechanism of harm to human body

Thermal effect. Human tissues and organs and body fluids of cells which contain large amounts of polar molecules such as water molecules have a certain orientation. That is, when the body is in the electromagnetic field, the molecules arranged with more disorders will rearrange themselves in the electric field in the direction of the anode and cathode. When alternating current electromagnetic waves constantly change, polar molecules will produce fast, high-frequency oscillatory motion. This will continue to cause collision and friction between polar molecules and between polar molecules and the media where they are, which will turn the electromagnetic energy into thermal energy. When the electromagnetic oscillations at higher frequencies and the blood flow velocity of the part that exposed to electromagnetic is lower, it is harder to take away the thermal energy, which will make the body temperature rise. And the body will show thermal effect leading to a series of physiological fever reactions, such as neurasthenia, reduced number of white blood cells and other diseases.

Non-thermal effect. Non-thermal effect also known as "resonance effect" refers to the phenomenon that when human body are exposed to long and low electromagnetic radiation, the body's temperature, although does not significantly increase, but the cell membrane resonate, cell membrane potential change, cellular activity is limited, which will affect the nervous system, hematopoietic system and the cellular immune system. There is also another opinion: the electromagnetic waves can interfere with the body's bio-electricity, especially EEG and ECG, which affect the normal function of the brain and heart activity.

Cumulative effects. Once the thermal effects and non-thermal effect affect the human body, the human body is subject to electromagnetic radiation damage again before the body repair itself. The extent of damage will accumulate. After a long time, it will become a permanent morbid life crisis. Even if the radiation power is very small and the frequency is very low, as long as the body is exposed to the electromagnetic radiation, the harm won't stop.

Example for the harm of electromagnetic radiation pollution to human and the relevant protective measures

Household electromagnetic radiation pollution and protection. For the public, the family of electromagnetic radiation on the health effects of pollution is the largest and most long-term. Family televisions, computers, refrigerators, microwave ovens, induction cooker, washing machine, etc are sources of electromagnetic radiation. Household electromagnetic radiation pollution protection should note the following.

To maintain a certain distance. UK National Radiological Protection Board (NRPB) on the part of the field to make a determination of the content of home appliances, the value shown in Table 1.

Table1 Some home appliances electromagnetic field data (unit: milli gauss)

Appliances	distance 3cm	distance 1m
TV	25 to 500	0.1 to 1.5
Microwave oven	750 to 2,000	2.5 to 6.0
Hair dryer	60 to 20,000	0.1 to 3.0
Refrigerator	5 to 17	<0.1
Shaver	150 to 15,000	0.1 to 3.0
Washing machine	8 to 500	0.1 to 1.5
Vacuum cleaner	2000 to 8,000	1.3 to 20
Lamps	400 to 4,000	0.2 to 2.5

As it seen from the table, a variety of electrical radiation intensity decreases rapidly with the increasing distance. At a distance of 1m, the electromagnetic field intensity of household appliances has been very small. Therefore, maintaining an appropriate distance away from home appliances is very important.

Setting appliances in the right places. Try to avoid putting home appliances in the same room, especially in the bedroom. When we decide how to set up these appliances, we can consider about the specific circumstance and different electrical power of appliances.

Control the using time. Try to avoid using appliances in the same time. Reduce the time of using appliances that should be used in a close distance with great electromagnetic radiation. Computers, television should be turned off when they are not used. Try to avoid use multiple appliances simultaneously.

Mobile phones, computers and protection of health hazards. Currently, the mobile phone penetration rate escalating, the Ministry of Industry statistics show that by the end of May, the number of Chinese mobile phone users has reached 1.256 billion, equivalent to 90.8% of Chinese people are using mobile phones. The mobile phone operating frequency is generally 600-900 MHz, it belongs to the microwave band, in the vicinity of the mobile phone antenna will produce a strong microwave radiation, cause harm to human.

In addition to mobile phones, computer also harm the human body. Especially in college students dormitory, because of its small size, more computers, placed relatively concentrated, the time of using computers is longer, the computer electromagnetic radiation pollution should not be overlooked. Nankai university Hu Yandi et al. search on "Students use computers and subject to electromagnetic radiation pollution situation investigation" , and the data show that the proportion of students after using the computer appear adverse symptoms (eye pain, dizziness, etc.) of 77.4%, with the daily use of computers extension of time, increase the number of adverse symptoms. The average daily use of computer time, girls were significantly lower than boys, but girls often have more serious symptoms than boys, that is, at the same exposure to electromagnetic radiation, girls are more sensitive to electromagnetic radiation, electromagnetic radiation absorption and accumulation are higher than boys.

For electromagnetic radiation pollution in mobile phones and computers, we can be equipped by using headphones and microphone in the process of using mobile phones, to make the phone away from the user's head, and the computer should install liquid crystal display screen, maintain a certain distance and try to shut down when not use them, to minimize the damage electromagnetic radiation pollution cause to the human body.

Summary

At present, the use of electromagnetic radiation protection standard is promulgated in 1988, but the electromagnetic wave energy density in the current environment has changed a lot, so the national standard is not suitable for present situation, the need to develop new electromagnetic radiation hygiene standards is very urgent. Because of the intensity of the electromagnetic field, electromagnetic radiation frequency, irradiation time and different conditions, such as age and gender, the damage on human health is different. We need to raise awareness of protection, do protection work daily to prevent electromagnetic radiation pollution to harm us.

Reference

- [1] Liya Xuan, Xiuying Yuan, Nanping Liu. Electromagnetic radiation on the human body injury and prevention, *Industrial Safety and Environmental Protection*, 2003,29(9):22-23
- [2] Jianhong Zhang. Electromagnetic radiation electromagnetic pollution and environmental monitoring, *JOURNAL OF ELECTRIC POWER*, 2007,22(1):39-43
- [3] Yandi Hu, Zhipeng Bai, Xiang Liu et al. Investigate the use of computers and subject to electromagnetic radiation pollution health of college students, *Journal of Safety and Environment*, 2005,5(2):36-39