

STUDY OF THE EFFECT OF ELECTROMAGNETIC FIELDS ON HUMANS

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This article discusses the problem of the influence of electromagnetic fields on a person, in order to compile a map of the intensity of this phenomenon in the canteen of the Ugra State University. The types of sources of electromagnetic radiation and their features are presented. Before starting work, the characteristics of the instruments required for scientific research, namely the "Teslameter TES-1392" tester and the portable radiation sensor of electromagnetic fields DT-1130, were carefully studied. The selected location is conventionally divided into coordinate points, as well as readings taken from the devices. The measurement results are analyzed and recorded on a map "Map of electromagnetic fields in the canteen of the University" in 3D format. It was established that the highest values of the magnetic field were obtained in the hot shop and next to the TVs. Particular attention is also paid to possible diseases resulting from the dangerous effects of electromagnetic fields. Methods of protection against them in accordance with regulatory legal acts are considered.

Keywords: electromagnetic fields, electromagnetic radiation, mapping, ecological safety, diseases, measuring instruments, protective measures, modern problem, technosphere safety, electric power industry

In the second half of the 20th – beginning of the 21st centuries, due to the rapid development of the technosphere, the level of exposure to man-made electromagnetic fields, which are now one of the most significant negative environmental factors, is constantly increasing.

According to the World Health Organization, in recent decades, another factor has emerged and systematically formed a significant negative impact on living systems, including the human body. This is a complex of system-forming and system-regulating electromagnetic fields and electromagnetic radiation of natural and man-made origin of various intensities. Sources of electromagnetic fields of industrial frequency can serve as current conductors of high voltage electrical transformer substations, power lines, solenoids, power plants [1]. Sources of electromagnetic fields in the radio wave range are antennas of broadcasting and television transmitting stations, as well as many industrial installations, laboratory devices, household appliances and office equipment.

Currently, we can talk about a real threat of electromagnetic fields to the entire population

of the planet. Numerous studies of scientists in different countries of the world show that for comfort and convenience brought by the development of technical science sooner or later it is necessary to pay for their own health [9]. The degree of exposure to radiation and methods of protection depend on its type. The radiating effect largely depends on such basic characteristics as the frequency and wavelength, which determine their penetration.

The following types of electromagnetic radiation are classified:

- radio waves from ultrashort (frequency 30 MHz-300 GHz at a wavelength of 1 mm-10 m) to ultra-long (less than 30 kHz at a length of more than 10 km);
- infrared radiation (300-430 THz at a wavelength of 770 nm-1 mm);
- visible light (430-755 THz at 385-785 nm);
- ultra-violet rays.

By exposing the brain (nerve) tissue to electromagnetic fields modulated by the frequency of its own biorhythms of the brain, they enhance the biological effect of electromagnetic fields due to resonance phenomena (table).

Dangerous and harmful frequencies (according to D.S. Kontorov et al. [4])

Frequency, Hz	Negative effect
0,02	Increased reaction time
0,06	Continuous intellectual braking
1–3 (brain rhythm)	Stress
5–7 (brain rhythm)	Mental fatigue. Stress. Negative emotional arousal
8–12 (brain rhythm)	Affects reactivity and emotional arousal, up to convulsive activity
12–31 (brain rhythm)	Mental fatigue. Stress enhancement
1000–12000	Decreased audio activity and overall auditory perception
40–70	At high field strengths, a worsening of metabolic processes. Individual physiological changes, anxiety
Около 400 (pace-maker vibrations)	Possible functional impairment

At the current level of civilization (with the increasing introduction of EMF sources in everyday human life and the high biological activity of technogenic electromagnetic radiation), the electromagnetic characteristic of the environment has changed dramatically. The decision of the Interdepartmental Commission of the Security Council of the Russian Federation on Environmental Safety № 2-2 of 02.20.96 noted that the adverse effects of electromagnetic radiation on humans and the environment are becoming dangerous [2]. And as a result, this effect significantly affects the health and well-being of people and, at the same time, like radioactive radiation, is not objectively felt by the senses.

The impact of anthropogenic fields in the industrial, urban and domestic areas can have a very negative effect on human health. With electromagnetic irradiation of the body, negative consequences are possible not only on the gene, but also on the physiological level as a result of inhibition of the lymphocyte genome and, as a result, a decrease in the body's immune system [6]. Manifestations on the part of a person when exposed to electromagnetic radiation (EMR) are expressed in the form of complaints of weakness, irritability, fatigue, weakening of memory, sleep disturbance [7]. Especially dangerous EMR can be for people with diseases of the central nervous, hormonal, cardiovascular systems and weakened immunity [8]. The last of them causes a lack of resistance to infectious diseases, as a result of which even banal flu can be fatal.

Gender, age, and intoxication have a significant effect on a person's sensitivity to weak magnetic fields [3].

It is worth noting that if you live near mobile communication stations, television, radio towers and repeaters that support a communication signal, do not be surprised where you get the above symptoms. All the symptoms of malaise are a consequence of exposure to electromagnetic radiation. In people who, by occupation, have to deal with electromagnetic fields, neurological disturbances and vegetovascular dystonia are often noted. In recent years, studies have appeared on the influence of electromagnetic fields on the development of cataracts, sexual disorders, hearing diseases and oncology.

The saddest thing is that, knowing the negative effects of electromagnetic waves on the human body, for the sake of civilization, we continue to place repeaters in sleeping areas, near public institutions, schools, universities, maternity hospitals and hospitals.

Scientific and technological progress has brought us radiation from mobile phones and computers, hitting directly into the brain. When mobile communications began to develop, the

first operators felt their impact on health. They began to complain of frequent headaches, various ailments, frequent colds, increased fatigue, and sleep disturbances.

Such dangerous consequences indicate that the human body needs protection from electromagnetic fields and radiation. There are sanitary standards that establish the maximum permissible levels of electromagnetic field intensity depending on the time spent in the danger zone – for residential premises, workplaces, and places near sources of strong fields. In Russia, such standards include SanPiN 2.2.4.3359-2016 “Sanitary and epidemiological requirements for physical factors in the workplace”, sanitary and epidemiological rules and regulations, as well as hygiene standards [5]. The maximum permissible dose of electromagnetic radiation for humans is 0.2 μT .

Various instructions regulate the time a person stays in a danger zone. Shielding nets, films, glazing, suits made of metallized fabric based on polymer fibers can reduce the intensity of electromagnetic radiation thousands of times. At the request of GOST 12.4.026-2015, the zones of electromagnetic fields radiation are fenced and equipped with warning signs “Do not enter, it is dangerous!” and a sign of the danger of the electromagnetic field.

This article presents the results of studies of the distribution of electromagnetic fields in the canteen of Ugra State University on the map of the intensity of electromagnetic fields. It should be noted that this is the most passable place for a qualitative assessment of the influence of electromagnetic fields simultaneously on a large number of people. In our case, these are both employees and students. About 150 people visit our chosen location hourly. In addition, in the cooking area there is a large number of household appliances that are sources of electromagnetic pollution. Thus, in order to be sure of our safety while in the university canteen, it is necessary to monitor the values of electromagnetic fields and visualize the obtained values in the form of a map, in order to know in the future which zones need monitoring.

Purpose of the study: Mapping the intensity of electromagnetic fields in the dining room of the Ugra State University.

Materials and research methods

Devices for measuring electromagnetic radiation can detect areas that adversely affect human health and well-being. In the abundance of household and computer equipment, such devices are needed not only in educational laboratories, but also in every home.

To compile a map of the intensity of electromagnetic fields, we measured using instruments such as a portable radiation sensor of

electromagnetic fields DT-1130 and a teslameter TES-1392. It is very important to observe the rules for the operation of devices and carefully study the technical descriptions for it in order to get the most accurate result.

The portable radiation sensor of electromagnetic fields DT-1130 is used to monitor the level of electromagnetic radiation around electrical appliances, power lines, household appliances and industrial equipment in everyday life and in industry. In this device, the accuracy of measurements is $\pm 1 \text{ V/m}$; $\pm 1 \text{ } \mu\text{W/cm}^2$ in the low frequency range (5 Hz-400 KHz) and high frequencies (30 MHz-2000 MHz). In order to reach the maximum value, we bring the radiation sensor as close as possible to the object under investigation by the upper side of the device and, moving it in space, see rapidly changing readings (1 time in 0.4 seconds).

Allowable radiation values in the first range are regulated by SanPiN 2.2.4.3359-2016 [5], the normalized value is the electric field strength (E), measured in V / m. With a tension of more than 20-25 kV / m, the permissible residence time in such an electric field is 10 minutes. When exposed for eight hours, the maximum permissible level of E is 5 V / m.

The constant excessive effect of electromagnetic radiation negatively affects health and increases the likelihood of contracting certain diseases. The device is indispensable for people suffering from cardiovascular diseases. It effectively determines the presence, strength of electromagnetic radiation, and by taking safety measures avoids its negative effects, both on the human body and on various electronic devices. For domestic purposes, it can detect hidden wiring. Thanks to this, you can pre-detect the cable and choose the right place for laying new wiring, drilling walls, installing outlets.

The magnetic field was measured using a Teslameter TES-1392 instrument with a measurement accuracy of $\pm 3\%$ with a magnetic field strength in the range from 20 to 200 μT or from 200 to 2000 mG.

Before starting the measurement, calibrate the device in accordance with the instructions.

The work of many models of teslameters is based on the induction principle, which includes an electrical measuring device, as well as an induction coil (converter). The tester is designed to provide the user a fast, reliable and simple way to measure electromagnetic field radiation levels around power lines, home appliances and industrial appliances.

Previously chosen by us location, conditionally divided into points with coordinates (x;y). The unit step was taken at a minimum and

equal to 3 m in order to visually see changes in the level of electromagnetic radiation and magnetic field strength. All readings taken from the instruments were averaged and recorded along the "z" coordinate.

Figure shows a map of electromagnetic fields in the dining room of the Ugra State University.

The obtained values with coordinates (x; y; z) are respectively applied to the map with a 1:3 scale in 3D format. The most vulnerable and dangerous places are highlighted in red. These include those that are most equipped with electrical household appliances: a hot shop and televisions.

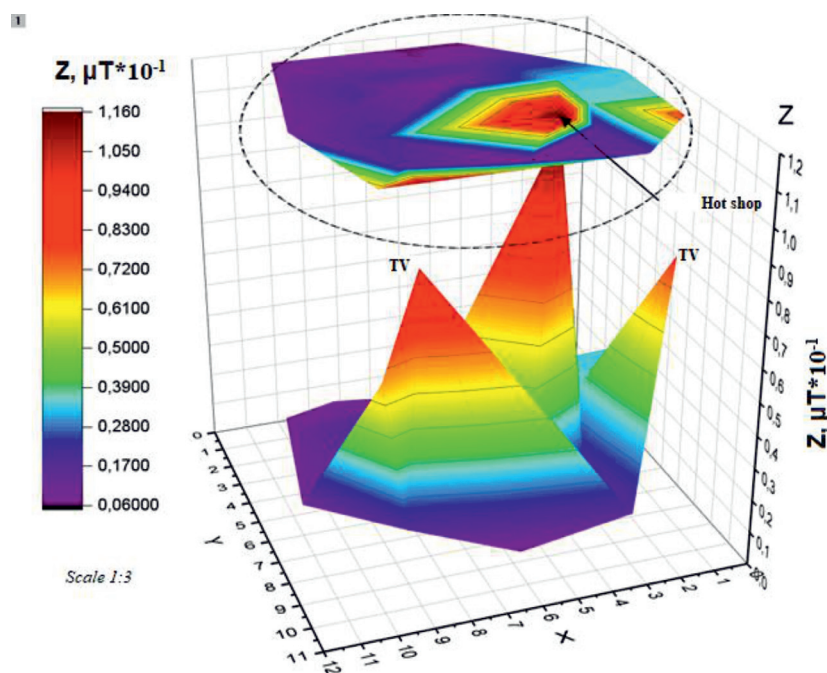
Research results and discussion

As a result of the research, data were obtained on the level of electromagnetic fields in the selected room belonging to the Ugra State University. Comparing with the established norms of SanPiN 2.2.4.3359-2016, in general, the level of electromagnetic fields does not exceed permissible values. However, based on the mapping, zones that require constant monitoring of the field level can be identified. Of the results we obtained, special attention should be paid to the hot shop, since there is a huge number of electrical appliances and the value of the level of electromagnetic fields is the maximum of all we received, equal to 1.16 mG.

It should be noted that based on our map of electromagnetic fields, we can monitor changes in the university cafeteria and take timely measures to increase safety.

Conclusion

In conclusion, I would like to say that the influence of electromagnetic fields on a person has a huge impact. In addition, you should not remember that all electrical appliances in your home or workplace emit electromagnetic fields that create dangerous grids in which we all must now live. In our homes, in our schools, in our workplaces, these destructive fields have created a new type of pollution that increases stress levels and even contributes to the incidence rate, and is possibly one of the factors that trigger cancer. To counteract this dangerous force, you need to protect yourself from electromagnetic frequencies created by alternating current in your environment. Today it is difficult to imagine our life without electrical appliances. It's important to understand that you don't need to use them thoughtlessly. Do not forget to unload the body: more time to move in the fresh air, engage in physical education, lead a healthy, active lifestyle.



Map of electromagnetic fields in the canteen of the University

In addition, you should also not forget that you should monitor the correct operation of electrical equipment, since this factor often leads to negative effects on the human body. Modern lifestyle involves a high concentration of household appliances. Electric heaters, fans, air conditioners, an additional lighting system, computer equipment, vacuum cleaners, blenders, a constantly turned on refrigerator and a microwave oven and many other devices that are in close proximity are quite capable of creating a powerful electromagnetic background. When household appliances are turned off, this network creates an electric field, and when the equipment is running, a magnetic field of industrial frequency occurs. It should be noted that the influence of electromagnetic waves from such devices is felt even if they are in the room behind the wall, because only distance can save from this phenomenon.

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