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THE ELECTROMAGNETIC EFFECT

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Abstract

Due to the tightening of the regulation of electromagnetic fields in foreign standards and the integration of the regulatory legal framework of Russia into the regulatory legal structure of developed countries, the problem of human electromagnetic safety is becoming more urgent, and its social significance will increase in the future.

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Purpose of the work: to analyze, systematize and propose technical means of protection against the harmful and dangerous effects of EMF on people serving traction electric networks and living along the tracks.

The first part of the work "Analysis of the propagation of electromagnetic fields of the railway contact network" is devoted to the study of the nature of the propagation of the electromagnetic field of the traction power supply system on railways.

Electromagnetic pollution is a combination of electromagnetic fields, various frequencies that negatively affect a person. Some researchers call electromagnetic smog, which has arisen and formed over the past 60-70 years, one of the most powerful factors that negatively affect a person at the moment. This is due to its virtually round-the-clock impact and rapid growth.

Electromagnetic pollution depends mainly on the power and frequency of the emitted signal.

According to the degree of their influence on the environment and the human body, the group of particularly dangerous sources of the electromagnetic field currently in operation of the railway of the Tashkent Railway can be attributed to:

- contact AC network of 25 kV and 2x25 kV;
- Electrical installations of traction substations and locomotive depots;
- Traction engines and conversion units of locomotives, electrical installations of trains, electric heating systems of cars;
- Overhead power supply lines for non-traction consumers with a voltage of more than 1000 V;
- Overhead lines of high and ultra-high voltage when they intersect with the railway track.

Electric-powered vehicles, including electric trains, are a relatively powerful source of magnetic field in the frequency range from 0 to 1000 Hz. The maximum values of the magnetic induction flux density in suburban "electric trains" reach 75 MCT with an average value of 20 MCT. The average value for vehicles with a DC electric drive is fixed at the level of 29 MCT.

On electrified sections of railways in the traction network, due to powerful transients in the modes of switching on and off traction, recovery, speed control in emergency modes (short circuits, lightning discharges, etc.), currents with a wide spectrum of interference from 1 to 109 Hz flow. In addition, various telemechanics and control systems, cellular communications, radio transmitters and computer equipment contribute a significant share to the intensity of electromagnetic fields. As a result, complex non-stationary electromagnetic fields arise along the railway tracks, the intensity of the electric and magnetic components of which in many places exceeds the permissible levels established in the regulatory documentation.

The roof of a locomotive is especially saturated in terms of the impact of magnetic fields when electric current is DC, because at the same time significant currents flow in the traction network (up to 4000 A). It is established that in these places the level of the magnetic field reaches values equal to 300-350 μT.

As part of this work, magnetic fields were evaluated in the open areas of locomotive depots, other office buildings and premises that are part of the locomotive economy. It is established that the intensity of electromagnetic fields in the power transmission lines in the territory of locomotive depots, other office buildings and premises that are part of the locomotive, where the repair and preparation of locomotives takes place, is from 3 to 30 MCT [3].

It is established that the level of electromagnetic radiation in public electric transport cars during engine operation is 10,000 times higher than the natural electromagnetic background of the planet Earth.

Thus, it is currently believed that railway transport in a densely populated city generates powerful electromagnetic radiation of a large extent. Spreading from the rails, electric currents are concentrated on the metal surfaces of underground pipelines, on communication cables and other objects that have a higher conductivity than the earth, which significantly increases the electromagnetic pollution of the city [1].

The second part of the work examines the harmful and dangerous influence of the electromagnetic field of the traction network on a person and presents the main problems faced by railway transport workers and the population of the city along the railway.

At relatively high levels of the irradiating electromagnetic field, the modern theory recognizes the thermal mechanism of action. At a relatively low level of the electromagnetic field (for example, for radio frequencies above 300 MHz it is less than 1 MW/cm2), it is customary to speak of an one thermal or informational nature of the impact on the body. The mechanisms of action of EMF in this case are still poorly understood.

As a result of the action of the electromagnetic field on a person, acute and chronic forms of violation of the physiological functions of the body are possible. These disorders occur as a result of the action of the electrical component of the electromagnetic field on the nervous system, as well as on the structure of the cerebral cortex and spinal cord, the cardiovascular system. There are frequent headaches, irritability, fatigue, sleep disorders, pain in the heart area, blood pressure drops, increased sweating. Serious diseases such as atherosclerosis, coronary heart disease, and stroke develop. Apparently, a sharp decrease in the number of heart attacks on weekends and holidays is associated with a decrease in the level of industrial magnetic fields on these days and a decrease in the number of people using electric transport [1].

Currently, work is actively underway to determine the zones of adverse effects of electromagnetic radiation in the city. The results of measurements of the alternating electric field in some areas of Volgograd show that in the area of the river port, airport, radio transmission centers and other sources of industrial radiation, some residential buildings fall into the so-called zone of restriction of buildings, i.e. the territory where the

maximum permissible levels of electromagnetic radiation are exceeded at an altitude of more than 2 m above the surface of the earth.

Organizational measures to protect against the effects of electromagnetic radiation include: the choice of operating modes of radiating equipment that provides a radiation level that does not exceed the maximum permissible, limiting the location and time spent in the area of electromagnetic radiation (protection by distance and time), marking and fencing areas with an increased level of electromagnetic radiation.

Engineering and technical protective measures are based on the use of the phenomenon of shielding electromagnetic fields directly in the places where a person is staying or on measures to limit the emission parameters of the field source. The latter is usually used at the development stage of a product that serves as a source of electromagnetic radiation. Radio emissions can enter rooms where people are located through window and door openings. Metalized glass with shielding properties is used for screening viewing windows, room windows, glazing of ceiling lamps, partitions. This property is given to glass by a thin transparent film of either metal oxides, most often tin, or metals-copper, nickel, silver or their combinations. The film has sufficient optical transparency and chemical resistance.

To protect the population from the effects of electromagnetic radiation in building structures, metal mesh, metal sheet or any other conductive coating, including specially designed building materials, can be used as protective screens. In some cases, it is sufficient to use a grounded metal mesh placed under the facing or plaster layer. Various films and fabrics with a metallized coating can also be used as screens. In recent years, metallized fabrics based on synthetic fibers have been used as radio shielding materials. They are obtained by chemical metallization (from solutions) of tissues of various structures and densities. The existing methods of production allow you to adjust the amount of metal applied in the range from hundredths to units of microns and change the surface resistivity of tissues from tens to fractions of ohms. Shielding textile materials have a small thickness, lightness, flexibility; they can be duplicated by other materials (fabrics, leather, films), they are well combined with resins and latexes.

Thus, modern railway transport, together with all the associated infrastructure in the urban area, is today one of the main elements of the aggressive impact and electromagnetic pollution of the natural planetary ecosystem. It is this circumstance that urgently requires minimizing the impact of electromagnetic fields on both children's and adult groups of the population, ensuring the release of fully protected industrial and household radiation sources, introducing personal protective equipment, strictly fulfilling preventive and hygienic requirements.

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