

Ecological Aspects of Electrodynamics Course

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Abstract: The article deals with the ecological problems of electrodynamics course. Ecological problems are the global ones and they can be solved only by means of integrated approach. These environmental aspects are described in the research work "Physics and Ecology". Under current conditions of scientific and technological progress due to development of different kinds of energetics and industry, the electromagnetic rays take the leading place among other factors in their ecological and industrial significance. The solution of problems of electromagnetic ecology is a complex task, affecting social and economical interests of different branches and departments, requiring interdisciplinary approaches and involving of experts of various spheres. The peculiarity of the problem is that the main sources of electromagnetic environmental pollution are the most dynamically growing branches (telecom, energetics) with significant called-up capitals and investments, both to technical platform and in a whole to the branch economics. The materials, represented in this paper, are carried out taking into account practical and investigative experience of the authors and also with required theoretical sources, including the urgent problems of electromagnetic ecology. Therefore, ecological aspects of electromagnetic fields of interaction of a man and equipment are analyzed. Much attention is paid to the impact of electromagnetic rays of technical instruments on human body in modern ecological crisis.

Key words: Physics • Equipment • Electrodynamics • Ecological aspect • Electromagnetic field
• Electromagnetic waves • Quantum generator • Human health • Electromagnetic sources
• Mobile communication means.

INTRODUCTION

Nowadays in conditions of society reforming and complex social-economical situation, tempos and directions of future country development are mainly provided by potential opportunities of a man and his health. Health status of the population is not only an important indicator of the social development, but also powerful economical, labor, defensive and cultural potential [1]. To solve the ecological problem, it is required to orient in accordance with objective logic of technological assimilation of nature for creation the necessary scientific background for harmonization of technological human activity with environmental processes and for control over natural factors. However, an organic interconnection of technical objects and environment shall be taken into consideration.

Alongside with the technology development as per intensive directions, it is necessary to create the brand new branches, aimed at compensating the inevitable anthropogenic impact on natural environment [2]. A new sphere of public production will have to be developed; its main purpose is the restoration of natural resources and the support of qualitatively definite standards of physical-chemical and biological environmental parameters, required for human life.

Procedure: The electrodynamics sector describes the electrostatic field and its characteristics (intensity and potential); when studying the direct current, it describes the magnetostatic field and its characteristics (field density), then electromagnetic field and waves, their characteristics and properties [3]. Ecological aspect of electrodynamics course is revealed at different examples:

the impact of radioactive emission on life activity of organisms, maximum permissible values of radioactive emission; the impact of natural and artificial electromagnetic fields (waves) and ionizing radiation on human health; consequences of atomic power plants operation. Electromagnetic waves, passing through the human body, bring the electrons of different matters in excited state. Due to the inflow of external energy, brought by radiation, the intensity of processes increases in the organism [4]. Consequently, many reactions, unfavorable for the organism, take place: after radiation impact the molecules are exposed to the secondary, although weaker, radiation; the ionization of the molecules of the living tissue results in adverse reactions (a cell can become a cancerous one after unsuccessful "regeneration"); the temperature of the matters increases.

The main danger represents the electromagnetic field in frequency band from 20Hz to 300MHz and the static electric field of the charge on-screen. The level of these fields in the area of user location usually exceeds the biohazardous one. The situation is complicated by the fact that the sense organs of a man do not perceive the electromagnetic fields in the frequency range covered, so the user can not estimate the danger himself.

Electromagnetic wave propagation is connected with the appearance of electrical and magnetic fields (EMF). The impact of EMF on the human body is mainly connected with the energy partial absorption by the body tissues, resulting in the heat effect. EMF bioactivity increases with the shortening of the electromagnetic wave length and it is higher in the area of ultrahigh frequency. Ultrahigh frequencies are the field, which destroys the functions of the immune and nervous systems, promotes the development of blood cancer, cataract, glaucoma, causes the accelerated aging of the organism [5].

Electromagnetic waves are widely used in different branches of human activity, for instance, in mechanical engineering EMF is used for metal heating in melting, hammering, hardening and soldering and for non-metal gluing, drying and other engineering processes. The use of EMF in different branches led to improvement of working conditions, reduction of labor intensity and a significant economical effect. Thus, implementation of electric heating by RF current of melting and heating oil and gas-burning furnaces significantly reduced gas content in the workshop air, sharply reduced time and intensity of workers radiation by radiated heat energy [6].

Main Part: Electromagnetic waves of high frequency are used for heat treatment of metals in alternating high frequency magnetic field - inductive heating (hardening, soldering, melting etc.), for dielectric heating in high frequency electric field - spot heating (drying of wood, mould cores, plastic mass heating, plastic welding, gluing of woodware), in radio communication during production and operation of oscillators of high, ultra and super high frequencies [7]. The field sources of high and ultrahigh frequencies in a workshop can be unscreened elements of oscillating circuit, high-frequency transformer, battery, condenser and energy transmission line. The work under the impact of electromagnetic waves of radio spectrum can cause functional disturbance of nervous and cardiovascular systems and the increase of threshold sensitivity of some analyzers. Longtime and intensive radiation can result in clinical syndrome, asthenic reaction and can cause morphological changes in crystalline lens. The reduction of arterial blood pressure is a specific response of the organism to the impact of radio waves of different bands. Physical parameters of fields, penetrating the biosphere, are the following: gravity acceleration (for gravitational field), intensity and potential (for electric field), magnetic induction vector (for magnetic field), wave length and density (for electromagnetic waves). To reduce the intensity of the electromagnetic field in the band of high and ultrahigh frequencies at work places during heat treatment, it is recommended to use the separate screening of the high-frequency elements, which are the sources of fields, or the full screening of the whole unit. The screening is done by means of aluminum or iron sheets of not less than 0,5 mm thickness. It is reasonable to screen the inspection holes of generators by fine brass mesh. Transmitter remote control and workshop screening are more effective [8].

Nowadays life and activity of a man is impossible without different technical facilities. In everyday life a man is surrounded by a sea of electromagnetic radiation (EMR), the sources of which are: overhead transmission lines, bulbs, transformers, washing machine, electric cooker, TV set, video recorder, microwave, mobile phone, base stations of wireless phones and mobile communications. All of them, as is known, are the sources of electromagnetic radiation.

In refrigerator a compressor air unit and a control box generate the electromagnetic field. Compressor air unit circulates the freon through the cooling system and cooling chamber [9]. Compressor drive is an electric

motor, the electromagnetic field is generated by the drive winding and brush sparking of a stator by a rotor contact block.

The emission of electromagnetic control unit and commutation electromagnetic relays is less significant. Electromagnetic impulses emerge at relay actuation (at closure and breaking of power contacts); the sources of emission are also the power cables, which pass the voltage to electric motor winding.

The main source of electromagnetic emission in a washing machine is an electric motor, which drives the drum, water pump motor, electric heating element, electronic control box, electromagnetic relays and supply lines. The largest electromagnetic sources are radio and television means of communication and data processing, radar-location and navigational aids, overhead transmission lines and laser systems. At the present time, lasers, or optical quantum generators (OQG) are widely used in different industries for such processing procedures, as welding, cutting, drilling in materials of any strength and also for monitoring test works [10].

Direct, flipped and diffusely-reflected emission of OQG is a serious danger for workers sight, as it can cause severe injuries of both eye outer coats, crystalline lens and especially retina. The affection is based on heat effect. OQG emissions can cause different general functional diseases, showing themselves in increased irritability, sleep disorder, heaviness and pain in the eyes. OQG radiation in visible spectrum has a more explicit local and general effect; it causes changes of sight functions, especially in low light conditions.

The use of electromagnetic emissions [11] in radio frequency band in electroheat units provides significant advantages. Alongside with that, the impact of the abovementioned fields on a human organism during a working day in doses, exceeding the permissible values, can result in severe occupational diseases. New electromagnetic sources comprise telecommunication equipment and all related devices, including mobile communication means. The most harmful ones are the high frequency radiation of S-band. Mobile communication means operate at the very beginning of this band yet, however the frequency constantly increases. An emission source in a mobile phone is a buggy-whip antenna, all the other - the transmitter itself, local oscillator, frequency synthesizer etc. - are so low-powered, that they can be not taken into account.

Strong electromagnetic fields are created by wires, laid in circles. The well-known harmful sources of emission, power transmission lines (PTL), wiring of poor quality and different electrical devices were supplemented by more insidious and unstudied impacts from personal computers, radar stations and similar equipment, that continue to develop.

CONCLUSION

At the present time, the electromagnetic contamination of a human environment significantly increases. Environmental contamination by electromagnetic emissions (EME) has taken the critical sizes. Harm to human health from EME impact is characterized by acute type of neuroticism, vascular disorder, severe headache, arteriotony variations, fall off working capacity and immunity; chronic actions of EME result in cancerous diseases and brain disorder with unpredictable effects.

In conclusion it can be said that even in complex present ecoconditions, a man, who is careful of his health, can not only correct it, but also change his life for the better. We would like to add that nowadays in our country there is a need in centers of electromagnetic safety, where all possible means to protect from electromagnetic emissions will be developed: special protective clothing, cloths and other protective materials, which can secure any device. Unfortunately, we are far from the implementation of these developments to broad everyday life.

To solve modern problems of ecology and nature protection, it is necessary to change the consciousness of a modern man, to form his attitude to nature as not only "a workshop", but also as "churchwise" and to increase his ecological culture. Ecological culture can be viewed as an organic unity of ecologically developed consciousness and scientifically grounded practical activity.

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