IMPACT ON THE LIFE OF THE ELECTROMAGNETIC FIELDS. ELECTROMAGNETIC POLLUTION

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Abstract

We live in an electrical universe and our bodies operate electrically. Unfortunately, many choose to ignore this concept because it is beyond the perception of their five senses. Living creatures consist of invisible electro-vibratory fields that not only form and develop what we recognize as our physical bodies, but also control the creation of new cells. These new cells replace those that are injured, worn out, or die from diseases or environmental poisoning. These electrical fields contain or have access to the complete information necessary to operate our physical body perfectly all the days of our lives. It has been estimated that the human body contains some 200 quintillion cells. Each cell is an electrically operated universe. When we consider the invisible matrix of interrelating fields that precede cell formation, it becomes obvious we are dealing with a mind-boggling information system.

Keywords: electromagnetic field, electromagnetic pollution

Introduction

Interaction between living organisms and the environment electric and magnetic fields, is an ongoing and increasingly emphasized the development of modern civilization. It highlights the negative influences such as electromagnetic pollution and benefits as medical therapeutic electromagnetic environment. In all these problems it must dosing and exposure control. Values of the electric field, that solenoid still not completely defined. Studies showed clear influences in people working in areas with intense electric fields. Such exposures lead to such diagnoses eg. change of blood characteristics, increasing heart attacks, agitation, fatigue, decreased attention, weakness in upper limbs, feeling dizzy, changing rhythm of sleep insomnia. And changes in the geomagnetic field serious problems might occur from people who live or work near electrical power lines. Synergism between natural local geomagnetic field and the electromagnetic field produced artificially by power lines, appliances, computers, printers etc., give that enhances cumulative effects. It is known that electromagnetic waves might have devastating effects on the human body structure resulting molecules generate free radicals. They combine with proteins or nucleic acids within cells, leading to serious change their structure. Erythrocyte membrane deteriorates, leading to their destruction. The leukocyte free radical act either to destroy or diminish their power of defense. Nucleic acids - carry genetic information - are the main target of free radicals, which cause genetic mutations and cancer. Proven electromagnetic impact on the human body, determines eleven days from processes taking place both at the cellular level and at the level of brain waves.

1. Production and propagation of electromagnetic waves

Electromagnetic waves were predicted theoretically by English physicist JC Maxwell in 1865 and confirmed experimentally by the German physicist H. Hertz, about 20 years later, becoming the last hundred years that is prevalent in human activity. The Hertz recalled that after their discovery, asked if they would serve something. [5]

Electromagnetism theory, theory that studies the production and propagation of electromagnetic waves, is based on four fundamental equations known as Maxwell's equations. [5, 8] These are:

- Gauss's law for electric field; electric field flux through a closed surface is given by the ratio of electric charge contained within this environmental surfaces and electrical permittivity;

$$\oint_S \vec{E} \cdot d\vec{s} = \frac{Q}{\varepsilon} \quad (1)$$

- Gauss's law for the magnetic field; the magnetic field flux through a closed surface is zero;

$$\oint_S \vec{B} \cdot d\vec{s} = 0 \quad (2)$$

- Faraday's law of induction; the movement of the electric field on a closed curve is given by the rate of change of flux through the surface magnetic field which is based on closed curve;

$$\oint_C \vec{E} \cdot d\vec{l} = -\frac{\partial}{\partial t} \int_S \vec{B} \cdot d\vec{s} \quad (3)$$

- Ampère-Maxwell's law; the movement of the magnetic field on a closed curve is given by the rate of change of flux through the surface electric field which is based on closed curve;

$$\oint_C \vec{B} \cdot d\vec{l} = \mu\varepsilon \frac{\partial}{\partial t} \int_S \vec{E} \cdot d\vec{s} \quad (4)$$

If Faraday's law of induction (3) characterizes the production of a variable electric field by a changing magnetic field, Ampere-Maxwell's Law (4) characterizes the reverse phenomenon, i.e. obtaining a variable magnetic field with a variable electric field.

The assembly of the two fields, variables electric and magnetic fields, that are generated each time, is the electromagnetic field. So if a region of space creates a changing electric field, which in turn generates a magnetic field also varies and each other throughout these two fields forming electromagnetic field that propagates in space as waves called electromagnetic waves.

This finding made for the first time by Maxwell, daring for that time (1865), was the birth of the theory of electromagnetic waves.

This finding made by Maxwell, challenged his contemporaries to add another one, all of Maxwell, bolder, concerning electromagnetic nature of light, Maxwell calculated the speed of electromagnetic waves in vacuum and found it equal to the speed of light in vacuum. Hence the conclusion that light is an electromagnetic wave.

The set of all electromagnetic waves constitute the electromagnetic spectrum. It consists of: alternating current, radio waves (radio), infrared (IR), visible light, ultraviolet (UV), X rays (Roentgen), gamma radiation and cosmic rays.

Maxwell's contribution to understanding electromagnetic phenomena can be considered one of the highest peaks in the knowledge attained by man. Because of this equations,

Maxwell has achieved a synthesis of electric and magnetic interactions, one of the most magnificent synthesis in physics. In the literature this theoretical synthesis is considered the first unification of physical phenomena (electric and magnetic).

Since the two fields, electric and magnetic energy store, the question of energy transport carried by electromagnetic waves.

Considering a region of space of volume V bounded by the surface S, which propagates an electromagnetic wave, W the total energy carried by electromagnetic waves inside this area has the expression:

$$W = \frac{\varepsilon}{2}\int_V \vec{E}^2 dv + \frac{1}{2\mu}\int_V \vec{B}^2 dv \qquad (10)$$

Because the two fields are functions of time, the time variation of the electromagnetic wave energy (10) has the expression:

$$\frac{\partial W}{\partial t} = -\frac{1}{\mu}\oint_S \vec{P}\cdot d\vec{s} - \int_V \sigma\cdot \vec{E}^2 dv \qquad (11)$$

where:

$$\vec{P} = \vec{E}\times\vec{B} \qquad (12)$$

represents Poynting's vector and σ environmental conductivity.

Relation (11) states that the energy carried by an electromagnetic wave in a region of volume V decreases over time, the rate of decrease is determined by two mechanisms:

- transport of energy outside the region considered the first fully, characterized the relationship (11), which is Poynting's vector flow (12), i.e. electromagnetic energy flux through closed surface which delimits the region;
- energy loss by Joule effect in the form of heat, to the medium through which the wave propagates, loss characterized by the second integral of relationship (11).

2. Biological effects of electromagnetic waves

Development of a biological environment penetrated by the wide variety of radiation on living organisms led to the development of their own systems of protection, sometimes reaching a high degree of perfection. The question refers to situations in which living organisms are required in which different both in frequency and in intensity toward the natural. [1, 2]

Electromagnetic waves produced by power transmitters have devastating effects on the body. Following their action on molecules in the human body structure results free radicals. They combine with proteins or nucleic acids within cells, leading to serious change their structure. Membrane erythrocytes (red blood cells) are damaged, leading to their destruction. The leukocytes (white blood cells), radicals also act to destroy or diminish their power of defense. Nucleic acids - carry genetic information - are the main target of free radicals, which cause genetic mutations and cancer. [3, 4, 12]

During a call, using the mobile phone, body temperature in the upper layers of the skin can be increased by more than 0.5°C. Temperature increase occurs but only to talk with a very long term, the effects are visible as early as half an hour of uninterrupted conversation.

Thermal effects seriously affect the human body only after local heating constant of 1 ° C. An exception is the eye: for it is crossed by a small amount of blood may well redirect the negative effects of temperature and radiation exposure. We can avoid or minimize the effects if kept away from the eyes or antenna changes from time to time longest ear during calls. [7]

Since the human ear canal hasn't a natural protection against exposure to electromagnetic radiation, may appear a potential risk of 100% for exposure to electromagnetic radiation emitted in the zone of the ear. Biological effects may occur when transmittance (electromagnetic flux absorbed by surface unit located in electromagnetic field) exceeds the value $0{,}1\ mW/cm^2$. [10]

Non-thermal effects are caused by the influence of electromagnetic waves on cells and nervous system tissue. These waves affect human hormone levels. Among other things, affect hormone melatonin is produced in the epiphysis, which regulates sleep and play an important role in the immune system. Usually increases melatonin levels during the night. Through a long-term effect of electromagnetic waves can be reduced melatonin production overnight. Therefore, the observed changes in mood, depression, sleep disturbances and fatigue. Also, there may be increased immune sensitivity and predisposition to cancer. [2]

In accordance with European Commission Recommendation no. 519/1999, to limit user exposure to electromagnetic fields, the permissible limit of Specific Absorption Rate (SAR) in Head and trunk for mobile phones, corresponding to the frequency range from 10 MHz to 10 GHz, is 2W/kg. Specific Absorption Rate is the average size of expressing absorption over the whole body or a part of the body and is defined as the rate at which power is absorbed by unit mass of body tissue and is expressed in W / kg. Specific absorption rate for the whole entire body is a universally accepted scale to establish the link between adverse thermal effects of RF exposure. In addition to whole body SAR values are necessary and local SAR values (for a portion of the body) to evaluate and limit excessive accumulation of energy in restricted areas (small) body, as a result of exposure to specific conditions. [10, 11, 13]

3. Sources of electromagnetic pollution

All activities of the organized biological systems takes place in a universe subjected to the action of multiple and varied range where the most noticeable directly with our senses and which also occupies a very narrow spectral beach, to the noticeable only through equipment.

For different types of electromagnetic sources, natural or manmade, studies have shown us that: up to 1 kV/m electric field intensity, up to 3 mGs magnetic induction, electromagnetic waves emitted does not cause biological effects, even for a long time. These results, excluding the value of electric field are consistent with the literature. [9]

After our observations, for the electric field, the minimum risk of 1 kV/m mentioned in the literature, may be increased up to 3 kV/m. Given these two minimum values, by which electromagnetic waves emitted does not create health problems, we can consider all other electromagnetic sources such as sources of electromagnetic pollution, and this phenomenon defined as electromagnetic pollution.

3.1 Household sources of electromagnetic pollution. High voltage power lines from 750 kV to 1500 kV, are dangerous because they constantly lose energy, and 40% of transported energy is lost to the environment in the form of low frequency electromagnetic radiation. World Health Organization published a report which considers environmental impacts of the same degree of toxicity as mercury or cadmium poisoning. Measurements in medium and high voltage lines showed particularly high levels of electromagnetic waves around, especially electric field strength; above 70 kV/m.

Similar measurements have led us to conclude that human presence is dangerous around electrical transformers even briefly, the human body becomes an antenna living strongly absorbs the energy of electromagnetic radiation emitted around, thereby increasing the local field strength. The synergism, groups of people or animals also increase the field strength. A school full of children or a group of workers who work in a power transmission line can be a tremendous source of electromagnetic field. [6, 14]

A video monitor, CRT (cathode ray tube), especially its high voltage transformer, creates at a distance of about 1 m, intense magnetic fields of 10 mGs, and electric field strength increases from 3 kV/m at distance of 50 cm to 100 kV/m near its screen.

A modern video monitors, LCD type, produce electric and magnetic fields of low, 5 - 50 V/m and 0.3 mGs, with virtually no negative effects to normal operating distance. We therefore recommend replacing old monitors with cathode ray tubes equipped with standard modern LCD monitors.

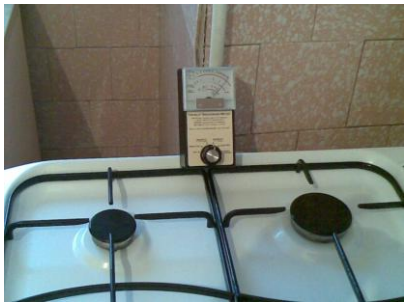

Fig. 1 Magnetometer near a gas pipe of a stove; B=5 mGs

Measurements have led us to draw the following conclusions: home or office, all appliances produce electromagnetic fields around them even if they are stopped. For example, a television cathode ray tube produces an electromagnetic field strong enough even when turned off while the device is held in the socket, at a distance of 10 cm magnetic field is measured over 3 mGs.

The same thing happens when electric lamps, the printers, photocopiers, video systems, telephones, electrical cables in the wall or off, gas lines, Fig. 1.

Fig. 2 Magnetometer near an energized iron; B=5 mGs

In many cases we observed high values of the two fields than normal, safe in bedrooms where electrical lamps, radio clocks, electric blankets, electric pollution sources are genuine. Electric iron ironing board is also polluting, Fig. 2. Refrigerators, microwaves cause serious problems of electromagnetic nature. In addition many people suffering from allergies when consuming food prepared in a microwave.

3.2 Electromagnetic pollution in a train wagon. It is determined by equipment class wagons and especially sleeping and couchette wagons with facilities for comfort. In Romania maximum permissible operating voltage for these cars, is 1500 V. The power supply is the source of the locomotive. It receives energy from the contact wire (27000V) and is passed through electric locomotive transformer through a high voltage socket and plug (IT), which provides the connection between locomotive and wagon respectively, and by,, pipe "general and pipelines' auxiliary under the wagon box to the control panel. Voltage work in the wagon is 24 V batteries from the equipment once the sleeper cars in the electrical control panel, located at one end of the wagon, where we find the command for four plants supply electricity wiring for lighting, heating and ventilation installation or special customers.

The presence of electrical and electronic equipment in these cars, the measurements that were made led to the conclusion that there used to travel in this area, a high electromagnetic pollution. For example, in the extreme couchettes, especially the upper beds, magnetic field measured during walking, sometimes reaching 15 mGs value, i.e. more than three times the maximum allowable 3 mGs.

3.3 Electromagnetic pollution of the office of a railway station. Is produced by electrical circuits that allow handling facility on land about train movement and maneuver. Voltage used in the control desk is 24 V DC, 12 V AC at 50 Hz and 75 Hz. The greatest power in the desk is 160 V at a current of 1A intensity for performing operations handling (about 2-6 seconds). She comes from a 160 V battery, charged by a rectifier 176 V, found in an adjoining room.

Measurements in the office of the station showed high values of the electromagnetic field, therefore the personnel serving suffers a strong electromagnetic impact. Magnetometer indicates a value of 10 to 24 mGs, well above the maximum value at about 30 cm from electromagnetic relay control panel, Fig. 3.

Fig. 3 Magnetometer near electrical switchboards in the office of a railway station; B = 17 mGs

Power switchboards, inner and outer circuits in this room, produce very intense electromagnetic fields with values over 40 mGs, too.

3.4 Electromagnetic pollution under the voltage lines of the electric locomotives. Passengers are affected not only in the wagons of a train, but also on the station platform because of the electromagnetic field generated by the electrical contact lines.

Thus, measurements were made in the railway station Bistriţa, Fig. 4, on the platform to zero at a height of 1.5 m, under 27000V network and under an electrical transformer installed on a pole. Electromagnetic field near railway lines and power lines are in many places more than twice the maximum permissible, that is B = 6 – 8 mGs, Fig. 5.

Fig. 4 Magnetometer at a height of 1.5 m; B = 6 mGs

Fig. 5 Magnetometer under 27000V network; B = 7 mGs

Also for the electrical transformers installed on the poles of high voltage line, located near the passenger platform, magnetometer indicates high values of the electromagnetic field.

4. Conclusions

The purpose of this study is to submit to environmental professionals, the negative effects caused by the emission of electromagnetic nature of electrical products used daily, but also in professional activities.

Study with reference to the persistent electromagnetic field values of the Romanian railway system was illustrated with a case study in Bistriţa Railway Station.

This type of pollution on working conditions in the railway system is still not integrated in current Romanian and European legislation. In this sense, we can illustrate cases of acute illness, even death, and a large number of eye diseases, which forces many people, many young to wear glasses and not all.

WHO (World Health Organization) published a report that considers the environmental impacts of the electromagnetic pollution is the same degree of toxicity as mercury or cadmium poisoning.

Global action is taken to limit the effects of electromagnetic fields on living organisms. Among the most important are allowable intensity normalization of electromagnetic fields and the application of safeguards in activities with sources of electromagnetic fields.

After all studies done, we considered that a human action awareness, in that everything that electrical and electronic equipment, which is around lives: electrical wiring in walls of home electronics, especially the bedroom, excessive use of mobile phones, placing within easy reach of television, using CRT monitors, there in the kitchen microwave oven and so on, are genuine sources of electromagnetic pollution which, in one form or another, affect health. As everyone has at home a set of drugs, a thermometer, or a sphygmomanometer, it is necessary be able to buy, from any electronic store, an electric and magnetic fields detector, or even a powerful device that would index values of these two fields anywhere in the house (living room, bedroom especially) or at work.

Fig. 6 Electromagnetic detector

Unfortunately still not widely marketed such devices, some very comfortable, such as electromagnetic detector that can serve as key ring, Fig. 6.

For exact measurements we need a device that measures the values of these fields, and even the energy of high frequency electromagnetic waves emitted by radio electronic devices (phones, GSM antenna, radio stations), Fig. 7, i.e. a magnetometer.

Fig. 7 Magnetometer

In a context of scientific uncertainty regarding the effects of exposure to electromagnetic fields, it is necessary to take precautionary principle already adopted in some EU countries, which requires reconsideration limits for certain frequencies and administrative measures:

- mobile antenna location away from areas where activities with children or sick;
- antennas are not located in any event on or residential buildings at ground level;
- use of mobile phones by children under the age of 16 is prohibited;
- public information (cell phone users etc.) to the risk of exposure to sources of electromagnetic waves;

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