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THE EFFECT OF RADON AND GEOMAGNETIC FIELD ON BIO-SYSTEMS

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ABSTRACT: *the paper deals with the processes of the effects of the radioactive gas radon and geomagnetic disturbance (occurring during magnetic hurricanes) on bio-systems.*

KEY WORDS: *geomagnetic field, magnetic hurricane, ozone, radon, magnetostriction, microsome, mitochondria.*

The entire biosphere including human beings is known to be affected by the background ionizing radiation. Besides, within the scope of the physics of the relation between the Sun and Earth, the emphasis is placed on the effect of the geomagnetic field disturbance (the so-called magnetic hurricanes) on the biosphere, more specifically on human beings. In recent years these potential relations have been intensively studied not only by doctors, but also by biologists, biophysicists, physicists and ecologists.

During strong magnetic hurricanes there are considerable changes in the tension of the magnetic field and the concentration of various chemical components of the troposphere (e.g. **radon**, ozone and other gases).

Accordingly, a distinction has been made between two possible mechanisms of the effects of magnetic hurricanes on human health: 1) the direct effect of radiation on different parts of human body; 2) the effect on bio-systems caused by the increased concentration of various gases during this period, which results in radioactive contamination.

Radiobiologists have proved that mountain rocks, such as granites and basalts are the major source of the radioactivity of soil and water. In addition, the degree of soil radioactivity is higher in the case of loam and black soils, whereas forest soils are characterized by lower degree of radioactivity. These

data seem to be appealing to agricultural workers as well, since the radioactivity of the water they consume and its constituent micro and macro elements are closely linked to the soil cover and the water of plant and animal habitats. Studies by ecologists show that through the link – soil-plant-animal-human – radioactive and toxic substances get into the body. The content of these substances is ten times and a thousand times greater than their original content.

A significant source of natural radioactivity is the gas of radon, which gets from the ground into the layers of the air of troposphere and afterwards gets into basements and residential areas. Radon is an odorless and coulourless gas produced as a result of the radioactive fission of uranium and thorium. The period of its semi-fission lasts 3,8 days. It has 3 isotopes that produce the elements of short life expectancy – polonium- 210, 216, 218. They emit alpha particles and the period of their semi-fission lasts from a fraction of a second to several minutes. The lead - 212, 214 and bismuth - 214 produced at this time emit beta particles.

During the process of breathing millions of radioactive atoms of radon get into the lungs in 1 minute. They are selectively concentrated in certain organs and tissues, particularly in hypophysis and the cortex of adrenal gland. These two major glands of internal secretion determine the hormonal activity of the body and regulate the function of the vegetative nervous system. The products dissolved in blood and lymph are rapidly transported throughout the whole body and lead to massive irradiation. The threats of radon include functional disorders (suffocation, dizziness, nausea, depression, etc.). Furthermore, lung cancer might occur after the lung tissues are irradiated. According to A. Shemi-zade, 25Bq/m^3 concentration of radon in houses leads to 3-4 cancer cases out of 1000. If the concentration level in a room equals 200Bq/m^3, the number of patients increases 10 times [2].

Nowadays the issue of radon irradiation is accentuated in various countries. In Sweden all the irradiation regions have been studied and a map of the level of radon activity has been made. According to the map, the level of concentration of this poisonous gas was very high in a number of residential buildings. Special measures have been taken in the USA to determine the limit of the radon concentration level in houses. The limit in this country is 190 Bq/m^3. In Europe and Georgia the limit is 100Bq/m^3 for new buildings and 200Bq/m^3 for residential apartments [3].

Radon has a particularly strong effect on the humans who live in basements or on the first floors. In order to reduce the risk of radon irradiation, it is necessary to take protective measures – special floor covers should be applied, the apartment should be aired properly, etc. Active ventilation that lasts for 2-3 hours reduces radon concentration 3-4 times. However, specialists believe that if radon concentration level in the air is higher than 400Bq/m^3, the residents are supposed to leave the apartment.

Studying the composition of radon and aeroins, A. Shemi-zade made an important discovery. He noticed that the "radon hurricanes", during which there is a considerable increase in the degree of radon radioactivity and aeroin concentration in the air, are closely linked to the disturbances of the Earth's magnetic field – the "geomagnetic hurricanes". Scientists believe that during the magnetic hurricane radon is intensively emitted from subterranean layers as a consequence of contraction of the micropores of mountain rocks (magnetostriction effect)[2].

Let us have a broader discussion about the possibility of the immediate impact of the geomagnetic field disturbances on the biosystems. Through the studies conducted it has been determined that even the influence of a short-term artificial field on a human body with a frequency of 0,01-5 Hz and an intensity of H=100 GAMMA (1 GAMMA = 10^{-5}G) sharply alters the character of electroencephalography. After being operated the weak variable field, in humans pulse frequency increases, self-awareness worsens; weakness, headaches, disturbed conditions and etc. emerge. There are lots of changes in the electrical activity of the brain. Besides, it is known that the geomagnetic field plays an important role in the orientation of living organisms. This applies to birds and animals as well as fish and plants [1].

It should be mentioned that during a severe magnetic storm the connection between electromagnetic field-component variations and the ongoing ones in biosystems has been revealed at several times at the Cosmophysical Observatory of Akaki Tsereteli State University, located in the outskirts of the high-mountainous village Khumuri in the district of Vani, in the area of pure geomagnetic conditions. The observation upon Earth's electromagnetic fields was continuously being conducted for 12 years in the range of hertz (Hz) by means of magnetometers and geovoltmeters. A particularly severe magnetic storm was detected on June 10, 1991, which was later followed by a heavy earthquake in the same year, June 15. The storm lasted for almost five years and it was registered almost at all the components of the geoelectromagnetic field. One of the fragments of this storm is presented.

In this period, in the observatory there were detected sharp changes in the various meteorological and geochemical parameters. In parallel, there were observed the variations of the various biomedical and psychological indicators in the working personnel. In particular, most of the employees suffered insomnia, nervous system problems, increased arterial pressure, seizure and vomiting.

According to the results obtained from a theoretical research, it has been shown that the flow of density and strength of the geomagnetic field energy in the occurrence of the disturbance exceeds the sensitivity threshold of the human in 2-5 orders. Besides, the statistical elaboration of the studies has enabled us to

draw a conclusion that a spontaneous increase in the geomagnetic field impacts a rising dynamics of cardiovascular diseases. Furthermore, large and long-lasting storms lead to much more intensive disturbances.

Now, briefly, let us touch upon the influential mechanisms of the geomagnetic storms on the human body including a cardiovascular system. The work conducted in geomagnetic biology relieved the geomagnetic field mechanisms perceived by the living organisms, which are connected to the biological field penetration. The biological influence of the variable electromagnetic fields (0,2-100Hz) occurs through the membrane penetration. A discovery of the link between the living organisms and geomagnetic fields via the penetration of the membrane mechanism gives way to new, broad perspectives generated in view of the explanation of the biological effects [5].

Indeed, a membrane – a structural element to be constituent of any cell – plays a key role in the functioning of all living organisms and the organ regulation. In particular, the coordinated work of a mechanism of the membrane penetration makes it possible to exactly maintain the self-regulating ability of the homeostasis of the living organism and all of its organs starting from submicroscopic particles like microsomes and mitochondres to separate organs.

The immediate effect of the geomagnetic field on the mechanism of the membrane penetration has a very deep influence on the whole organism and induces a huge chain of occurrences, displayed in the various modes of the neuro-psychical activity. At this point, we should consider that the immediate effect of the geomagnetic field on the mechanism of the membrane penetration takes place in parallel to a large number of different adaptive-regulatory reactions of the body of which the optimal level of the interdependence between the body and the environment is achieved. But the necessitated effect of the geomagnetic field on the penetration of all membranes in the biosystem induces the fluctuations of their functional-dynamic indicators. According to the contemporary suppositions, in the pathogenesis of cardiovascular disease, significant importance is attached to the penetration of the tonus in the walls of the blood vascular system and the fluctuations related due to the balance of electrolytes, which are generated in response to the geomagnetic field forces and we could consider it as one of the components of the complicated pathogenesic mechanism in the case of the circulatory system disease. In addition, the geomagnetic field activation covers the central nervous system and alters the penetration of the mechanism of the brain cell membrane and bioelectric activities.

In the second half of the last century the magnetic fields of the biological objects of their own were discovered. Such kind of magnetic fields were registered during the working of the heart (approximately 10^{-5} oersted order) whilst the nerve impulses were travelling through the fibber, at the time of the electrical activity of nerve and the brain etc. In particular, the magnetic field of

the human brain is of 10^{-8} oersted order, and in the human body there are (3-5) 10^{-6} amperian order currents. This current is generated in the human skin and not resulting from the processes undergoing in the muscles. It is supposed that they are produced by the brain's ion electrical current. The sharp alternations of the geomagnetic field intensity influence the human psyche, too. In the years of 1977-1984, in New York Psychiatric Hospital, (the USA) scientists registered the dynamics of the in-coming patients. It turned out that the number of the incoming patients and their psychic irritation was sharply increasing during the periods of the magnetic field disturbances.

The main source of illness and radiacion of jaw- teeth system of human organism in the radioactive fields represent Radon Which enter into the organism through the our,wator and food. If the number to couse of components is more than 200 bk/l, then it is expected important complications injaw-teeth system and other organs . [6]

We think that in this perspective the exposition of the increased sensitivity (magnitolability) towards the geomagnetic storms created as a result of the Sun-Earth relationship will be of importance for us to define the degree of the risk.

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