

A Study on Health Effects by Electromagnetic Fields

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Abstract -This paper gives a brief study on Health effects by electromagnetic fields (EMF). Extremely high voltages in EHV lines cause electrostatic effects, where as short circuit currents & line loading currents are responsible for electromagnetic effects. The effect of these electrostatic fields is seen prominent with living things like humans, plants, animals along with vehicles, fences & buried pipes under & close to these lines. The magnetic field has influence on tissues in the human body. These influence harmful effects depending upon its nature. The magnitude of surface charge and internal body currents that are induced by any given source of power-frequency fields depends on many factors. These include the magnitude of the charges and currents in the source, the distance of the body from the source, the presence of other objects that might shield or concentrate the field, and body posture, shape, and orientation. For this reason the surface charges and currents which a given field induces are very different for different Human and animals. This paper gives a brief outline about the various effects caused by the Electromagnetic Fields.

Keywords- Health Effects, World Health Organization, Electromagnetic field, World Health Organization

I INTRODUCTION

Nowadays, the significant use of electromagnetic energy in various areas of human activity has increased in greater levels and in the fact that existing electric and magnetic fields of the Earth, atmospheric electricity, solar and galaxy radio radiation were added by an artificial electromagnetic field. Its level significantly exceeds the level of natural electromagnetic background [1-10]. Every ten years world energy resources are doubled and within

this period specific gravity of Electromagnetic Field (EMF) variables in power industry has thrice increased. Electromagnetic radiation sources, which include overhead high voltage and extra high voltage transmission lines, radio broadcasting, TV, radio relay and satellite communication equipment, radar and navigation systems, laser beacons ,etc., have extensively prejudiced the natural electromagnetic background. Within rather wide areas and, in particular, near overhead high voltage and extra high voltage transmission lines, radio and tele-centers, radar systems electric and magnetic fields strength has shown from two to five time increase, thus raise the valid perils for humans, flora and fauna.50 Hz industrial electric fields created by overhead transmission lines and substations are of biological significance. Electromagnetic radiation influence of household electric devices on a human organism, which can be rather high, is also observed [10-15]. Since 1970s several millions of microwave cookers, which use ultra high frequency radiation energy have been manufactured. Wide spread occurrence of electromagnetic radiation and their rush penetration in all spheres of human activity led to the appearance of a comparatively new set of pollutants, named “electromagnetic smog”, which means a totality of electromagnetic fields and various radiations, emerging in the course of operation of complex electromagnetic equipment. The spectrum of electromagnetic radiation frequencies is very wide and covers wavelengths from tens and hundreds of kilometers to fractions of nanometers; from short frequency radio waves to ionizing radiation in the form of space rays. Nowadays, high level of electromagnetic fields biological activity is

established; all living organisms are actually extremely sensitive to artificial electromagnetic fields if anthropogenic origin. Some types of living organisms and plants are particularly sensitive to certain frequencies. Thus, fish endure frequency if of 50Hz and not well if field strength is rather high. Forest growth is slowed down if affected by ultra high frequency with 12, 25, 50 and 100 Hz modulation. Flowers react to acoustical frequencies. On a superior level of organization a variety comes into existence and sensibility to electromagnetic fields is differentiated.

Industrial fields are accompanied by different frequencies, parasite ultra high frequency radiations, harmful resonance phenomena, from which a human organism cannot yet protect itself. Regular electromagnetic field exposure may lead to performance, memory, and attentiveness disorders. Electromagnetic fields augment the risk of cardiovascular, endocrine, and ontological diseases, decrease immune resistance and potency. According to World Health Organization (WHO) specialists, today electromagnetic pollution of the environment is on a level typical for its current pollution by harmful chemical substances.

II LOW & HIGH FREQUENCY ELECTROMAGNETIC FIELD BIOLOGICAL EFFECTS

With regard to low frequency (<105 Hz) electromagnetic fields, a human body possesses a conductor's properties. Under an external field influence, conduction current appears in tissues. Low frequency electromagnetic field's influence on an organism does not lead to a marked tissues heating since thermal energy, which is absorbed by the tissues at this, is less than metabolic heat production. Studies of a range of authors prove common non specific mechanisms of ultra low frequency electromagnetic field influence on an increase in pituitary adrenal axis capacity, which in most examined is accompanied by reproductive and in some cases also pituitary thyroid system enhancement [24,27]. A range of conducted studies have also shown positive coherence of low frequency electromagnetic radiation and neoplasm's development [16-20]. The most pronounce effect of electromagnetic fields is observed in the development of children's leukemia, as well as leukemia and encephaloma of adults exposed to these fields radiation at work [7,8,16]. The influence of thermal intensity radio frequency band on life span and neoplasm's development is not directed unambiguously. In different test conditions animals exposure gave opposite effects. Electromagnetic fields effects are multiple; they are not fully

examined and are unpredictable. There are yet too many gaps and all kinds of uncertainties in this issue.

Ultra low frequency fields, as well as high frequency and ultra high frequency detected fields with ultra low frequency harmful modulation, which release active free radicals, are particularly hazardous. They affect DNA and RNA as hard radiation and may cause extremely negative remote effects up to a genotype retrogression. These effects are rather difficult to be directly found [18,20]. Within the band of frequencies from 1.0 to 300 MHz the mechanisms of electromagnetic fields interaction with an organism are governed by conduction current, as well as by offset current, at this at a frequency of about 1 MHz it is conduction current that plays the leading role and on frequencies higher than 20 MHz it is offset current and both the kinds of current cause tissue heating. Thermal effect strengthens as an external field frequency grows. Among a great number of electromagnetic phenomena microwave radiations are worthy of special notice; at this, radar and radio relay stations, as well as other objects, which operation is based on the generation of ultra high frequency electromagnetic radiation, considerably contribute to microwave pollution of the environment [20-27]. People working at troposphere, satellite, radio, and radio-relay stations start to feel headaches, irritation, sleepiness, memory weakening and etc.

- Short term Health Problem

Headaches, Fatigue, Anxiety, Insomnia, Prickling and or burning skin, Rashes, Muscle pain

- Long term Health Problem

Following serious health Problems may be arise due to EMF effects on human Body.

a) Risk of damaging DNA

Our body acts like an energy wave broadcaster and receiver, incorporating and responding to EMFs. In fact, scientific research has demonstrated that every cell in your body may have its own EMF, helping to regulate important functions and keep you healthy. Strong, artificial EMFs like those from power lines can scramble and interfere with your body's natural EMF, harming everything from your sleep cycles and stress levels to your immune response and DNA.

b) Risk of Cancer

After hundreds of international studies, the evidence linking EMFs to cancers and other health problems is loud and clear. High Voltage power lines are the most obvious and dangerous culprits, but the same

EMFs exist in gradually decreasing levels all along the grid, from substations to transformers to homes.

c) Risk of Leukemia

Researchers found that children living within 650 feet of power lines had a 70% greater risk for leukemia than children living 2,000 feet away or more.

d) Risk of Neuro degenerative disease

“Several studies have identified occupational exposure to extremely low-frequency electromagnetic fields (EMF) as a potential risk factor for neuro degenerative disease.”

e) Risk of Miscarriage

There is “strong prospective evidence that prenatal maximum magnetic field exposure above a certain level (possibly around 16 mG) may be associated with miscarriage risk.”

A. EMF Effects on Animals

Many researchers are studying the effect of Electrostatic field on animals. In order to do so they keeps the cages of animals under high Electrostatic field of about 30 kV/m. The results of these Experiments are shocking as animals (are kept below high Electrostatic field their body acquires a charge & when they try to drink water, a spark usually jumps from their nose to the grounded Pipe) like hens are not capable to pick up grain because of chattering of their beaks which also affects their growth.

B. EMF Effects on Plant Life

Most of the areas in agricultural and forest lands where high power transmission lines pass. The voltage level of high power transmission Lines are 400KV, 230KV, 110KV, 66KV etc. The electromagnetic field from high power transmission lines affects the growth of plants. Current in Power transmission lines varies according to Load (it depending upon the amount of electricity consumed by the consumers). From various practically study it was found that the response of the crop to EMF from 110 KV and 230 KV Power lines showed variations among themselves. Based on the results the growth characteristics like shoot length, root length, leaf area, leaf fresh weight, specific leaf weight, shoot/root ratio, total biomass content and total water content of the four crop plants were reduced significantly over the control plants. Similar trend were observed in the biochemical characteristics like chlorophyll. Reduced growth and physiological parameter was primarily due to the effect of reduced cell division and cell enlargement. Further the growth was stunted which may be due to poor action of hormones responsible for cell division and cell enlargement. The bio-chemical changes produced in

this plant due to EMF stress quite obvious and it affects the production leading to economic loss. It is concluded that the reduced growth parameter shown in the crop plants would indicates that the EMF has exerted a stress on that plants and this EMF stress was quite obvious and it affects the production leading to economic loss. Further research activities are needed to safe guard plants from EMF stress.

C. EMF Effects on Vehicles parked near Line

When a vehicle is parked under high voltage transmission line an electrostatic field is developed in it. When a person who is grounded touches it a discharge current flows through the human being. In order to avoid this parking lots are located below the transmission lines the recommended clearance is 17 m for 345 kV and 20 m for 400 kV lines.

D. EMF Effects on Pipe Line/Fence/Cables

A fence, irrigation pipe, pipeline, electrical distribution line forms a conducting loops when it is grounded at both ends. The earth forms the other portion of the loop. The magnetic field from a transmission line can induce a current to flow in such a loop if it is oriented parallel to the line. If only one end of the fence is grounded, then an induced voltage appears across the open end of the loop. The possibility for a shock exists if a person closes the loop at the open end by contacting both the ground and the conductor. For fences, buried cables, and pipe lines proper care has been taken to prevent them from charging due to Electrostatic field. When using pipelines which are more than 3 km in length & 15 cm in Diameter they must be buried at least 30 laterally from the line center.

E. EMF Effects on Maintenance Worker

For providing continuous and uninterrupted supply of electric power to consumers maintenance operations of power lines are often performed with systems energized or live. This is live line maintenance or hot line maintenance. The electric fields and magnetic fields associated with these power lines may affect the health of live line workers. Its electric field and current densities affect the health of humans and cause several diseases by affecting majority parts of the human body. These electric field and current densities affects humans of all stages and causes short term diseases in them and sometimes death also.

III CONCLUSION

This paper outlines about effect of Electromagnetic field on various aspects. Various methods of Research work is going on around the world to study

about the effects caused by EMF radiation. Various types of research are going on about the effects of EMF radiation on plants and animals. These type of study and research will enhance the young students, scholars and scientist to have a enlarge idea about the effects of EMF radiation and new formulations will be evolved to decrease the effects cause by EMF.

REFERENCES

- [1]. Bingy V.N., Savin A.V. Physical Challenges of Weak Magnetic Fields Effect on Biological Systems // Physical Sciences Successes.- V.173.-№ 3.- P.265 – 300.
- [2]. Broun G.R., Ilyinsky O.B. Receptors Physiology.-L.: Nauka, 1984.
- [3]. Vvedensky V.L., Ozhogin V.I. Ultrasensitive Magnetometry and Biomagnetics.- M.: Nauka, 1986.
- [4]. Davydov A.S. Solitons in Molecular Systems.- Kiev: Naukova dumka, 1984.
- [5]. Kuchma V.R., Yarmolskaya E.G., Kotler N.Y., Yushkova O.I. Changes in Functional Status of a Visual Analyzer When Working With Graphic Display Terminals // Labor Medicine and Industrial Ecology.- 1995.- №10.-P.5-8.
- [6]. Kuchma V.R., Barbysheva-Pushkina N.D. Performance Efficiency and Functional Status of Organisms of Persons Working With Automatic and Training Systems on PC // Labor Medicine and Industrial Ecology.- 1995.- №4.-P.17.
- [7]. Muratov E.I. Ultra-Low Frequency Electric and Magnetic Fields and Their Role in Neoplasms Development // Oncology Issues.-1996.- V.42.- № 5.- P.13.
- [8]. Muratov E.I., Zabezinsky M.A., Popovich I.G., Arutyunyan A.A. Effect of Radiation Generated by PC Video Terminal on the Level of Free Radical Processes, Reproductive Function and Neoplasms Development in Animals// The theses of reports for the fourth scientific and technical conference “Electromagnetic compatibility of technology and biological objects ”.- 1996.- P.506-512.
- [9]. Nikolaenko N.N., Rybina L.A., Serov I.N. Changes in Electric Activity and Behavior When Using Optical Filters With Matrix Fractal Topology. Reports of the Academy of Science. 2002. V.383, № 1, p. 132-133.
- [10]. Polonnikov R.I. Weak and Ultra-Weak Electromagnetic Fields and Information and Psychological Safety of a Person // Information and psychological problems of personal and public safety: the theses of a report for the scientific and practical seminar, S.-Petersburg, the 26th and the 27th of November, 1997.-P.37.
- [11]. Presman A.S. Electromagnetic Fields and Wild Life.- M.: Nauka, 1968.
- [12]. Romanovsky Y.M., Stepanova N.V., Chernavsky D.S. Mathematical Biophysics.-M.: Nauka, 1984.
- [13]. I.N. Serov, V.N. Sysoev, L.A. Rybina, V.N. Ananyeva. Influence of Products with Fractal Nanodimensional Topology on Some Human Vital Processes and Ecology //Materials of the 6th Specialized Exhibition “Double-purpose products and technology. Military industrial complex conversion. Collection of scientific papers and engineering developments.- M.-2005.- P.63-73.
- [14]. Serov I.N., Sysoev V.N., Rybina L.A. Protective and Stabilizing Properties of Products With Fractal and Matrix Structure // Materials of the 4th Saint-Petersburg Interregional Conference “Informational safety of Russian regions”.- S.-Petersburg.- 2005.- P. 75-76.
- [15]. Serov I.N. General BIP Course. S.-Petersburg. «Accident», 2002, 492 p.
- [16]. Temuryants N.A., Vladimirsky B.M., Tushkin O.G. Ultra-Low-Frequency Electro-magnetic Signals in the Biological World.- Kiev: Naukova dumka, 1992.- 186 p.
- [17]. Kholodov Y.A., Lebedeva N.N. Human Nervous System Responses to Electromagnetic Fields.-M.: Nauka, 1992.
- [18]. Adey W. R., Sheppard A. R. Mechanistic Approaches to Interactions of Electric and Electromagnetic Fields with Living Systems.-New York: Plenum Press, 1987.- 365 p.
- [19]. Blank M. Electromagnetic fields: Biological Interactions and Mechanisms // Adv. In Chem.Ser.- Vol.250.-1995.-P.38.
- [20]. Goodman E. M., Greenebaum B, Marron M.T. A Survey of Cell Biology //in Intern. Rev. of Cytology Vol. 158.-1995.- P. 279.
- [21]. Liboff A.R., Smith S. D., McLeod B.R. Mechanistic Approaches to Interactions of Electric and Electromagnetic Fields with Living Systems.-New York: Plenum Press, 1987.- 109 p.
- [22]. Polk C., Postow E. Handbook of Biological Effects of Electro- magnetic Fields.- Boca Raton, FL: CRC Press, 1996.
- [23]. Sagan L. A. Electric and Magnetic Fields: Invisible Risks.-Amsterdam: Gordon and Breach Publ., 1996.
- [24]. Stevens R. G., Wilson B. W., Anderson L. E. The Melatonin Hypothesis: Breast Cancer and Use of Electric Power.-Columbus, OH: Battelle Press, 1997.
- [25]. Simon N.J. Biological Effects of Static Magnetic Fields: A Review.- Boulder,CO: In-tern.Cryogenic Materials Commission, 1992.
- [26]. Wiltshcko W. et al., in Biophysical Effects of Steady Magnetic Fields //Springer Proc. in Physics.- Vol. 11.- 1986.- P. 154.
- [27]. Wilson B.W., Stevens R.G.,Anderson L.E. Extremely Low Frequency Electromagnetic Fields: The Question of Cancer.- Columbus: Battelle Press, 1990.