

LOW FREQUENCY ELECTROMAGNETIC FIELDS OCCUPATIONAL RISK FACTORS

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Abstract: Particular attention is paid to low frequency electromagnetic field generated by high voltage transmission networks and electricity distribution, by the electricity distribution networks for the inside, low voltage electrical appliances and video terminals. During a medical examination in 2010, we examined the employees of the three power stations in Salt Lake, Tulcea and Constanta. The general conclusion was, each time, it can not be determined accurately a defining influence, clearly, of the exposure to the radiation of low frequency electromagnetic field on the rate of certain diseases (cancer, in particular). Information obtained by carrying out this work is intended: to establish a policy of appropriate health and safety at work, to identify aspects of health and safety arising from activities, products or services to beneficiaries, existing or planned earlier, to determine the significant impact on the quality of life.

Cuvinte cheie: factori de risc, examinare medicală, constante hematologice și biochimice

Rezumat: O atenție deosebită este acordată câmpului electromagnetic de joasă frecvență, generat de rețelele de înaltă tensiune de transport și distribuție a energiei electrice, de rețelele electrice de distribuție interioară, de aparatele electrice de joasă tensiune și de terminalele video. În cursul anului 2010 au fost examinați medical salariații din cele 3 stații electrice de la Lacu Sărat, Tulcea și Constanța. Concluzia generală a fost, de fiecare dată, că nu se poate stabili cu precizie o influență definitorie, clară, a expunerii la radiațiile câmpului electromagnetic de joasă frecvență asupra ratei anumitor afecțiuni (cancerigene, în special). Informațiile obținute prin derularea prezentei lucrări sunt destinate: să stabilească o politică de sănătate și securitate în muncă corespunzătoare; să identifice aspectele de sănătate și securitate în muncă care rezultă din activitățile, produsele sau serviciile beneficiarului, existente, anterioare sau planificate, pentru a determina impactul semnificativ asupra calității vieții

INTRODUCTION

In the 1990s, in response to growing problems commonly present in the media, but also in literature, in many countries have begun to review studies of all available data on low frequency electromagnetic field influence on biological structures, and possible correlations between the health of personnel exposed to electromagnetic radiation and this radiation dose.

Particular attention is paid to low frequency electromagnetic field generated by high voltage transmission networks and electricity distribution, electricity distribution networks inside, low voltage electrical appliances and video terminals.

The result was a large number of reports prepared by independent organizations, such as, for example, U.S. Environmental Protection Agency (USEPA), World Health Organization (WHO), National Radiological Protection Board (NRPB) and International Radiological Protection Association (IRPA).

Recently there have been concerns about possible adverse health effects to people working in the areas of electric and magnetic fields generated by power plants (even those of low voltage).

- Assessment of the risk factors in high voltage substations electric measures of protection and prevention of the professional diseases.
- Assessing the health of exposed personnel and the splitting of any influence of electromagnetic fields generated by these stations

MATERIAL AND METHODS

Risk factors for high-voltage electric station (400 KV)

Protection systems are designed to supervise the operation of energy systems equipment - generators, transformers, busbars, lines, etc. and to intervene in case of exceeding beyond certain limits of the parameters that characterize the normal functioning, isolating the equipment failure to the rest of the plants appeared. Isolation is achieved by triggering switches protect equipment that connects to the power system. If the parameters change in relation to normal values does not immediately jeopardize the protected equipment (PE) or the energy system (IS), plant protection (IP) regime indicating abnormal operation.

If IP does not fulfill its functions, defects and abnormal regimes can turn into failure, so it can not ensure supply of electricity to consumers. At the same time increase the likelihood of human casualties.

Operative serving staff performing a complex activity, induced by specific facilities served. Interventions, work and

AIM OF STUDY

The purpose of the study consisted of:

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checks on power plants require special training, personnel selection and motivation of this work in relation to the particular risks inherent in the performer that human errors in terms of wrong actions and omissions.

During movement on the territory of 400 kV substation personnel must use the access roads and avoid parking near any live plants.

Employment protection legislation in force, and IEC 61786, ENV 50166-1, provide that the maximum allowable intensității electric field $E = 10 \text{ kV / m}$ for 8 hours a day. In conditions where $E > 10 \text{ kV / m}$, reducing the residence time in these areas using the formula:

$$t = \frac{80}{E} \text{ where:}$$

t = permissible working time (hours)

E = electric field strength (kV / m).

Risk factors are classified as follows:

- Risk factors to the production means: electrical hazard, risk of heat (flames in the production of electric arc fault), mechanical risks,
- Risk factors work task;
- The performer's own risk factors.

To assess the health of exposed personnel and the splitting of any influence of electromagnetic fields generated by these stations, the body's homeostasis, a protocol was established for medical investigations including clinical examination, neuropsychological examination, functional investigation, laboratory tests on biological products (blood, urine) to establish hematological and biochemical constants.

His state of health of personnel working in high voltage electrical substations examined, taking into account the specific activity and occupational exposure.

Clinical examination was performed for each power station investigated, representing the service staff of these stations being completed neuropsychological examination and collection of biological products for laboratory analysis.

Blood examinations were made to the study of peripheral blood picture: red blood cell number, hematocrit, erythrocyte mean volume, the concentration of hemoglobin, white blood cell number and leukocyte formula.

These measurements were made on Minitron device, produced by Diatron, collection of blood samples is done on anticoagulant (EDTA).

Interest and research in this area must focus on three main issues:

1. research into biological mechanisms of action of electromagnetic fields of basic and high frequency;
2. the clinical investigation of electro and magnetosensitivității hypothetical;
3. studying effects of low and high frequency fields and health implications.
4. Fields, which induce suppression of pineal gland hormone, influences the synthesis and secretion and other hormones (cortisol, estrogen, prolactin), which could increase the risk oncogenic (Stevens 1996).

Protocol of investigations

During a medical examination in 2010 were employees of the three power stations of the Transport Branch Constanta (Constanta North, Salt Lake and Tulcea).

Medical examinations included the entire staff of these service stations.

These investigations included clinical examination, with the addition of a piece of observation, laboratory hematology, biochemistry and urine dosage melatonin metabolite (6 - OHMS, 6 - hydroxymelatonin sulfate)

These medical implications (particularly hematologic and endocrine) were made from data in the literature, which highlights the quite inconsistent or even contradictory changes to the staff of the respective parameters with similar exposures.

A great difficulty presented to establish collection protocol on melatonin metabolite. This hormone known as having a circadian rhythm, has a maximum disposal 2nd of the night and is strongly influenced physiologically by the intensity of light radiation. On the other hand, staff in the study, working in a regime of 12/24 hour work shifts.

The difficulty in assessing the results came home, so influenced by two variables. To capture the possible influence of melatonin on the homeostasis fields was established for each subject within 72 hours of each spot where the determination was made micțional metabolite of melatonin. The same system of collection was repeated for each of the subjects investigated, after a year.

RESULTS AND DISCUSSIONS

Expected Results

Information obtained by carrying out this work is intended:

- Establish a policy of appropriate health and safety at work;
- To identify aspects of health and safety arising from activities, products or services to beneficiaries, existing or planned earlier, to determine a significant impact on quality of life;
- Identify relevant legal regulations and provisions;
- Identify priorities and set objectives and targets of appropriate health and safety at work;
- Establish a structure and one or more programs to implement policy and achieve objectives set health and safety at work;
- To facilitate planning, control, monitoring, corrective action, auditing and analysis, to ensure that health and safety policy at work is respected;

Results:

Results of haematological investigations carried out electrical substation staff had not investigated the significant changes to normal.

Leukocytes have values between 3.8 and 10 with an average of 6.5 erythrocytes take values between 4.2 and 6.35 with an average of 4.9, the hemoglobin values between 12.5 and 18.2 with an average of 15.1, the hematocrit values between 4.3 and 52.5 with an average corpuscular volume of 45.6 and takes values between 65.7 and 105.3 with a 93.1 average.

Figure no. 1. Results of determinations of WBC

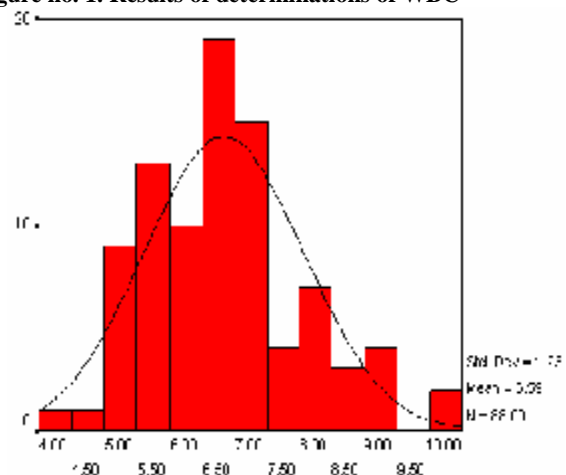
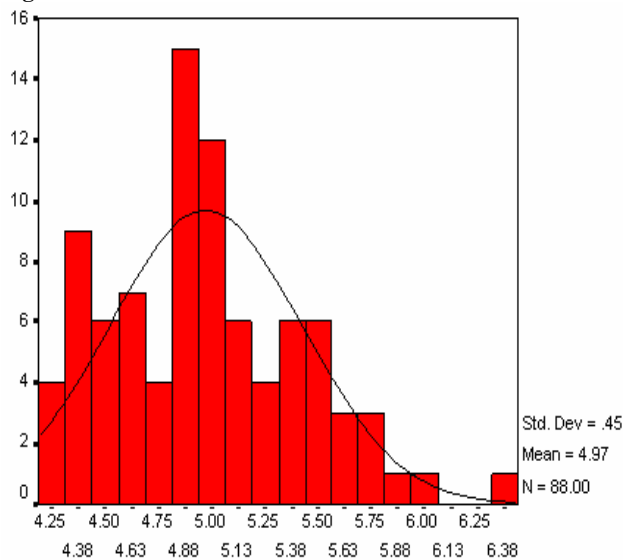
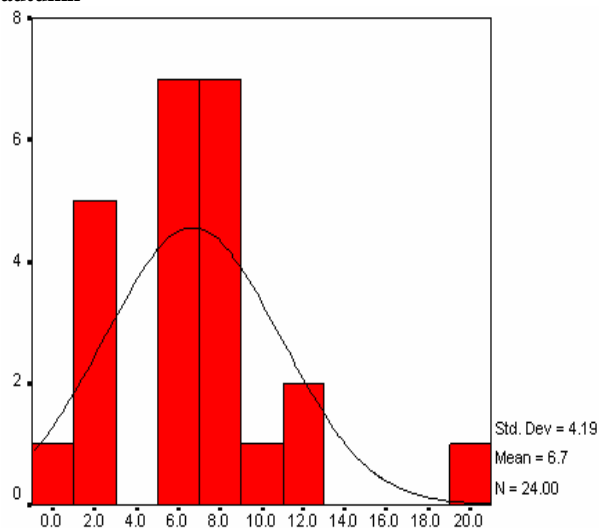
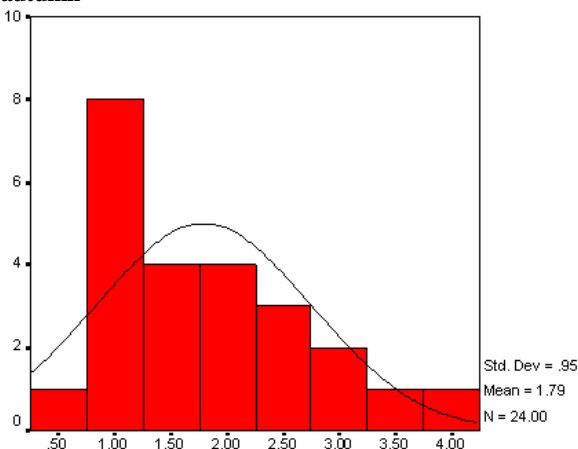


Figure no. 2. Results of determinations of RBC**Figure no. 3. Results of measurements of 6-OHMS -ng/ml autumn****Fig. 4. Results of the determination of creatinine in the autumn**

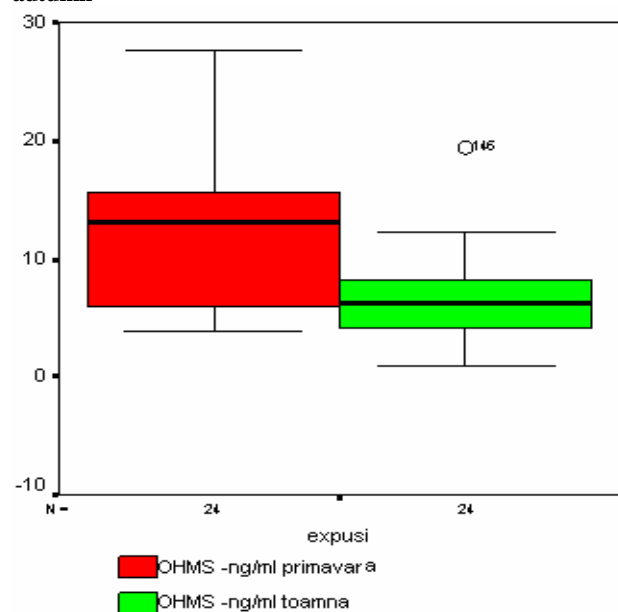
It is noted that the mean 6-OHMS in the autumn are lower than in the spring, which is maintained even if the mean creatinine values. To see if this difference between the values in spring and autumn, is statistically significant, further testing was

used in "Paired Samples T Test"

Table no. 1. Test "Paired Samples T Test for 6-OHMS values in the autumn to spring respectively, subjects exposed

	Paired Samples		Statistics		t	Sig. (2-tailed)
	Paired Sample 1	Paired Sample 2	Mean	Std. Deviation		
6-OHMS -ng/ml autumn	Mean = 6.7	Mean = 10.2	Mean = 6.7	Std. Deviation = 4.19	1.000	.000

Analyzing the results it is noted that 6-OHMS values in the autumn are significantly lower than those during spring ($p = 0.000 < 0.05$)

Fig. 5. Determinations of melatonin levels in spring and autumn**Table no. 2. Test "Paired Samples T Test for creatinine values during the autumn to spring respectively, subjects exposed**

	Paired Samples		Statistics		t	Sig. (2-tailed)
	Paired Sample 1	Paired Sample 2	Mean	Std. Deviation		
creatinine -mg/dl autumn	Mean = 1.79	Mean = 1.79	Mean = 1.79	Std. Deviation = .95	1.000	.000

Analyzing the results it is noted that creatinine values during the winter are significantly lower than those during spring ($p = 0.008 < 0.05$)

Test results "Independent Sample T Test" show that:

- the average value of leukocytes in the exposed subjects is not significantly different from the average value of leukocytes in less exposed subjects ($p = 0.785 > 0.05$)
- average in subjects exposed erythrocytes is significantly lower than the average value of erythrocytes in subjects less exposed ($p = 0.000 < 0.05$)

CONCLUSIONS

The general conclusion was, every time, that can not be determined accurately defining influence, clearly, exposure to radiation of low frequency electromagnetic field on the rate of

certain diseases (cancer, in particular).

Major interest is currently focused on the magnetic field generated by power plants, although the electric and magnetic field are simultaneously present in the area occupied by these installing.

Pineal gland secretion changes between the second and sixth decade of life, is characterized by loss of secretion rhythm linked not only by night fall's peak, and the diurnal increase compared with young subjects.

There is a difference between the level of melatonin secretion caused by the sex of the subject. Finally we say that the pineal gland exert a modulator of pituitary secretion.

Summary of melatonin assessed by its metabolite 6-OHMS dosage is changed (decreased), about 45% of the cases studied with occupational exposure to electromagnetic radiation. All in about 45% of cases occur and changes in the secretion of the melatonin hours recorded maximum, this leads to changes in circadian rhythm affecting the health of the body.

In terms of the difference between the three stations, changes are encountered relatively constant among subjects coming from the station at Salt Lake.

Synthesis and secretion of melatonin follows a circadian rhythm, reaching a maximum during the night. Over three decades is known that light influences the circadian rhythm in the night very deeply.

Analysis of data from questionnaires on possible extra-exposure to electromagnetic fields showed a more than 50% of subjects who used mobile phones, few cases of exposure by appliances (microwave ovens) and approx. 10% live between 50 - 100 m of various transformers

Final results will lead to:

- increasing the performance of technologies used / provided: rationalization of energy consumption and resources (including the introduction of recuperative)
- Cleaning process (cleaning up pollution, introduction of clean technologies)
- The application of quality standards and health and safety;
- Increased efficiency and quality service.

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