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DETERMINATION OF THE INFLUNCE FROM ELECTROMAGNETIC RADIATION OF THE LATHES ON OCCUPATIONAL SAFETY AND HEALTH OF THE OPERATORS

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Abstract: This paper presents the effects of electromagnetic radiation on occupational safety and health of the turners. It was discussed the size of electromagnetic radiation on turners parts of the body while lathes Potisje Ada PA C 22 and Potisje Ada PA B 30 are in operating and idling mode. There are determined influential factors on electromagnetic radiation and so that in lathes electromagnetic radiation increases with the cutting speed, cutting depth, and cutting feed.
Keywords: electromagnetic radiation, lathes, health and safety

1. INTRODUCTION

Aim of the study is to experimentally determine the size of the electromagnetic radiation on turners parts of the body, while lathes Potisje Ada PA C 22 and Potisje Ada PA B 30 are operating and idling.

In human body that is staying in variable EM field it is induced a current, whereby E field induce currents significantly greater intensity than the magnetic. Under the influence of this field, there were generated oscillations of free ions and rotation of dipole molecules in the frequency field. A strong EM fields can perform rotation, deformation, destruction and merging cells and to disrupt the cell membrane potential.

In the paper was examined the impact of EM fields on the incidence of malignant diseases in exposed population. It was discovered increased mortality from all forms of leukemia and acute leukemia in adults chronically exposed to EM field of over 0.3 μT. The higher occurrence of cancer (lung tumors predominate, pharynx, digestive tract, respiratory and sinus, thyroid, nervous system tumors, lymphomas and melanoma of the skin and eyes) was established among workers whose profession is related to work with electricity. The International Committee of ionizing radiation has recommended 10 Kv/m and 0.5 μT for workspaces and 5 kV/m or 0.1 μT for public spaces [4].

2. MATERIAL AND METHODS

Electromagnetic radiation

Electromagnetic radiation represents electromagnetic wave motions that may arise and to transmit at the speed of light, both in the material middle and in vacuum (air free). Electromagnetic radiation is energy that electromagnetic waves or particle matters transmit through space.

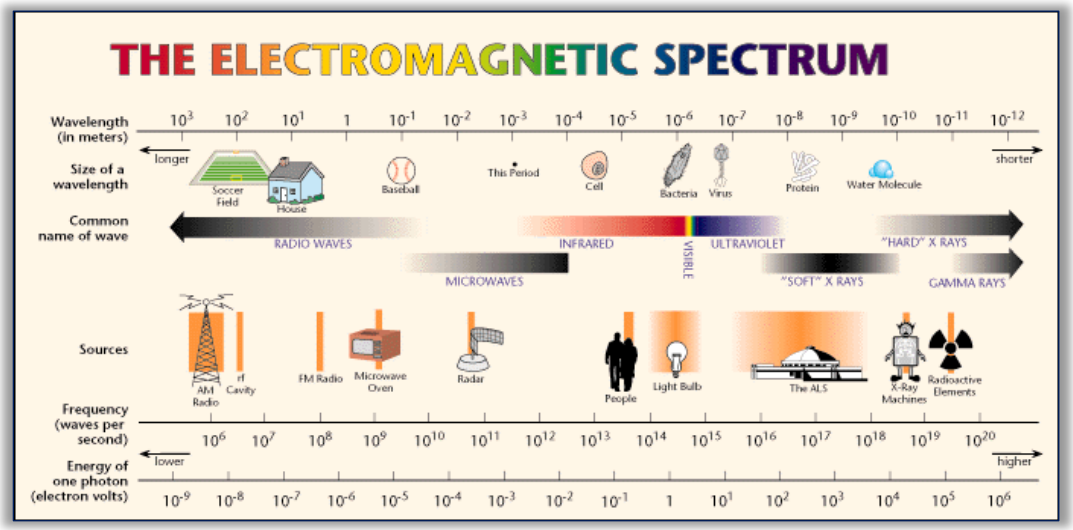

Figure 1. Electromagnetic spectrum

An electromagnetic wave (electromagnetic radiation) is a combination of oscillating electric and magnetic fields that travel together through space in the form of mutual orthographically waves. Alternately, magnetic field causes a turbulent time variable electric field, and turbulent electric field causes the variable magnetic field. The fields are characterized by the vectors of the strength on electric and magnetic fields, which are mutually orthographical, and plain formed by these two vectors is normally appointed to the direction of propagation - transverse waves. Figure 1 shows the electromagnetic spectrum with wavelengths (m), names of the radiation, corresponding frequencies and single photon energy (eV) [5].
Directive of the European Parliament and of the Council 2004/40/EC defines the limit and action values for exposure to EM fields to 300 kHz in the working environment [6].

Table 1. Limits and action values for exposure to EM fields up to 300 kHz in the working environment

Frequency range	Current density for head and trunk J (mA/m2) (rms)	Whole body average SAR (W/kg)	Localised SAR (head and trunk) (W/kg)	Localised SAR (limbs) (W/kg)	Power density S (W/m2)
Up to 1 Hz	40	–	–	–	–
1 — 4 Hz	40/f	–	–	–	–
4 — 1 000 Hz	10	–	–	–	–
1 000 Hz — 100 kHz	f/100	–	–	–	–
100 kHz — 10 MHz	f/100	0,4	10	20	–
10 MHz — 10 GHz	–	0,4	10	20	–
10 — 300 GHz	–	–	–	–	50

SAR – Specific energy absorption rate

Lathes

Machines in the processing of scraping – lathes are divided into categories for individual, serial and mass production, depending on the volume of production. Lathes Potisje Ada PA C 22 and Potisje Ada PA B 30 (Figure 2) are universal lathes belonging to individual production, which can easily costumize the transition from one configuration of the workpiece to another, and from one dimension to another. Technical characteristics of the lathes Potisje Ada PA C 22 and Potisje Ada PA 30 B are shown in Table 2.

Figure 2. Lathe Potisje Ada PA B 30

Table 2. Technical characteristics of latheas Potisje Ada PA C 22 and Ada Potisje PA 30 B

Machines in the processing of scraping Characteristic		Universal lathe PA B 30	Universal lathe PA C 22
Max. turning diameter D_{max} (mm)		800	650
Height spikes channel H (mm)		300	220
Distance spikes channel L (mm)		1500	1000
Electromotor	Typ	-	-
	P_M (kW)	7,5	7,5
	Speed n_M (o/min)	2400	2400
Cuttinig speed	n_{min} (o/min)	20	20
	n_{max} (o/min)	2400	2400
	φ_n	1,25	1,25
Cutting feed	s_{min} (mm/o)	0,040 (0,321)	0,040 (0,321)
	s_{max} (mm/o)	1,142 (9,136)	1,142 (9,136)
	φ_s	1,12	1,12

Experimental conditions

- Machine tool: Lathe Potisje Ada PA C 22, Lathe Potisje Ada PA B 30.
- Material and dimensions: Steel 17MnCr5 (SRPS EN 10027) Φ35 mm.
- Measuring equipment: Magnetosmog TYP WKDA 02.705.

3. RESULTS AND DISCUSSION

In Figure 3 is presented the electromagnetic induction in nT at the distance of 0.5 m from the lathe Potisje Ada PA C 22 with the following working conditions: cutting speed- n (rpm), cutting feed- s (mm/o) and cutting depth- t (mm).

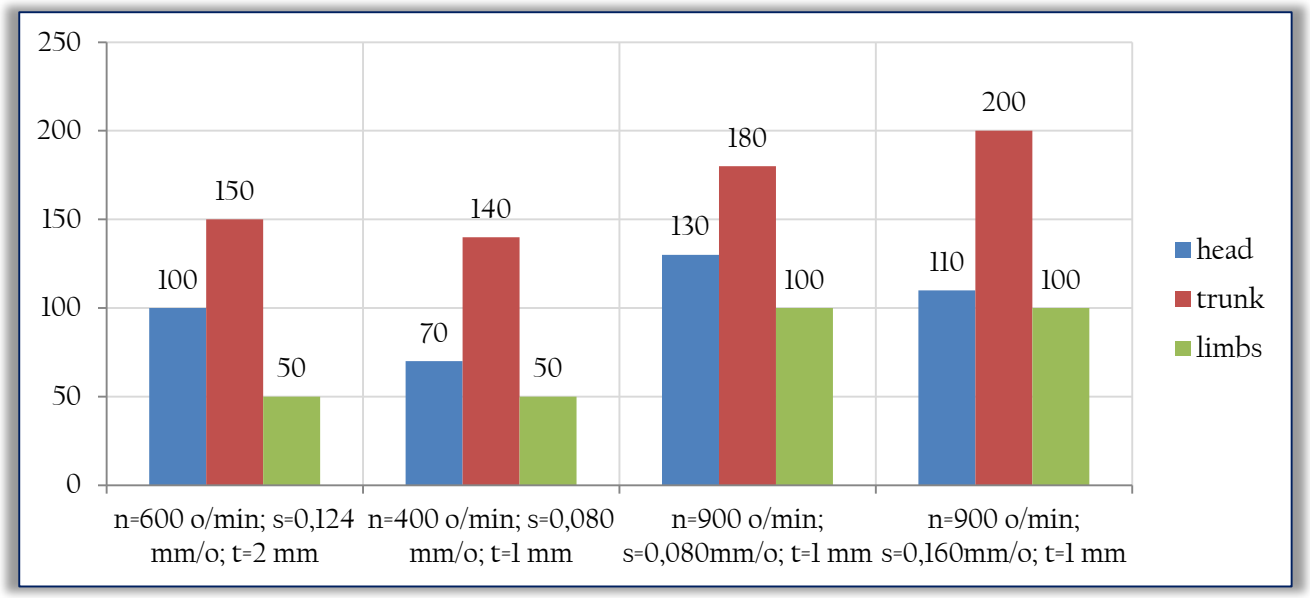

Figure 3. Electromagnetic induction in nT of the lathe Potisje Ada PA C 22

In figure 4 is presented the electromagnetic induction in nT at the distance of 0.5 m from the lathe Potisje Ada PA B 30 with the following working conditions: cutting speed - n (rpm), cutting feed - s (mm/o) and cutting depth - t (mm).

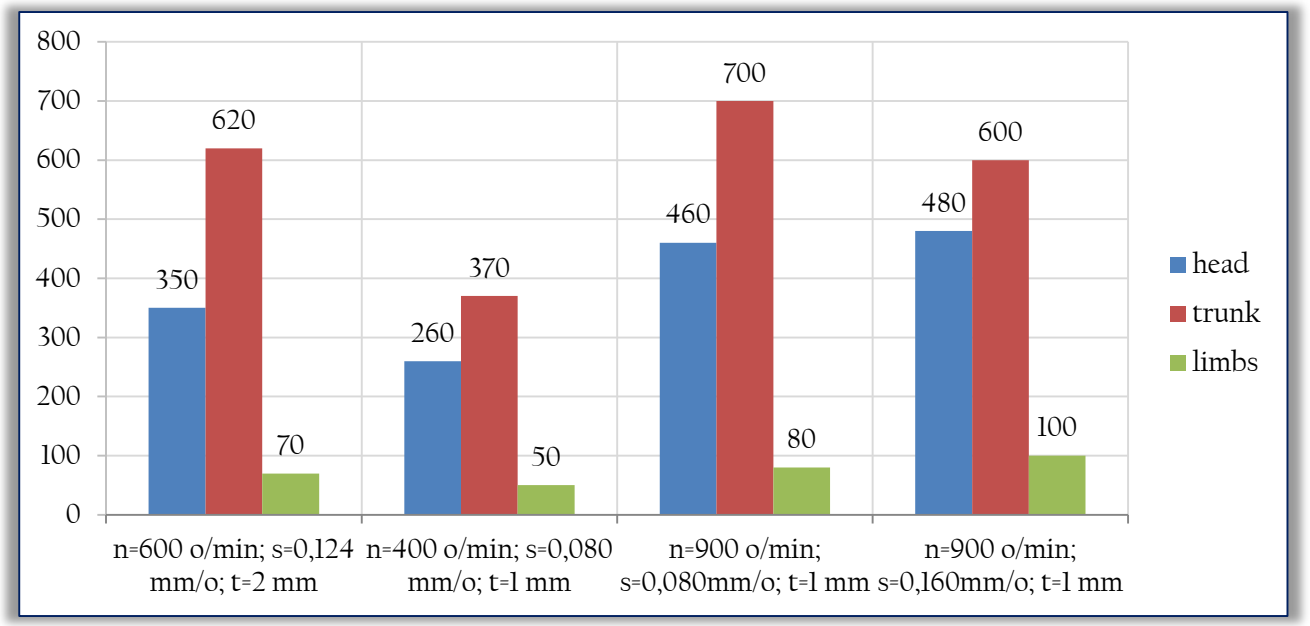

Figure 4. Electromagnetic induction in nT of the lathe Potisje Ada PA B 30

4. CONCLUSION

Based on the above presented it can be concluded that electromagnetic radiation that occurs in the process of scraping can cause adverse effect on the turner safety and health.

It can be concluded for the electromagnetic radiation that it exceeds the limit of normal levels (about 0.5 nT) in the area of the body for the lathe Potisje Ada PA B 30, while in other parts of the body the electromagnetic radiation is within the acceptable limits.

In the case of the lathe Potisje Ada PA C 22 the electromagnetic radiation is well below the permissible limits in all modes og cutting and all parts of the body.

In the end, it can be concluded that the electromagnetic radiation of the lathes increases with the increases of the cuting speed, cuting depth, and cuting feed.

Note

This paper is based on the paper presented at 7th International Conference Industrial Engineering and Environmental Protection 2017 – IIZS 2017, organized by University of Novi Sad, Technical Faculty "Mihajlo Pupin", in Zrenjanin, SERBIA, 12 – 13 October 2017.

References

[1] www.osha.gov, Occupational Safety and Health Administration.
[2] Pravilnik o bezbednosti mašina ("Sl. glasnik RS", br. 13/2010).
[3] Machinery Directive 2006/42/EC 1/3.
[4] Jovanović, J., Đinđić, B., Sokolović, D., Krstić, D., Petković, D., Babović, P., Marković, I., The damaging effects of exposure to extremely low frequences of electromagnetic fields, Acta Medica Medianae 2010, Vol.49 (1).
[5] www.znrfak.ni.ac.rs/, Cvetković, D., Fizički parametri radne i životne sredine elektromagnetna zračenja.
[6] Directive of the European Parliament and of the Council 2004/40/EC
[7] Jovanić, D., Milutinović, Z., Ristić, M., Determination of the welding machine electromagnetic field effect on health safety and protection, Welding and welding construction, ISSN 0354-7965, 2/2016, pp 63-62.
[8] Desnica, E., Nikolić, I., Trninić, V., Bojanić M., Reliability Design of the Casting Machines under High Pressure, Technical Gazette 24, 4(2017), pp. 1277-1282.

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