

Health effects of low frequency electromagnetic radiationM. Bilban^a and C. Bilban-Jakopin^b^a*Institute of Occupational Safety, Repnje 50, 1217 Vodice, Slovenia;* ^b*Institute of Oncology, Repnje 50, 1217 Vodice, Slovenia**marjan.bilban@zvd.si*

Introduction: We are surrounded by non-ionizing electromagnetic radiation of different frequencies, emitted by various apparatus. In vitro experiments have demonstrated that low-frequency electromagnetic radiation affects the modulation of ions in biological cells, especially Ca²⁺, whose homeostasis is crucial for vital physiological processes. This can cause oxidative stress, structural changes in the cell membrane and consequently changes in DNA and in protein biosynthesis. Cells function and proliferation can thus be changed, possibly leading to malignancy.

Materials and methods: Our research included 34 workers exposed to low frequency electromagnetic radiation in production and transfer of electric energy. The European Directive 2004/40/EC exposure limits were not exceeded for the electric field (10 kV/m), however they were at times exceeded for the magnetic field (100 μ T). For each participant a standard preventive medical examination, an analysis of structural aberration (200 metaphases per participant) and a micronuclei (MN) test (500 cells per participant). All participants also filled out a special questionnaire. **Results:** Average age of participants was 41.97 (SD 9.29). They worked at current workplace for 16.55 years (SD 11.58). In the questionnaire the following disorders were most frequently mentioned: tiredness, sleep disorder, irritability, excessive perspiration, low immune function and feeling of heat. The average share of structural aberrations was 4.02 % (SD 0.98), which is significantly more than the Slovene average of 1.88 %, and the same is true for the MN test (9.647 vs. 6.4). Those participants exposed to excessive magnitudes of magnetic field averaged higher values in structural aberration (4.13 %) and MN (9.82) than the rest of the participants, as did participants with a longer period of working at their workplaces (4.21 %; 10.42) however the differences were not statistically significant. **Conclusions:** Our study shows that working in areas of low frequency electromagnetic radiation can influence the workers' state of health. Increased levels of genome changes have been found in workers working in areas of higher magnetic fields and in workers with more years at the exposed workplace. Since our tests are non-specific, we cannot attribute the changes only the working environment and exposition to low frequency electromagnetic radiation. A comparison with a control group with no history of exposures is necessary.