

Power-Line frequency Magnetic Fields Effects on Human Neurophysiology and Motor Behaviors

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Various aspects of human behaviours have been studied in response to acute exposure to Extremely Low Frequency (ELF, < 300 Hz) magnetic fields (MF). Interestingly, a few studies have shown an increase in occipital alpha rhythm of resting electroencephalographic activity (EEG), a reduction of standing balance amplitude and a decrease in physiological tremor intensity with exposure. In the current context of reconsideration of the International Commission of Non Ionizing Radiation guidelines, the main objective of this study is to evaluate subtle effects of a 60 Hz MF exposure at 1800 μ T on human physiology, neurophysiology and motor functions in a single procedure in a multidimensional study. We hypothesize that MF exposure will (1) decrease peripheral blood flow but not affect ECG, (2) increase EEG power in occipital alpha rhythm, (3) decrease of standing balance sway amplitude, (4) not affect performance in voluntary movements of the hands, and (5) decrease physiological tremor amplitude. Effects should appear after several minutes of exposure.

This is a currently ongoing study, and to date 35 subjects between 18 and 55 of the 70 planned by the end of April 2007 have completed the experiment. They have completed a real and a sham exposure sessions given following a double blind counterbalanced procedure entirely computer driven. Each session includes 4 blocks of 15 minutes' testing (spaced with 15 minutes rest in between), each including: resting EEG, physiological tremor (dominant index finger), hands' voluntary movements, standing balance, local blood perfusion (tip of the non dominant middle finger), systolic blood pressure, skin temperature and ECG recordings. Blocks of testing are given 15 minutes before the exposure, 15 and 45 minutes after the beginning of the exposure, and 15 minutes after the end of the exposure. After each block, the subject answers the Field Status Questionnaire (FSQ) to assess his ability to detect the presence of the field

The full results will be presented at the URSI meeting, but currently only preliminary data are available: Occipital EEG, postural tremor and postural oscillations have been analyzed in 6 subjects comparing results of blocks 1 and 3. Within-subjects ANOVAs did not show any significant block effect for EEG, postural tremor and postural oscillations. Our positive control comparisons (significant eyes open/eyes closed differences) confirmed the sensibility of our protocol. A sample size calculation found that 68 subjects would be required to obtain significant differences between the real and sham conditions for the sway velocity index (i.e. standing balance, α fixed at .05, power = .80). It suggests that our final results (including 70 subjects) may indicate statistically significant effects of the exposure on specific human behaviours.