EXTREMELY LOW FREQUENCY (ELF, 0 TO 300 Hz) ELECTRIC AND MAGNETIC FIELDS, AND HEALTH PROTECTION

P. Czerski
Division of Risk Assessment - HFX 130
Food and Drug Administration, PHS, DHHS
Rockville, MD 20857
U.S.A.

The principal and universal source of human exposure at ELF frequencies is the widespread use of electrical energy distributed at frequencies of 50 Hz and 60 Hz. Research on biological effects concentrated at 50/60 Hz and thresholds for several effects (paralysis, heart fibrillation, field perception, etc) have been estabilshed. Levels, at which no immediate health effects and no discernible pathology over a period of years appear, can be indicated. However, recent research raised the question of long-term effects, such as leukemogenic and genetic effects. This is far from proven, and epidemiological and animal studies are needed to verify these hypotheses.

At frequencies other than 50/60 Hz, frequency-dependent phenomena appear over a certain field strength range, below and above which the effect cannot be demonstrated (amplitude window). Such an effect is the calcium efflux from brain tissue at 8 to 16 Hz. The threshold for induction of magnetophosphenes varies with frequency. Specific time-amplitude relationships are needed to induce electrical bone growth stimulation, electrical cell fusion and rotation.

The empirical observations will be discussed in the light of possible mechanisms of interaction, the understanding of which is still incomplete, and which are still controversial. Most data indicate that the site of primary interaction for several phenomena is the cell membrane, and that interference with electrochemical information transfer plays an important role.

Practical implications for general public, occupational and patient (bone growth stimulation, electroanaesthesia, nuclear resonance imaging) health safety will be discussed.