

Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the second trimester of 2006 .

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1. Reviews

SELECTION BIAS AND ITS IMPLICATIONS FOR CASE-CONTROL STUDIES: A CASE STUDY OF MAGNETIC FIELD EXPOSURE AND CHILDHOOD LEUKAEMIA.

Mezei G., Kheifets L.

Int J Epidemiol. 2006; 35 : 397-406.

Based on the epidemiological association between residential exposure to extremely low frequency-magnetic fields (ELF-MF) and childhood leukaemia, the International Agency for Research on Cancer classified ELF-MF as a possible human carcinogen. Since clear supportive laboratory evidence is lacking and biophysical plausibility of carcinogenicity of MFs is questioned, a causal relationship between childhood leukaemia and magnetic field exposure is not established. Among the alternative explanations, selection bias in epidemiological studies of MFs seems to be the most plausible hypothesis. In reviewing the epidemiological literature on ELF-MF exposure and childhood leukaemia, the authors found evidence both for and against the existence of selection bias. To evaluate the potential for selection bias, they examined the relationship of socioeconomic status to subject participation and exposure to MFs. They find that, often, reporting of selection processes in itself is biased and incomplete, making the interpretation and evaluation of a potential for bias difficult. However, if present, such a bias would have wide implications for case-control studies in general. They call for better reporting and for evaluation of the potential for selection bias in all case-control studies, as well as, for the development of novel methods in control selection and recruitment.

ELECTROMAGNETIC FIELDS AND FEMALE BREAST CANCER.

Feychting M., Forssen U.

Cancer Causes Control. 2006; 17 : 553-558.

The possibility that long term exposure to relatively weak power frequency electromagnetic fields (EMF) could increase the risk of breast cancer has been investigated during the past decade. The hypothesis is based on the assumption that magnetic field exposures suppress melatonin production and that melatonin is protective against breast cancer. Most epidemiological studies have indicated little or no overall effect of EMF exposure, but some early studies suggested effects among premenopausal women, particularly for estrogen receptor positive breast tumors. The early studies were often limited by small numbers, crude exposure information and lack of information on confounding factors. In more recent occupational studies, again no overall risk increases were reported, but some studies found increased risks in certain subgroups, although with no consistent pattern across studies. A recent very large occupational study with improved exposure assessment and enough statistical power also for subgroup analyses found no indications of increased risks in any

subgroups. Most of the recent well-designed residential studies report no increased risks, and similar findings are reported in the majority of studies of bed heating devices. Overall, the weight of the evidence available today does not suggest an increased risk of breast cancer related to EMF exposure.

IS MELATONIN THE HORMONAL MISSING LINK BETWEEN MAGNETIC FIELD EFFECTS AND HUMAN DISEASES?

Touitou Y., Bogdan A., Lambrozo J., Selmaoui B.
Cancer Causes Control. 2006 ; 17 : 547-552.

The disruption of melatonin secretion has been largely studied since it could provide the missing link between the exposure to 50/60-Hz electric and magnetic fields (EMF) and the occurrence of possible health effects as the "melatonin hypothesis". The authors analysed the current experimental data from animal (rodents) where contradictory results have been observed, and from human studies conducted with volunteers or with workers in various conditions of exposure, biological endpoints and metrics. In humans, even in long lasting exposures, the overall results of these studies do not support the "melatonin hypothesis". It is unlikely that malignancies or mood disorders reported by people exposed to 50/60-Hz EMF could be related to the disruption of the melatonin levels.

2. Experimental research

INDIVIDUAL SUBJECT SENSITIVITY TO EXTREMELY LOW FREQUENCY MAGNETIC FIELD.

Legros A., Beuter A.
Neurotoxicology. 2006 ; 27 : 534-546.

It is becoming important to specify the smallest effects of extremely low frequency (ELF) magnetic fields (MF) on human physiology. One difficulty is that some people seem more sensitive and more responsive than others to MF exposure. Consequently, within- and between-subject differences have to be taken into account when evaluating these effects. As shown in previous work, human postural tremor is sensitive to MF exposure. But data about individual responses have not been examined in detail. Thus, postural tremor of 24 subjects was evaluated under ELF MF "on" and "off" conditions in a double-blind real/sham exposure protocol. The direction of the tremor changes was analyzed individually for three tremor characteristics. Results showed that subjects with high amplitude tremor seem to be more responsive to MF exposure. MF had an instantaneous effect (between "on" and "off" conditions) and also a more delayed and persistent one (between real and sham conditions), but differences were small. Moreover, due to the within- and between-subject variability, no statistical analysis could be done. However, these results do not show any potentially harmful effect of domestic or industrial 50Hz MF on humans. They provide a starting point to orient future studies and should be taken into account in the establishment of new exposure limits.

BIOPHYSICAL MECHANISMS: A COMPONENT IN THE WEIGHT OF EVIDENCE FOR HEALTH EFFECTS OF POWER-FREQUENCY ELECTRIC AND MAGNETIC FIELDS.

Swanson J., Kheifets L.

Radiat Res. 2006 ; 165 : 470-478.

Comparatively high exposures to power-frequency electric and magnetic fields produce established biological effects that are explained by accepted mechanisms and that form the basis of exposure guidelines. Lower exposures to magnetic fields (< 1 microT average in the home) are classified as "possibly carcinogenic" on the basis of epidemiological studies of childhood leukemia. This classification takes into consideration largely negative laboratory data. Lack of biophysical mechanisms operating at such low levels also argues against causality. We survey around 20 biophysical mechanisms that have been proposed to explain effects at such low levels, with particular emphasis on plausibility: the principle that to produce biological effects, a mechanism must produce a "signal" larger than the "noise" that exists naturally. Some of the mechanisms are impossible, and some require specific conditions for which there is limited or no evidence as to their existence in a way that would make them relevant to human exposure. Others are predicted to become plausible above some level of field. We conclude that effects below 5 microT are implausible. At about 50 microT, no specific mechanism has been identified, but the basic problem of implausibility is removed. Above about 500 microT, there are established or likely effects from accepted mechanisms. The absence of a plausible biophysical mechanism at lower fields cannot be taken as proof that health effects of environmental electric and magnetic fields are impossible. Nevertheless, it is a relevant consideration in assessing the overall evidence on these fields.