

Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the third trimester of 2008

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1. Reviews

EXTREMELY LOW FREQUENCY (ELF) ELECTRIC AND MAGNETIC FIELD EXPOSURE LIMITS: RATIONALE FOR BASIC RESTRICTIONS USED IN THE DEVELOPMENT OF AN AUSTRALIAN STANDARD.

Wood AW.

Bioelectromagnetics. 2008; 29: 414-428.

There are large disparities between basic restrictions for exposure to extremely low-frequency (0-3 kHz) Electric and Magnetic Fields set by two major international bodies. Both bodies agree that these basic restrictions should prevent neuro-stimulatory effects: the retinal phosphene at frequencies up to a few hundred Hertz and peripheral nervous stimulation (PNS) at higher frequencies. The disparity arises from differences in estimated thresholds and frequency dependence, and whether restrictions should be of tissue induced current density or electric field. This paper argues that the latter metric more directly relates to neurostimulatory processes. By analysing available literature, a threshold for retinal phosphenes occurrence is found to be 56 mV/m (95% Confidence Interval 2-1330 mV/m), with a characteristic frequency of 20 Hz. Similarly, the smallest PNS sensation threshold is identified at 2 V/m (characteristic frequency above 3 kHz). In the case of the former, the large range of uncertainty suggests a 'power of ten' value of 100 mV/m. For the latter, because of the small margin between sensation and pain threshold, and because of the large individual variation, the smallest estimate of sensation threshold (2 V/m) represents a basic restriction with precaution incorporated.

2. Environmental exposure

SENSITIVITY TO ELECTRICITY--TEMPORAL CHANGES IN AUSTRIA.

Schröttner J, Leitgeb N.

BMC Public Health. 2008; 12: 310.

An increasing number of persons suffer from non-specific health symptoms such as headache, sleep disturbances, difficulties in concentrating and more. In lack of a medical explanation, more and more persons take refuge to the assumption that they were electromagnetic hypersensitive (EHS) and electromagnetic pollution causes their problems. The discussion whether electromagnetic fields (EMF) could cause such adverse health effects is still ongoing. Based on the Austrian inhabitants a statistical cross-sample of the general population with regard to age, gender and federal state had been investigated to assess the actual situation and potential temporal changes in comparison with a former study of 1994. In a telephone survey a total number of 526 persons were included. This study showed an actual EHS prevalence of 3.5% compared with 2% estimated in 1994. About 70% of the sample believed that electromagnetic pollution could be a risk factor for health. More than 30% declared to at least some degree to be concerned about their well-being near mobile phone base stations or power lines. However, only 10% were actively looking for specific information. Media triggered EHS hypothesis in 24% of the cases.

Conclusion: The results show that concerns about EMF did not decrease with time in spite of scientific studies and health risk assessments concluding that a causal relationship of EMF below recommended reference levels and non-specific health symptoms would be implausible.

A NEW ELECTROMAGNETIC EXPOSURE METRIC: HIGH FREQUENCY VOLTAGE TRANSIENTS ASSOCIATED WITH INCREASED CANCER INCIDENCE IN TEACHERS IN A CALIFORNIA SCHOOL.

Milham S, Morgan LL.

Am J Ind Med. 2008; 51: 579-586.

In 2003 the teachers at La Quinta, California middle school complained that they had more cancers than would be expected. A consultant for the school district denied that there was a problem. To investigate the cancer incidence in the teachers, and its cause the authors conducted a retrospective study of cancer incidence in the teachers' cohort in relationship to the school's electrical environment. Sixteen school teachers in a cohort of 137 teachers hired in 1988 through 2005 were diagnosed with 18 cancers. The observed to expected (O/E) risk ratio for all cancers was 2.78 (P = 0.000098), while the O/E risk ratio for malignant melanoma was 9.8 (P = 0.0008). Thyroid cancer had a risk ratio of 13.3 (P = 0.0098), and uterine cancer had a risk ratio of 9.2 (P = 0.019). Sixty Hertz magnetic fields showed no association with cancer incidence.

A new exposure metric, high frequency voltage transients, did show a positive correlation to cancer incidence. A cohort cancer incidence analysis of the teacher population showed a positive trend (P = 7.1 x 10⁻¹⁰) of increasing cancer risk with increasing cumulative exposure to high frequency voltage transients on the classroom's electrical wiring measured with a Graham/Stetzer (G/S) meter. The attributable risk of cancer associated with this exposure was 64%. A single year of employment at this school increased a teacher's cancer risk by 21%.

Conclusion: The cancer incidence in the teachers at this school is unusually high, was not associated with the 60 Hz magnetic fields but is strongly associated with high frequency voltage transients.

3. Occupational exposure

CARDIAC IMPLANTS AND ELECTROMAGNETIC EXPOSURE IN THE WORKPLACE.

M. Souques, I. Magne, A. Trigano, R. Frank, M. Héro, P. Schmitt, M. Nadi, F. Audran, J. Lambrozo.

Archives des Maladies Professionnelles et de l'Environnement 2008 ; 69 :547-552.

Pacemakers (PM) or implantable cardioverter-defibrillators (ICD) can be disturbed by magnetic field exposure at work. Based on experimental exposure of volunteers and the experience from in situ case studies, the authors present an approach to evaluate work safety and the worker's fitness in such situations.

For the PMs situations, there are data allowing to make a decision in the majority of the cases. In the case of ICD, an adapted study is necessary. A protocol for risk evaluation was finalized, where the worker may move within the framework of his professional activity. These measures are made in his presence, while simultaneously monitoring the operation of the device.

Three practical realized cases of measurements are presented, with their difficulties of realization and their results.

Conclusion: A decision about the worker's fitness can then be taken on the basis of this information. This approach can be extended to the other medical implants and with electromagnetic spectrum frequencies different from 50 Hz.

4. Leukemia studies

RESIDENTIAL TRAFFIC DENSITY AND CHILDHOOD LEUKEMIA RISK.

Von Behren J, Reynolds P, Gunier RB, Rull RP, Hertz A, Urayama KY, Kronish D, Buffler PA.

Cancer Epidemiol Biomarkers Prev, 2008; 9: 2298-2301

Exposures to carcinogenic compounds from vehicle exhaust may increase childhood leukemia risk, and the timing of this exposure may be important. The authors examined the association between traffic density and childhood leukemia risk for three time periods: birth, time of diagnosis, and lifetime average, based on complete residential history in a case-control study. Cases were rapidly ascertained from participating hospitals in northern and central California between 1995 and 2002. Controls were selected from birth records, individually matched on age, sex, race, and Hispanic ethnicity. Traffic density was calculated by estimating total vehicle miles travelled per square mile within a 500-foot (152 meter) radius area around each address. Conditional logistic regression analyses was used to account for matching factors and to adjust for household income. 310 cases of acute lymphocytic leukemias (ALL) and 396 controls were included in the analysis. The odds ratio for ALL and residential traffic density above the 75th percentile, compared with subjects with zero traffic density, was 1.17 [95% confidence interval (95% CI), 0.76-1.81] for residence at diagnosis and 1.11 (95% CI, 0.70-1.78) for the residence at birth. For average lifetime traffic density, the odds ratio was 1.24 (95% CI, 0.74-2.08) for the highest exposure category.

Conclusions: Living in areas of high traffic density during any of the exposure time periods was not associated with increased risk of childhood ALL in this study.