

Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the third trimester of 2011

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1. Residential exposure

OCCUPATIONAL AND RESIDENTIAL EXPOSURE TO ELECTROMAGNETIC FIELDS AND RISK OF BRAIN TUMORS IN ADULTS: A CASE-CONTROL STUDY IN GIRONDE, FRANCE.

Baldi I, Coureau G, Jaffré A, Gruber A, Ducamp S, Provost D, Lebailly P, Vital A, Loiseau H, Salamon R.

Int J Cancer. 2011; 129: 1477-1484.

The etiology of brain tumors remains largely unknown. Among potential risk factors, exposure to electromagnetic fields is suspected. The authors analyzed the relationship between residential and occupational exposure to electromagnetic field and brain tumors in adults. A case-control study was carried out in southwestern France between May 1999 and April 2001. A total of 221 central nervous system tumors (105 gliomas, 67 meningiomas, 33 neurinomas and 16 others) and 442 individually age- and sex-matched controls selected from general population were included. Electromagnetic field exposure [extremely low frequency (ELF) and radiofrequency separately was assessed in occupational settings through expert judgement based on complete job calendar, and at home by assessing the distance to power lines with the help of a geographical information system. Confounders such as education, use of home pesticide, residency in a rural area and occupational exposure to chemicals were taken into account. Separate analyses were performed for gliomas, meningiomas and acoustic neurinomas. A nonsignificant increase in risk was found for occupational exposure to electromagnetic fields [odds ratio (OR = 1.52, 0.92-2.51)]. This increase became significant for meningiomas, especially when considering ELF separately [OR = 3.02; 95 percent confidence interval (95% CI) =1.10-8.25]. The risk of meningioma was also higher in subjects living in the vicinity of power lines (<100 m), even if not significant (OR = 2.99, 95% CI 0.86-10.40).

Conclusion: These data suggest that occupational or residential exposure to ELF may play a role in the occurrence of meningioma.

2. Exposure assessment

EXTREMELY LOW FREQUENCY MAGNETIC FIELD MEASUREMENTS IN BUILDINGS WITH TRANSFORMER STATIONS IN SWITZERLAND.

Röösli M, Jenni D, Kheifets L, Mezei G.

Sci Total Environ. 2011; 409: 3364-3369.

The aim of this study was to evaluate an exposure assessment method that classifies apartments in three exposure categories of extremely low frequency magnetic fields (ELF-MF) based on the location of the apartment relative to the transformer room. Measurements in 39 apartments in 18 buildings were completed. In each room of the apartments ELF-MF was concurrently measured with 5 to 6 EMDEX II meters for 10 min. Measured arithmetic mean ELF-MF was 0.59 μ T in 8 apartments that were fully adjacent to a transformer room, either directly above the transformer or touching the

transformer room wall-to-wall. In apartments that only partly touched the transformer room at corners or edges, average ELF-MF level was 0.14 μT . Average exposure in the remaining apartments was 0.10 μT . Kappa coefficient for exposure classification was 0.64 (95%-CI: 0.45-0.82) if only fully adjacent apartments were considered as highly exposed ($>0.4 \mu\text{T}$). The authors found a distinct ELF-MF exposure gradient in buildings with transformer.

Conclusion: Exposure classification based on the location of the apartment relative to the transformer room appears feasible. Such an approach considerably reduces effort for exposure assessment and may be used to eliminate selection bias in future epidemiologic studies.

ASSESSMENT OF OCCUPATIONAL EXPOSURE TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS IN HOSPITAL PERSONNEL.

Úbeda A, Martínez MA, Cid MA, Chacón L, Trillo MA, Leal J.

Bioelectromagnetics. 2011; 32: 378-387.

It has been proposed that chronic exposure to extremely low frequency (ELF) magnetic fields (MF) in occupational environments could represent a risk factor for a number of disorders. Medical and technical workers in hospitals have been reported to be exposed to relatively strong ELF fields. The present work aims to characterize exposure to MF in the 5 Hz to 2 kHz frequency range in a large hospital through both instantaneous environmental measurements and personal monitoring of workers.

The study was conducted in different working environments of a hospital with about 4400 employees, many of them working at two or more different work stations and consequently, exposed to MF levels that were expected to be unevenly distributed in space and time.

Conclusion: The results indicate that: (1) The dominant frequency at the studied environments was 50 Hz (average 90.8 \pm 6 % of the total B value); (2) The best descriptive information on a worker's exposure is obtained from personal monitoring of volunteer workers; (3) The arithmetic averages of exposure levels obtained from the monitoring ranged from 0.03 \pm 0.01 μT in nurses to 0.39 \pm 0.13 μT in physiotherapists; and (4) The description of the MF environment through spot measurements in the workplace, although coherent with the data from personal monitoring, might not adequately estimate MF exposure in some professional categories.

MEASURING EXPOSED MAGNETIC FIELDS OF WELDERS IN WORKING TIME.

Yamaguchi-Sekino S, Ojima J, Sekino M, Hojo M, Saito H, Okuno T.

Ind Health. 2011; 49: 274-279.

The assessment of the occupational electromagnetic field exposure of welders is of great importance, especially in shielded-arc welding, which uses relatively high electric currents of up to several hundred amperes. In the present study, the authors measured the magnetic field exposure level of welders in the course of working. A 3-axis Hall magnetometer was attached to a subject's wrist in order to place the sensor probe at the closest position to the magnetic source (a cable from the current source). Data was acquired every 5 s from the beginning of the work time. The maximum exposed field was 0.35-3.35 mT (Mean \pm SD: 1.55 \pm 0.93 mT, N=17) and the average value per day was 0.04-0.12 mT (Mean \pm SD: 0.07 \pm 0.02 mT, N=17). The authors also conducted a finite element method-based analysis of human hand tissue for the electromagnetic field dosimetry. In addition, the magnetic field associated with

grinders, an air hammer, and a drill using electromagnetic anchorage were measured; however, the magnetic fields were much lower than those generated in the welding process. These results agreed well with the results of the electromagnetic field dosimetry (1.49 mT at the wrist position), and the calculated eddy current (4.28 mA/m(2)) was much lower than the well-known guideline thresholds for electrical nerve or muscular stimulation.

3. Leukaemia studies

EXPOSURE TO PESTICIDES AND RISK OF CHILDHOOD CANCER: A META-ANALYSIS OF RECENT EPIDEMIOLOGICAL STUDIES.

Vinson F, Merhi M, Baldi I, Raynal H, Gamet-Payrastre L.

Occup Environ Med. 2011; 68: 694-702.

The authors performed a meta-analysis of case-control and cohort studies to clarify the possible relationship between exposure to pesticides and childhood cancers.

Two cohort and 38 case-control studies were selected for the first meta-analysis. After evaluating homogeneity among studies using the Cochran Q test, the authors calculated a pooled meta-OR stratified on each cancer site. The authors then constructed a list of variables believed to play an important role in explaining the relation between parental exposure to pesticide and childhood cancer, and performed a series of meta-analyses. The authors also performed a distinct meta-analysis for three cohort studies with RR data.

Meta-analysis of the three cohort studies did not show any positive links between parental pesticide exposure and childhood cancer incidence. However, the meta-analysis of the 40 studies with OR values showed that the risk of lymphoma and leukaemia increased significantly in exposed children when their mother was exposed during the prenatal period (OR=1.53; 95% CI 1.22 to 1.91 and OR=1.48; 95% CI 1.26 to 1.75). The risk of brain cancer was correlated with paternal exposure either before or after birth (OR=1.49; 95% CI 1.23 to 1.79 and OR=1.66; 95% CI 1.11 to 2.49). The OR of leukaemia and lymphoma was higher when the mother was exposed to pesticides (through household use or professional exposure). Conversely, the incidence of brain cancer was influenced by the father's exposure (occupational activity or use of household or garden pesticides).

Conclusion: Despite some limitations in this study, the incidence of childhood cancer does appear to be associated with parental exposure during the prenatal period.

PARENTAL EXPOSURE TO CARCINOGENS AND RISK FOR CHILDHOOD ACUTE LYMPHOBLASTIC LEUKEMIA, COLOMBIA, 2000-2005.

Castro-Jiménez MÁ, Orozco-Vargas LC.

Prev Chronic Dis. 2011 ; 8: A106.

The objective of this study was to determine the risk factors for childhood acute lymphoblastic leukemia (ALL) and, in particular, the role of parental occupational exposure to carcinogenic and probably carcinogenic hydrocarbons before the child's conception.

For this case-control study, cases were children younger than 15 years who were newly diagnosed with ALL between January 2000 and March 2005 at 1 of 6 Colombian hospitals. An interview with both parents of 170 children (85 cases and 85

individually matched neighborhood controls) gathered information about each child's exposures and parental demographic and occupational characteristics, medical history, health risk behaviors, and pregnancy and birth history. A job-exposure matrix was used to classify parental exposure to hydrocarbons on the basis of the main industrial activity of each workplace where parents worked before (both parents) or during the index pregnancy (mother only). Conditional odds ratios and 95% confidence intervals were calculated by period of exposure (preconception, pregnancy, and childhood).

The risk of childhood ALL was linked to 1) parental occupational exposure to hydrocarbons before conception, 2) parental smoking before conception, 3) maternal low socioeconomic status during pregnancy, and 4) higher maternal age (≥ 35 y) at the child's birth.

Conclusion: These findings suggest an association between childhood ALL and parental occupational exposure to carcinogenic and probably carcinogenic hydrocarbons before conception. Outcomes depended on the parent exposed. Future research should investigate the additive or multiplicative role of other environmental sources of hydrocarbons.