

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

Dr. Maurits De Ridder
Occupational and Environmental Health Section
Ghent University

1. Residential exposure

NON-SPECIFIC PHYSICAL SYMPTOMS IN RELATION TO ACTUAL AND PERCEIVED PROXIMITY TO MOBILE PHONE BASE STATIONS AND POWERLINES.

Baliatsas C, van Kamp I, Kelfkens G, Schipper M, Bolte J, Yzermans J, Lebrecht E.
BMC Public Health 2011;11:421.

Evidence about a possible causal relationship between non-specific physical symptoms (NSPS) and exposure to electromagnetic fields (EMF) emitted by sources such as mobile phone base stations (BS) and powerlines is insufficient. So far little epidemiological research has been published on the contribution of psychological components to the occurrence of EMF-related NSPS. The prior objective of the current study is to explore the relative importance of actual and perceived proximity to base stations and powerlines and psychological components as determinants of NSPS, adjusting for demographic, residency and area characteristics.

Analysis was performed on data obtained in a cross-sectional study on environment and health in 2006 in the Netherlands. In the current study, 3611 adult respondents (response rate: 37%) in twenty-two Dutch residential areas completed a questionnaire. Self-reported instruments included a symptom checklist and assessment of environmental and psychological characteristics. The computation of the distance between household addresses and location of base stations and powerlines was based on geo-coding. Multilevel regression models were used to test the hypotheses regarding the determinants related to the occurrence of NSPS.

After adjustment for demographic and residential characteristics, analyses yielded a number of statistically significant associations: Increased report of NSPS was predominantly predicted by higher levels of self-reported environmental sensitivity; perceived proximity to base stations and powerlines, lower perceived control and increased avoidance (coping) behavior were also associated with NSPS. A trend towards a moderator effect of perceived environmental sensitivity on the relation between perceived proximity to BS and NSPS was verified ($p = 0.055$). There was no significant association between symptom occurrence and actual distance to BS or powerlines.

Conclusions: Perceived proximity to BS, psychological components and socio-demographic characteristics are associated with the report of symptomatology. Actual distance to the EMF source did not show up as determinant of NSPS.

2. Exposure assessment

EXPOSURE TO 50HZ MAGNETIC FIELDS IN APARTMENT BUILDINGS WITH INDOOR TRANSFORMER STATIONS IN ISRAEL.

Hareuveny R, Kandel S, Yitzhak NM, Kheifets L, Mezei G.

J Expo Sci Environ Epidemiol. 2011 ; 21(4):365-371.

To advance the understanding of an association between exposure to power frequency magnetic fields (MFs) and the risk of childhood leukemia, a study that is convincingly free of selection and response bias, with highly accurate exposure assessment and a large number of highly exposed individuals should be conducted. Previous measurements revealed that MF in apartments located above internal transformer stations (ITSs) are higher than in other apartments in the same building. An international epidemiologic study of childhood leukemia, TransExpo, was designed to take advantage of this scenario. This article presents the results of an exposure assessment study performed in apartment buildings with ITS in Israel. Measurements were performed in 41 apartments within 10 buildings. Average MF at the height of 0.5 m was 0.40 μ T in apartments above the ITS and 0.06-0.12 μ T in all other apartments. These results confirm that classification of MF exposure based on apartment location is feasible with remarkable specificity (0.98 and 0.96 for cutoff points of 0.2 and 0.4 μ T, respectively) and sensitivity (1.00 for both cutoff points).

Conclusions: Because the location of an apartment relative to the ITS can be easily determined, an exposure assessment can reliably be performed without obtaining access to residences.

SURVEY OF ELF MAGNETIC FIELD LEVELS IN HOUSEHOLDS NEAR OVERHEAD POWER LINES IN SERBIA.

Vulevic B, Osmokrovic P.

Radiat Prot Dosimetry. 2011; 145(4):385-388.

During the last eight years, 'VINČA' Institute-Radiation and Environmental Protection Laboratory has performed environmental 'spot' broadband measurements of extremely low frequency (ELF-50 Hz) electric and magnetic fields and RF (100 kHz-3 GHz) electromagnetic fields in over 35 municipalities in Serbia. These investigations were motivated by the local population requesting information about levels of general public exposure to time-varying electric and magnetic fields in living spaces. This paper presents a summary of values measured in households under overhead power lines. These measurements are useful in determining the exposure levels of the general public, which in turn determines whether the exposure levels are within reference levels recommended by International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines.

Conclusions: It has turned out that measured values are far below the recommended safe levels.

OCCUPATIONAL EXPOSURE TO ELECTRIC AND MAGNETIC FIELDS WHILE WORKING AT SWITCHING AND TRANSFORMING STATIONS OF 110 KV.

Korpinen L, Kuisti H, Pääkkönen R, Vanhala P, Elovaara J.

Ann Occup Hyg. 2011; 55(5):526-36.

The aim of the study was to measure occupational exposure to electric and magnetic fields during various work tasks at switching and transforming stations of 110 kV (in some situations 20 kV), and analyze if the action values of European Union Directive 2004/40/EC or reference values of International Commission on Non-ionizing Radiation Protection (ICNIRP) were exceeded. The electric (n = 765) and magnetic (n = 203) fields were measured during various work tasks. The average values of all measurements were 3.6 kV m⁻¹ and 28.6 μT. The maximum value of electric fields was 15.5 kV m⁻¹ at task 'maintenance of operating device of circuit breaker from service platform'. In one special work task close to shunt reactor cables (20 kV), the highest magnetic field was 710 μT.

Conclusions: In general, the measured magnetic fields were below the reference values of ICNIRP.

MEASUREMENT OF THE MAGNETIC FIELDS OF HIGH-VOLTAGE SUBSTATIONS (230 KV) IN TEHRAN (IRAN) AND COMPARISON WITH THE ACGIH TRESHOLD LIMIT VALUES.

Sharifi Fard M, Nasiri P, Monazzam MR.

Radiat Prot Dosimetry. 2011;145(4):421-425.

Measurements were made according to IEEE standard 644-1994 at a height of 1 m above floor level. It is concluded that none of the measurements exceeded the ACGIH threshold limit value. Among all control rooms the highest measured density amount is 0.69 μT in the control room of Ozgol substation and the lowest is 0.2 μT in the post of Shahid Firouzi. The control room of Ozgol substation is located in the second floor and bus-bars are located at a short distance from the window on the east, and so the highest recorded magnetic field is measured in this control room. Among all switchgear parts the highest amount 9.15 μT is measured in Kan substation.

Conclusions: None of the measurements exceeded the ACGIH threshold limit value.

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(3):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, we 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 ± SD: 1.55 ± 0.93 mT, N=17) and the average value per day was 0.04-0.12 mT (Mean ± SD: 0.07 ± 0.02 mT, N=17). We 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.

Conclusions: 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/m²) was much lower than the well-known guideline thresholds for electrical nerve or muscular stimulation.

3. Leukaemia studies

ROAD TRAFFIC AND CHILDHOOD LEUKEMIA: THE ESCALE STUDY (SFCE).

Amigou A, Sermage-Faure C, Orsi L, Leverger G, Baruchel A, Bertrand Y, Nelken B, Robert A, Michel G, Margueritte G, Perel Y, Mechinaud F, Bordignon P, Hémon D, Clavel J.

Environ Health Perspect. 2011;119(4):566-572.

A national registry-based case-control study [ESCALE (Etude Sur les Cancers et les Leucémies de l'Enfant, Study on Environmental and Genetic Risk Factors of Childhood Cancers and Leukemia)] carried out in France was used to assess the effect of exposure to road traffic exhaust fumes on the risk of childhood leukemia.

Over the study period, 2003-2004, 763 cases and 1,681 controls < 15 years old were included, and the controls were frequency matched with the cases on age and sex. The ESCALE data were collected by a standardized telephone interview of the mothers. Various indicators of exposure to traffic and pollution were determined using the geocoded addresses at the time of diagnosis for the cases and of interview for the controls. Indicators of the distance from, and density of, main roads and traffic nitrogen dioxide (NO₂) concentrations derived from traffic emission data were used. Odds ratios (ORs) were estimated using unconditional regression models adjusted for potential confounders.

Acute leukemia (AL) was significantly associated with estimates of traffic NO₂ concentration at the place of residence > 27.7 µg/m³ compared with NO₂ concentration < 21.9 µg/m³ [OR=1.2; confidence interval (CI), 1.0-1.5] and with the presence of a heavy-traffic road within 500 m compared with the absence of a heavy-traffic road in the same area (OR=2.0; 95% CI, 1.0-3.6). There was a significant association between AL and a high density of heavy-traffic roads within 500 m compared with the reference category with no heavy-traffic road within 500 m (OR=2.2; 95% CI, 1.1-4.2), with a significant positive linear trend of the association of AL with the total length of heavy-traffic road within 500 m.

Conclusions: This study supports the hypothesis that living close to heavy-traffic roads may increase the risk of childhood leukemia.

EXPOSURE TO HOUSE PAINTING AND THE USE OF FLOOR TREATMENTS AND THE RISK OF CHILDHOOD ACUTE LYMPHOBLASTIC LEUKEMIA.

Bailey HD, Milne E, de Klerk NH, Fritschi L, Attia J, Cole C, Armstrong BK; Aus-ALL Consortium.

Int J Cancer. 2011;128(10):2405-2414.

Painting in the home has been identified as a potential risk factor for childhood acute lymphoblastic leukemia (ALL). The aim of this analysis was to investigate

whether exposure to house painting or floor treatments before birth or during childhood increased the risk of childhood ALL. Data from 389 cases and 876 frequency-matched controls were analyzed using unconditional logistic regression, adjusting for study matching variables and potential confounders. Overall, there was little evidence of an increased risk with painting inside the house in the year before the pregnancy, during the pregnancy, or after the child's birth; however, the risk appeared to be increased in certain circumstances. The odds ratio (OR) for more than three rooms being painted during pregnancy was 1.68 [95% confidence interval (CI) 1.01, 2.80]. The OR for someone other than the parents painting inside the house in the year before the pregnancy was 2.37 (95% CI 1.30, 4.30) and 3.07 (95% CI 1.46, 6.46) when more than three rooms were painted. The OR for the mother painting the outside of the house with oil-based paint in the year before the pregnancy was 2.97 (95% CI 1.06, 8.33). No association was found with having floor treatments in any time period.

Conclusions: The authors found some evidence of an increased risk of ALL associated with house painting. An apparently increased risk associated with someone other than the parents painting inside the house may be related to the amount of paint used and the intensity of the dose received.

ASSOCIATIONS BETWEEN VACCINATION AND CHILDHOOD CANCERS IN TEXAS REGIONS.

Pagaoa MA, Okcu MF, Bondy ML, Scheurer ME.
J Pediatr. 2011;158(6):996-1002.

The purpose of this study was to determine whether children born in Texas regions with higher vaccination coverage had reduced risk of childhood cancer.

The Texas Cancer Registry identified 2800 cases diagnosed from 1995 to 2006 who were (1) born in Texas and (2) diagnosed at ages 2 to 17 years. The state birth certificate data were used to identify 11 200 age- and sex-matched control subjects. A multilevel mixed-effects regression model compared vaccination rates among cases and control subjects at the public health region and county level.

Children born in counties with higher hepatitis B vaccine coverage had lower odds of all cancers combined (OR = 0.81, 95% CI: 0.67 to 0.98) and acute lymphoblastic leukemia (ALL) specifically (OR = 0.63, 95% CI: 0.46 to 0.88). A decreased odds for ALL also was associated at the county level with higher rates of the inactivated poliovirus vaccine (OR = 0.67, 95% CI: 0.49 to 0.92) and 4-3-1-3-3 vaccination series (OR = 0.62, 95% CI: 0.44 to 0.87). Children born in public health regions with higher coverage levels of the Haemophilus influenzae type b-conjugate vaccine had lower odds of ALL (OR: 0.58; 95% CI: 0.42 to 0.82).

Conclusions: Some common childhood vaccines appear to be protective against ALL at the population level.