

Emfs

CEMinder et al. American Journal of Epidemiology. May (2001) Vol. 153 #9 p 825.

A study of a proposed association between mortality from leukaemia or brain cancer, with exposure to Emfs at 16.6 Hz.

Line engineers (drivers) (6879), shunting yard engineers (1314), train attendants (5720) and stationmasters (4157) were studied. The stationmasters were used as the control group. It was assumed that job description at the time of the study was also the job of longest duration.

In principle, an engine drivers position and exposure are accurately known, ELF magnetic fields can be accurately measured at the seat and therefore total, at-work exposure, can be reliably calculated.

The study accounted for 270155 person years exposed. Subjects were typically aged 45 at the beginning of study (1973 to 1993 employment cohort).

The link between employment record and health outcome was made on a probabilistic basis (in order to protect medical confidentiality). The accuracy of the link was believed to better than 99%.

The exposure of concern to this study was 16.66 Hz magnetic field. Measurements of actual exposure were recorded as root mean square magnetic field and, the fraction of the working day spent with exposures above 10 micro Tesla. For fixed position staff, exposures were recorded every 10 seconds. For mobile staff, spot measurements were made at their usual location.

Use of cleaning agents and smoking history were recorded and discussed as potential confounders.

Typical exposures range from 3 to 6000 micro Tesla, but see table below

In 1990:

Occupation	Mean Exposure - Micro Tesla years	% of time at > 10 microTesla
Line Engineer	25.9	47.5%
Shunter	13.4	9.7%
Train attendant	3.3	3.6%
Stationmaster	1.0	0.0 %

Exposure has been increasing over the course of the century.

Two statistically significant results were found.

1. An association between thoracic exposure to more than 10 micro Tesla for more than 6 months had a Risk Ratio for leukaemia of 2.43 (95% CI = 1.1, 5.4).
2. Shunting yard engineers had a higher risk of brain cancer, RR = 5.06 (95% CI = 1.21, 21.2)

For line engineers the relative risk of leukaemia was 2.44 (95% CI = 0.97, 6.11), which is of borderline statistical significance.

The authors state their belief that there is evidence for a dose response relationship for leukaemia and that high peak exposures could also be problematic.

Comment

This is a very powerful and on the whole, well designed study, employing objective measurements in an unusually thorough manner. However, there remains some doubt about the socioeconomic status of the control group. Other research in this field has made extensive use of socioeconomic variables in analysis and has generally found them to be significant.

Our own view of the evidence as presented would not concur with that of the authors, on the point about dose response relationships. In fact the results seem to show a chaotic relationship with exposure unless more weight is given to the less statistically significant results. The validity of such an approach may at first appear doubtful, but a full reanalysis of the data is beyond the scope of this review.

It still remains unclear exactly what form of exposure measurement should be made when assessing the proposed association between emfs exposure and ill health outcomes. Much more work is needed on pathogenesis before the relevant exposure metric can be identified with certainty. One further point of note is that the pathogenesis of the various types of leukaemia need not be uniform. That is, studies of proposed associations should really attempt to discriminate one form of leukaemia from another.

