Australian Government
Australian Radiation Protection and Nuclear Safety Agency

Fact Sheet 19

Electricity and Health

The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health

This fact sheet has been prepared to address concerns that exposure to electric and magnetic fields may increase the risk of childhood leukaemia. Powerlines are a highly visible source of these fields, but any electrical device is capable of producing them. Australians are exposed to these fields, to varying extents, throughout their lives.

The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near power lines is a hazard to human health.

Current science would suggest that if any risk exists, it is small.

Electric and Magnetic Fields

Electrical power distribution and use generates both electric and magnetic fields. These fields are generated in Australia at a frequency of 50 hertz (Hz) (number of oscillations per unit time), and are referred to as extremely low frequency (ELF) fields. The strength of the electric field depends on the voltage (typically 240 V for households) and is present near any live wire whether an electrical appliance is being used or not. At the present time there is no proven evidence that exposure to low level electric fields is a health hazard (excluding of course electric shock).

Magnetic fields are produced by electric currents. When an electrical appliance is turned off at the wall, there is no magnetic field - a magnetic field is created around the lead and the appliance when it is operating. It is the magnetic fields from street wiring which have given rise to concerns over a possible association with childhood leukaemia.

Scientific Studies on Health Effects

Several types of studies have been conducted to determine whether there is a health hazard from 50 Hz magnetic fields. In cell studies, cells are exposed to magnetic fields and then examined to see whether changes occur in their normal growth pattern. The experiments performed on cells demonstrate that the magnetic fields do not bring about the changes normally associated with the start of cancer initiation. Animal studies on rats and mice have not shown that magnetic fields increase the risk of cancer. Other studies have not convincingly demonstrated that magnetic fields reduce or alter melatonin levels in humans. Melatonin is thought by some to be a natural cancer suppressor. There is, however, weak evidence of an association with childhood leukaemia from modern epidemiological studies. Epidemiological studies investigate possible associations between magnetic fields and health effects by studying the patterns of magnetic field exposure and disease in different groups of people.

The 2001 Doll Report

The following conclusions are from a review of the research literature published in March 2001 by a committee chaired by Sir Richard Doll, for the National Radiological Protection Board in the UK.

> *"Laboratory experiments have provided no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer, nor do human epidemiological studies suggest that they cause cancer in general. There is, however, some epidemiological evidence that prolonged exposure to higher levels [more than 0.4 µT] of power frequency magnetic fields is associated with a small risk of leukaemia in children. In practice, such levels of exposure are seldom encountered by the general public in the UK. In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukaemia in children. Unless, however, further research indicates that the finding is due to chance or some currently unrecognised artefact, the possibility remains that intense and prolonged exposures to magnetic fields can increase the risk of leukaemia in children."*
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> From ELF Electromagnetic Fields and the Risk of Cancer, National Radiological Protection Board, 2001.

The average level of 0.4 µT referred to in the conclusion to the Doll report is not an exposure limit or safe level. This

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exposure level was arbitrarily selected to distinguish 'exposed' and 'unexposed' participants in epidemiological studies. More detailed studies, that include a determination of any relationship between exposure and risk, are required before an exposure limit relevant to avoiding a cancer risk, if it exists, can be determined.

The IARC Classification and the WHO Health Risk Assessment

In 2002 the International Agency for Research on Cancer (IARC) reviewed all the available evidence in relation to ELF fields and cancer. Based on the 'limited' association between ELF magnetic fields and childhood leukaemia found in epidemiologic studies and 'inadequate' animal data, IARC classified ELF magnetic fields as a 'possible human carcinogen'.

In 2007, the World Health Organization (WHO) reviewed the evidence in an Environmental Health Criteria Monograph by focusing mainly on studies published after the IARC review. The WHO concluded that new studies do not change the overall classification of ELF magnetic fields as a possible human carcinogen.

The Possible Risk

If the relationship between prolonged and higher than-normal magnetic fields and childhood leukaemia was found to be causal it would be possible to estimate how many of the annual cases of childhood leukaemia (age 0-14 years) are due to residential magnetic field exposure. A survey of 296 randomly selected houses conducted by ARPANSA in Melbourne suggested that the magnetic field in a child's bedroom exceeded 0.4 µT in approximately 2% of houses. If this percentage applied to all Australian houses and the epidemiological results showing an association with childhood leukaemia were valid in Australia then it could be estimated that about 5 cases out of 228 annual cases of childhood leukaemia[1] could be due to exposure to residential magnetic fields.

Exposure to 50 Hz Magnetic Fields

The strength of magnetic fields is described in one of two distinct units, microtesla (µ) and milligauss (mG), where 1 µT = 10 mG.

Magnetic fields within homes can vary greatly. The figure opposite shows a range of measurements of magnetic fields made around powerlines and in Australian homes.

ARPANSA has meters available for hire to measure the levels of magnetic fields. It is important to remember, however, that research suggests that if any health effects exist, they are associated with prolonged exposure. Measurements at one point in time do not accurately reflect prolonged exposure levels.

Reducing Exposures to Magnetic Fields

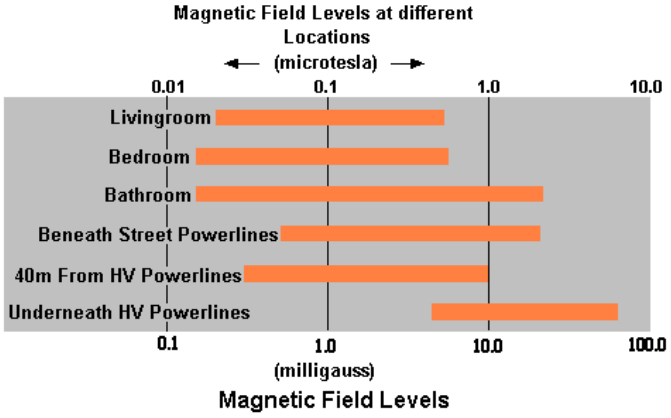
The magnitude of both electric and magnetic fields decreases rapidly with increasing distance from the source. The easiest way to reduce your exposure to these fields, if you wish to do so, may simply be to separate areas where people spend a lot of time (for example, chairs, beds) from electrical appliances and facilities by re-arranging room layouts.

Some electric blankets and underfloor heating installations are capable of producing relatively high exposure levels. However, more recent wiring designs utilise layouts where the magnetic fields from adjacent cables cancel each other, resulting in a minimal field (consult your supplier for more details). Electric blanket users, who are concerned about exposures, might preheat the bed and then switch the blanket off before they go to bed, as recommended by authorities for other safety reasons.

It is noteworthy that the Doll report did not relate proximity to high voltage powerlines to childhood leukaemia. Living further away from powerlines will not necessarily decrease magnetic field exposures in the home or reduce any possible risks associated with magnetic fields from electricity.

Conclusion

The scientific evidence does not firmly establish that exposure to 50 Hz electric and magnetic fields found around the home, the office or near powerlines is a hazard to human health. In view of the epidemiological studies, however, the possibility remains that intense and prolonged exposures to magnetic fields may increase the risk of leukaemia in children. If exposure to higher-than-normal magnetic fields does actually cause leukaemia at the level indicated in the Doll report, then, on average, there would be 5 cases of leukaemia in Australia every year due to this cause. The evidence does not allow health authorities to decide whether there is a specific magnetic field level above which prolonged exposure is a hazard to human health.



[1] According to data supplied by the Australian Institute of Health and Welfare in 2007