

EMFs from Electrical Wiring and Appliances

A guide for Homeowners

Pollution of all types affects the body - pollution we can smell, see and hear. One of the more controversial pollutants, however, is entirely invisible: electromagnetic fields (EMFs). While we may live a long, healthy life with no ill effects from electromagnetic fields, a significant body of research indicates that some people may be sensitive to being adversely affected to EMFs at levels that may sometimes be encountered in the home (and work) environment. However, where these levels are found, steps can usually be taken to adequately reduce these exposures.

EMFs are invisible lines of force that surround all powerline distribution systems, electrical devices and wiring. They consist of an electric and magnetic component. As most of the scientific research investigating adverse health effects have to do with the magnetic field, that is what this information sheet mainly addresses. Magnetic field levels are measured in units of **milligauss (mG)** Electric fields may also be a problem but steps taken to reduce magnetic field exposure should also reduce the electric component as well. In Australia the powerline frequency is 50 Hz which is at the Extremely Low Frequency (ELF) part of the electromagnetic spectrum.

Until very recently epidemiological studies on health effects of exposure to EMFs have concentrated on the incidence of cancer. However as evidence continues to accumulate on the health effects of exposure to EMFs, at certain levels and for long duration, it is becoming clear that the fields may act as a low-level immune-system stressor which can manifest in a number of health problems, not just cancer. What those problems may be, very much depends upon the individual's particular immune system strengths and weaknesses.

It is important to note, however, that people's exposure to these fields are mostly below the levels where research is presently indicating a possibility of adverse health effects. Where excessive levels are encountered they can usually be reduced or avoided without greatly changing a persons way of life.

The Evidence:

- In the **September 2000** issue of the *British Journal of Cancer* (Vol. 83, pp.692-698) a team of leading world epidemiologists reported that pooled data from nine different electromagnetic field (EMF) studies has found that children exposed to 4 mG or more were twice as likely to develop leukemia.
- In **December 1998** a paper was published in *The Journal of the Australian College of Nutritional and Environmental Medicine* (ACNEM) titled: "Chronic Fatigue Syndrome- Is Prolonged Exposure To Environmental Level Powerline Frequency Electromagnetic Fields A Co-Factor To Consider In Treatment?" (D. Maisch, J.Podd and B. Rapley)

This paper examined the illness commonly known as Chronic Fatigue Syndrome (CFS). The authors detail evidence that this condition is associated with a persistent, low level impairment of the immune system which may be caused by many possible factors. They then examine evidence of a link between impairment of immune system function and prolonged low-level exposure to EMFs and suggest that this may be a co-factor in some cases of CFS. The paper concludes that existing evidence indicates that exposure to environmental level 50 - 60 Hz EMFs may be an immune system stressor with the potential to cause hormone disruption and changes at a cellular level.

- In **April 2002** the above researchers conducted a clinical study of 49 subjects suffering CF and CFS who were exposed to varying levels of magnetic fields in their homes. Out of the 49 subjects 14 had prolonged EMF exposures over a benchmark level of 2 milliGauss (mG). Three people from this group were excluded from analysis as they failed to meet the criteria for the study. This left 11 subjects in Group A (high exposure with an average exposure of 7.1 mG). The low exposure Group B (34 subjects) had an average of 0.67 mG.

Exposures were reduced to below the 2 mG benchmark level for Group A and no intervention was done for Group B. Both groups were monitored for 6 months for changes in health status. Group A reported a 55% definite improvement in health while group B reported a 14% improvement in health. Clearly indicating that excessive EMF exposure was a factor in their condition. The results of this study was published in the April 2002 journal of the Australasian College of Nutritional and Environmental Medicine.

- On **June 24, 1998** a 30 member working group of scientists assembled by the U.S. National Institute of Environmental Health Sciences (NIEHS) voted 19 to 9 in favor of categorizing powerline frequency electromagnetic fields (EMFs), such as those from electrical wiring and appliances, as a possible Group 2B carcinogen.
- A **1998** study by Bonhomme-Faivre et al. found evidence that chronic human exposure to environmental low frequency EMFs "can cause neurovegetative, hematological and immunological disorders". Specifically they found that a group of workers who were exposed to magnetic fields ranging from 0.9 mG to 66 mG had significantly lower lymphocyte counts than a similar control group not exposed to these levels. The exposed group also reported significantly more occurrence of subjective conditions - mental and physical fatigue, depression, melancholy, irritability, fainting and diminished libido - than did the control group. Of particular interest with this study were two workers who had exposures from 3 mG to 66 mG and worked full-time above transformers. Both were found to have depressed lymphocyte levels which quickly returned to normal when they stopped working in that area.
- On **November 18, 1997** an international panel of scientists at the U.S. Etiology Working Group of the National Action Plan on Breast Cancer in Washington D.C. announced that electromagnetic fields may be considered a potential risk factor for breast cancer, based on existing scientific evidence.

- On **July 3, 1997** the U.S. National Cancer Institute (NCI) published a study in the *New England Journal of Medicine* of powerline frequency EMFs and childhood leukemia which found a statistically significant increase in childhood cancer in children exposed to magnetic fields in excess of 3 mG.
- In **June of 1997** at the *Second World Congress for Electricity and Magnetism in Biology and Medicine*, held in Bologna, Italy, a research paper by Beale et al. (1997) examined eight immune-related and chronic illnesses (variables) in a group of 560 adults living near extra high voltage transmission lines in Auckland New Zealand. Using a design to examine the dose-response relationship between EMF exposure of adults in their homes and prevalence of these illnesses, five of the eight health variables showed a linear dose-response relationship with exposure. The authors concluded that, "The results are consistent with a possible adverse effect of environmental magnetic field exposure on immune-related and other illnesses".
- In **August 1995** a draft report of the U.S. National Council on Radiation Protection and Measurements (NCRP) was leaked to the New York publication *Microwave News*. The 800 page document recommended drastically reducing the current allowable powerline frequency exposure levels from 1000 milligauss (mG) to **2 mG**. The scientific committee found that; "In key areas of bio-electromagnetic research, findings are sufficiently consistent and form a sufficiently coherent picture to suggest plausible connections between ELF EMF exposures and disruption of normal biological processes, in ways meriting detailed examination of potential implications in human health."

From studies on humans the committee cited evidence for a link between EMFs and "neuroendocrine and autonomic responses which, separately or collectively, may have pathophysiological implications" and "neurochemical, physiological, behavioural and chronobiological responses with implications for development of the nervous system."

From laboratory studies the committee noted that EMFs "alter gene transcriptional processes, the natural defense response of T-lymphocytes and other cellular processes".... and "affect neuroendocrine and psychosexual responses".

According to the Committee, problematic sources of ELF EMFs include local electrical distribution systems as well as high voltage power transmission systems. Particular appliances, including electric blankets and video display units also rate highly as problem sources along with "various occupational environments".

The NCRP committee report stated that the evidence points to human health hazards in everyday exposures to EMFs, particularly magnetic fields exceeding 2 mG .

According to the committee:

"..there is an implication that a significant proportion of the world's population may be subjected to a low level of risk, but a risk factor with significant societal consequences, by reason of its pervasive nature and the serious consequences for affected individuals."

What EMF levels are “safe”?

The question of what is a “safe” level is not as simple as it first appears. Overall the evidence indicates that **prolonged** exposure to levels in the order of **2 to 12 mG+** are implicated with adverse health effects, such as cancer and possible immune system effects. People living in homes with levels in excess of 2 mG should seek ways to reduce these exposures to below the 2 mG level. However research has found that the average EMF levels in Australian homes are well below these levels.

A previous *Emfacts* survey of 33 suburban Melbourne homes found that average home exposures from that group were in the order of **0.5 to 0.7 mG**. Extensive surveys in the USA found that in some 98% of U.S. homes, the average strength of magnetic fields ranges from **0.5 to 0.9 mG**. Though this indicates that most homes have an adequate margin of safety there are specific areas of concern where people may be exposed to significant EMFs without realizing. This paper attempts to address those concerns and advises on ways to reduce these exposures as a precautionary approach.

What to look for in the home:

1) Is Proximity to Powerlines a Problem?

In a 1997 residential survey conducted in Melbourne for a group of 33 people, the contribution to household magnetic field levels from external sources, such as powerlines, was very low. However the time-of-day of measurements may have resulted in lower levels than may be found at other times. Research looking at the incidence of cancer and proximity to powerlines has shown that in many cases the fields within the homes were higher from local sources, such as Electrical currents on metal water pipes than the outside fields from the nearby powerlines. The only way to determine possible problems with nearby powerlines is to have the levels measured by a qualified technician.

2) Electrical currents on metal water pipes

Research over the last few years has found that high 50 or 60 Hz magnetic fields can be generated in buildings due to electrical current flow on copper and steel water pipes, earth wires and neutral lines. One landmark study by Wertheimer et al (1995) titled: “Childhood Cancer in Relation to Indicators of Magnetic Fields From Ground Current Sources” concluded that, “The associations of cancer with conductive plumbing . . . suggest that cancer risk is increased among persons with elevated magnetic field exposure from residential ground currents.”.

In simple terms, it is not uncommon for an electrical current to flow from the neutral line through the earth wire, then through the electrically conductive metal water pipe, because this route offers the path of least resistance back to the supply transformer. As a result high fields can be generated in the building. This problem can usually be corrected easily by placing a two metre length of gray poly water pipe in the water line between where the metal water pipe is bonded by an earth wire to the house earth spike and the water meter. This acts to isolate the metal piping from any electrical current flow. This work must be carried out by a licensed plumber. It should be a building requirement that all homes which have a metal pipe

water system be electrically isolated from the street water mains. A detailed report specifically on this problem is available from *Emfacts*.

3) In-Floor Electrical Heating

This type of heating, where energized electrical wiring is embedded in the concrete floor is of special concern. When turned on the fields can be in the order of 100+ mG at the floor and 30+ mG at waist height. It is advisable to turn off particular rooms when spending time in them. Hazardous to small children who may spend much of their day playing on the floor.

4) Electrical Appliances

We usually spend many hours per week in close proximity to various electrical appliances, both at home and work. While individual exposures may not be a problem, the accumulated weekly total exposure may be significant. The following chart gives an indication of emissions from everyday appliances. Generally, with the exception of the microwave oven, at a distance of one metre from the appliance no discernible fields are present. Just increasing your 'safe' distance may greatly reduce your cumulative exposure.

Sample of Magnetic Fields for Common Appliances* (in milligauss units)

Appliance	Distance from appliance		
	10cm	30cm	50cm
Hair Dryer	185	10	4.6
Dishwasher	24	4.8	1.8
Iron	20	3	nil
Vacuum Cleaner	45	9	2.6
Photocopier	27	6	2.1
Colour TV	20	6.2	2.2
Computer monitor	4.9	2.1	0.6
Microwave Oven	120	24	12
Bedside clock radio	140	4.6	1.4
Juicer	700	2.3	0.9
Electric range	11.5	2.2	0.7
Washing machine	12.3	8.2	5.4
Sewing machine	23	3.5	1.2
Juicing machine	220	12.8	6.6

*Fields vary widely according to manufacturer and depends upon how the appliance is wired. Some appliances give off EMFs even when switched off at its internal switch but still plugged into the energized power point. Such appliances need to be switched off at the wall, or unplugged, to remove the fields.

5) Nighttime exposures & Electric Blanket Use

Electric blankets are perfectly safe for warming the bed but should be turned off before sleeping. This is because the magnetic fields emitted by an energised electric blanket are well over the 2 mG level.

Emission levels of electric blankets vary widely but generally have emissions in the range of:

Setting #1 **8 mG**
Setting #2 **14 mG**
Setting #3 **21 mG**

These levels are well into the range of possible health effects and are for prolonged periods of time. For instance a level of 12 mG has repeatedly been shown to suppress both the human hormone melatonin and some anti-cancer drugs in laboratory studies.

It is also important to ensure that no sources of excessive EMFs are close to the bedhead or on the other side of the wall from the bedhead (such as a meter box, TV, etc.).

Bed head night exposures should ideally be below 1 mG and certainly under 2-4 mG if you wish to be exposed to less magnetic fields than are implicated in some of the studies showing adverse health effects.

Do the official EMF exposure standards protect us?

While the scientific evidence clearly indicates that **prolonged** EMF exposures in the order of 2 to 4 mG and over are implicated with adverse health effects. The official Australian National Health & Medical research Council (NH&MRC) guidelines allow a 1000 mG level for homes and a 5000 mG level for occupational areas. What is usually not admitted however is that these levels are only designed to provide protection against immediate biological damage at high levels of exposure. They are NOT designed to provide any protection against long term exposures to environmental level EMFs.

The fact is that most official EMF standards actually serve to protect the power industry against litigation and are usually quoted as “safe levels” by those wishing to give a false sense of security.

For the references on the information contained in this sheet, further information and home/office surveys please contact:

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Updated March 2004