



Powerlines, electromagnetic fields and health

What are electromagnetic fields?

An electromagnetic field (EMF) has two components: an electric field and a magnetic field.

An electric field exists when two objects have a voltage difference between them. For example, there is an electric field between a power line and the ground below because the power line is at a large voltage relative to the ground.

A magnetic field exists when electric current flows through a wire. Thus magnetic fields surround the power lines conducting current from the power station to our homes. Normally, both electric and magnetic fields are present, so we can use the term EMF to mean either.

The magnetic field from a power line can vary widely because the current in the wires depends on the amount of power consumed. On the other hand, the electric field from a power line varies very little because the voltage essentially remains constant.

Electric and magnetic fields are also different in the way they interact with our bodies. Electric fields have very little penetration, while magnetic fields can penetrate to our inner organs.

What is known about the health effects of EMFs?

We have reliable human evidence for the biological effects of EMFs at much higher levels than we would be exposed to at home

or work. Very strong EMFs can induce currents in the body that produce immediate physiological responses. Under such extreme conditions, the central nervous system and heart can be affected.

A substantial amount of current research, however, is focussing on long term exposure to low levels of EMFs.

What is known from the epidemiological studies of human exposure to low levels of EMFs?

Since the late 1970s, a number of epidemiological studies have looked at cancer rates in populations who live near major power lines, and among electrical workers.

Some of the studies have reported an association between exposure to the EMFs from these power lines and increased rates of certain cancers, such as leukaemia in children and cancers of the lymph and central nervous systems in adults.

Other epidemiological studies, however, have found no association between EMFs and cancer. Taken as a whole, the epidemiological evidence is inconclusive.

A weakness common to all the studies is low statistical power. That is, the population studied is too small or the number of cases of a particular cancer in excess of the normal incidence of that cancer is too low for reasonable certainty. Further studies on much larger populations are needed to establish whether or not a link exists.



What is known from laboratory research into EMFs?

The epidemiological studies have stimulated laboratory research into how EMFs could be associated with cancer.

It is generally acknowledged by researchers that EMFs cannot initiate a cancer. They suggest instead that EMFs may play a part in promoting the growth of an existing cancer.

Some mechanisms have been proposed, such as suppression by EMFs of the body's immune response. But in common with the epidemiological data, the research results are inconclusive.

The principal weakness in the laboratory evidence is that experiments are done with cell cultures in test tubes or with animals; the results do not relate directly to human biology.

What can be concluded from the research studies?

The studies indicate that if there is a link between long term, low level EMF exposure and cancer, it is a very weak one. That is, the excess risk of cancer from living near power lines is at best zero, and at worst very low.

This very low risk must be balanced against the high cost of modifying existing power systems and designing new ones to minimise EMFs. The option of putting power lines underground is not the complete solution, as many people suppose, because the magnetic field remains largely unaffected by this measure.

Research evidence must be firmly established before expensive decisions based on health concerns are made.

The process of making such decisions is greatly assisted by the international expert bodies which review and assess research findings.

How are exposure limits determined?

The World Health Organisation (WHO) has published interim guidelines for exposure to electromagnetic fields from power lines and other electrical devices that operate at mains frequency. These guidelines have been endorsed by the National Health and Medical Research Council of Australia.

WHO based these guidelines on a review of the epidemiological and laboratory research up to 1989. It concludes that neither area of activity has proven any link between power lines and cancer. The recommended limits for exposure are based on the known EMF levels for physiological response, as described previously.

Following release of its guidelines, WHO was criticised for disregarding the research into low levels of exposure, such as the residential studies.

However, in 1992 the National Radiological Protection Board of the United Kingdom published another comprehensive review of EMF research, and reached the same conclusion as WHO.

In 1993 the committee that prepared the WHO guidelines became the International Commission on Non-Ionising Radiation Protection. One of the first acts of this body was to review the guidelines in the light of recent research. The resulting statement confirmed the guidelines as originally published.

The WHO guidelines are thus still applied, and their recommended limits have been adopted for use in Western Australia by the



Department of Health and Western Power.

Do Western Australian Power lines exceed exposure limits?

Surveys of power lines in Western Australia have shown that the WHO limits are not exceeded in any publicly accessible area, including directly under the wires.

The Department of Health suggests, however, that while there is doubt about the effect of EMFs on humans, it is only sensible to minimise unnecessary exposure.

Since the EMFs get lower as distance from the power line increases, keeping a reasonable separation is the easiest way of controlling exposure. This is called *prudent avoidance*.

Is there a 'safe' distance from power lines?

The strongest EMFs are found around those major transmission lines that carry the highest voltages and currents.

EMFs are also present around suburban distribution systems that, although at much lower voltages, still carry large currents.

Each power line runs along a corridor of land called an easement. The width of the easement is determined by a number of factors, including the electrical load on the line. The widest easements, naturally, are given to the lines with the highest loads e.g. an easement width of 60 metres is typical for 330kV lines.

Public access to an easement is permitted, but building and long-term occupation are not. At the edge of an easement, the EMFs are appreciably lower than they are in the centre. The WHO limits are not exceeded anywhere within easements; the EMFs

outside easements are consequently well below these limits.

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basis,
there is no reason to discourage either residential development that borders power line easements, or short term recreational activity within easements.

Further information

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