Western Power's Position on Power Frequency Electromagnetic Fields (EMF)

27 September 2006
The issue of possible health effects from exposure to power frequency EMF has been the subject of scientific research and media comment for many years. However, to date and after more than 30 years of research and studies around the world, there is still worldwide scientific consensus that adverse health effects from EMF exposure have not been established, but that further well-conducted research should be undertaken.

EMFs are found wherever electricity is used. They are a natural by-product of the use of electricity and occur around all electric wires and electrical appliances.

Western Power designs and operates all its plant and facilities to comply with the guideline for human exposure to power frequency EMF as recommended by the Australian National Health & Medical Research Committee. This guideline is currently administered by the Australian Radiation Protection and Nuclear Safety Agency, an agency of the Commonwealth Department of Health charged with the responsibility for developing safety standards associated with electromagnetic radiation, and electric and magnetic fields.

1 EMF Exposure Guidelines

The Australian National Health and Medical Research Committee’s (NH&MRC) guideline for human exposure to power frequency EMF is similar to that as recommended by the World Health Organisation (WHO). These guidelines recommend a set of limits of exposure to EMF based on the WHO environmental health criteria. Western Power accepts and endorses these guidelines implicitly and designs, constructs and operates all its transmission lines, plants and facilities in compliance with these exposure guidelines.

The NH&MRC exposure guideline has also been adopted by health agencies of many other countries around the globe. All these bodies have considered many studies investigating the possibility that there may be an association between exposure to weak power frequency EMF and some types of cancer. They have concluded that, taken together, the evidence does not support such an association, and does not form a basis from which exposure guidelines can be formulated. In the United States, there are no national guidelines; however, some individual States have set their own limits.

To date, there is still no conclusive evidence to prove that exposure to normally experienced power frequency EMF in the home or workplace can adversely affect human health. If there are adverse effects, it is not known what measure of ‘dose’ - whether exposure level, cumulative exposure over time or rate of change of level – might be appropriate. Some studies of effects on cells suggest that higher field levels may not produce a larger effect than lower field levels, that is, it is not necessarily the case that ‘more is worse’. Studies relating to concerns about possible cancer development therefore do not provide any basis for proposing limits for exposure to power frequency EMF.

Different limits have been set for persons exposed occupationally and for the general public. The main reason for this is that the occupationally exposed population consists of adults exposed under controlled conditions; these workers would have received training to inform them of potential risk, and precautions that should be taken. Occupational exposures are also limited to the duration of the working day and over the working lifetime. The general public, on the other hand, includes individuals of all ages in all states of health, who will not normally be aware of the exposure they are receiving.
The typical EMF profile is such that the field levels drop off very rapidly as you move away from the electrical source. In the case of transmission lines the field level is at its maximum directly under the conductors of the line and drops off as one moves away from it. Western Power does impose restrictions on the usage of the land in close proximity to a transmission line that is based upon the electrical clearance requirements and the EMF profile of the line. For example, no buildings or construction of any type are allowed within the restriction zone of a transmission line and the size of the restriction zone is dependent upon the voltage, configuration and construction of the line.

2 Potential Health Effects of Power Frequency EMF

Power frequency EMF is not a form of radiation. Many newspaper and magazine articles on the subject talk about ‘radiation’ from powerlines or electrical equipment. The word ‘radiation’ is a broad term, but generally refers to the propagation of energy away from some source. For example, light is a form of radiation, so are x-rays, radio waves and microwaves. EMF do not travel away from their source, but are fixed in place around it. They do not propagate energy away from their source. They bear no relationship, in their physical nature or effects on the body, to true forms of radiation such as x-rays or microwaves.

For most people the greatest exposure to power frequency EMF arises from distribution lines in the street, household wiring and domestic appliances. Living near a transmission line may not substantially increase this exposure. If in the future a positive association between exposure to power frequency EMF and cancer were to be demonstrated beyond any doubt, the indications are that EMF would have to be a very weak carcinogen (cancer causing or promoting agent) in view of the very large-scale use of electricity.

Although most research has investigated possible associations between EMF and cancer, other studies have looked at other outcomes, such as birth defects and functioning of the nervous system. To date, no reliable conclusions can be drawn from this work.

Any risks associated with electricity use, which include risks of fatal shock, are likely to be more than balanced by the benefits that electricity provides. If there is any risk from EMF it is unlikely to be much larger, and is likely to be small compared to other risks to life.

Several studies aimed at finding out if power frequency EMF are a potential cause of cancer have looked at whether, in a group of cancer sufferers, the proportion living near powerlines (both high and low voltage lines) is greater than in a similar group of healthy ‘control’ subjects. Such studies have to be designed carefully to eliminate the effects of factors such as age, income, smoking or exposure to chemicals, which might distort the results.

Studies on adults generally show no association between risk of cancer and residence near powerlines, but not enough work has been done to draw firm conclusions.

Powerlines are only one source of exposure to power frequency EMF. Even people living quite close to powerlines may be exposed to higher (but more intermittent) fields produced by wiring and appliances in the home. Studies of relationship between adult and childhood cancer and the use of electrical appliances have been problematic and inconclusive.
In studies of adult cancers there have been indications of a slightly increased risk to workers in electrical industries. However, many of the workers may also have been exposed to potential cancer causing agents such as solvent fumes and solder fluxes. Very few measurements of the actual field levels to which electrical workers are exposed have been made. Welders, who are exposed to very high level of power frequency EMF, do not appear to be at any particular risk.

Research in laboratories suggests that power frequency EMF cannot directly initiate cancer. If they do play some role, it may be in promoting its subsequent development; however, experiments on cell cultures and animals do not provide good support for this hypothesis. There are also considerable theoretical doubts that there could be any effect of EMF at levels found around powerlines and electrical appliances. Recent attempts to replicate some of the effects reported in cell cultures have been unsuccessful, hence, casting doubt on the original findings.

It is worthy to note that the carcinogenic risks of both asbestos and smoking did show up very prominently in the very early, initial studies which investigated them, and were confirmed by subsequent studies. However, similar studies on EMF have still shown no clear, unambiguous evidence of a carcinogenic risk. A prominent researcher who carried out studies establishing the carcinogenic potential of both asbestos and smoking has concluded that there is only very weak evidence to suggest the possibility that EMF may be associated with cancer.

3 Prudent Avoidance

Different attitudes to risk can lead to different actions. Some people conclude that the current scientific ambiguity about possible health risks from EMF is so large, and the possible risks so small, that no action is necessary. They feel that there are plenty of known risks in life, and they would do better to direct their energies towards reducing these. Others find even the slight possibility of a risk sufficiently disturbing that they would like to take precautions anyway, just in case.

The concept of prudent avoidance has been suggested as a means to control exposures to EMF if there is any doubt that they are harmless. Historically, it has been difficult to scope because, by its very nature, it cannot be defined in precise terms. Nevertheless, it is possible to adopt certain measures that are consistent with the notion of doing what can be done at modest cost and without undue inconvenience to reduce people’s exposure to the EMF; that is, limiting exposures that can be avoided with small investments of money and effort, but not doing anything drastic or expensive.

Western Power is committed to the concept of prudent avoidance; it designs, constructs and operates all its plants and facilities prudently within the guidelines recommended by the Australian Radiation Protection & Nuclear Safety Agency. Western Power sees ‘prudence’ as embracing a range of actions which is sensible to the current state of scientific uncertainty as to whether power frequency EMF cause adverse human health effects, the ongoing research on the subject, and the current community concerns. Such actions include monitoring research, sponsoring research, continually reviewing policies in the light of the most up-to-date research findings (with particular emphasis on the findings of scientific review panels), informing the public, and engaging in prudent avoidance when designing new plants and facilities.
4 EMF Policy

The Energy Networks Association (ENA) is the national voice for members of the electricity supply business in Australia, of which Western Power is a member. Western Power has adopted the EMF policy of the ENA. The policy states:

- ENA recommends to its members that, within Australian health guidelines, they design and operate their electricity generation, transmission and distribution systems *prudently*.
- ENA will closely monitor engineering and scientific research including reviews by scientific panels, and overseas policy development.
- ENA will communicate openly with all stakeholders in conducting community and employee education programs, distributing information material including newsletters, brochures, booklets, videos and the like, liaising with the media and responding to enquiries from members of the public.
- ENA will co-operate fully with any bodies established by governments in Australia to investigate and report about power frequency electric and magnetic fields.

5 EMF Exposure Levels

The NH&MRC guideline recommends the following set of limits for human exposure to power frequency EMF:

- For continuous 24 hour per day exposure for the general public: 1,000 milliGauss (mG)
- For whole working day for occupational purposes: 5,000 milliGauss (mG)
- For a few hours per day for the general public: 10,000 milliGauss (mG), and for occupational purposes: 50,000 milliGauss (mG)

It is important not to fixate on the location of overhead powerlines as the prime cause of power frequency EMF exposure. Exposure to power frequency EMF can arise from ground currents, internal household wiring and the use of electrical appliances as much as, if not more, from overhead powerlines.

The following are EMF exposure levels from typical overhead powerlines in the Perth metropolitan area and typical household electrical appliances:

- 132kV single circuit transmission line under maximum load condition = 10-30mG under the conductors, 5-10mG at the edge of line easement;
• 132kV double circuit transmission line under maximum load condition = 10-30mG under the conductors, 2-5mG at the edge of line easement;

• Low voltage distribution lines = typically 2-5mG under the conductors.

• Electric Blanket = 5 - 30mG

• Hair Dryer = 10 - 70mG

• TV at 30cm = 40mG

• Electric cook top at 30 cm = 40mG

• Personal Computer = 2 - 20mG

6 EMFs from Mobile Phones and their Base Station Facilities

Newspaper and other media reports have an increasing tendency to erroneously associate the power frequency EMF issue with the mobile phone EMF issue. These issues are fundamentally different.

The fields emitted from a powerline operate at the extremely low frequency range of 50 Hz whereas those from mobile phones operate at the radio frequency range of between 800MHz and 1.5 GHz. Both the power frequency and radio frequency fields are non-ionizing and therefore, incapable of imparting enough energy to break up the chemical bonds of a molecule or atom; hence, incapable of altering the DNA genetic materials of cells.

Nevertheless, the potential health effects from exposure to power frequency fields can be very different from those caused by RF fields.

7 Position of Western Power on the Power Frequency EMF Issue

It has been accepted that it will be difficult to prove that power frequency EMF is safe. Experiments can prove whether there are harmful effects, and the levels at which these effects occur. However, the absence of some effect under particular exposure conditions does not prove safety as there is an infinite number of other effects and exposure conditions which could be tested. If there are harmful effects from exposure to power frequency EMF, it is not at all clear what feature of the field – average level, exposure integrated over time, rate of change, etc – may be important. Nevertheless, the absence of a wide range of potentially harmful effects over a variety of exposure conditions can give good grounds for believing that harmful effects are unlikely.
In the light of the existing evidence on the power frequency EMF, it is obvious that the EMF health effects issue is and will remain dynamic. The challenge to Western Power is to get ahead of the issue by adopting policies which meet the needs of its employees and the general public but at the same time allowing it to remain cost effective and competitive in a changing commercial environment. Western Power believes that the policies it has adopted so far have been responsive to both the community needs and commercial expectations.

Western Power takes all concerns about the potential health effects from exposure to power frequency EMF extremely seriously. It will continue to support independent, high quality research into the issue, and is committed to following the NH&MRC recommended safe limits of exposure for both workers and the public while any shred of doubt concerning the health effects exists.

In the meantime, Western Power will continue to closely monitor overseas research and support such research here in Australia through its membership of the Energy Networks Association. It will also continue to take advice from the Australian Radiation Protection & Nuclear Safety Agency and other Australian health authorities on the issue.
Powerlines and electromagnetic fields

**Electromagnetic fields (EMFs)** occur wherever electricity is used. They are a natural by-product of electricity and occur around electric wires and electrical appliances.

They are also present near the distribution lines that supply power to our homes and businesses as well as higher voltage transmission lines that transport bulk power over long distances to feed these lines.

EMFs are not a form of radiation. In broad terms, radiation refers to the propagation of energy away from a source. EMFs bear no relationship, in their physical nature or effects on the body, to forms of radiation such as x-rays or microwaves. EMFs do not propagate energy away from their source. The strength of EMF emissions diminishes as we move further away from the object.

Powerlines are only one source of EMF emission. Home wiring and electrical appliances also emit EMFs. Some examples of typical EMF exposure levels from household electrical appliances include:

- Electric Blanket = 5 – 30 mG
- Hair Dryer = 10 – 70 mG
- TV at 30cm = 0.2 – 2 mG
- Personal Computer = 2 – 20 mG

In contrast, typical emissions from powerlines are as follows:

**Distribution line** (the lines which distribute lower voltage power to homes and businesses):

- When a person is standing directly under the line = 2 – 20 mG

**Transmission line** (the lines which transport high voltage electricity over long distances):

- When a person is standing directly under the line = 10 – 200 mG
- At the edge of an easement = 2 – 50 mG

Western Power designs, constructs and operates all of its powerlines and facilities in compliance with the guidelines recommended by the World Health Organisation (WHO) and the National Health & Medical Research Council of Australia (NHMRC). Their guidelines for human exposure to EMFs are:

- 1000 milliGauss (mG) for continuous 24 hour per day exposure.
- 10,000 milliGauss (mG) for a few hours per day (occupational purposes).

(Different levels have been set for the general public and those people exposed because of their occupation.)

Western Power continues to develop and implement prudent policies to be responsive to both community needs and commercial expectations. We remain committed to following the recommended safe limits of exposure for workers and the public.

Further information on EMFs is available from:

- Energy Networks Association - www.ena.asn.au
- World Health Organisation - www.who.int
- National Health and Medical Research Council of Australia - www.nhmrc.gov.au
- Australian Radiation Protection and Nuclear Safety Agency - www.arpansa.gov.au

August 2007