What do the experts say on safe levels of Electric and Magnetic Fields (EMF)?

The National Radiation Laboratory (NRL), part of the New Zealand Ministry of Health, recommends the use of the exposure guidelines provided by the International Commission for Non-Ionizing Radiation Protection (ICNIRP).

These guidelines are also identified as the appropriate basis for public health protection by Policy 9 of the National Policy Statement on Electricity Transmission under the Resource Management Act.

How are the safety guidelines set?

The ICNIRP guidelines set fundamental limits on electrical currents induced in the body by EMF. The limits on induced body current are termed ‘basic restrictions’ and are measured in current per cross sectional area of body tissue in units of milliamps per meter squared (mA/m²).

Since induced currents in the body are difficult to measure or calculate, ICNIRP also provides reference levels. Reference levels are in terms of the more easily measured ambient electric and magnetic fields that give rise to the induced body currents.

Provided field strengths are below the reference levels, resulting induced currents will be within the basic restriction. If exposures exceed the reference level, this does not necessarily mean that the basic restriction is being exceeded, but that a more careful evaluation is required.

ICNIRP is:
- a formally recognised non-governmental organisation of the World Health Organization (WHO) and the International Labour Organization.
- an independent scientific organisation.
- responsible for providing guidance and advice on the health hazards of non-ionising radiation.
- established to advance non-ionising radiation protection for people and the environment.
What are the exposure guidelines from ICNIRP?

The ICNIRP guidelines applying at 50 Hz (the frequency of the fields from all equipment carrying or using mains electricity) are summarised in the table below:

<table>
<thead>
<tr>
<th>ICNIRP Guidelines 1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
</tr>
<tr>
<td>Occupational</td>
</tr>
<tr>
<td>Basic restriction</td>
</tr>
<tr>
<td>Reference level</td>
</tr>
<tr>
<td>Electric field</td>
</tr>
<tr>
<td>Magnetic field</td>
</tr>
</tbody>
</table>

For exposures of the general public, the ICNIRP reference levels for 50 Hz magnetic and electric fields are 100 µT and 5 kV/m (5,000 V/m) respectively. These limits apply to both children and adults. The reference levels refer to the spatially averaged field strength over the body. Since the established effects of interest, as described above, are instantaneous, the purpose of controls is to limit maximum exposure at any point in time. As such there is no greater effect associated with long term exposures than with short term exposures.

ICNIRP’s limiting thresholds for general public exposure, are widely accepted as providing complete protection against all known adverse health effects of electric and magnetic fields. Indeed, so do the occupational levels, which allow for higher exposure for trained workers, the difference being provision of a greater safety margin for the general public.

ICNIRP maintains a constant review of the research in this area (for example, a major review was published in 2003), but to date has not needed to make any revisions to its 1998 guidelines. The guidelines have been widely accepted and implemented in many countries. For example the guideline values are reflected in the European Union’s recommendation on public exposures.

'It is the view of ICNIRP that the results for the epidemiological research on EMF field exposure and cancer, including childhood leukaemia, are not strong enough in the absence of support from experimental research to form a scientific basis for setting exposure guidelines'.

ICNIRP Guidelines 1998
What about studies showing links between health and lower levels of exposure?

People find it difficult to reconcile the ICNIRP reference level of 100 µT with the findings from some epidemiological research showing an apparent correlation between an approximate doubling in the very low risk of childhood leukaemia and long-term exposure to average fields greater than 0.4 µT. The nature of epidemiological research is described in Fact Sheet 5.

ICNIRP considered the epidemiological data suggesting possible associations with childhood leukaemia when preparing their guidelines, and have reviewed the data several times since then.

While ICNIRP recognises the association, they do not consider that a risk has been established. Rather, there is a possibility that there might be a very low risk. The review of scientific knowledge is an ongoing process that entails the periodic review of the full body of scientific literature by national and international bodies.

In June 2007 the World Health Organization reported on the possible health effects of exposure to extremely low frequency electric and magnetic fields. In its summary section WHO state that, ‘Only the acute effects have been established and there are two international exposure limit guidelines (ICNIRP, 1998a; IEEE, 2002) designed to protect against these effects’.

How is uncertainty managed by public health authorities?

Scientific uncertainty around the association between EMF and childhood leukaemia and in particular, whether EMF is the cause of the health effect, has led to significant debate. From a risk management perspective, prudent avoidance and precautionary approaches have been advocated.

The idea of prudent avoidance was advanced by risk management academic Professor Granger Morgan at Carnegie Mellon University in the 1980s. It provides for an approach that allows caution to be applied, even when this is not absolutely indicated by scientific considerations, on the basis that many people feel more comfortable with that approach.

The approach can be simply defined as “the idea of avoiding human exposure to power-frequency electric and magnetic fields when it can be done at modest cost and little inconvenience”.

In Australia, prudent avoidance was defined by the former Chief Justice of the High Court of Australia, Sir Harry Gibbs, as doing what can be done without undue inconvenience and at modest expense to avert the possible risk to health from exposure to new high voltage transmission facilities.

In line with this approach, in New Zealand, the NRL and Ministry of Health encourage the voluntary adoption of such low or no cost measures to reduce or avoid exposures. This is consistent with Ministry recommendations for other agents.
These organisations, as well as the World Health Organization, do not support the introduction of additional exposure limits, below those determined by the analysis of the health effects research. Such limits are considered to undermine the science-based limits, and also risk creating unnecessary alarm should exposures exceed the new level chosen.

In its June 2007 report on possible EMF health effects the World Health Organization make the following statements.

‘In recommending precautionary approaches, an overriding principle is that any actions taken should not compromise the essential health, social and economic benefits of electric power.’

‘Provided that these benefits are not compromised, implementing precautionary procedures to reduce exposures is reasonable and warranted.’

‘Given the weakness of the evidence for a link between exposure to ELF magnetic fields and childhood leukaemia and the limited potential impact on public health, the benefits of exposure reduction on health are unclear and thus the cost of reducing exposure should be very low.’

‘However, it is not recommended that the limit values in exposure guidelines be reduced to some arbitrary level in the name of precaution. Such practice undermines the scientific foundation on which the limits are based and is likely to be an expensive and not necessarily effective way of providing protection.’

Prudent avoidance can embrace a range of actions that it is sensible to take, having regard to the current state of scientific knowledge. For the electrical supply industry, such actions could 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), providing awareness training for electricity supply business employees and keeping them informed, sharing information freely with the community, measuring fields levels and attention to design and careful siting of new transmission and distribution facilities.

This is one of five fact sheets produced by Transpower to provide the public with information about electric and magnetic fields. Other fact sheets that are available and provide more detailed information include:

- Fact Sheet 1 on electric and magnetic fields and Transpower
- Fact Sheet 2 on the nature of electric and magnetic fields
- Fact Sheet 3 on the typical strength of electric and magnetic fields
- Fact Sheet 5 on electric and magnetic fields and the question of health effects.

If you have further questions concerning EMF please call Transpower on 0508 526 369 or contact us through our website www.transpower.co.nz.