

# **Why 4 mG is preferable to the NH&MRC's 1000mG as a reference level for a health based environmental EMF exposure limit**

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## **Introduction**

Over the past decade there have been a number of buildings in Australia where concerns have been raised over apparent excess rates of cancer and other illnesses amongst the occupants. Examples are Ross House (Melbourne)(1) RMIT Building 108 (Melbourne)(2) and the Capalaba Post Office (Queensland)(3). In each case, in response to concerns that the illnesses may be due to 50 Hz extremely low frequency (ELF) magnetic fields, and measurements were made, reassurance was given that the measured levels were well below the National Health & Medical Research Council's Interim guideline reference level of 1000 milliGauss (mG) for residential exposures (4). The impression given was that the NH&MRC limits were designed to protect against the possibility of ill health as long as exposures were kept under that level.

In the example of RMIT Building 108, ELF magnetic field measurements were taken by EMC Technologies but it was stated in their initial report that *"the extra [extremely] low frequency (ELF) magnetic field recommendations set by NH&MRC for the general population were used as limit recommendations"* (5). Individual room ELF magnetic field measurements are given as well as the % of the NH&MRC's 1000 mG public limit recommendation (6). The reader was to assume that compliance with the limits assured safety in relation to the apparent brain tumour cluster in the top floor of the building. However in the RMIT Final Report, they made a departure and used a reference level of 4 mG . Subsequent testing determined that there was no association with the brain tumour cases and occupancy of offices with ELF magnetic fields greater than 4 mG (7).

Another departure from the norm is seen in the current controversy over the ABC studies at Toowong, Qld., where a high incidence of breast cancer is reported. In this case, the expert panel conducting the environmental risk assessment on all possible factors in the building, has specifically stated, that in relation to ELF magnetic fields, comparisons with other workplaces should be made and not just assessed against the "accepted reference levels"(NH&MRC)(8).

This article briefly examines the foundation of the NH&MRC recommendation of 1000mG, what level of health protection it provides, and what may constitute a more realistic reference level in relation to providing a measure of protection against possible cancer and other illnesses in the built environment. The point being made is **not** that there may be a link between EMF exposure and cancer and other illnesses in the above mentioned cases, but that the NH&MRC Interim guidelines are irrelevant to environmental EMF exposures, do not address cancer and other illnesses, and therefore should not be used as a reference level in building EMF assessments.

### **The NH&MRC Interim guidelines for 50 Hz**

The ELF limit recommendations in the NH&MRC Interim guidelines (1989) are based on the International Radiation Protection Association's (IRPA) interim guidelines which also served as the basis for the current guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The same rationale for setting exposure limits applies to the ELF guidelines set by the UK's National Radiation Protection Board (NRPB). The rationale for all these guidelines is based on providing health protection only against **immediate health hazards** from high levels of exposure. This limitation was explained by the predecessor to ARPANSA, the Australian Radiation Laboratory in 1994, in discussing a 1994 Senate report criticising the limitations to the standards.

To Quote:

*“The criticism of the IRPA interim guidelines (and consequently of the NH&MRC counterpart) derives from their ambiguity about what parts of the available evidence can be used in standard setting at present (and consequently what health effects can be confidently prevented by their implementation) and the expectation of the public. The NRPB has explicitly qualified the scope of their guidelines (based on the same rationale as the IRPA limits):*

*Restriction on exposure to extremely low frequency magnetic fields are expressed in terms of induced current density and are intended to avoid the effects of induced electric currents on function of the central nervous system such as the control of movement and posture, memory, reasoning and visual processing” (McKinlay, 1993) ” (9).*

Similar comments about the limitations and purpose of the NH&MRC guidelines were made in 1991 by Dr. Keith Lokan, from the Australian Radiation Laboratory, in a conference paper published in *Radiation Protection in Australia*:

*"One thing which we have done, though it has little direct bearing on the issue of chronic low level exposure, is to adopt the (above) recommendations on field limits. These limits represent plausible field values, below which immediate adverse health effects are unlikely, and as such serve a useful purpose. They are not intended to provide protection against possible cancer induction by continued exposure at the lower field levels implicated in the studies..." (10).*

As cancer takes many years to develop after exposure to an environmental agent, such as asbestos (an obvious example), the NH&MRC ELF limits are clearly not relevant to the above mentioned cases. It is therefore deceptive to infer that compliance with such limits removes the risk of cancer from exposure below these limits.

As clearly stated by Dr. Keith Lokan in 1991, the MH&MRC's recommendation of 1000 mG is not relevant to the question of exposure levels and cancer so any reference to it in relation to cancer risk is not justified, to say the least. A far more useful level from both a public health and an occupational health and safety viewpoint would be one that is consistently related with an increase risk or incidence of cancer in humans. A level of 4 mG is recommended for the following reasons.

\* On June 24, 1998, the National Institute for Environmental Health Sciences (NIEHS) Working Group voted to classify ELF-EMF as a Group 2B possible carcinogen. The Working Group saw this as *"A conservative, public health decision based on limited evidence for an increased occurrence of childhood leukemia and an increased occurrence of chronic lymphocytic leukemia in occupational settings."* The NIEHS Working Group identified a magnetic field level range of **2 –5 mG** in the scientific research literature as being related to an increased risk of leukemia. They recommended that *"prudence would establish firm EMF limits below 2 mG by some reasonable margin of safety"* (11).

\* In 2001 the International Agency for Research on Cancer (IARC) reviewed the scientific evidence on the potential carcinogenicity of ELF - EMFs and using the IARC classification system, classified power frequency EMFs as *"possibly carcinogenic to humans"*, based on a fairly consistent statistical association between a doubling of risk of childhood leukemia and ELF magnetic field exposure above 4 mG. However, the IARC found no consistent evidence that ELF magnetic fields increased cancer risk in adults (12).

\* The Advisory Group on Non-Ionizing Radiation (AGNIR) in March 2001 called a 4 mG level as a *"relatively heavy"* average exposure that is *"associated with a doubling of the risk of leukaemia in children under 15 years of age"* (13).

\* In a summary of the overall evidence, Cindy Sage from Sage Associates, Santa Barbara, California, USA saw an increased risk of both childhood and adult cancers at exposure ranges associated with increased risk of cancer in the order of 2 –5 mG (Time Weighted Average-TWA) and up to 16 mG intermittent exposure levels (14).

\* In an interview with Microwave News in May 2001, Dr. David Savatz, said that he was pessimistic about the value of conducting further epidemiological studies because he did not think that the public health threat was great enough to prioritize EMF work over other research. However he agreed with recommendations to follow a policy of prudent avoidance – reducing exposures when one can do so at low cost. He felt that *“the epidemiological research suggests that limiting exposures to less than 0.4 – 0.5 uT (4 – 5 mG) could have a health benefit”* (15).

\* On 18th March 2002, a Queensland judge made a ruling that ELF-EMFs from a proposed substation next to a predominantly residential area, should not exceed 0.4 microtesla (4 mG). Energex, the power supply company named in the case accepted the decision. The judge’s precautionary ruling stated the following:

*“The issues relating to the placement of the substation are significantly different from those that may have existed in the past, as research now available accepts that a possible risk to the surrounding community may exist. Not only were the magnetic field levels in and around the substation to be taken into account, but recognition of the fields from the infeed and distribution cables had to be limited, by undergrounding, and monitoring, to ensure compliance with the 0.4 microtesla maximum allowed magnetic flux density”* (16).

According to *Powerwatch News*, Roger Lamb, a Melbourne based electrical engineer who sat in for the five day hearing, said it would hopefully provide a model for the resolution of similar situations in the future. In response to the level of scientific uncertainty as to the extent of a health hazard, which Energex’s expert witnesses couldn’t deny, the judge stated that *“The supply of electricity must not only be reliable, it must be as safe as it reasonably can be”* (17).

\* In June 1995, the Australian Services Union and library equipment manufacturer RAECO signed an Australia wide agreement that the Union considered necessary to protect ASU library members from exposure to ELF-EMFs associated with some library security systems. The agreement stated that no ASU member should be exposed to a magnetic field of more than 4 mG averaged over a normal working day. As for the justification for using a 4 mG level the agreement stated that:

*“ Current studies indicate that Extra Low Frequencies (ELFs) increase susceptibility to cancers, they do not generate cancers. It is thought that ELF’s “degrade” the immune system. This susceptibility to cancers is only during the period of exposure; it doesn’t result in permanent degradation of the immune system. Therefore the longer the exposure, the longer the opportunity for the cancers to take hold. The current understanding is that the greatest exposure risk is to the head and torso. Current evidence suggests health problems could arise with prolonged exposure above 4 mG” (18).*

\* An important development in Europe has been the decision in 2004-5 by the the Dutch Ministry of Housing, Spatial Planning and the Environment to prepare a precautionary policy in setting a 4 mG (0.4 uT) exposure limit for new transmission lines, and banning the construction of buildings and developments that would expose people to prolonged magnetic fields of 4 mG and over (19).

In response to this precautionary policy, TenneT the administrator of the Dutch electrical grid, in tandem with Holland Railconsult, have designed a new high voltage transmission line concept featuring significantly reduced magnetic field intensity compared to existing lines. This will ensure that the maximum levels at the right-of-way boundary of the new transmission lines will conform to the 4 mG limit. (20)

## **Conclusion**

As far as how common environmental exposures to 4 mG are in Australia, no comprehensive nation-wide estimations have yet been done. A small scale survey by the Australian Radiation Protection & Nuclear Safety Agency (ARPANSA) in Melbourne in 2005 found approximately 12% of homes surveyed had levels above 4 mG in areas where children were likely to spend large amounts of time, but this could not be extrapolated as typical in Australian homes (21). In the U.S. it has been estimated that about 4% of the US population is subjected to prolonged ELF-EMF levels at or greater than 4 mG (22). If we consider 1000mG however, it would be highly unlikely that any homes or workplaces (outside of electrical switchyards, aluminum smelters, etc.) in Australia would ever approach this high level.

So, in response to the concerns of people working in buildings where there are apparent cancer clusters or other illnesses, and EMFs are thought to be a possible issue, we might ask: Which is preferable as a reference level: The NH&MRC’s 1000 mG limit that *is “not intended to provide protection against possible cancer induction”* or one (4 mG) that has been classified as *“possibly carcinogenic to humans”*?

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